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Determinants of the cash retention in Brazilian companies: a post-crisis analysis of 2008

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1. Introduction

Theories that deal with the trade-off between the costs and benefits of maintaining cash may make it possible to identify the reasons that make a company hold a great amount of cash from the perspective of maximizing shareholder wealth. However, different points of view focus on this issue as directors and shareholders view the costs and benefits of holding net assets differently, thus generating insights about the advantage of having liquid balances.

Since Keynes (1936) studies, it has been speculated on the advantages of having liquid balances, which allow the company to invest in valuable projects as they arise, thus constituting two main benefits of holding liquid assets. The first is about generating lower transaction costs to raise funds and not having to settle assets to make payments. The second is about the use of liquid assets to finance their activities and investments if other sources of financing are not available or are too expensive for the company.

On the other hand, if the company has unrestricted access to external financing, it will not have to save money to make investments and liquidity will no longer be relevant. To elucidate the issue of cash reserves, several studies were conducted to identify the determinants and implications of this variable in companies, among them, Opler. Et al. (1999) and Bates, Kahle and Stulz (2009), who discuss the reasons that made the American companies to retain more cash. However, these studies predated the financial crisis of 2008, leaving a gap on the behavior of this variable. In the post-crisis, the reasons were later clarified by Pinkowitz, Stulz and Williamson (2015), who identified that, after the crisis of 2008, the American organizations had a considerable reduction in their cash level. This phenomenon was identified in Brazilian companies analyzing historical data on cash retention and there was a rise in the pre-crisis period, reaching its apex in 2009. After, there was an abrupt drop and a smoothing retention from 2010 to 2015.

It is comprehensible that there has been oscillation around the 2008 crisis, which extended to the following two years. However, there is still doubt as to why companies continue to retain less cash in the periods from 2010 to 2015. Although Brazil suffered an economic crisis of considerable magnitude in mid-2014, which affected public expenditures, inflation and solvency of companies, this article aims to verify the influence of issues pointed out by the corporate finance literature to justify this change, starting from the presuppositions related to the transaction, speculation, precaution, tributes and problems of governance.

This paper aims to analyze the determinants of cash retention in Brazilian publicly traded companies, based on the approach proposed by Hansen (2000) that allows the description of breakpoints in the variables for different individuals, segmenting the sample based on the value of an observed variable. Thus, this study differs from the other approaches proposed in the literature by the method that will be used to achieve the objective because the data will be analyzed with threshold data panel.

Afterwards, the other components of the article structure are presented, starting with the revision of the concepts about the cash holding and their determinants followed by the methodology and results. At the end, the conclusions of this study are presented.

2. Cash holding and their determinants

Determining the choice between cash holding and borrowing from external sources has been a challenge for corporate finance in an imperfect capital market. The administration of

cash resources from the formulation of the economic batch of purchase used for inventory management gave rise to the Baumol Model (Baumol, 1952), which incorporates opportunity costs, transaction costs of investment operations and recovery in financial assets to determine the appropriate cash balance. The Baumol model performs an analysis of the cost associated with maintaining cash that is the cost of opportunity determined by the interest that the company fails to earn by not applying these resources in more profitable alternatives, and the transaction cost determined when the transfer occurs between the cash and the financial asset. Although this model has brought several contributions to cash management, it has as a restriction the applicability of its concepts in situations in which the company has constant inputs and outputs of resources.

Considering the unpredictability of the inflows and outflows, Miller and Orr (1966) have developed a cash management model based on the premise that their balance could reach a maximum value, so resources above this point would be transferred to other assets of equal liquidity, and minimum balances, in which the funds would return to the cash flow through the conversion of these assets. In this way, both models proposed by Baumol (1952) and Miller and Orr (1966) focused on the transactional motive and on theoretical models to explain the companies cash levels.

In terms of transactions, Almeida and Campello (2007) state that assets that serve as collateral are important to obtain more financing, reducing the need for cash retention. Peyer and Shivdasani (2001) have identified that the pressure of reducing outside capital causes firms to generate high cash levels. Due to these factors, the following hypothesis has been formulated:

H1: Investment in fixed assets and leverage, as they facilitate the acquisition of funds from outside capital, generate less need for cash retention for transactions.

There are other reasons highlighted in the literature that influence the cash reserves in companies such as speculation, precaution, taxes and agency costs. The speculation reason is related to the idea that companies retain liquidity to take advantage of growth opportunities. According to Harford (1999), the cash is an important tool for the companies to operate in imperfect capital markets, because reserves can provide a valuable source of resources for investment opportunities. For this reason, the following hypothesis is formulated:

H2: T*he companies generate greater cash retention to speculation as they need to mantain liquidity to take advantage of growth opportunities.*

The precautionary is based on the idea that companies maintain a safe cash level to protect themselves from adverse scenarios in which the access to the capital market has high cost (Bates, Kahle & Stulz, 2009). This sense is based on the findings of Opler et al., (1999) since these authors examined the determinants and implications of the cash positions and commercial titles of US publicly traded companies from 1971 to 1994 and found evidence that firms with more difficulties in accessing the capital market tend to hold higher cash levels. In particular, the findings of Opler et al., (1999) highlight that organizations that have higher risk cash flows, such as large corporations and those with high credit ratios, tend to maintain lower cash ratios related to total non-cash assets.

