

Impact of the cash position on the performance of Brazilian companies during periods of economic recession

Impacto da posição de caixa na *performance* das empresas brasileiras em períodos de recessão econômica

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Abstract

Purpose: This study aims to analyze if, during periods of economic recession, the cash position impacts the performance of Brazilian companies. In addition, it seeks to identify if there are differences in the intensity of such relationships for the different sectors in which companies operate.

Originality/value: The appropriate management of a company's cash position is key for the maintenance of its financial health in the long term. This subject is particularly relevant for emerging countries, such as Brazil, considering the track record of frequent economic recessions. Such economic recessions lead to the deterioration of the companies' operating results and shortage of credit facilities, negatively affecting the companies' liquidity. In the last decade, studies have been discussing the relevance of the companies' cash position to improve their performance in periods of financial constraint.

Design/methodology/approach: To develop this study, a sample composed of 200 Brazilian companies listed on B3 was used, grouping information from the period between 2013 and 2016, organized in a balanced dynamic panel.

Findings: The results obtained through regressions indicate that there is a positive and statistically significant relationship between cash position and the performance of the companies, measured by the return on assets (ROA) – but not by the market to book ratio –, and it was also identified that the sector in which the company operates has a moderating factor on the intensity of such a relationship.

Keywords: cash position, performance, recession, panel data, sector





Resumo

Objetivo: O presente trabalho analisa se, em momentos de recessão econômica, a posição de caixa tem impacto na *performance* das empresas brasileiras. Além disso, busca-se identificar se há diferenças na intensidade dessa relação para os diferentes setores de atuação das empresas.

Originalidade/valor: A adequada gestão da liquidez das empresas é fundamental para a manutenção da sua saúde financeira e para a sua sustentabilidade econômica em longo prazo. Esse tema é especialmente importante em países emergentes, como o Brasil, que tem um histórico de frequentes recessões econômicas. As recessões levam à piora dos resultados operacionais das empresas e à escassez de linhas de crédito, e, portanto, afetam negativamente a liquidez das companhias. Na última década, tem sido discutida a importância do uso de caixa pelas empresas para melhorar sua *performance* em períodos de restrição financeira.

Design/metodologia/abordagem: Para desenvolver este estudo, foi utilizada uma amostra de 200 empresas listadas na B3, agrupando informações do período de 2013 a 2016, organizadas em um painel dinâmico balanceado.

Resultados: Os resultados obtidos por meio das regressões indicam que há relação positiva e estatisticamente significativa entre a posição de caixa e a *performance* medida pelo ROA (mas não pelo *market to book*). Identificou-se também que o setor de atuação da empresa modera a intensidade dessa relação.

Palavras-chave: posição de caixa, *performance*, recessão, dados em painel, setor



INTRODUCTION

Studies related to the retention of cash positions by companies have been evolving, and conclusions have been changing throughout the years. According to the classic theory, the maintenance of a high cash position with no specific need is detrimental to companies. It poses inefficiencies to the financial management since there are financial costs and opportunity costs involved in carrying such a cash position, not creating value to shareholders (Jensen, 1986, 1987). However, in accordance with the modern theory, a high cash position is important to ensure that companies have liquidity when there are uncertainties or risks related to future cash generation or to provide companies with the capacity to make quick investment decisions (George, 2005; Han & Qiu, 2007; Harford et al., 2013; O'Brien & Folta, 2009).

This subject gained additional relevance during the 2008 global financial crisis (Almeida et al., 2014), when the United States' financial institutions were hit by the subprime mortgage crisis and, facing significant losses, significantly reduced the offer of credit to companies, which had to rely on their own funds to fulfill their financial obligations and fund their operations (Adjei, 2013).

As stated by Iquiapaza and Amaral (2008), cash management must be a priority for companies that face financial constraints when their own or third-party capital is not available at a reasonable cost. The Brazilian market has these characteristics: 1. concentrated financial market – according to the Brazilian Central Bank (Banco Central do Brasil, 2017) data, the four largest banks in Brazil are responsible for 75% of the total credit market; 2. capital markets still not fully developed (Rocca, 2018); and 3. a track record of frequent financial recessions (Sicsu, 2019). Thus, we believe that Brazilian companies should maintain a high cash position as a financial management tool.

Therefore, this study aims to identify whether a high cash position positively impacts the performance of Brazilian companies in periods of economic recession. Also, we assessed if the sector in which companies operate moderates the relationship between cash position and performance. Compared to similar studies, our study innovates by using different variables to measure performance and assess a period of financial recession, besides focusing on the Brazilian market. Studies such as Adjei (2013) analyze the impact of cash position on the profitability of companies, while we also analyzed its impact on the share price of companies. Fresard (2010), in turn, focused on the companies' growth, not on analyzing a specific period of financial recession.

To develop this study, the database of Economatica was used, encompassing 200 listed Brazilian companies. The methodology applied to this work was based on multiple linear regression with data organized on a balanced dynamic panel. The results indicate that when the performance of the companies is measured based on return on assets (ROA) (but not on the market to book ratio), there is a positive and statistically relevant relationship between the companies' cash position and their performance. It was also identified that the sector in which companies operate moderates the intensity of such a relationship.

