

TRADITIONAL INDICATORS AND FLEURIET MODEL FOR LIQUIDITY MEASUREMENT IN THE TREASURY OF NON-FINANCIAL INSTITUTIONS IN TIMES OF CRISIS

Abstract

The purpose of this article is to identify the relevance of the indicators that measure the behavior of liquidity in treasury departments in times of recession. As for the objective, the article is descriptive, the technical procedures are seen as bibliographic / documentary, and with a quantitative approach. The study was based on a sample of publicly traded and non-financial companies between 2007 and 2016. The statistical tool used was the regression with panel data, being the dependent variables: NWC, WCR, and TB. Evidence shows that in times of economic recession, the liquidity levels of each company vary greatly. It is also shown that the variables debt capacity and cost of debt can influence liquidity levels. The importance of the study is related to liquidity in times of crisis and as well as the real needs of efficiency and control of the liquidity level in treasury management.

Keywords: Liquidity, Treasury, Financial Indicators, Crisis, Panel Data.

INTRODUCTION

Two crisis periods were identified in Brazil between 2008 and 2018, the first referring to the *subprime* crisis and the second referring to the fiscal crisis. Within the scenario of economic cycles, it is observed that companies increase their concern with the behavior and the impact of liquidity in the Treasury Departments, having as analysis criteria several types of traditional or dynamic indicators, and the reasons causing the increase or decrease in liquidity.

In this crisis scenario, business management considers the Treasury Management as an issue of its main concerns. On a cloudy outlook and a clear decrease in consumption companies face enormous difficulty in getting financing from the market and there is also the risk of poor collection. All of these factors are decisive for the Treasury Departments and emerge as a basic policy of financial risk management that impacts directly on businesses outcome.

One of the organizations main pillars is the financial performance, and one of the objectives is to achieve financial sustainability. Thus, institutions must constantly reexamine and improve the planning of financial resources, as a target for the liquidity balance in the short term. For, within business management, the financial cycle coordination is fundamental, since its result influences the companies' capital structure (Nascimento, Espejo, Voese & Pfitscher, 2016).

Several studies (Ferreira, Custodio & Raposo, 2005; Rogers, Rogers & Ribeiro, 2005; Han & Qiu, 2007; Frank & Goyal, 2009; Koshio & Nakamura, 2013; Loncan & Caldeira, 2014) approach the *trade-off* concept between the benefits and costs of excess or shortage of liquidity

since, during times of crisis it is essential to focus on early estimation of their obligations and rights, in order to fulfill the responsibilities avoiding the risks of default, bearing in mind that, in times of recession, an excessive drop in sales strongly impacts the liquidity of companies with inadequate capital structure, and may cause the end of the activities (Fleuriet, Kehdy & Blanc, 2003).

The purpose of this article is to understand how the 2008 financial crisis and the Brazilian economic crisis of 2014 alter, in some way, the usual liquidity model adopted in the Treasury Departments of non-financial companies, as well as to determine which are the liquidity indicators that best represent the Treasury Departments status.

The article's contribution consists in providing investors and the market with information on how crises affect companies and a more assertive understanding in the decision-making process about liquidity levels in the Treasury Department during times of crisis.

To achieve the proposed objective and provide theoretical and practical contributions, this article is divided into: introduction, theoretical framework, methodology, analysis of results on the proposed objective, in addition to the conclusion and suggestions for future research.

LITERATURE REVIEW

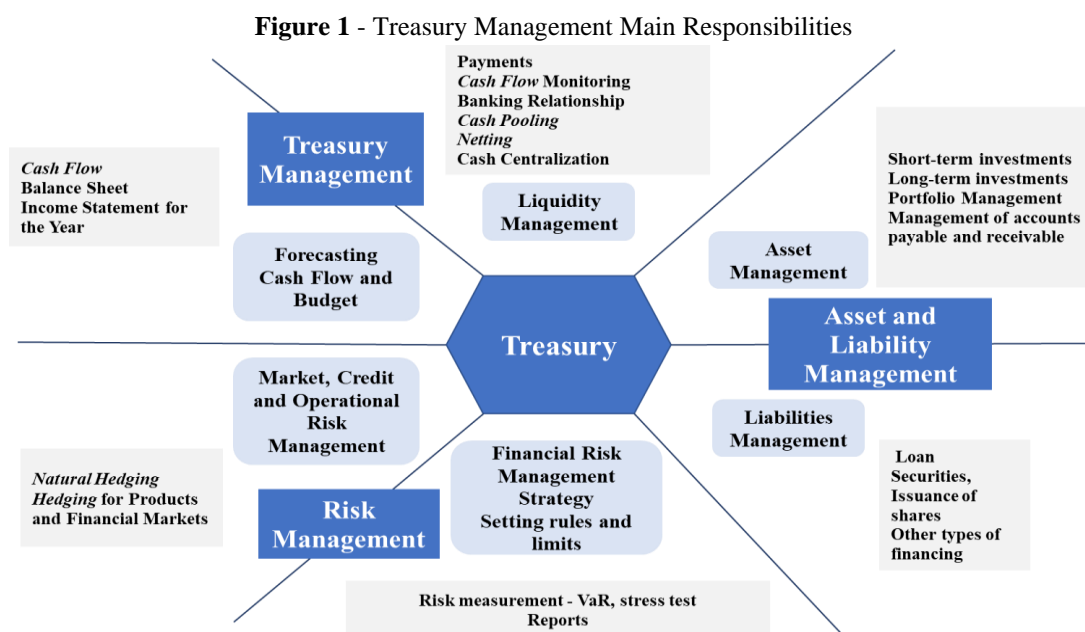
The literature review is organized in this topic, which is dedicated to the presentation of some fundamental concepts, among them: the management of the companies' Treasury Departments, addressing their main activities and concepts considered essential; the importance of cash management and how it is affected in times of crisis; the very definition of crisis (growth or recession); and the need for liquidity, which goes through its own issues within the subject.

Treasury Management

The Treasury Department of a company within its management way and its core activities encompasses issues related to liquidity. However, liquidity itself has its own inquiries, such as the concept definition for Treasury, and the importance of using indicators in a financial analysis.

For Montigelli (2010), Treasury is the momentary control of bank account balances, either national or international, and the ability in forecasting the payments and receipts flow. Thus, the evolution of cash resources, considering both, the access as well as the preservation of short, medium, and long-term funding sources, corroborate the Treasury essential goals (Hollein, 2010).

This scenario is proven when the Treasury refers to liquidity management, when investing the surpluses in case of superavit and capture the surpluses in case of deficit (Helliar & Dunne, 2004). Figure 1 summarizes the Treasury main activities.



Source: Adapted from Polak e Klusáček (2010).

In view of difficulties and limitations in the market and the dizzying pattern with which businesses thrive, it is essential for companies to have a consistent and efficient treasury management.

As a result, there are four basic principles (López Martínez, 2003; Torre, 1997): (i) positioning management, (ii) liquidity planning and control, (iii) management and control of banking conditions and (iv) risk management.

There is agreement that sufficient cash generation is essential for a company's survival. Thus, the Treasury is responsible for controlling financial information arising from all areas of the company. Treasury also shows its systemic view within organizations, as it manages and supervises the company's money (Zanchin, 2002).

In view of the highlights presented, it is concluded that the Treasury plays a key role in the companies' strategic decisions, ensuring the means and mechanisms essential for the strategies' conservation or facilitation.

Cash Management

One of the Treasury main features is to solve and control the cash management adversity, since the target is to give greater flexibility to the inputs compared to disbursements, thus optimizing the financial status and current obligations (Dalbello, 1999).

The optimal level of cash is one of the consequences of imperfect markets, as there is a need to balance the benefits and costs in order to maximize the company's value (Teruel & Solano, 2003).

It is evident that costs and uncertainties, resource limitations and market barriers are the boosters for a higher level of cash, as a means of survival in the financial market (Iturralde, Maseda & San-José, 2009; Morellec, Nikolov & Zucchi, 2013).