Han and Qiu (2007) developed a two-period model in which cash investments of financially constrained firms are sensitive to cash flow volatility, generating an intertemporal trade-off between current and future investments. In this context, Almeida, Campello and Weisbach (2004) have been studying the relationship between financial constraints and company liquidity, evidencing that cash sensitivity to cash flow is positive for companies with restrictions to access capital markets, especially in periods of negative macroeconomic shocks. Han e Qiu (2007) indicate that an increase in cash flow volatility causes firms with financial constraints to increase their cash level. Due to these factors, the following hypothesis is formed:

H3: The change in cash flow generates uncertainties, causing companies to operate with greater cash retention as a precaution to protect themselves from adverse scenarios.

A motive that is different from the previous ones and currently considered by the literature was presented by Foley *et al*. (2007) because these authors pointed out questions related to ratios and taxes. They identified that US companies maintain significant amounts of cash in their balance sheets and these financial holdings were justified in the existing literature by transaction costs and precautionary reasons. However, the authors state an additional explanation that US multinational corporations maintain money in their overseas subsidiaries because of the tax costs associated with repatriating foreign income.

Based on this statement, firms facing higher repatriation tax burdens maintain higher cash levels and retain this money abroad or at branches, thereby avoiding high tax costs in repatriating profits. By analisyng the cash holding from Latin America companies, Rochman e Dylewski (2011) argued that tax benefits such as the payment of interest on equity – what is a deductible income tax expense in Brazil– may encourage the company to lower its cash level and distribute it to its shareholders. This argument is presented by Graham (2000, 2003) who states that high taxation companies have more developed tax benefit policies, impacting on the lower retention of cash. In this context, the following hypothesis is formulated:

H4: As companies acquire more outside capital, they increase tax payments, generating tax benefits and encouraging companies to retain less cash.

The fifth reason presented in the literature for cash retention relates to governance problems. This question raises the conflict of interests between agent and principal. Berle and Means (1932) were the first to discuss the potential benefits and costs of the separation of ownership and control in some large corporations. Despite the indisputable relevance of the study of these authors, it was the work of Jensen and Meckling (1976) that was considered seminal in the line of research in corporate governance. According to Saito and Silveira (2008), the studies of Jensen and Meckling (1976) represent a true milestone from which many empirical works were developed and new theoretical models were generated.

In this sense, Myers and Majluf (1984) discuss the impact of asymmetric information on cash-use policy of companies. For these authors, it is always better to issue bonds that are safer. Therefore, the cash retention policy is aligned with the pecking order model because the company would have net assets to finance future investment projects with equity.

Another aspect that is presented by Jensen and Meckling (1976) is that as companies generate a substantial cash flow, conflicts of interest between shareholders and directors over payment policies can be especially serious. The central issue from this point of view is the argument that existing agency conflicts between shareholders and managers can be more severe when companies have large free cash flows. In accordance with these authors, the entrenchment directors prefer to withhold money rather than increase payments to shareholders when the company has bad investment opportunities. However, Bates, Kahle and Stulz (2009) found no significant relationship between corporate governance – analyzed through GIM index (GOMPERS, ISHII & METRICK (2003) – and cash holding.

Dittmar, Mahrt-Smith and Servaes (2003) found evidence suggesting that firms hold more cash in countries with greater agency problems by investigating cash retention and agency problems. Shleifer and Vishny (1997) verified that firms located in countries with weak legal protection of investors have difficulty in obtaining funds. In developing economies with high concentration in the ownership structure, such as Brazil, it is possible to extend this concept to the existing relationship between majority shareholders and minority shareholders in order to mitigate the conflict of interest between them and prevent the expropriation of minority shareholders by the controllers (La Porta et al., 2000).

Analyzing the owership structure around the world, La Porta, Lopes-De-Silanes and Shleifer (1999) identified that more than 60% of the firms are of concentrated ownership structure. These findings show that firms in the world's largest economies are usually controlled by government or by family groups, which have decision-making power over the company's

flows in addition to the control. The scenario is not different in Brazil, because the highest concentration of voting share is a fundamental characteristic of governance model of Brazilian publicly traded companies, with an almost total absence of companies with pulverized ownership structure. In this context, the following hypothesis is formulated:

H5: The higher the control structure of the principal shareholder, which represents the governance problems, the more need for liquid assets to finance future projects of investment with internal resources the shareholder will have.

3. Methodology

The sample is composed by 144 Brazilian publicly traded companies with stock in BM&FBOVESPA from 2010 to 2015, excluding the financial firms. These firms represent a total of 864 observations. The data were collected in Economática and the panel data is balanced, so firms with no existing data were not considered in this study. The variables that compound this study were identified in relevant national and international researches which investigated the companies cash retentions. Therefore, the choice of variables was based on two criteria: theory support and use in previous researches.

The data analysis is divided into two parts. The first is the analysis of the historical data of the companies' cash in order to verify if there were increase or decrease in the retention of cash, as well as the application of the descriptive statistics. The second part consists in the methodology proposed by Hansen (1999) that deals with the application of data in panel with threshold. The data were analyzed with Stata 14 and R.