RELATED LITERATURE AND HYPOTHESES

Theories related to cash position

Cash is the set of financial resources held by companies, immediately available for use. According to Almeida et al. (2014), cash is the main instrument of liquidity management used by companies. The importance of the maintenance of cash position by companies has been discussed since Keynes (1936), aiming at not missing investment opportunities when they are presented. The amount of cash retention is determined by a series of conditions faced by the companies, such as cash flow volatility, investment opportunities, or access to credit (Opler et al., 1999).

By balancing costs and benefits, companies should maintain a cash position just enough to cover their transaction needs (Ferreira & Vilela, 2004). Amongst the benefits, there is the reduction of transactional costs and the maintenance of a financial buffer to preserve the company from any market adversity or to fund investments. In turn, the main cost mentioned is the opportunity cost (explicit and implicit costs) in maintaining unused financial resources as cash instead of investing them in projects or investments with positive returns. Jensen (1986) argues that any funds in addition to the companies' optimal cash level generate financial inefficiencies. One of the central aspects of the author's study is related to the agency cost, which refers to the agent (companies' manager) being able to use the company's cash surplus for their own benefit instead of investing in projects that could generate positive results (wealth) to the principal (shareholder). Based on The Free Cash Flow Theory, the author mentions that companies must maintain a cash position that is just enough to meet their short-term financial obligations and to invest in projects that create value (positive net present value)



for the company. If the company is managed in an efficient way and seeks to maximize shareholders' value, any positive cash flow should be distributed to shareholders in the form of dividends.

The Pecking Order theory (Myers, 1984), based on the assumption of asymmetry of information between the companies' management and market agents, suggests that companies follow a hierarchical order to fund their investments, namely: 1. the use of their retaining earnings (earnings that remain in the company in the form of cash of financial investments); 2. debt; and 3. attraction of new equity. Cash would play a moderating factor between the company's retained earnings and investment needs. Myers (1984) demonstrated that, from 1973 to 1982, 62% of the capital investments performed by United States' companies were financed by the companies' own cash position.

However, Almeida et al. (2014) argue that the perception of the costs and benefits of maintaining a high cash position can vary depending on the company, the sector in which it operates, and the market conditions, and, thus, it may significantly change management's understanding related to the optimum level of cash position for a given company.

The 2008 global financial crisis and its impacts on the companies, such as the reduction in the credit offered by the financial institutions, contributed to the development of new approaches to this subject, with a particular focus on the relationship between the maintenance of a high cash position and performance of the companies. In this regard, Nason and Patel (2016) argue that there are costs and benefits for companies in maintaining a high cash position and that, during periods of recessions, these effects are more pronounced. If, on the one hand, the maintenance of a high cash position protects companies, on the other, it prevents companies from investing in new business opportunities.

Empirical evidence

Given the relevance of this subject to the liquidity management of the companies, research indicates that 1. there are determinant factors in the maintenance of cash position, such as growth opportunities, investments in research and development, cash flow volatility, precautionary and macroeconomic factors (Chen & Mahajan, 2010; Dutra et al., 2018; Ferreira & Vilela, 2004; Harford et al., 2008; Opler et al., 1999; Ozkan & Ozkan, 2004; Ranajee & Pathak, 2019), and 2. there are costs and benefits for companies in maintaining high cash position (Kim & Bettis, 2013). The precautionary factors





were also observed in Brazilian companies by Carracedo (2010), Iquiapaza and Amaral (2008), and Manoel et al. (2017), who concluded that cash management is a priority for companies facing financial constraints. Opler et al. (1999) focused their study on United States' companies, Ozkan and Ozkan (2004) researched companies in the United Kingdom, Ferreira and Vilela (2004) studied companies in the European Monetary Union (EMU) countries, while Ranajee and Pathak (2019) researched companies in India. The conclusions of the first three studies are similar, pointing out that the company's cash position is positively related to companies' growth opportunities and investments. However, Ranajee and Pathak (2019) did not find evidence related to the Indian companies' growth opportunities. All the studies identified that companies that operate in sectors with higher volatility over cash flows tend to preserve a higher position in liquid assets, such as cash. Although MacKay and Phillips (2005) point out the higher importance of the specific characteristics of companies, they also found evidence of the relevant role of the sector in which the company operates to explain the firm's capital structure.

In Brazil, Carracedo (2010) concluded that a company's cash position is related to the amount of short-term debt that the company has, and, therefore, the main reason for maintaining a high cash position is precaution. Dutra et al. (2018) observe that this motivation is only relevant to sizable companies. Iquiapaza and Amaral (2008) and Manoel et al. (2017) concluded that cash management must be a priority for companies facing financial constraints when their own resources or third-party funding are not available at a reasonable cost.

Simutin (2010) demonstrates that companies maintain cash reserves in anticipation of investments that promote growth. Kim and Bettis (2013) confirm this conclusion and state that a high cash position plays a relevant role as a strategic asset since it can be used by companies to ensure the continuity of investments in research and development, contributing to innovation.