National studies present a different perspective, since, according to Forti, Peixoto and Freitas (2011), cash retention can be explained by two assumptions, with a positive relationship between: a) cash maintenance and performance; and b) cash maintenance and value of the company. In the words of Fresard (2010), these two pieces of evidence corroborate the existence of a set of benefits, both operational and strategic, in which companies that retain levels of available operating cash flows higher than their competitors can use their reserves to finance their operations.

However, this retention deserves to be highlighted, since American companies prefer to issue shares, following the *pecking order theory*. Thus, the retention of operating cash flows is equivalent to only a small part of the retentions (Bates, Kahle & Stulz, 2009; McLean, 2011).

For Forti, Peixoto and Freitas (2011), a high cash value was seen as a harmful practice to the profitability of organizations. However, crises and credit control policy, show that a more liquid balance sheet aims to avoid cash problems (Frésard, 2010).

In the executives' view, cash management is crucial, as there is an inevitability to seek a balance between risk and return, profitability, and liquidity, with the purpose of generating value for the company (Palombini & Nakamura, 2012).

Expansion and Recession Periods

The term economic cycles, according to the literature, is a method of determination of past economic gaps, in order to forecast or to develop long-term assumptions (Mello & Spolador, 2010).

According to Burns and Mitchell (1946), economic cycles can be characterized as a variability in countries' global economic activities. In other words, it is an oscillation of the economic movement around the tendency for long-term growth, which is often represented by GDP (Mello & Spolador, 2010).

The economic cycle includes changes in time, regarding the growth intervals, the stagnation, or the decline (Mello & Spolador, 2010). These are divisible into shorter periods, but they maintain a similar character and the same amplitude. The economic cycles duration, in turn, may vary from one year to ten / twelve years (Burns and Mitchell, 1946).

The recession is seen as a sequence of economic disturbances, a decline in asset values, failures of financial agents and a rupture in foreign exchange markets at the international level (Baxter & King, 1999).

According to the National Bureau of Economic Research (NBER, 2011), the recession is a considerable decline in a country activity which spreads quickly throughout the economy, impacting industrial production, employment, income, and retail and wholesale trade.

Within this context, some studies show the importance of understanding the of countries economic behavior and proposing scenarios regarding this behavior, and how these aspects can influence liquidity in companies' treasury and cash. Table 1 presents some studies referring to the theme and its main conclusions, considering that all these studies were carried out taking into account the level of cash or liquidity of companies.

Table 1 - Impact of Crisis on Treasury Departments

Authors	Year	Article	Study Period	Results
Korajczyk e Levy	2003	Capital Structure choice: Macroeconomic Conditions and Financial Constraints	1984 a 1998	The result is significant, that is, for companies with limited credit and cash, the macroeconomic outlook is fundamental
Ferreira, Custodio e Raposo	2005	Cash Holdings and Business Conditions	1996/2002	During the period there was an increase of USD 300 billion in company cash. This increase confirms the concerns of pecking order theory and also of the cash retention
Almeida, Campello e Liu	2006	The Financial Accelerator: Evidence from International Housing Markets	1970 a 1999	The observed consequence showed a trend in crisis periods for a raise in the organizations' cash level
Elkinawy e Stater	2007	Cash Holdings and Firm Value during Latin American Financial Crisis	1995/1999	Mexican, Argentine and Brazilian companies had an increase in the cash level, as a result of the crises in Mexico and Brazil
Chen	2009	Corporate Liquidity in Emerging Markets: a Retrospect of Asian Financial Crisis	1990 a 2006	Companies least affected were those with higher amounts of liquid assets. Thus, companies started to use the trade-off model as a tool to maintain liquidity
Álvarez, Sagner e Valdivia	2010	Liquidity Crises and Corporate Cash Holdings in Chile	1996 a 2009	It was found a dramatic decrease in liquidity in the period. The hypothesis is that the incident was due to the limitations in obtaining capital
Alimov e Mikkelsen	2010	Economic Conditions, Corporate Governance and the Value of Cash Holdings	2008/2009	During the crisis organizations prefer cash increase; cash availability is more valuable than foreign credit
Campello, Giambona, Graham e Harvey	2011	Liquidity Management and Corporate Investment during a Financial Crisis	2008/2009	It is indicated that credit lines soften the impacts of the crisis, but limit credit; there is a choice, that is, either cash reserves or investment

Source: Prepared by the authors (2018).

In summary, the organizations' cash is correlated with economic indexes, either in periods of expansion or in periods of recession. This denotes that the issues related to both, the

excess, and the constraint of capital, in the cash management, is a thermometer that characterizes the correct or incorrect liquidity management.

Liquidity

Liquidity is as important an aspect as Treasury, and these two aspects are linked together. To address liquidity, it is essential to discern it in two parts: corporate liquidity and financial assets liquidity (Famá & Grava, 2000).

Corporate liquidity is linked to the management way. In short, corporate liquidity denotes the ways to settle obligations with third parties within the agreed period, in addition to providing credibility and opportunity in the market, as well as discounts on transactions (Dalbello, 1999).

This liquidity that meets the payments within the agreed deadlines is called Effective or Dynamic Liquidity, which, for Dalbello (1999, p. 15) "admitting the rotations of each of the liquidity components, that is, how much each means of payment rotates, in daily averages, and how much is required, also in daily averages, for the payment needs".

According to Keynes (1937a; 1937b), in his studies to formulate *The General Theory*, four fundamental reasons for demanding liquidity can be identified. They are:

- i. *Transaction* - need for cash (money) for current personal or commercial transactions;
- ii. *Precautionary* - certainty as to the future cash (money) equivalent of a certain amount of total resources;
- iii. *Speculative* – obtaining profits through heavily liquid assets or not so strongly liquid assets, in order to predict the market and the future;
- iv. *Finance* - required liquidity between the planning of a determined expense and what it actually accomplishes.

The demand for liquidity can be justified by reasons of unpredictability in relation to economic events and in relation to the expected performance of past and present investments.

After further studies, two new motives were added to the original motives presented by Keynes. The first one is the Tax, which is defended by Foley, Hartzell, Titiman and Twite (2007); according to these authors, countries where the tax burden on resources repatriation is high, the cash levels in companies is significantly high.

The second motive is the Agency Conflict, where executives are not willing to distribute dividends to shareholders, providing an increase in cash even if there is no investment opportunity (Jensen, 1986). A development of Jensen's study is presented by Dittmar and Mahrt-Smith (2007), showing that low levels of corporate governance decrease companies' surplus cash, destroying the value.

According to Iturralde, Maseda and San-Jose (2009), the definition of greater or lesser liquidity must be decided by executives and shareholders, through costs and benefits. Organizations need to define a position on the trade-off between liquidity and profitability.

This trade-off is structured on two pillars, in Lameira's view (2005, p. 9), the first pillar: "the optimal amount of liquidity is an increasing function of the external financing cost, the volatility of cash flows, and the profitability of future investments". Also, according to Lameira (2005, p. 9), the second pillar: "it is a decreasing function of the spread between the return of physical assets and liquid assets".

The real importance and functionality of liquidity comes from the need to perform a "healthy" liquidity management. In the opinion of Sá (2004, p. 12) "the generation of liquidity is more important than the generation of profit since what breaks a company is not the lack of profit; is the lack of liquidity".

METHODOLOGY

Sampling and Data Collection

The companies listed in B3 (the main Stock Exchange in Brazil) were the population used, as they follow a high standard of information disclosure. With this population, the companies that make up the theoretical portfolio of Ibovespa were selected. This portfolio is related to the third four-monthly of 2017, that is, September, October, November, and December. The main source of data for this collection were the quarterly financial statements, obtained through the Economatica system and on the organizations' own website.

After this first selection, a new selection was proceeded using as a basis the non-financial domestic companies, that is, excluding all financial companies. This exclusion is justified by some particularities, the cash being one of them, according to Zani (2013), as its composition is also formed by deposits from customers whose function is to support their withdrawals.