The literature about cash maintenance employs several alternative definitions to verify the firm's cash ratio, among them (1) cash to assets ratio; (2) cash to liquid assets; and (3) cash values to the sales. Although authors as Bates, Kahle and Stulz (2009) assert that the relation cash for assets is the traditional measure, Opler et al. (1999) use the cash to liquid assets ratio and Foley at al. (2007) the log of the cash in relation to liquid assets. In this research, the traditional approach of the relation between cash and assets.

Table 1 shows the independent variables that compound the study as well as the form that this variable is calculated. It is also verified the relation and the expected effect according to the theory studied and the authors that support such theory.

Table 1 – The independent variables and description

Indep Variables	Measure	Relation	Authors	Efect
H1: Transation	$LEV = \frac{Short-term\ and\ Long-term\ Debt}{Total\ assets}$	The firms will use cash to reduce the leverage if the debt is sufficiently restrictive, and this may result in a negative relation between cash and leverage.	Bates, Kahle e Stulz (2009); Miller e Orr (1966); Almeida e Campello (2007)	-
H1: Transation	$IA = \frac{CapitalExpediture}{TotalAssets}$	If the capital expenditure generates assets that may be used as collateral, the capital expenditures may increase their capacity of the debt and	Bates, Kahle e Stulz (2009); Miller e Orr (1966); Almeida e Campello (2007)	-
H2: Especulation	$MB = \frac{MarketValue}{BookValue}$ *	Firms with better growth opportunities value cash the most once it is more expensive to them to be financially restricted.	Kim, Mauer e Sherman (1998); Opler et al (1999)	+

H3: Precautionary	$VOL = \frac{\Delta EBITDA}{\text{Total Assets}}$	The higher the volatility of cash flow, the higher the risks what may cause an increase in cash retention.	Kim, Mauer e Sherman (1998); Han e Qiu (2007)	+
H4: Taxes **	$TAX = \frac{T \times DF}{\text{Total Assets}}$	It is expected that the higher the tax benefit the smaller the cash retention will be.	Graham (2000, 2003)	-
H5: Governance Problems	*Percentage of common shares held by the controlling shareholder in relation to the total shares*	The higher the percentual of ordinary stocks held by the controller, the higher the need for liquid assets to finance future projects of investment with internal resources.	Dittmar, Mahrt-Smith e Servaes (2003); Shleifer e Vishny (1997)	+
Threshold	$SIZE = \ln(Total\ Assets)$	Larger firms usually retain less cash.	Opler, Pinkowitz, Stulz e Williamson (1999);	-

Note: * For the calculation of the MV (market value), the concept of Chung and Pruitt (1994) was used, which is the sum of MVE - the firm stock price multiplied by the number of outstanding common share, PS (Current Liabilities minus current assets plus inventories and long-term debt), only divided by Shareholders' Equity (PL); ** TxDF is the tax rate multiplied by the financial expense.
Source: Organized by the authors

The technique of aggregating time series and cross-sectional data, such as the panel data, allows a more complete estimation of econometric models; however, the estimation of such models becomes more complex as the heterogeneity between the units of the cross section increase. Due to this fact, the present study follows the methodology proposed by Hansen (1999) who developed an estimation method for panel data that allows the division of the sample into different classes based on values of an observed variable.

Threshold panel data emerges as an option that can organize in a more refined way the heterogeneity of individuals in the sample. The approach proposed by Hansen (1999) allows a description of the leaps or structural breaks in the variables for different individuals, segmenting the sample based on the value of a certain variable. In this way, an initially heterogeneous sample can be segmented into two, three or four less heterogeneous sub samples where a specific structural relationship between the variables is identified.

The model proposed by Hansen (1999) allows the coefficient of the regression equation to change its value depending on the sub-sample or regime in which it is found. The single-threshold model can be described as (1).

$$y_{it} = \mu_i + x_{it} I(q_{it} \leq \gamma)\beta_1 + x_{it} I(q_{it} > \gamma)\beta_2 + \varepsilon_{it} \quad (1)$$

In (1) I is an indicator function assuming values of $I = 1$, when $(q_{it} \leq \gamma)$ and 0 in others cases, and $I = 1$, when $(q_{it} > \gamma)$ and 0 in other cases; q_{it} is the *thresholdI* variable, γ is the threshold parameter that divides the equation into two regimes with coefficients $\beta = (\beta_1, \beta_2)$; ε_{it} it is the assumed error term to be independent and identically distributed (iid) with zero mean and finite variance, which can be heteroscedastic. An alternative representation of (1) can be describe by (2).

$$y_{it} = \mu_i + \beta z_{it}(\gamma) + \varepsilon_{it} \quad (2)$$

In (2), $z_{it}(\gamma) = (x_{it} I(q_{it} \leq \gamma), x_{it} I(q_{it} > \gamma))$ and $B = (\beta_1$ e $\beta_2)$, we define a sample space $\Gamma = (\underline{\gamma}, \overline{\gamma})$, onde $\underline{\gamma} > min\{q_{it}\}$ e $\overline{\gamma} < max\{q_{it}\}$. It should be noted that, for each value of $\gamma \in \Gamma$, the vector $z_{it}(\gamma)$ assumes a specific form. The estimation of the coefficients is by means of Ordinary Least Squares and the selection is by grid search of the estimates of the coefficients that generate lower the *Sum of Squared Error* (*SSE*), that is, for each value of $\gamma \in \Gamma$, by OLS

the coefficients and the *Sum of Squared Error* ($SSE_\gamma = \sum\sum \varepsilon_{it}^2$). The most appropriate estimates are those that minimize the function SSE_γ no espaço Γ.