Regarding the impact of cash position on the performance of companies, Deb et al. (2017), Faulkender and Wang (2006), Fresard (2010), Mikkelsen and Partch (2003), and O'Brien and Folta (2009) argue that the maintenance of a high cash position is positively related to the performance (measured mainly by ROA) and market value of companies (measured by the Tobin's Q or the market to book) and generates value to shareholders. This occurs mainly when cash is held and used for the company's adaptation to a number of market situations that can lead to investment needs or pressure their liquidity. Deb et al. (2017) determined three situations in which adaptation



is most relevant: fierce competition, industry growth, and intensity of research funding and investments.

Several studies analyzed the companies' cash position and its determinants and impact on performance during the 2008 global financial crisis. Adjei (2013) argues that during the recession, companies' cash generation capacity is compromised. Thus, companies must rely on their cash position or external funds – which, in recession periods, are scarce and expensive – to finance their operations. For that study, the author used the companies' cash position in 2006 – the last fiscal year before the recession, which started in August 2007 – and compared the 2006 company's ROA and the 2008 company's ROA. In this case, the reduction in the ROA was more intense for companies with low cash positions before the recession than for companies with high cash positions, meaning that the firms' performance was indeed impacted, but on different levels depending on the cash position held prerecession. The author concluded that cash reserves help firms to maintain better financial health and reduce bankruptcy risks during recession. Chang et al. (2017) assessed the impact of maintaining a cash position before and after the 2008 global financial crisis and found evidence that the maintenance of a cash position adds more value during the crisis and for companies with deeper financial constraints. Nason and Patel (2016) affirm that the value that the cash position adds depends on the amount of cash held. Chen et al. (2018) analyzed companies with financial constraints and found evidence that those that held excess cash presented higher returns and lower bankruptcy risks after the 2000 and 2008 crises in the United States' market. They also found learning evidence, meaning that companies that were affected due to the lack of cash position in the 2000 recession presented a higher level of cash balance before the 2008 recession.

Overall, the existing literature related to the relationship between the companies' cash position and performance is based mainly on studies focused on the United States' market, and there is little research on this subject focused on the Brazilian market. Forti et al. (2011), relying on Fresard (2010), studied Brazilian companies listed between 1995 and 2009 and identified that performance, measured by ROA and market value (market to book ratio), was positively affected by the company's cash position. This conclusion is similar to Pamplona, Silva, and Nakamura's (2019), who concluded that financial slack positively impacts performance, measured by ROA, return on equity (ROE), and return on sales. Pamplona, Silva, Nakamura, and Rodrigues Junior (2019) also found similar evidence pointing out differences in this relationship between family-owned and non-family companies.



However, there are few studies, such as Adjei (2013), that researched this relationship in periods of recession. Although Pamplona, Silva, and Nakamura (2019) and Pamplona, Silva, Nakamura, and Rodrigues Junior (2019) have also used a recent set of data, there was no special attention to recession periods. In Brazil, the focus of this study, economic recessions, is frequent. According to data from the Comitê de Datação de Ciclos Econômicos – Codace (Fundação Getulio Vargas, 2021), since 1980, Brazil has been through nine periods of recession, the last one being the most intense, lasting from the second quarter of 2014 to the last quarter of 2016 – and its impacts remained until 2017. Table 1 details the periods of economic recession and expansion that Brazil has been through from 1981 to 2016. This track record suggests that Brazil faces, on average, one period of recession every four years.

Considering that the Brazilian companies' access to credit is more restricted than that of companies in developed markets, Brazilian companies face the risk of a lack of access to credit to fund their working capital, investments, or even to refinance maturing debt, mainly in periods of economic recession. In line with the results obtained by Opler et al. (1999) and Harford et al. (2008), it is expected that Brazilian companies held a high cash position as a precaution to protect themselves from occasional recessions that could impair their future cash generation and their capacity to access credit to fund their operations or refinance existing debt.



Table 1
Quarterly timeline of the Brazilian business cycle

Period	Recessions			Expansions		
	Duration in # of quarters	Accumulate growth from peak to valley	Quarterly growth average (annualized)	Duration in # of quarters	Accumulate growth from peak to valley	Quarterly growth average (annualized)
1Q 1981 to 1Q 1983	9	-8.5%	-3.9%	17	30.0%	6.4%
3Q 1987 to 4Q 1988	6	-4.2%	-2.8%	2	8.5%	17.7%
3Q 1989 to 1Q 1992	11	-7.7%	-2.9%	12	19.2%	6.0%
2Q 1995 to 3Q 1995	2	-2.8%	-5.6%	9	8.0%	3.5%
1Q 1998 to 1Q 1999	5	-1.1%	-0.9%	8	7.3%	3.6%
2Q 2001 to 4Q 2001	3	-0.9%	-1.1%	4	5.2%	5.2%
1Q 2003 to 2Q 2003	2	-1.5%	-3.0%	21	30.2%	5.2%
4Q 2008 to 1Q 2009	2	-5.1%	-10.0%	20	22.5%	4.1%
2Q 2014 to 4Q 2016	11	-8.0%	-3.0%	12	5.1%	1.7%

Source: Fundação Getúlio Vargas (2021).