Using a third filter, from 01/01/2007 to 12/31/2016, there are a total of 36 companies in the sample. This selection is mandatory, since the period of analysis between 2007 and 2016 is based on covering two crises, which will be represented by *dummy* variables in the model. Moreover, the choice of this time period covers the changes in the new economic matrix and macroprudential media, and it is based on covering a whole period before and after the fiscal crisis.

Table 2 presents the 36 companies and the relevant information about the sample

Table 2 - Sample of Companies

Company	Code	Segment B3	Economic Sector	Listing on B3	Ibovespa (%)
Ambev S/A	ABEV3	Beer and soft drinks	Non-cyclical consumption	Traditional	7,382
Bradespar	BRAP4	Metallic minerals	Basic materials	Level 1	0,477
Braskem	BRKM5	Petrochemicals	Basic materials	Level 1	1,022
BRF SA	BRFS3	Meat and meat products	Non-cyclical consumption	New Market	2,617
CCR SA	CCRO3	Highway exploration	Industrial goods	New Market	1,503
Cemig	CMIG4	Electricity	Public utility	Level 1	0,542
Copel	CPLE6	Electricity	Public utility	Level 1	0,198
CPFL Energia	CPFE3	Electricity	Public utility	New Market	0,095
Cyrela Realt	CYRE3	Buildings	Cyclic consumption	New Market	0,253
Ecorodovias	ECOR3	Highway exploration	Industrial goods	New Market	0,191
Eletrobras	ELET3	Electricity	Public utility	Level 1	0,430
Embraer	EMBR3	Aeronautical and defense equipment	Industrial goods	New Market	0,977
Energias BR	ENBR3	Electricity	Public utility	New Market	0,347
Engie Brasil	EGIE3	Electricity	Public utility	New Market	0,615
Equatorial	EQTL3	Electricity	Public utility	New Market	1,078
Gerdau	GGBR4	Steel Mill	Basic materials	Level 1	0,938
Gerdau Met.	GOAU4	Steel Mill	Basic materials	Level 1	0,247
JBS	JBSS3	Meat and meat products	Non-cyclical consumption	New Market	1,031
Klabin S/A	KLBN11	Paper And Cellulose	Basic materials	Level 2	0,781
Localiza	RENT3	Car rent	Cyclic consumption	New Market	0,842
Lojas Americanas	LAME4	Miscellaneous Products	Cyclic consumption	Traditional	0,845
Lojas Renner	LREN3	Fabrics, clothing and footwear	Cyclic consumption	New Market	2,032
Marfrig	MRF3	Meat and meat products	Non-cyclical consumption	New Market	0,234
Natura	NATU3	Personal use products	Non-cyclical consumption	New Market	0,427
Pão de Açúcar-Cbd	PCAR4	Food	Non-cyclical consumption	Level 1	0,925
Petrobras	PETR3	Exploration, refining and distribution	Oil, gas and biofuels	Traditional	3,677
Rumo S.A.	RAIL3	Rail transport	Industrial goods	New Market	1,236
Sabesp	Sbsp3	Water and sanitation	Public utility	New Market	0,947
Sid. Nacional	CSNA3	Steel Mill	Basic materials	Traditional	0,377
Suzano Papel	SUZB3	Paper And Cellulose	Basic materials	New Market	0,693
Taesá	TAE11	Electricity	Public utility	Level 2	0,334
Telef Brasil	VIVT4	Telecommunications	Telecommunications	Traditional	1,678
Tim Part S/A	TIMP3	Telecommunications	Telecommunications	New Market	0,812
Ultrapar	UGPA3	Exploration, refining and distribution	Oil, gas and biofuels	New Market	2,426
Usiminas	USIM5	Steel Mill	Basic materials	Level 1	0,372
Vale	VALE3	Metallic minerals	Basic materials	Level 1	8,977
Total					47,558

Source: Prepared by the authors (2018).

Analyzing this table, some important characteristics are noticed: segment, economic sector, and level listing. So, these segregation criteria are established according to B3. This sample percentage of participation in the Bovespa index is approximately equivalent to 48% of the Ibovespa.

Finally, the Economic Cycles Dating Committee and the Institute of Applied Economic Research were consulted to gather pieces of information that accurately detail the economic cycles in the country and make it possible to characterize the quarters in expansion or recession over the years.

Statistical Technique

The regression method chosen for this article is the panel data. This choice is due to the sample characteristics, that is, time series for several company observations and a large number of variables. According to Baltagi (2005), Gujarati and Porter (2017), the

results found in this model provide more explanatory data, of more variability, less collinearity in the samples, and more degrees of freedom and efficiency.

The approach is unbalanced, that is, the number of observations is not equal for all variables, thus characterizing a long panel, in which the number of time periods (T) is greater than the number of observations (N) in the cross section ($T > N$).

The choice of linear regression with panel data is mirrored in the possibility of explaining liquidity in Treasury Departments, considering the periods of recession. The dependent variable is the liquidity in the Treasury and the independent variables are the selected indicators, in addition to the variable binary to check the influence of the crisis.

Dependent Variable

The dependent variable, by definition, is the variable that is influenced by other variables (explanatory and binary). Accordingly, for the present study, liquidity is the dependent variable, which will be assessed in this study using three different metrics: Net Working Capital (NWC), Working Capital Requirement (WCR) or Treasury Balance (T).

Net Working Capital

The NWC can be interpreted by the disparity between current assets and current liabilities. However, there are questions and doubts regarding the liquidity information obtained through the NWC concept (Zanolla, Gartner, Silva & Scalco, 2014). For example, the interrelationships between current assets and liabilities that affect the accounts, highlight the fact that, in the opinion of Assaf Neto e Silva (2012, p. 20), “the assessment of liquidity based on the NWC value is not enough for more decisive conclusions”.

Working Capital Requirement

The WCR is a model for assessment of performance, whose objective is to separate the required investments in working capital and the means that companies use to finance these investments (Zanolla et al, 2014).

Both current assets and current liabilities are reclassified in this assessment model, thus distinguishing between the financial and the operational part, showing the features of each in the Balance Sheet. Accordingly, the difference between operating current assets (OCA) and operating current liabilities (OCL) results in the WCR, which includes only operational elements. From this perspective Melo and Coutinho (2007, p. 3), state “that the WCR is a function that has the same size as the Financial Cycle”.

According to Fleuriet (2005), one of the most fundamental aspects of the WCR model is the issue of liquidity and its relationship with the Operating Cash Flow (OCF), and one can reason that working capital is the soul of the business. Following this reasoning, Assaf Neto and Silva (2012) claim that working capital is paramount for companies' operational performance.

Treasury Balance

According to Araújo, Oliveira Costa and Camargos (2013), the T calculation is made as from the checking between the accounts of current financial assets (CFA) and the accounts of current financial liabilities (CFL). For Assaf Neto and Silva (2012), the Treasury Balance represents the remaining of the long-term resources available for financial investments, serving as a financial *buffer* for organizations.

Thus, this indicator is able to determine the organizations' behavior and their state of financial liquidity, serving as a support and a guide in periods of economic cycles.

Explanatory Variables

Explanatory variables can be described as those that, independently, influence the dependent variable, so that the dependent variable behavior can be explained via explanatory variables.

In view of the financial index's variety, 21 indicators frequently used for the purpose of measuring liquidity were tested. A description of the coefficients is found below in Table 3.