The three-regime (double-threshold) model can be described as (3).

$$y_{it} = \mu_i + x_{it} I(q_{it} \leq \gamma_1)\beta_1 + x_{it} I(\gamma_1 < q_{it} \leq \gamma_2)\beta_2 + x_{it} I(\gamma_2 < q_{it})\beta_3 + \varepsilon_{it} \quad (3)$$

One way of writing the double-threshold model is (4).

$$y_{it} = \begin{cases} \mu_i + \beta_1 x_{it} + \varepsilon_{it}, & q_{it} \leq \gamma_{1,} \\ \mu_i + \beta_2 x_{it} + \varepsilon_{it}, & \gamma_1 < q_{it} \leq \gamma_{2,} \\ \mu_i + \beta_3 x_{it} + \varepsilon_{it}, & \gamma_2 < q_{it}. \end{cases} \quad (4)$$

In (4), the sample is divided into three regimes depending only whether the threshold variable is smaller, greater or is between a range of values defined by the thresholds. By definition, this procedure ensures greater homogeneity within each regime, which contributes to obtaining more realistic coefficients. The Hansen model (1999) supports up to three thresholds. For a better understanding of the estimation process, an alternative representation of equations (3) and (4), given by (5) is considered.

$$y_{it} = \mu_i + \beta z_{it}(\gamma_1, \gamma_2) + \varepsilon_i \quad (5)$$

In (4), $z_{it}(\gamma_1, \gamma_2) = (x_{it} I(q_{it} \leq \gamma_1), x_{it} I(\gamma_1 < q_{it} \leq \gamma_2), x_{it} I(\gamma_2 < q_{it}))$ and $B = (\beta_1, \beta_2$ e $\beta_3)$. Note that for each pair $(\gamma_1, \gamma_2) \in \Gamma x \Gamma$, the vector $z_{it} = (\gamma_1, \gamma_2)$ will assume a specific form. The estimation of the coefficients by OLS and the selection is by grid search of the estimates of the coefficients that generate the Sum of Squared Error, that is, for each value of $\gamma_1 e\, \gamma_2 \in \Gamma x \Gamma$, the coefficients are obtained by OLS and the *Sum of Squared Error* ($SSE_{\gamma 1,\gamma 2} = \sum\sum \varepsilon_{it}^2(\gamma_1, \gamma_2)$), the most appropriate estimates are those that minimize the function $SSE_{\gamma 1,\gamma 2}$ in the space ΓxΓ.

For values of (γ_1, γ_2) the coefficients$(\beta_1, \beta_2$ e $\beta_3)$ are linear and the OLS estimation by *grid search* is adequate. The coefficients are those that minimize the *Sum of Squared Error* ($SSE_{\gamma 1,\gamma 2} = \sum\sum \varepsilon_{it}^2(\gamma_1, \gamma_2)$).

In the context of the model (1), it is necessary to verify the significance of the threshold effect (γ) that is, if the difference $\beta_1 - \beta_2$ is large enough so that γ)it is significant). The Lagrange test (LR) proposed by Hansen (1999) is described by (6.a, 6.b e 6.c).

$$LR(\gamma) = (SSE(lm) - SSE(\gamma))/\sigma_\gamma^2 \quad (6.a)$$

$$LR(\gamma 1, \gamma 2) = (SSE(\gamma) - SSE(\gamma 1, \gamma 2))/\sigma_{\gamma 1,\gamma 2}^2 \quad (6.b)$$

$$LR(\gamma 1, \gamma 2, \gamma 3) = (SSE(\gamma 1, \gamma 2) - SSE(\gamma 1, \gamma 2, \gamma 3))/\sigma_{\gamma 1,\gamma 2,\gamma 3}^2 \quad (6.c)$$

The LR test is robust to heteroskedasticity and has its critical values determined by a boostrap procedure. In (6a), if the value of the LR statistic exceeds the critical value, it is concluded that there are two regimes and the association between the dependent variable and the independent variables is distinct, at least for one of the variables. On the other hand, if the LR statistic does not exceed the critical value, it is concluded that the linear model (lm) of fixed effect is the most adequate. Finally, the analysis for 6.b and 6.c is identical to 6.a, but the comparison performed is 1vs2 threshold and 2vs3