Hypotheses

In this context, this study has the purpose of analyzing the relationship between the cash position of Brazilian companies and their performance during periods of economic recession. It is also observed whether the sector in which the companies operate is a moderating factor for the intensity of the relationship between the company's cash position and its performance. This study is based on the methodologies used by Adjei (2013), Forti et al. (2011), Fresard (2010), and Talberg et al. (2008).

According to Keynes (1936), the maintenance of cash poses both transaction and precautionary benefits. As precautionary benefits, cash enables companies to invest in business opportunities even in moments of volatility in cash flow generation or periods of crisis when third-party funds are scarce (Opler et al., 1999), and the transactional benefits are related to higher liquidity, fewer efforts needed to raise funds, and lower cost of debt (Keynes, 1936). Thus, the expectation is that a positive relationship exists between the maintenance of an elevated cash position and the companies' performance during periods of economic recession, as, in these situations, it is expected that companies that have higher liquidity have greater bargaining power when negotiating with suppliers and clients, so that these companies would have more access to credit under more reasonable terms (Ivashina & Scharfstein, 2010).

- H1: During periods of economic recession, the greater the cash position, the better the performance of Brazilian companies.

It is important to note that the impact of cash position on the companies' performance may vary according to the sector in which they operate. According to the theory proposed by Maksimovic et al. (1999), differences in the predictability of costs and demand between the different sectors end up determining different capital structures for companies. As stated by Talberg et al. (2008), each sector experiences a different economic and competitive environment. For example, a sector that is naturally more volatile and that has uncertain cash flows or a sector that is more intense in capital investments may benefit from the maintenance of a higher cash position than a sector with lower volatility or less capital investments. Therefore, it is expected that the moderating factor played by the sector in which the companies operate will be confirmed.

- H2: The sector in which companies operate moderates the relationship between cash position and performance.

METHODOLOGY

This section of the study presents the data, variables, and methodology used to test the hypotheses elaborated in the previous section.

Database

The period analyzed in this study was determined based on the methodology adopted by Adjei (2013), who established as the starting point the fiscal year ended immediately before the economic recession, aiming to observe the evolution of the companies' results during the entire period of the recession, and, as the final point of analysis, the author used the fiscal year of the recession. Considering that, according to Codace (Fundação Getulio Vargas, 2021), the most recent economic recession in Brazil started in the second quarter of 2014 and lasted until the fourth quarter of 2016, this study analyzes data from 2013 to 2016 (four years).

The sample was extracted from the Economatica database. At first, information from all the 340 companies listed on the São Paulo Stock Exchange was collected. To reach the final sample, the database was adjusted according to the following criteria: financial companies, banks, and insurance companies were excluded from the database, since, according to Talberg et al. (2008), companies from these sectors operate under a specific regulatory environment that directly impacts their capital structure, thus, jeopardizing comparison with the remaining companies. Holding companies were excluded since the calculation of the model variables would be distorted for these type of company, as they are used as a vehicle to hold participation in other operating companies, in which most of the group's assets, results, and debt are accounted for. Besides, some of the operating companies held by the holdings are also listed, which would lead to duplicates.

Finally, companies that did not have the datasets for the four years of observation were excluded, which could happen if a company was listed or delisted during the observed period or if the company ceased operations and, thus, ceased to present operational results. The reason for considering only companies that had complete datasets for the analyzed period is to use a balanced panel, further discussed in the next section.

After this first screening in the database, outliers were also excluded. Considering that many companies were affected by the recession, which is exactly what this study aims to analyze, the selection of the outliers was made carefully to prevent the exclusion of valid information. Therefore,

companies that had significant variations in their results were considered outliers, regardless of their operational performance or market situations. Thus, four outliers were excluded, such as Refinaria de Petróleo Manguinhos S. A., which was being indicted due to corruption allegations and, thus, had its operational licenses revoked by the government. After all the adjustments, the final database was composed of 200 companies and a total of 800 observations (companies/year) for each variable. Table 2 shows the screening in the database.

Table 2
Companies in the database

Sample	Number of companies	Number of observations	Percentage (%)
Initial sample	340	1,360	100%
(-) Financial institutions and insurance companies	12	48	-4%
(-) Holdings	27	108	-8%
(-) Companies with missing data	97	388	-29%
Partial sample 1	204	816	60%
(-) Outliers	4	16	1%
Final sample	200	800	59%

Source: Elaborated by the authors.

For the classification of the sectors, it was adopted the standard classification used by the São Paulo Stock Exchange, with some adjustments, as proposed by Zarowny (2016). The oil, gas, and biofuels and the telecommunications sectors were grouped together with “public utility”, and the information technology sector was included in “others” due to the low number of companies from this sector in the sample. Therefore, the 200 companies analyzed were grouped into the following sectors: 1. basic materials, 2. industry, 3. consumers, 4. health, 5. public utility, and 6. others.