Table 3 - Financial indicators

Código	Indicators	Formula	Autors
X1	Current liquidity	CA / CL	Silva Brito and Assaf Neto, 2008
X2	Immediate liquidity	AVAILABILITY / CL	Silva Brito and Assaf Neto, 2008
X3	Debt coverage with cash	(CL + NCL) / OCF	Silva Brito and Assaf Neto, 2008
X4	Short-term debt coverage with cash	CL / OCF	Silva Brito and Assaf Neto, 2008
X5	Debt coverage using Ebitda	ND / EBITDA	Silva Brito and Assaf Neto, 2008
X6	Third party capital participation	TPC / SE	Silva Brito and Assaf Neto, 2008
X7	Composition of indebtedness	CL / (CL + NCL)	Silva Brito and Assaf Neto, 2008
X8	Total indebtedness	(CL + NCL) / CA	Silva Brito and Assaf Neto, 2008
X9	Return on equity	NI / ASE	Silva Brito and Assaf Neto, 2008
X10	Return on assets	NI / ATA	Silva Brito and Assaf Neto, 2008
X11	Operational margin	EBIT / NSR	Silva Brito and Assaf Neto, 2008
X12	Cost of debt	FE / LFL	Silva Brito and Assaf Neto, 2008
X13	Net working capital	CA – CL	Fleuriet, Kehdy and Blanc, 2003
X14	Working Capital Requirement	(OCA – OCL)	Fleuriet, Kehdy and Blanc, 2003
X15	Treasury balance	(CFA – CFL)	Fleuriet, Kehdy and Blanc, 2003
X16	Treasury balance on sales	(CFA – CFL) / NSR	Iudícibus, 2017
X17	Net treasury	(CFA – CFL) – OR	Iudícibus, 2017
X18	Treasury flow	FTV – ITV	Iudícibus, 2017
X19	Operating cash flow on assets	OFC / CA	Silva Brito and Assaf Neto, 2008
X20	Operating cash flow over total liabilities	OCF / (CL + NCL)	Silva Brito and Assaf Neto, 2008
X21	Operating cash flow on financial debt	OCF / (CFL + LTL)	Silva Brito and Assaf Neto, 2008

Notations: CA - Current Assets; CFA - Current Financial Assets; OCA - Operating Current Assets; TA - Total Assets; ATA - Average Total Assets; TPC - Third Party Capital; ND - Net Debt; FE - Financial Expense; OR - Other Receivables; AVAILABILITY - CCE - Cash and Cash Equivalent; LFL - Loans and Financing Liabilities; OCF - Operating Cash Flow; EBIT - Earnings Before Interest and Income Tax; NI - Net Income; CL - Current Liabilities; NCL - Non-current Liabilities; OCL - Operating Current Liabilities; CFL - Current Financial Liabilities; LTL - Non-current Financial Liabilities (*long-term liability*); SE - Shareholders Equity; ASE - Average Shareholders' Equity; NSR - Net Sales Revenue; ITV - Initial Treasury Value; FTV - Final Treasury Value.

Source: Prepared by the authors (2018).

The selected indexes were divided into 8 groups where CL (Current Liquidity) and IL (Immediate Liquidity) are liquidity indicators that measure ability to meet immediate and short-term obligations, comparing realizable rights and liabilities. The CDC (Cash Debt Coverage) and STDC (Short-Term Debt Coverage) are debt coverage indicators with cash, which measure the time to pay off short-term debt and total debt. The DSCE (Debt Service Coverage) is an indicator that measures debt coverage using EBITDA, which would be the ability to pay the company's onerous debts after the restructuring. The variables TPCP (Third Party Capital Participation), the IC (Indebtedness Composition) and the TI (Total Indebtedness) are capital structure indicators, which has the function of assessing the company's indebtedness level.

The profitability coefficients ROE (Return on Equity), ROA (Return on Assets), OM (Operating Margin), and CD (Cost of Debt) assess the results generated by the company. The next ones, NWC (Net Working Capital), WCR (Working Capital Requirement) and TB (Treasury Balance) are indicators of dynamic analysis, which assess the companies' financial needs. The indexes TBS (Treasury Balance on Sales), NT (Net Treasury) and TF (Treasury Flow) assess treasury state, in certain periods. Finally, OCFA (Operating Cash Flow on Assets), OCFTL (Operating Cash Flow over Total Liabilities) and OCFFI (Operating Cash Flow on Financial Indebtedness) are cash flow indicators that measure the resources generated by operating activities.

Dummy Variable and Exogenous Variable

Binary variables, also known as *dummy* variables, indicate the presence or absence of a certain characteristic. In this article, the characteristic is the crisis influence, and for the proper achievement and writing of the article *dummies* were built for the periods of expansion as well as periods of recession (CODACE, 2009).

Table 4 describes the expansion and recession quarters during the analysis period, in which the recession periods are represented as a *dummy* variable equal to one, and

expansion periods are represented as a *dummy* variable equal to zero (CODACE, 2017). The acronym "Dumc" was used to indicate the variable.

Table 4 - Annual and quarterly chronology of Economic Cycles

Year	1° quarter	2° quarter	3° quarter	4° quarter
2007	Expansion	Expansion	Expansion	Expansion
2008	Expansion	Expansion	Expansion	Recession
2009	Recession	Expansion	Expansion	Expansion
2010	Expansion	Expansion	Expansion	Expansion
2011	Expansion	Expansion	Expansion	Expansion
2012	Expansion	Expansion	Expansion	Expansion
2013	Expansion	Expansion	Expansion	Expansion
2014	Expansion	Recession	Recession	Recession
2015	Recession	Recession	Recession	Recession
2016	Recession	Recession	Recession	Recession

Source: CODACE (2017).

Still a recent methodology in Brazil, but according to the Dating Committee of Economic Cycles - CODACE itself (2009), "form of organization and method of work [...] follows the model adopted [...] by the National Bureau of Economic Research".

Thus, another method of analysis that assists and supports the statements on periods of expansion or recession is the analysis of the quarterly variation of Gross Domestic Product. As it can be seen in Table 5, the actual values of the quarterly GDP (accumulated 12 months) of the years used in this paper, represent this new exogenous variable that indicates the growth or decline of the quarterly Gross Domestic Product, following the methodology of the Institute of Applied Economic Research .

Table 5 – Actual Quarterly GDP (% a.a.)

Year	1° quarter	2° quarter	3° quarter	4° quarter
2007	5,2	6,5	5,9	6,6
2008	6,2	6,3	7,0	1,0
2009	-2,4	-2,2	-1,2	5,3
2010	9,2	8,5	6,9	5,7
2011	5,1	4,6	3,5	2,5
2012	1,7	1,0	2,5	2,5
2013	2,8	4,1	2,8	2,4
2014	3,2	-0,8	-1,1	-0,7
2015	-2,0	-3,0	-4,5	-5,9
2016	-5,4	-3,6	-2,9	-2,5

Source: IPEA (2017).

With this additional analysis, it is confirmed that the methodology used, CODACE - Economic Cycle Dating Committee, is able to validate what happened to the

Brazilian economic cycles and, therefore, is an index for assessments of expansion or recession.

Given the above, it is proposed the use of six regressions with panel data. That is, two regressions for each dependent variable NWC (Net Working Capital), WCR (Working Capital Requirement) and TB (Treasury Balance) in which the crisis situations will be tested in the first moment through the *dummy* “Dumc” and in a second moment through the real quarterly GDP (% per annum - p.a.).

Thus, it is sought to contribute to the most appropriate determination of liquidity measurement, focused on decision making in Treasury. In view of the variables available: dependent, explanatory, and binary, the following regressions are proposed:

1. $NWC = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} WCR + \beta_{14} TB + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} Dumc + \varepsilon_{pt}$
2. $WCR = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} NWC + \beta_{14} TB + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} Dumc + \varepsilon_{pt}$
3. $ST = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} NWC + \beta_{14} WCR + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} Dumc + \varepsilon_{pt}$
4. $NWC = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} WCR + \beta_{14} TB + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} GDP + \varepsilon_{pt}$
5. $WCR = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} NWC + \beta_{14} TB + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} GDP + \varepsilon_{pt}$
6. $NWC = \alpha + \beta_1 CL + \beta_2 IL + \beta_3 CDC + \beta_4 STDC + \beta_5 DSCE + \beta_6 TPC + \beta_7 CE + \beta_8 TI + \beta_9 ROE + \beta_{10} ROA + \beta_{11} OP + \beta_{12} CD + \beta_{13} NWC + \beta_{14} WCR + \beta_{15} TBS + \beta_{16} NT + \beta_{17} TF + \beta_{18} OCFA + \beta_{19} COET + \beta_{20} OCFOL + \beta_{21} GDP + \varepsilon_{pt}$

Being,

α = intercept;

ε_{pt} = error term.