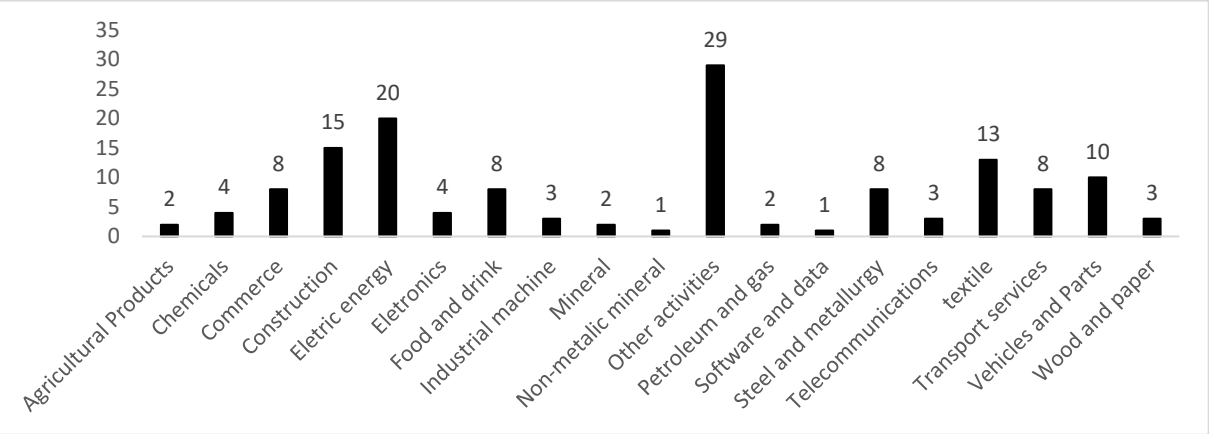
4. Discussion

In order to have a better understanding of determinants of cash retention in publicly traded Brazilian companies, the following section is presented: (i) characterization of the sample, descriptive statistics and correlation; and, (ii) analysis of determinants of the decrease in cash retentions.

4.1 characterization of the sample, descriptive statistics and correlation

As specified in the methodology, the sample of this study consists of companies registered as publicly traded corporations, which have data for the analyzed period, excluding those classified as financial. In total, 144 companies were analyzed from 2010 to 2015, totalizing 864 observations. These companies are located in 19 sectors of the Economática database. Among them, Electric Energy, Other and Construction sectors are the three most representative as it is shown in Figure 1.

Figure 1 Firms classified according to sectors of the Economática database.

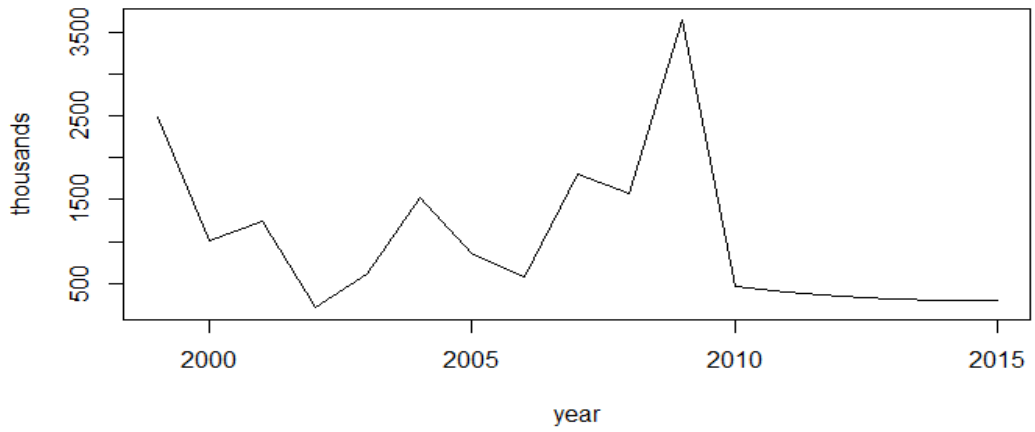


Source: Organized by the authors

In order to identify the behavior of the cash retentions of these companies, the historical data of this variable were analyzed. In a study carried out with US companies, Bates, Kahle and Stulz (2009) identified that these companies retained more cash between 1980 and 2006 and that such behavior was justified by the risk of cash flows and the increase in research and development costs. However, in a later study, Pinkowitz, Stulz and Williamson (2015) identified that after the 2008 economic crisis, the American organizations had a considerable reduction in their cash levels.

The study was motivated by the identification of this decrease in the retention of cash of the Brazilian companies, following the logic of the American market indicated by previous studies. As it can be seen in Figure 2, there was an abrupt drop in cash retention after the crisis of 2008, and between 2010 and 2015 this drop continued to happen, but in a smoother way. The crisis of 2014 may have affected this decline, but the structural breakdown has not been consistently noticed as doubts about the determinants of this decline in cash retention remained and whether corporate finance fundamentals can explain this phenomenon in the case of the 2008 crisis.

Figure 2 Brazilian Companies Cash retention between 1999 and 2015*



* Inflated by IGP-DI index.
Source: Organized by authors

To better understand the dynamic of the variables used, the descriptive statistics is presented in Table 2. As can be seen, all variables presented very close averages and medians, with the exception of the total assets, justifying the application of the logarithm in this variable. On average, the variation in cash is small, around 0.7%. The company's fixed assets, represented by CAPEX, represent around 5.66% of the total assets of the company.

Table 2 – Summary statistics of the variables used in the model

Statistic	Cash	Capex	Leverage	MB	Tax	Vol. CF	% Princ. share	Assets*
Average	0.007	0.057	34.47	2.131	0.023	-0.001	44.366	19600000.000
Medium	0.003	0.051	33.98	1.336	0.017	0.009	46.043	4546163.000
p10	-0.044	0.002	10.26	0.245	0.006	-0.050	13.783	652500.300
p25	-0.016	0.020	23.32	0.621	0.010	-0.012	23.934	1450849.000
p75	0.029	0.082	44.68	2.383	0.026	0.028	59.412	12700000.000
p90	0.063	0.126	55.70	4.145	0.045	0.059	78.585	33700000.000
Variance	0.004	0.005	305.65	25.816	0.001	0.066	59.585	$5.69x10^{15}$
Minimum	-0.277	-0.549	0.000	-17.710	-0.008	-6.990	0.000	16512.000
Maximum	0.654	0.473	97.43	99.246	0.339	1.069	100.000	932000000.000
S.Desv	0.063	0.071	17.483	5.081	0.025	0.256	24.410	75400000.000
Asymmetry	1.889	-0.457	0.348	11.163	5.677	-23.377	0.311	910148.000
Kutosis	24.545	18.371	3.325	183.938	54.331	641.417	2.405	9525661.000

* Inflated data to 2015, according to IGP-DI index.
Source: Organized by authors.