Variables

The dependent variable is the companies’ performance, measured by two of the main ratios used for company value. Thus, the performance indicator varies between ROA, which measures the operational performance, as studied by Adjei (2013), Forti et al. (2011), and Fresard (2010), and market to book ratio, which measures the market value of the companies, as studied

by Deb et al. (2017), Forti et al. (2011), Fresard (2010), Kim and Bettis (2013), and O'Brien and Folta (2009).

The ROA is calculated based on the Ebitda divided by the total assets of the company. According to Forti et al. (2011), this definition of ROA was used in order not to account for the way that the assets were financed since Ebitda is commonly used as a proxy for operational cash generation, that is, before accounting for the companies' financial income and financial expenses accounts.

For the market value of companies, it was used the market to book ratio, which, according to Talberg et al. (2008), is calculated by dividing the companies' market value (share price multiplied by number of shares) by the book value (accounting value) of the company. This indicator represents the market value assigned to a company. In accordance with Deb et al. (2017) and O'Brien and Folta (2009), the market to book variable is important as it captures the costs and benefits of the maintenance of the cash for shareholders, and its value incorporates market expectations related to the companies' results and future growth perspectives.

The independent variable is the standardized cash position of companies. Defined in this study as z_cash_{t-1} , its definition is based on the methodology used by Forti et al. (2011) and Fresard (2010). Given that the aim is to observe if companies have better or worse performance than their peers depending on the cash position, it is important to balance and standardize this variable according to the sector in which the company operates. Companies' cash position was obtained in the Economatica database by summing "cash" and "cash equivalents" accounts reported in their financial statements. Then, the ratio of the cash position over the total assets of each company was calculated. Out of this result, it was subtracted the average ratio of the sector in which the company operates. The result was then divided by the standard deviation of the sector.

Also, the one-year lagged data are used, meaning that the data refer to the year immediately before the observed year, since the impact of the cash position on the companies' performance could not be measured simultaneously to the current value of the dependent variables (Forti et al., 2011). Equation 1 illustrates the construction of this variable.

$$z_cash_{t-1} = \frac{\left(\frac{\text{Cash of the company}_{t-1}}{\text{Total Assets}} \right) - \left(\frac{\text{Cash sector average}_{t-1}}{\text{Total Assets}} \right)}{\frac{\text{Cash standard deviation of the sector}_{t-1}}{\text{Total Assets}}} \quad (1)$$



In line with the studies of Adjei (2013), Deb et al. (2017), Forti et al. (2011), Fresard (2010), Kim and Bettis (2013), and O'Brien and Folta (2009), the control variables used were 1. size of the company ("size"), 2. indebtedness ("leverage"), 3. investments ("investments"), 4. sales growth (" Δ growth"), 5. distribution of profits ("payout"), and 6. sectors in which the companies operate ("sectors"). According to Kim and Bettis (2013), the control variables were selected since they relate specifically to the impact of the cash position on the performance of the companies. Also, for the model that uses the market to book indicator as the dependent variable, it was included the variation of the São Paulo Stock Exchange index as a control variable, aiming at capturing the variations of the stock market during the period of the analysis.

In this study, it was decided to follow the methodology used by Forti et al. (2011) and Fresard (2010), which uses control variables with a one-year lag and standardized by their corresponding sector averages. The ROA and market to book variables were also used with a one-year lag to control the time persistence in the regression (Lemmon et al., 2008). For 2013, the variables were lagged by using data from 2012 to preserve the size of the sample. To ensure the consistency of the estimators, the second lag (two-year lag) of each variable was used as an instrumental variable of the first lag (Wooldridge, 2004/2016). Table 3 details all the variables used in this study.

This study contributes to the existing literature by adding to the analysis of the relationship between the companies' cash position and their performance during a specific period of recession in Brazil and by evaluating the differences in the intensity of such relationships in the several sectors of the economy.

For comparison purposes and to verify the robustness of the methodology used, the following approaches were considered: models with control variables with a one-year gap and not standardized for the sector averages; models with no time lag in the control variables and not standardized for the sector averages; and models with a one-year lag in the control variables and standardized for the sector averages, including the period from 2009 to 2013, as a comparison of the impact of the cash position on the companies' performance before the recession period. The findings were similar to the ones presented in this study and can be made available upon request to the authors.