RESULTS AND DISCUSSION

Initially, the observations covering the period from 01/01/2007 to 12/31/2016, were placed in the GRETL software and underwent quantitative procedures. It is noteworthy that, for all models and tests, the significance level (α) is 5%. A descriptive statistic on the variables was prepared, using 777 observations for the years 2007 to 2016,

showing the mean (average), median, standard deviation, minimum and maximum of the data.

Table 6 - Variables Descriptive

Variable	Observations	Mean (Average)	Median	Standard Deviation	Minimum	Maximum
CL	777	1,797664	1,538808	2,006636	0,176780	34,699153
IL	777	0,602984	0,408662	0,889592	0,000023	11,241021
CDC	777	5,394829	3,114995	64,240234	-1823,903811	1262,779561
STDCC	777	1,996441	1,038621	11,961037	-243,354551	283,903153
DCE	777	8,022477	6,753413	15,181024	-213,339945	238,990924
TPCP	777	2,185923	1,437554	2,921162	0,025344	43,823803
CI	777	0,385957	0,362747	0,176842	0,017871	0,998743
TI	777	0,592579	0,589366	0,152595	0,024718	0,977690
ROE	777	3,552016	3,273513	7,573639	-109,149518	50,228245
ROA	777	1,375774	1,338113	2,124900	-20,450008	12,497080
OP	777	19,519573	16,706965	22,440431	-266,260959	168,223041
CD	777	0,301249	0,212874	0,342566	-0,746498	5,148348
NWC	777	0,000000	-0,296148	1,000000	-1,236993	8,025327
WCR	777	0,000000	-0,360157	1,000000	-1,140042	5,904177
TB	777	0,000000	-0,145446	1,000000	-2,503571	9,035034
TBS	777	0,023474	0,028055	0,243097	-2,273003	1,888256
NT	777	0,000000	0,171979	1,000000	-5,901505	5,569012
TF	777	0,000000	-0,000614	1,000000	-8,765126	10,675904
OCFA	777	0,263164	0,178552	0,279643	-0,204778	2,365524
OCFIL	777	0,465791	0,299202	0,486726	-0,347183	3,202858
OCFFD	777	0,914609	0,483141	1,348002	-0,404076	20,050049
GDP	777	2,02	2,50	4,02	-5,90	9,20

Source: Prepared by the authors (2018).

The information in Table 6 provide the sample characteristic. The three variables (NWC - Net Working Capital, WCR- Working Capital Requirement and TB – Treasury Balance) have undergone *standardization*, which means that they have become standard. This standardization was necessary to achieve comparability between variables measured in different units, the liquid treasury (net cash) and the cash flow were also *standardized*.

The standardization used was the normalization, $X_{norm(i,j)} = \frac{X_{(i,j)} - \bar{X}_j}{S(X_j)}$, which causes the variables have a mean (average) of zero and standard deviation equal to one. Therefore, it can be concluded that the standard elements enable comparability, since they have no size and are highlighted in uniformity of standard deviation.

Table 7 shows the results of the statistical tests used for each of the equations. The tests used were: the Chow test (checks the model stability estimated by structural changes over the estimation period); the Breusch-Pagan test (checks whether the random effects model is more suited to the panel analysis than the *pooled* least squares model) and the Hausman test (checks whether, with respect to the panel under study, the random effects model is more appropriate than the fixed effects model).

Table 7- Regression Methods

	$\alpha = 5\% (0,05)$			Regression Methods
	Chow Test	Breusch-Pagan Test	Hausman Test	
	<i>Pooled</i> vs Fixed Effects	<i>Pooled</i> vs Random Effect	Random Effect vs Fixed Effects	
Equation 1 (NWC and CODACE)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,0417	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 9,74E-15	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 < 0,254401	Random Effect
Equation 2 (WCR and CODACE)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 < 0,0750	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 1,96E-15	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,003080	Pooled Effect
Equation 3 (TB and CODACE)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,0252	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 9,77E-24	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 8,77E-13	Fixed Effect
Equation 4 (NWC and GDP)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,0382	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 2,08E-14	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 < 0,164581	Random Effect
Equation 5 (WCR and GDP)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 < 0,0718	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 3,65E-15	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,001343	Pooled Effect
Equation 6 (TB and GDP)	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 0,0242	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 3,03E-23	H0 = $\alpha < p$ -value H1 = $\alpha > p$ -value 0,05 > 1,46E-13	Fixed Effect

Source: Prepared by the authors (2018).

In Equations 1 and 4 the random effect method is applied, where the intercept varies for each individual, but not over time (Fávero, 2013). In Equations 2 and 5, the *pooled* effect method is selected, in which behavior is uniform for all individuals and over time, and the observations are homogeneous (Gujarati and Porter, 2017). And finally, in Equations 3 and 6 the assertive method is the fixed effect, which aims to control the effects of omitted variables that vary between individuals and remain constant over time (Fávero, 2013).

Regressions for Net Working Capital (NWC)

Table 8 shows a comparison between the significant variables of the regressions. It was adopted 5% for significance level.

Table 8 - Comparative Regression 1 versus Regression 4

Regression 1: NWC - CODACE				Regression 4: NWV - GDP			
Variable	Coefficient Beta	P-Value	Sig.Level	Variable	Coefficient Beta	P-Value	Sig.Level
Const	0,116254	5,73E-92	***	Const	0,108875	4,73E-87	***
CI	-0,056789	1,44E-05	***	CI	-0,060641	2,95E-06	***
WCR	0,750752	0,0000	***	CD	0,015050	0,0296	**
TB	0,547795	0,0000	***	WCR	0,751350	0,0000	***
TBS	-0,015839	0,0384	**	TB	0,547751	0,0000	***
CODACE	-0,010324	0,0004	***	TBS	-0,016018	0,0355	**
				GDP	0,001226	0,0065	***
R²		0,998753		R²		0,998763	
Sig. of the Model		0,000000		Sig. of the Model		0,000000	
Stat. F		3,535660		Stat. F		1,237110	
P-value		0,060440		P-value		0,266375	

Significance Level: * indicates 10%, ** indicates 5%, *** indicates 1%.

Source: Prepared by the authors (2018).

The variable Debt Composition (DC) shows negative coefficients in the two regressions, being statistically significant at 1%, 5% or 10%. The result found makes sense since the increases in Current Liabilities (CL) are greater than the increases in Non-Current Liabilities (NCL), since the value of CL directly impacts the result arising from the Net Working Capital (NWC).

The positive coefficient found in Regression 4 for the Cost of Debt (CD) is consistent with the expected, since one of the ways to obtain liquidity in treasury is got through loans, financing, or investments. This borrowing, financing or investment entails an increase in financial expenses (installment payments, interest, fees or service charges) for companies.

In turn, the variables Working Capital Requirement (WCR) and Treasury Balance (TB) showed positive coefficients and were statistically significant for all the three levels. This result shows that the higher the WCR and / or the TB of a company, the higher the NWC value will be. The result was expected, as the NWC analyzes the difference between Current Assets and Current Liabilities. This indicator can be defined as a sum between the WCR and the TB since the WCR assesses the operational part of the current assets and liabilities, and the TB analyzes the financial part of the current assets and liabilities.

For the sample and in both regressions, the variable Treasury Balance on Sales (TBS) shows a negative coefficient. The result was in line with the Fleuriet Model, as the Treasury Balance will become increasingly negative with the rapid growth in sales, which is characterized as the “Scissors Effect”. This effect shows a mismatch between the evolution of available long-term sources and the investments that need to be financed, showing an increasing dependence on short-term resources to finance the company's activities (Fleuriet, Kehdy & Blanc, 2003).

The exogenous variable, GDP, showed a positive coefficient and had an expected response, being statistically significant at 1%, 5% and 10%. This positive relationship must be connected to the fact that the variable is linked to some aspects, including consumption and investment. In other words, increased consumption provides greater revenue for companies and the investment by companies is elastic in relation to sales revenues.