In terms of leverage, the outside capital represents, in average, 34.5% of the total asset. In the Market-to-Book, the market value exceeds in 2.13 the value of shareholders' equity, demonstrating that more leveraged companies have greater tax benefits. The volatility of the cash flow is around -0.11%, showing that companies do not have much variation in this item, reducing the uncertainties regarding the cash retention.

The studies related to the Brazilian market show that the main shareholder control structure is very high, varying around 44.37%, and the total assets of the company are, on average, R$ 19.6 billion, showing that Companies have a size that does not meet the market standards.

Finally, a correlation analysis was performed to identify if there is multicollinearity, that is, a very strong relation between the variables of the model. If any variable had a correlation

above 0.7 in relation to the others, it would have to be excluded from the study. No variables reached this level, and there was no need to suppress variables from the analysis. The results are presented as follow.

4.2 Analysis of the determinants of the decrease of the cash retentions.

In the second phase of analysis, the methodological procedures proposed by Hansen (1999) are adopted. According to this method, the division of the sample into classes, or regimes, is determined endogenously and arises as an option that can more accurately accommodate the heterogeneity of the individuals in the sample. The Size variable is set to the Threshold of the model. The procedure consists of verifying if there is evidence for the Threshold effect, considering the null hypothesis of non-existence of this effect and computing the p-values by means of the bootstrap technique, that is, the test is applied repeatedly until there is no more statistical evidence of the need for new subdivisions.

To define the number of thresholds for the estimation, the null hypothesis of a linear model against the alternative hypothesis of a Threshold effect model was checked. This test was accomplished sequentially for zero, one, two or three effects according to the procedure developed by Hansen (1999). It is evidenced that the most appropriate model is the double threshold, that means, the one that subdivides the sample into three regimes (1^{st}, 2^{nd} and 3^{rd}), according to the size.

It can be seen from Table 3 that the F test for double effect of the threshold was significant since the value of (F = 41.790) is higher than the Critical Value at 1%, and it presents a reduction of the sum of the squares of the errors in relation to the single threshold test. These results show that the model that considers three regimes for the cash variation is more appropriate and the value of the first threshold is 15.139 and the second threshold is 15,485.

Table 3 - Test for determining the threshold number

Threshold Effect	SSR*	*Threshold Value*	F	*p*-valor	Critical Value (5%)	Critical value (1%)
Single	2.800	15.139	37.660	0.000	26.360	28.499
Double	2.670	15.485	**41.790**	0.000	29.166	32.961

*SSR – Sum of the squares of the residuals
Source: Organized by authors.

In this way, the sample is divided in firms with size until the first threshold and the first regime contains firms with Size ≤ 15.139. In this regime, a total of 50% of the firms studied are concentrated, so up to this threshold there are the smallest companies in the sample. Between the value of the first and second threshold, 9.60% of the companies are concentrated (15.139 <Size ≤ 15.485), denominated intermediate companies in relation to the others. Finally, in the last analysis regime, companies with Size> 15.485 are present in 40.40% of the observations. After the identification of the regimes, Table 4 is presented with the results of the determinants of the cash change

Table 4 – Variation of the cash according to the regimes

Var.of Cash	Coefficient	Standard Desviation	P>|t|	[95% Confidence Interval]	
Transation: Leverage					
1º	0.000	0.000	0.405	0.000	0.001
2º	0.000	0.001	0.923	-0.001	0.001
3º	0.000	0.000	0.365	-0.001	0.000

Transation: Capex					
1º	**-0.294**	0.046	**0.000**	-0.385	-0.203
2º	**-0.815**	0.132	**0.000**	-1.074	-0.555
3º	-0.082	0.075	0.274	-0.228	0.065
Especulation: *Market-to-Book*					
1º	0.00	0.00	0.52	0.00	0.00
2º	0.00	0.00	0.49	-0.01	0.01
3º	0.00	0.00	0.11	0.00	0.01
Precautionary: Volatility of the Cash Flow					
1º	0.003	0.009	0.740	-0.014	0.020
2º	**0.600**	0.162	**0.000**	0.281	0.919
3º	**0.164**	0.065	**0.012**	0.036	0.293
Taxes: Taxation					
1º	**-0.443**	0.139	**0.002**	-0.717	-0.169
2º	0.174	0.557	0.754	-0.919	1.268
3º	**0.846**	**0.350**	**0.016**	0.158	1.534
Governance Problems: Majority Shareholder Participation					
1º	**0.070**	0.033	**0.036**	0.005	0.135
2º	**0.083**	0.045	**0.064**	-0.005	0.170
3º	-0.046	0.037	0.213	-0.120	0.027
Constante	0.006	0.018	0.758	-0.030	0.041
F test for all u_i=0:		F(143, 702) = 0.72		Prob > F = 0.9926	

Source: Organized by authors.