Table 3
Definition of the study's variables

Variable	Type	Definition	Reference	Signs
ROA	Dependent	$EBITDA$ (Total assets)	Fresard (2010), Adjei (2013), and Forti et al. (2011)	
Market to book ratio	Dependent	$\frac{\text{Market Value}}{\text{Book Value}}$	Fresard (2010), Forti et al. (2011), Kim and Bettis (2013), O'Brien and Folta (2009), and Deb et al. (2017)	
$z\text{-cash}(t-1)$	Independent	Variable defined in Equation 1, with a one-year lag.	Fresard (2010) and Forti et al. (2011)	+
ROA (t-1)	Control	$\frac{EBITDA_{t-1}}{\text{Total assets}_{t-1}}$	Fresard (2010)	+
Market to book (t-1)	Control	$\frac{\text{Market Value}_{t-1}}{\text{Book Value}_{t-1}}$	Fresard (2010), Kim and Bettis (2013), O'Brien and Folta (2009), and Deb et al. (2017)	+
Size adj. sector (t-1)	Control	$\frac{\ln(\text{assets}_{t-1}) - \text{avg} \ln(\text{assets}_{t-1}) \text{ sector}}{\text{standard deviation} \ln(\text{assets}_{t-1}) \text{ sector}}$	Fresard (2010) and Forti et al. (2011)	+
Leverage adj. sector (t-1)	Control	$\frac{\left(\frac{\text{Leverage}_{t-1}}{\text{Assets}_{t-1}} \right) - \text{avg} \left(\frac{\text{Leverage}_{t-1}}{\text{Assets}_{t-1}} \right) \text{ sector}}{\text{standard deviation} \frac{\text{Leverage}_{t-1}}{\text{Assets}_{t-1}} \text{ sector}}$	Fresard (2010), Adjei (2013), and Forti et al. (2011)	-

(continue)

Table 3 (conclusion)
Definition of the study's variables

Variable	Type	Definition	Reference	Signs
Investments adj. sector (t - 1)	Control	$\left(\frac{\text{Fixed assets}_{t-1} - 1}{\text{fixed assets}_{t-1}} - 1 \right) - \text{avg} \left(\frac{\text{Fixed assets}_{t-1} - 1}{\text{limob}_{t-2}} - 1 \right) \text{ sector}$ <i>standard deviation of</i> $\left(\frac{\text{Fixed assets}_{t-1} - 1}{\text{Fixed assets}_{t-2}} - 1 \right) \text{ sector}$	Fresard (2010) and Forti et al. (2011)	+
Δ growth adj. sector (t - 1)	Control	$\left(\frac{\text{Revenues}_{t-1} - 1}{\text{Revenues}_{t-2}} - 1 \right) - \text{avg} \left(\frac{\text{Revenues}_{t-1} - 1}{\text{Revenues}_{t-2}} - 1 \right) \text{ sector}$ <i>standard deviation of</i> $\left(\frac{\text{Revenues}_{t-1} - 1}{\text{Revenues}_{t-2}} - 1 \right) \text{ sector}$	Fresard (2010) and Forti et al. (2011)	+
Payout (t - 1)	Control	Dummy to identify if the company pays dividends.	Fresard (2010)	+
Sector	Control	Dummy for each of the sectors in which the companies operate (basic materials, industry, consumers, health, public utility, others).	Fresard (2010), Forti et al. (2011), Adjei (2013), Kim and Bettis (2013), O'Brien and Folta (2009), and Deb et al. (2017)	+

Source: Elaborated by the authors.

Statistical model

To develop the proposed analysis, data were organized in a balanced dynamic panel (Wooldridge, 2004/2016) for the period between 2013 and 2016. According to Wooldridge (2016), this methodology must be used when the goal is to capture in the model the lagged effects of the dependent variables. In this case, the dependent variables present a time persistency effect, meaning that the result of the previous year impacts the result of the current one since both ROA and market to book indicators reflect the results of a continuous effort generated by the companies over a structural asset base, workforce, clients, among others, which are in constant development. To test the hypotheses defined in this study, the following equations are proposed:

$$ROA_{i,t} = \alpha_0 + \alpha_1 z_cash_{i,t-1} + \delta X_{i,t-1} + \alpha_2 ROA_{i,t-1} + a_i + b_t + \varepsilon_{i,t} \quad (2)$$

$$Market\ to\ Book_{i,t} = \beta_0 + \beta_1 z_cash_{i,t-1} + \gamma X_{i,t-1} + \alpha_2 Market\ to\ Book_{i,t-1} + a_i + b_t + \varepsilon_{i,t} \quad (3)$$

In equations (2) and (3), i represents the company, and t represents the year of the observation. $X_{i,t-1}$ contains the control variables mentioned and detailed in the previous sections. The term a_i represents the non-observable effect of the company, and the b_t represents the non-observable effect of the time, while ε is the term of the idiosyncratic error.

The Hausman test was applied to decide on the use of fixed effects or random effects in the models' estimation. The Hausman test indicated that the model with random effects would be the most appropriate, suggesting the non-existence of correlation between the non-observed heterogeneous effects and the error term, allowing the exclusion of the non-observed heterogeneity using the first difference. To account for the heteroscedasticity of the errors in the models, standard errors robust to heteroscedasticity were used.

RESULTS

Table 4 details the evolution of the variables during the analyzed period. Regarding the ROA variable, one can observe the deterioration of this indicator over the years, with a slight deterioration in 2014 and, after that, a

deepened deterioration of this indicator during 2015 and 2016, which were the harshest years of the recession, when a cumulative factor of the recession contributed to intensifying the negative impacts on the companies. Consistent with these findings, in this same period, it can be observed an increase in the variability of the results, measured by the standard deviation, indicating a higher variability in the companies' operational performance.