The *dummy* used to capture the crises effect has a negative result. This variable has significance at the three levels. According to the coefficient obtained, downturns in the economy would have resulted in a reduction of liquidity in the treasury, exposing one

of the crises impacts that, at first, may cause a decrease in liquidity in the treasury resulting from a fall in economic activity .

Regressions for Working Capital Requirement (WCR)

The comparative between regressions can be seen in Table 9, where WCR is shown as a dependent variable. With significance level of 5%.

Table 9 – Comparative Regression 2 *versus* Regression 5

Regression 2: WCR - CODACE				Regression 5: WCR - GDP			
Variable	Coefficient Beta	P-Value	Sig.Level	Variable	Coefficient Beta	P-Value	Sig.Level
Const	-0,162678	1,65E-12	***	Const	-0,138206	3,72E-21	***
CL	0,007697	0,0315	**	CI	0,071568	0,0243	**
CI	0,066120	0,0321	**	CD	-0,028825	0,0376	**
NWC	1,320740	3,69E-54	***	NWC	1,319790	7,97E-54	***
TB	-0,719634	3,18E-43	***	TB	-0,717702	3,89E-42	***
CODACE	0,013795	0,0309	**	GDP	-0,001642	0,0488	**
R ²		0,996883		R ²		0,996890	
Sig. of the Model		0,000000		Sig. of the Model		0,000000	
Stat. F		3,888880		Stat. F		3,885600	
P-value		0,056786		P-value		0,056885	
Durbin-Watson		1,516706		Durbin-Watson		1,522717	

Significance Level: * indicates 10%, ** indicates 5%, *** indicates 1%.

Source: Prepared by the authors (2018).

The variable Current Liquidity (CL) has a positive coefficient for Regression 2, showing significance only for 5% and 10%. The result depicts that in the short term, companies' rights are higher than obligations, which highlights a financial clearance possible after settlement of liabilities.

In Regression 5, the Cost of Debt (CD) has a negative value, which confirms the expected from the variable in the liquidity studies, since the temporary increase in liquidity in treasury, through loans and financing to meet the obligations due, also provides an increase in liabilities. This type of liquidity brings with it an increase in financial expenses, which may cause a decrease in the liquidity itself and an increase in corporate insolvency. The variable Composition of Indebtedness (CI) showed positive values for the two regression estimates, showing relevance only for 5% and 10%.

The result shows that the companies' indebtedness is directed to an operational need, so that increased liquidity in Working Capital Requirement (WCR) is a fact generated by the operational investments, raising the percentage of the non-current liabilities (NCL) compared to current liabilities (CL).

The analysis of the variables Net Working Capital (NWC) and Treasury Balance (TB) presented results expected by the Fleuriet Model. In both results, the variables

showed a significant value for the three levels addressed. Since the WCR is a part that makes up the variable NWC, that is, a positive correlation, this only confirms the fact that the higher the NWC index, the higher the WCR, and the inverse also applies. In relation to the TB, there is a negative correlation, whose value resulting from the financial part of the current assets and current liabilities impacts the WCR in reverse, corroborating the scissors effect fact.

The variable GDP in Regression 4 presented a negative coefficient with significance at 5%. This result proved to be as expected, since the increase in GDP is caused by an increase in economic activity in the country, that is, when there is more capital circulating in the economy, in order to make it easier for companies to obtain capital from third parties.

This result may occur because there is a capital shortage in the economy, leading to periods of decline in GDP, that is, an economic recession. This event brings many difficulties for organizations. One of these difficulties is the smaller possibility of borrowing and financing through the market. When this alternative is discontinued, solutions for organizations become scarcer. One of the solutions is to interrupt investments and new projects, in such a way that capital can return to the treasury cash to reinforce liquidity in times of crisis.

The variable CODACE - Dating Committee of Economic Cycles (binary), proved to have a positive coefficient with respect to Regression 2, having a 5% significance. This finding is a second reflex provided by the crises, as an increased liquidity in the treasury is fostered by investments postponement which had been already authorized before the crisis, so that, in not making these investments, such funds are held in cash for future opportunities.

Another point highlighted to support the liquidity increase in times of crisis is the rise in interest rates, an action practiced by the government as a possible measure, depending on the type of crisis. For companies, the interest rates increase may be an opportunity to reap gains from debt securities, in order to mitigate operating losses.

Regressions to Treasury Balance (TB)

Table 10 performs a collation, where the significant variables of each regression are found. For a 5% level of significance.

Table 10 - Comparative Regressions 3 *versus* Regressions 6

Regression 3: ST - CODACE				Regression 6: ST - GDP			
Variable	Coefficient Beta	P-Value	Signif. Level	Variable	Coefficient Beta	P-Value	Signif. Level
Const	-0,201274	5,73E-48	***	Const	-0,191660	2,17E-45	***
CI	0,131982	4,89E-05	***	CI	0,132499	4,91E-05	***
NWC	1,516080	2,57E-279	***	NWC	1,516460	2,19E-278	***
WCR	-1,061080	8,67E-186	***	WCR	-1,060730	6,70E-185	***
TBS	0,042984	0,0024	***	TBS	0,042012	0,0031	***
NT	0,143731	1,11E-26	***	NT	0,143663	1,91E-26	***
TF	0,006023	0,0354	**	TF	0,006124	0,0331	**
CODACE	0,020089	5,41E-05	***	GDP	-0,002531	0,0010	***
R²		0,996037		R²		0,996007	
Model Sig.		0,000000		Model Sig.		0,000000	
F Statistic		0,685389		F Statistic		1,63938	
P-value		0,408006		P-value		0,200816	
Durbin-Watson		1,610598		Durbin-Watson		1,599044	

Significance Level: * indicates 10%, ** indicates 5%, *** indicates 1%.

Source: Prepared by the authors (2018).

The coefficient of Composition of Indebtedness (CI) presented positive coefficients for the two regressions, demonstrating relevance to the three levels of significance. The result makes it evident that the companies' Composition of Indebtedness is for an operational need, and therefore the increase in the Treasury Balance (TB) liquidity is brought on by financial investments. Thus, an explanation for this behavior would be an increase in the values of Operating Current Liabilities (OCL) in relation to Financial Current Liabilities (FCL), so that a decrease in FCL provides a TB growth.

The indicators of Net Working Capital (NWC) and Working Capital Requirements (WCR) were statistically significant for all the three levels, and for the Fleuriet Model and for the Liquidity Theory, the results are in line with expectations. Considering that TB is a part of the NWC index, it can be said that this fact confirms that the higher the NWC, the greater the TB, and the reverse situation is also valid. In the relationship involving WCR, there is a negative correlation, the value of which is a result of the operating part of current assets and liabilities. Such a result affects the TB in an opposite way, reaffirming the status of the WCR coefficient being negative.

For both regressions, the Treasury Balance on Sales (TB) indicator had a positive and significant coefficient for the three levels. The result was expected as this variable is a TB derivation which is the variable dependent of the model. So, the higher the TB value, the greater the Treasury's financial liquidity.

The variable Net Treasury (NT) shows a positive coefficient for the three levels of significance in both regressions. This result is within the expected, as the indicator measures the organizations' gap or financial exposure, so, the identification of financial slack in companies is a sign of increased liquidity in the treasury.

The analysis of the Treasury Flow (TF) identifies relevance for the three levels of significance and positive coefficients, as predicted by the Fleuriet Model. This positive index correlation can be explained by the basic function of the TF, which is the verification of changes in the TB from one period to the next.

Regarding GDP and the CODACE index, the explanations developed for regressions 2 and 5 are also accepted in the case of regressions 3 and 6. In other words, GDP had a negative coefficient and CODACE had a positive value, and the existence of a difference was evident, that is, for regressions 3 and 6 the two variables were statistically relevant for the values of 1%, 5% and 10%.

CONCLUSIONS

This paper sought to analyze the behavior of treasury liquidity in times of crisis, and this liquidity measurement through indicators. Periods of recessions lead to the reduction of capital circulating in the market, limiting the funds raising by organizations. During the economic cycles, an increase in the treasury liquidity (operational and financial) was statistically verified by the three dependent variables NWC, WCR and TB.