As it can be seen, in the first group of variables related to the transaction motive, the leverage is not significant in any of the regimes, and its coefficients had lower values, close to zero, identifying that this variable has no influence on the cash change. However, the other variable related to the transaction motive is significant in the two first regimes, indicating that the increase of 1% in capex generates a decrease in the cash variation of 0.29% for the smaller companies and 0.81% for the larger ones, both at 1% of significance. In spite of presenting negative relation, the third regime is not significative.

The variable that measures the speculation motive is the growth opportunities and is not significant in all analyzes, evidencing that the Market-to-Book does not decisively influence the cash retention of the analyzed companies. In the precautionary motive, analyzed through the volatility of the cash flow, the variable is positive and significantly related to the cash holding in the two last regimes. It is possible to verify that the increase of 1% in the volatility increases the cash flow by 0.60% for intermediate companies, at a level of significance of 1%, and 0.16% for the largest companies, at a level of significance of 5%. In this case, the smallest firms are not significantly affected by the cash variation.

Regarding the tax variable, related to the taxation motive, it presented different influences in the regimes, where the 1% increase in the fiscal debt benefit generates a decrease in the cash retention of 0.44% for the smaller companies, at a level of 1% and a 0.84% increase for the largest companies, at a significance level of 5%. For intermediate companies, this result is not significant. This difference can be explained by the fact that the tax benefit through the increase in financing only has an effect on the reduction of the cash variation for smaller companies, and for larger ones, this benefit is not so great as to affect this variable, what makes the firms focus on other determinants of cash variation.

Finally, it is considered that the control structure proxy to the governance problems is positively related to the cash retention in the two first regimes. It is possible to observe that an increase of 1% in the shareholder control concentration generates an increase in the cash variation of 0.07% to smaller firms, at a level of 5% of significance and 0.08% to the

intermediary firms, at a level of 10% of significance. This result is not significant to lower firms.

Table 5 – Effect of the theorical motive in a cash holding.

Theorical Motive	Expected signal	Regime	Significância Encontrada
H1: Transation	-	1º	- ***
		2º	- ***
		3º	n/s
H2: Speculation	+	1º	n/s
		2º	n/s
		3º	n/s
H3: Precautionary	+	1º	n/s
		2º	+ ***
		3º	+ **
H4: Taxation	-	1º	- ***
		2º	n/s
		3º	+ **
H5: Governance problems	+	1º	+**
		2º	+*
		3º	n/s

Note: ***, **, * indicate statistical significance at 1, 5 and 10 percent. n/s is non-significant relation.
Source: Organized by authors.

In Table 5, a summary table is drawn up with the expected effects and that were found in this study in relation to the decrease of cash of Brazilian companies in the post-crisis period. The following are some conclusions, the limitations and suggestions for further research.

5. Concluding Remarks

The article aims at analyzing the determinants of this phenomenon through the literature presuppositions related to the transaction, speculation, precaution, taxes and governance problems in Brazilian firms negotiated in BM&FBovespa. The result shows that transactions and taxation are the main reasons to the decrease in a cash retention for smaller firms. However, the reason related to precautionary to bigger firms and the governance problems to smaller firms showed positive relation to the cash variation.

Leverage was not statistically significant in any of the regimes analyzed, so it does not allow confirmation or rejection of the theory. Although the method employed allows a detailed analysis through the size of the companies, it is not possible to compare these results with researches such as Fazzari and Petersen (1993), which show that small firms are more prone to credit constraints than larger firms. Under this view that capital expenditures create assets that can be used as collateral to increase the capacity to contract debt and consequently reduce the demand for cash, CAPEX is negatively related to this variable in the first two regimes, corroborating with Almeida and Campello (2007), and not rejecting the first hypothesis (H1). This effect is not identified for larger companies, probably because they already have a basis that is strong enough not to rely on outside capital to determine the company's cash retention policy.

In analyzing the speculation motive, represented by the growth opportunities measured through the Market-to-Book, this variable is not significant in any of the three regimes, rejecting the second hypothesis (H2). Although the studies by Opler et al (1999) show that firms that have greater access to capital markets tend to maintain lower rates of money in relation to total assets, the results do not support this behavior. Therefore, it is not possible to confirm that the cash flow is used as a tool for companies to take advantage of opportunities with positive present value.

The empirical evidence on the precautionary motive, represented by the volatility of the cash flow, confirms the studies of Han and Qiu (2007) and Kim, Mauer and Sherman (1998) for the firms that are in the second and third regimes, bringing evidences for the rejection of the third hypothesis (H3). Therefore, an increase in the volatility of cash flow tends to increase the cash levels of the companies. Nevertheless, this assertion cannot be applied to the companies in the first regime, showing that, on average, they do not take consistent measures aiming at a reserve for contingencies.

In terms of the tax benefits of the debt, which served as a proxy for taxation, a peculiar result is evident. For smaller companies, the fourth hypothesis (H4) was not rejected since this variable is negative and significant, corroborating with Graham (2000, 2003), who states that companies with high taxation have more developed tax benefit policies, opting for more outside capital than cash retention. However, for larger companies, this hypothesis cannot be confirmed, although the result is significant. On the other hand, this finding is aligned with the theory of the Pecking Order proposed by Myers and Majluf (1984), which predicts that companies follow a hierarchy to make their investments, preferring to generate internal cash to make investments, even if the tax benefits are large.