Regarding the market to book variable, it is important to remind that it measures the market value of the companies, calculated as the market value (shares' price multiplied by number of shares) over the book value of the company. Therefore, considering that during the recession period the performance of the Brazilian stock market has been significantly impacted, the average of the market to book indicator reduced during the analyzed period, indicating an overall reduction in the market value of companies. In 2015, as a result of the combination of the economic recession with the political uncertainties – that ultimately resulted in the replacement of the Brazilian president –, the stock market was significantly affected by the political and economic uncertainties, which was reflected in the sharp decrease in the average of the market to book ratio and in the significant increase of the standard deviation in that year. These oscillations observed in the companies' performance indicators are consistent with the expected results for a recession period (Adjei, 2013). Lack of growth, reduction in the investment level, increase in leverage, and decrease in the revenues of the companies are also expected results due to the prolonged crisis. An increase in leverage in periods of economic recession was also observed by Zeitun et al. (2017).

Table 4
Descriptive statistics of variables

Variable	Year	Average	Median	Standard deviation	Min.	Max.
ROA	2013	9.93%	9.72%	8.40%	-35.98%	38.35%
	2014	7.98%	8.97%	9.88%	-62.66%	30.74%
	2015	5.84%	7.38%	11.85%	-88.04%	30.69%
	2016	5.04%	7.44%	13.80%	-97.46%	33.40%
Market to book	2013	1.85	1.22	2.90	-14.97	26.08
	2014	1.57	1.04	2.28	-2.17	23.55
	2015	0.89	0.74	7.87	-103.23	23.19
	2016	1.68	0.91	2.62	-1.11	21.38

(continue)

Table 4 (conclusion)*Descriptive statistics of variables*

Variable	Year	Average	Median	Standard deviation	Min.	Max.
z-cash (t - 1)	2013	0.00	-0.20	0.99	-1.37	5.13
	2014	0.00	-0.18	0.99	-1.50	4.95
	2015	0.00	-0.19	0.99	-1.48	4.92
	2016	0.00	-0.18	0.99	-1.43	4.82
Size	2013	14.93	15.03	1.67	9.69	20.44
	2014	14.99	15.17	1.72	9.64	20.49
	2015	15.03	15.16	1.77	9.85	20.62
	2016	14.99	15.09	1.78	10.11	20.51
Investments	2013	5.21%	3.03%	30.31%	-99.44%	227.63%
	2014	6.49%	3.03%	30.09%	-72.37%	202.45%
	2015	11.45%	3.39%	71.53%	-67.22%	870.63%
	2016	-3.32%	-3.10%	22.60%	-86.57%	154.19%
Leverage	2013	0.31	0.31	0.19	0.00	1.26
	2014	0.33	0.32	0.20	0.00	1.11
	2015	0.34	0.34	0.23	0.00	1.44
	2016	0.34	0.33	0.25	0.00	2.00
Δ growth	2013	8.45%	9.26%	25.58%	-91.85%	193.08%
	2014	8.07%	6.51%	27.21%	-81.98%	189.72%
	2015	1.30%	3.20%	22.79%	-83.51%	102.09%
	2016	-6.50%	-2.62%	24.29%	-116.03%	86.41%

Source: Elaborated by the authors.

Table 5 presents the correlations between the variables used in the model. For the analysis of the full sample, the variables did not present a high level of correlation, and, thus, undesirable effects of multicollinearity are not expected in the model.

Table 5
Correlation matrix

Total sample	ROA	(1)	(2)	(3)	(4)	(5)	(6)
Market to book (1)	0.1633*	1.0000	-	-	-	-	-
z-cash (t-1) (2)	0.1626*	0.1835*	1.0000	-	-	-	-
Size (3)	0.2015*	0.0708*	0.0279	1.0000	-	-	-
Investments (4)	0.1720*	0.0824*	0.0791*	0.0983*	1.0000	-	-
Leverage (5)	-0.1694*	-0.0701*	-0.0261	0.1145*	-0.0475	1.0000	-
Δ growth (6)	0.3390*	0.0593	0.0630	0.1545*	0.2618*	-0.0373	1.0000
Payout (7)	0.3550*	0.1320*	0.1471*	0.3559*	0.1212*	-0.2460*	-0.1156*
ROA (t-1)	0.5890*	0.1424*	0.1500*				
Market to book (t-1)	0.1807*	0.2899*	0.2029*				

Source: Elaborated by the authors.

Note. * p value < 0.05.

The analysis of the correlations points out that ROA has a significant correlation to all the variables, being negative to leverage and positive to the others. This indicates that companies with higher ROA retain a higher cash position, are bigger, have a larger amount of investments, lower leverage, and higher annual growth and pay dividends, which is consistent with the expected directions according to the existing literature. Companies with a higher market to book ratio present similar results, except for the growth variable, which presented a low correlation.

The lagged cash position has a positive and significant correlation to the investments and payout variables, meaning that companies with higher cash positions invest more and pay more dividends to their shareholders. It is important to note that since cash position measures the relative cash position of companies weighted by their size (total assets) and sector, the correlation comparison of z_cash_{t-1} with the size of the company is compromised.