Thus, with this evidence it can be said that periods of crisis impact negatively or positively the cash level in organizations. This statement is confirmed by the study carried out by Álvarez, Sagner and Valdivia (2012), in the sense that in times of recession organizations do not reach the ideal level of cash in the treasury, that is, there is always an oscillation between a fall and a rise in the cash, and a rise and fall in the cash.

Liquidity concepts indicate the importance of having the ability to pay the obligations in due time, where the equity resources supply the payment needs. Based on statistical data, Regressions 1 and 4 are more in line with operational and financial liquidity as they present elements that may indicate current and / or future liquidity situations. In other words, the variables Composition of Indebtedness (CI) and Cost of Debit (CD) are determinants in the liquidity level, as there is a negative association between short and long term debts (CI) and cash liquidity (NWC); In addition, the market capitalization reflected by the cost of debt at first may be positive indicating increased liquidity, but at some point its increase will impact the reduction of cash liquidity (NWC),

that is, an inverted U curve (Locan & Caldeira, 2014). The variable Treasury Balance on Sales (TBS), being negative, corroborates in identifying that there is a scissors effect, possibly due to the increase in indebtedness; this effect represents a high need for working capital and a decrease in the treasury balance (Assaf Neto & Silva, 2012).

The 2008/09 period is marked by a reliability crisis between organizations and the financial market and this scenario has resulted in a need for liquidity in terms of transactions, that is, the evidence shows an increase in leverage and indebtedness / financing ratios, and a drop in liquidity ratios. As elucidated by Almeida and Campello (2007) companies leveraged themselves with third-party capital (banks or governments) to support their operational transactions, using assets as collateral for financing, thereby reducing the need for cash retention.

With regards to the fiscal crisis period from 2014 to 2016, the precautionary aspect found in the liquidity reasons is present in the findings, the prolonged effects of the crisis on the economy creating an adverse scenario, where there is an urgent short-term cash need. What, according to Bates, Kahle and Stulz (2009), has conditioned the companies to maintain a high level of cash to hedge against financial and economic storms, and to honor payments.

The limitations to this study refer first to the use of the CODACE index for periods of recession / expansion, without applying the difference between the periods. As a solution to this issue, it is necessary to use time series to highlight the impact and differences between periods of expansion and recession. Still regarding the limitations of this study, there was a sample of only 36 companies on the Ibovespa, which could be mitigated by an increase in the sample within the B3 list itself, or even conducting a study to other countries, would have the probability of evidencing new information.

As a suggestion for future work, the inclusion of other exogenous variables is recommended, such as the exchange rate, taxes, *US T-bond*, interest rate, reserves, inflation and public debt, moreover other endogenous aspects of companies, such as mergers and acquisitions, investments, and *hedge*. It is also suggested to apply it in other emerging and developed countries, which in a way is fundamental for a comparative analysis between the results obtained, as well as the testing of other more refined econometric methods to measure treasury liquidity in economic cycles.

Finally, this work concluded that the treasury balance (cash balance) in periods of fluctuations (crisis) decreases and increases depending on the company's liquidity policy,

and that the treasury liquidity must be checked, taking into account operational and financial aspects.

REFERENCES

Alimov, A.; & Mikkelsen, W. (2010). Economic Conditions, Corporate Governance and the Value of Cash Holdings. *In: ASIAN FINANCE ASSOCIATION INTERNATIONAL CONFERENCE*, Paper presented, China, 2010.

Almeida, H.; Campello, M.; & Liu, C. (2006). The financial accelerator: evidence from international housing markets. *Review of Finance*, 10(3): 321-352. <http://dx.doi.org/10.1007/s10679-006-9004-9>

Almeida, H.; & Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *The Review of Financial Studies*, 20(5): 1429-1460. <http://dx.doi.org/10.1093/rfs/hhm019>

Álvarez, R.; Sagner, A.; & Valdivia, C. (2012). Liquidity crises and corporate cash holdings in Chile. *The Developing Economies*, 50(4): 378-392. <http://dx.doi.org/10.1111/j.1746-1049.2012.00180.x>

Araújo, E. A. T.; De Oliveira Costa, M. L.; & De Camargos, M. A. (2013). Mapeamento da produção científica sobre o Modelo Fleuriet no Brasil. *Gestão Contemporânea*, (14): 311-347.

Assaf Neto, A.; & Silva, C. A. T. (2012). *Administração do Capital de Giro*. 4ª ed. São Paulo, Atlas, 259 p.

Baltagi, B. H. (2013). *Econometric analysis of panel data*. 5ª ed. New York, John Wiley & Sons.

Bates, T. W.; Kahle, K. M.; & Stulz, R. M. (2009). Why do US firms hold so much more cash than they used to?. *The Journal of Finance*, 64(5): 1985-2021. <https://doi.org/10.1111/j.1540-6261.2009.01492.x>

Baxter, M.; & King, R. G. (1999). Measuring business cycles: approximate band-pass filters for economic time series. *The Review of Economics and Statistics*, 81(4): 575-593. <http://dx.doi.org/10.1162/003465399558454>

Burns, A. F.; & Mitchell, W. C. (1946). *Measuring Business Cycles*. National Bureau of Economic Research – NBER books.

Campello, M.; Giambona, E.; Graham, J. R.; & Harvey, C. R. (2011). Liquidity management and corporate investment during a financial crisis. *The Review of Financial Studies*, 24(6): 1944-1979. <http://dx.doi.org/10.1093/rfs/hhq131>

Chen, N. (2009). Corporate liquidity in emerging markets: a retrospect of Asian financial crisis. In: CONFERENCE ON THE THEORIES AND PRACTICES OF SECURITIES AND FINANCIAL MARKETS, XVII, 2009. Anais... China. <https://ssrn.com/abstract=1594625>

Comitê de Datação de Ciclos Econômicos - CODACE. (2009). *Comunicado de Criação do CODACE e Datação de Ciclos Trimestrais Brasileiros*. Instituto Brasileiro de Economia – IBRE. Fundação Getúlio Vargas, Brasil. Available in: <https://portalibre.fgv.br/data/files/A8/62/69/5D/6529A610CABD1A968904CBA8/Comite%20de%20Data%20de%20Ciclos%20Economicos%20-%20IBRE-FGV%2027.05.09.pdf>. Access in: 13/10/2017.

Comitê de Datação de Ciclos Econômicos - CODACE. (2017). *Tendências Econômicas*. Instituto Brasileiro de Economia – IBRE. Fundação Getúlio Vargas, Brasil. Available in: <http://portalibre.fgv.br/main.jsp?lumChannelId=4028808126B9BC4C0126BEA1755C6C93>. Access in: 13/10/2017.

Dalbello, L. (1999). *A Relevância do uso do Fluxo de Caixa como ferramenta de gestão financeira para avaliação da liquidez e capacidade de financiamento de empresas*. 1999, 202 f. Master's Thesis, Universidade Federal de Santa Catarina, Florianópolis, Brasil.

Dittmar, A.; & Mahrt-Smith, J. (2007). Corporate governance and the value of cash holdings. *Journal of Financial Economics*, 83(3): 599-634. <http://dx.doi.org/10.1016/j.jfineco.2005.12.006>

Elkinawy, S.; & Stater, M. (2007). Cash holdings and firm value during Latin American financial crisis. *Loyola Marymount University*. Web Site. Los Angeles.

Famá, R.; & Grava, J. W. (2000). Liquidez e a teoria dos elementos causadores de insolvência. *Caderno de Pesquisas em Administração*, 1(12): 10-21.

Fávero, L. P. P. (2013). Dados em painel em contabilidade e finanças: teoria e aplicação. *BBR-Brazilian Business Review*, 10(1).