From the perspective of the governance problems represented by the control structure of the main shareholder, a positive relationship was identified between this variable and the cash retention for the first two regimes, not rejecting the fifth hypothesis (H5) of this study. This result corroborates with Dittmar, Mahrt-Smith and Servaes (2003), who have found evidence to suggest that firms hold more cash in countries with greater agency problems. It is also aligned with Shleifer and Vishny (1997), who found that companies located in countries with weak legal protection to investors have difficulty in obtaining funds.

The empirical gain in the conduction of the analysis from the threshold methodology is evidenced, since it allowed the analysis of the coefficients in different regimes, surpassing the analysis of coefficients that were analyzed as if they were identical, therefore, it was drawn the detailed determinants of the decrease of cash in Brazilian companies, obtaining consistent results.

As limitations for the study, the very short period of analysis, marked by economic crises in Brazil can be considered. Also, there is a possibility that the relationship between the variables will be endogenous, damaging the results. For further research, it is suggested to increase the period of study and test other variables that may explain the variations of cash in Brazil. Another possibility would be to use different threshold measurements to separate the sample into regimes.

References

Almeida, H., Campello, M. (2007). “Financial constraints, asset tangibility, and corporate investment”, *Review of Financial Studies.* pp. 1429–1460.

Bates, T. W., Kahle , K. M., Stulz, R. M. (2009). “Why Do U.S. Firms Hold so Much More Cash than They Used To?”, *The Journal of Finance, **64*** (5), 1985-2021.

Baumol, W. (1952). “The Transactions demand for cash: an inventory theoretic approach”, *Quarterly Journal of Economics*.

Berle, A., Means, G. (1932). “The modern corporation and provate property”, New York: Macmillan, 1932.

Chung, K., Pruitt, Stephen (1994). “A Simple Approximation of Tobin's q”, *Financial Management*, 23, 70- 74.

Dittmar, A., Mahrt-Smith, J., Servaes, H. (2003). “Internacional Corporate Governance and Corporate Cash Holding”, *Journal of Financial and Quantitative analysis, **38***, 111-133.

Faulkender, M. W., Wang, R. (2006). “Corporate Financial Policy and the Value of Cash”, *Journal of Finance, **61***, 1957 - 1990.

Fazzari, S. M., Peterson, B. (1993). “Working capital and fixed investment: new evidence on finance constraints, *The Rand Journal of Economics*, **24**, 328- 342.

Foley, F., Hartzell, J. C., Titman, S., Twite, G. (2007). “Why do firms hold so much cash? A tax-based explanation”, *Journal of Financial Economics, **86***, 579-607.

Gompers, P. A., Ishii, J. L., Metrick, A. (2003). “Corporate governance and equity prices”. *The Quarterly Journal of Economics*, 107 - 155.

Graham, John R. (2000). “How big are the tax benefits of debt?”, *Journal of Finance*, **55**.

_____ (2003). “Taxes and corporate finance: a review. *The review of financial studies”*, 1075 - 1129.

Han , S., Qiu, J. (2007). “Corporate precautionary cash holdings”, *Journal of Corporate Finance*, 43-57.

Hansen, B. E. (2000). “Sample Splitting and threshold estimation”. *Econometrica*, 575 - 603.

Harford, J. (1999). “Corporate cash reserves and acquisitions”. *The journal of finance, **54***, 1969 - 1997.

Jensen, M. C., Meckling, W. H. (1976). “Theory of the firm: managerial behavior, agency costs and ownership structure”. *Journal of Financial Economics*, 305 - 360.

Keynes, J. M. (1936). “The general theory of employment, interest and money”. *McMillan, London.*

Kim, C. S., Mauer, D. C., Sherman, A. E. (1998). “The determinants of corporate liquidity: theory and evidence”. 335-359.

La Porta, R., Lopes-De-Silanes, F., Shleifer, A. (1999). “Corporate ownership around the world”. *The journal of finance*, 471 - 517.

Miller, M., Orr, D. (1966). “A model of the demand for money by firms”. *The Quarterly Journal of Economics*, 413 - 435.

Myers, S. C., Majluf, N. S. (1984). “Corporate financing and investment decisions when firms have information that investors do not have”. *Journal of Financial Economics* 187-221.

Opler, T., Pinkowitz, L., Stulz, R., Williamson, R. (1999). “The determinants and implications of corporate”. *Journal of Financial Economics, **52***, 3-46.

Peyer, U. C., Shivdasani, A. (2001). “Leverage and internal capital markets:evidence from leveraged recapitalizations”. *Journal of Financial Economics*, 477 - 515.

Pinkowitz, L., Stulz, R. M., Williamson, R. (2013). “Do U.S. firms hold more cash?” *Fisher College of Business Working Paper Series*.

Rochman, R. R., Dylewski, C. (2011). “Determinantes do nível de caixa das empresas: análise de amostra de países da América Latina” . *Anais do XXXV Encontro da Anpad*. Rio de Janeiro.

Saito, Richard., Silveira, Alexandre, M. (2008). “Governança corporativa: custos de agência e estrutura de propriedade. Revista de Administração de Empresas. 79 – 86.
Shleifer, A., Vishny, R. W. (1997). “A survey of corporate governance”. *The journal of finance*, 737 - 783.