Ferreira, M. A., Custodio, C.; & Raposo, C. C. (2005). Cash holdings and business conditions. *ISCTE Business School*, 1-43. <http://dx.doi.org/10.2139/ssrn.608664>

Fleuriel, M. J., Kehdy, R.; & Blanc, G. (2003). *O modelo Fleuriel: A dinâmica financeira das empresas brasileiras*. (1ª ed). Rio de Janeiro, Elsevier.

Fleuriel, M. J. (2005). Fleuriel's Rebuttal to "Questioning Fleuriel's Model of Working Capital Management on Empirical Grounds". *SSRN*, 1-8. <http://dx.doi.org/10.2139/ssrn.741624>

Foley, C. 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(3): 579-607. <https://doi.org/10.1016/j.jfineco.2006.11.006>

Forti, C. A. B., Peixoto, F. M.; & Freitas, K. S. (2011). Retenção de caixa, desempenho operacional e valor: um estudo no mercado de capitais brasileiro. *Revista de Contabilidade e Organizações*, 5(13): 20-33. <http://dx.doi.org/10.11606/rco.v5i13.34802>

Frank, M. Z.; & Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important?. *Financial management*, 38(1), 1-37. <http://dx.doi.org/10.1111/j.1755-053X.2009.01026.x>

Fresard, L. (2010). Financial strength and product market behavior: The real effects of corporate cash holdings. *The Journal of Finance*, 65(3): 1097-1122. <http://dx.doi.org/10.1111/j.1540-6261.2010.01562.x>

Gujarati, D. N.; & Porter, D. C. (2017). *Econometria Básica*. 5ª ed. Porto Alegre, McGraw Hill.

Han, S.; & Qiu, J. (2007). Corporate precautionary cash holdings. *Journal of Corporate Finance*, 13(1), 43-57. <http://dx.doi.org/10.1016/j.jcorpfin.2006.05.002>

Helliar, C.; & Dunne, T. (2004). Control of the treasury function. *Corporate Governance: The international journal of business in society*, 4(2): 34-43. <http://dx.doi.org/10.1108/14720700410534958>

Hollein, M. (2010). The treasurer as chief liquidity officer. *Journal of Corporate Treasury Management*, 4(1): 28-34.

Instituto de Pesquisa Econômica Aplicada – IPEA. (2017). *Banco de Dados - Série PIB trimestral real (% a.a.)*. Brasília, Brasil. Available in: <http://www.ipeadata.gov.br>

- Iturralde, T.; Maseda, A.; & San-Jose, L. (2009). The cash management routines: Evidence from Spain. *Frontiers in Finance & Economics*, 6(1): 93-117. <http://dx.doi.org/10.2139/ssrn.728365>
- Itudícibus, S. D. (2017). *Análise de Balanços*. (11^a ed). São Paulo, Atlas.
- Keynes, J. M. (1937a). The General Theory of Employment. *The Quarterly Journal of Economics*, 51(2): 209-223. <http://dx.doi.org/10.2307/1882087>
- Keynes, J. M. (1937b). Alternative Theories of the Rate of Interest. *The Economic Journal*, 47(186): 241-252. <http://dx.doi.org/10.2307/2225525>
- Korajczyk, R. A.; & Levy, A. (2003). Capital structure choice: macroeconomic conditions and financial constraints. *Journal of Financial Economics*, 68(1): 75-109. [http://dx.doi.org/10.1016/S0304-405X\(02\)00249-0](http://dx.doi.org/10.1016/S0304-405X(02)00249-0)
- Koshio, S.; & Nakamura, W. T. (2013). Efeitos de risco de mercado e regime de caixa sobre a relação liquidez-rentabilidade. *Práticas em Contabilidade e Gestão*, 1(1).
- Lameira, L. D. (2005). *Determinantes do nível de liquidez das firmas brasileiras*. 2005, 51 f. Master's Thesis, Fundação Getúlio Vargas, Rio de Janeiro, Brasil.
- Lind, M.; Bergström, P.; & Andersson, K. (2007). The role of key performance indicators for corporate treasury. *Journal of Corporate Treasury Management*, 1(2): 125-132.
- Loncan, T. R.; & Caldeira, J. F. (2014). Capital structure, cash holdings and firm value: a study of Brazilian listed firms. *Revista Contabilidade & Finanças*, 25(64), 46-59. <https://doi.org/10.1590/S1519-70772014000100005>
- López Martínez, F. J. (2003). *Manual de cash management. Cómo obtener beneficios manejando mejor su dinero*. (4^a ed). Bilbao, Deusto.
- Mclean, R. D. (2011). Share issuance and cash savings. *Journal of Financial Economics*, 99(3): 693-715. <https://doi.org/10.1016/j.jfineco.2010.10.006>
- Melo, A. C.; & Coutinho, E. S. (2007). O modelo Fleuriet como indicador conjunto de solvência e rentabilidade. In: *Encontro da ANPAD, XXXI, Anais*. Rio de Janeiro.
- Mello, P. C. D.; & Spolador, H. (2010). *Crises Financeiras: quebras, medos e especulações do mercado*. (3^a ed). São Paulo, Saint Paul Editora.
- Montigelli, S. (2010). A crossroads of liquidity management and technology: Treasury's time is now. *Journal of Corporate Treasury Management*, 3(4): 358-367.

Morellec, E.; Nikolov, B.; & Zucchi, F. (2013). Competition, Cash Holdings, and Financing Decisions. *Swiss Finance Institute Research Paper*, no. 13-72. <http://dx.doi.org/10.2139/ssrn.1364009>

Nascimento, C. D., Espejo, M. M. D. S. B.; Voese, S. B.; & Pfitscher, E. D. (2016). Estrutura financeira de empresas nas perspectivas tradicional e dinâmica de análise do capital de giro em meio à crise financeira de 2008. *RIC-Revista de Informação Contábil*, 10(1): 59-77.

National Bureau of Economic Research – NBER. (2017). *Information on Recessions and Recoveries, the NBER Business Cycle Dating Committee, and related topics*. Cambridge. Available in: <https://www.nber.org/cycles/main.html>.

Palombini, N. V. N.; & Nakamura, W. T. (2012). Key factors in working capital management in the Brazilian market. *Revista de Administração de Empresas*, 52(1): 55-69. <http://dx.doi.org/10.1590/S0034-75902012000100005>

Polak, P.; & Klusáček, I. (2010). *Centralization of Treasury Management*. (1^a ed). Dzerzhynsky, Business Perspectives.

Rogers, P.; Rogers, D.; & Ribeiro, K. C. (2005). Risco, retorno e liquidez na administração de caixa: integração do Modelo de Miller-Orr com a probabilidade de exaustão dos recursos líquidos. In: *Asamblea Consejo Latino Americano de Escuelas de Administracion (CLADEA)*, XL, Anais... Santiago do Chile.

Silva Brito, G. A.; & Assaf Neto, A. (2008). Modelo de classificação de risco de crédito de empresas. *Revista Contabilidade & Finanças-USP*, 19(46): 18-29. <https://doi.org/10.1590/S1519-70772008000100003>

Teruel, P. J. G.; & Solano, P. M. (2003). La Tesorería en la empresa y sus determinantes. *Instituto Valenciano de Investigaciones Económicas, SA (Ivie)* (19).

Torre, L. J. (1997). *Manual de Tesorería*. Madrid: Ed. Instituto Superior de Técnicas y Prácticas Bancarias.

Zani, T. B. (2013). *Restrição financeira e preferência pela liquidez: a volatilidade como determinante para retenção de disponibilidades*. 2013, 89 f. Master's Thesis, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.

ZANCHIN, R. 2002. *A gestão de tesouraria e sua interface com as estratégias financeiras das empresas de pequeno porte do setor metal-mecânico de Caxias do Sul*. Caxias do Sul, RS. Dissertação de Mestrado. UFRGS, 112 p.

ZANOLLA, E.; GARTNER, I. R.; SILVA, C. A. T.; SCALCO, P. R. 2014. Indicadores de liquidez e o fluxo de caixa operacional: um estudo nas empresas brasileiras de capital aberto. *Contabilidade, Gestão e Governança*, 17(2): 137-151.