Since this study also aims at evaluating the relationship between the cash position and the performance of companies according to their sector of activity, Table 6 was prepared to show the correlation between the dependent variables and the independent variable for each of the sectors.

Table 6*Correlation between ROA and market to book with z-cash (t - 1) by sector*

Sector	Correlation (ROA, z-cash t - 1)	Correlation (Market to book, z-cash t - 1)
Industry	0.0282	-0.1169
Consumers	0.2331*	0.2801*
Basic materials	0.1427	0.0371
Others	-0.0713	0.3439*
Health	0.4194*	0.3522*
Public utility	0.2079*	0.3037*

Source: Elaborated by the authors.*Note.* *p value < 0.05.

The asterisk in the indicators of correlation means that the correlation between the dependent variables and the independent variable is significant at the 5% level. It can be noted as a positive and significant relationship for some of the sectors, which reinforces that the sector in which the company operates can impact the intensity of the relationship between cash position and performance. These results are aligned with the indication provided in Table 2 by showing a stronger relation in the health and other sectors and a less intense relation in the public utility and consumers sectors. It was not identified a statistically significant relationship for the industry and basic materials sectors.

Econometric analysis

Table 7 presents the results of the econometric analysis proposed for this study. In total, three regressions were performed for each of the dependent variables (ROA and market to book). All regressions were performed by using instrumental variables, aiming at factoring in the bias in the estimators caused by the dynamic panel model.

According to the results presented in Table 7, the null hypothesis of serial autocorrelation in the first-order errors (AR1) can be rejected, and there is no evidence of serial correlation in the second-order errors (AR2), being valid the conditions used by Arellano and Bond (1991). All variables used as instruments presented statistically relevant correlations with the

endogenous independent variable (lagged independent variable). Therefore, the validity of the instruments used in this study is confirmed.

Models 1 and 2 aim to test hypothesis 1. Regression 1 presents only the control variables, while model 2 adds the cash position variable. Model 3 tests hypothesis 2 by adding the interactions between cash position and performance for each of the sectors.

Table 7
Results of the regression models with panel data

Regressions	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Dependent variable	ROA	ROA	ROA	Market to book	Market to book	Market to book
z-cash (t - 1)		0.0057*** (0.0021)	0.0036** (0.0018)		0.0635 (0.0938)	0.0022 (0.1190)
ROA (t - 1)	0.7401*** (0.0919)	0.7181*** (0.0923)	0.7088*** (0.1066)			
Market to book (t - 1)				0.7115*** (0.08496)	0.7048*** (0.0923)	0.6931*** (0.1105)
Size adj. sector (t - 1)	0.0020 (0.0021)	0.0023 (0.0020)	0.0008 (0.0020)	0.0724 (0.0544)	0.0751 (0.0577)	0.0765 (0.0593)
Investment adj. sector (t - 1)	0.0035 (0.0084)	0.0035 (0.0083)	0.0036 (0.0096)	0.0309 (0.1058)	0.0296 (0.1049)	0.0352 (0.1073)
Leverage adj. sector (t - 1)	-0.0449** (0.0239)	-0.0456** (0.0232)	-0.0398** (0.0201)	-0.9283* (0.5436)	-0.9450* (0.5453)	-0.8855* (0.5332)
Δ growth adj. sector (t - 1)	0.0457*** (0.0114)	0.0451*** (0.0113)	0.0513*** (0.0123)	0.0738 (0.1600)	0.0693 (0.1577)	0.0686 (0.1584)
Payout dummy	0.0143** (0.0079)	0.0138** (0.0072)	0.0182** (0.0088)	0.1138 (0.2330)	0.0980 (0.2215)	0.1184 (0.2341)
Varlbov	No	No	No	2.054* (1.1066)	2.0379* (1.0927)	2.0137* (1.0662)
z-cash (t - 1) Industry			0 (omitted)			0 (omitted)

(continue)

Table 7 (conclusion)**Results of the regression models with panel data**

Regressions	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
z-cash (t - 1) Consumers			0.0104 (0.0070)			0.1391 (0.2787)
z-cash (t - 1) Basic materials			0.0019 (0.0066)			-0.0956 (0.2378)
z-cash (t - 1) Others			0.0083 (0.0110)			0.1310 (0.1539)
z-cash (t - 1) Health			0.0176** (0.0084)			0.1770 (0.3475)
z-cash (t - 1) Public utility			0.0101* (0.0056)			0.0621 (0.1515)
Dummy sector	Yes	Yes	Yes	Yes	Yes	Yes
Instrumental variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.0098 (0.0080)	-0.0058 (0.0096)	0.0142 (0.0128)	0.2166 (0.2063)	0.2374 (0.2086)	0.3439* (0.1966)
Observations	800	800	800	800	800	800
Companies	200	200	200	200	200	200
R ²	38.92%	42.29%	43.44%	9.11%	9.23%	9.40%
AR1 (p value)	0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01
AR2 (p value)	0.23	0.15	0.17	0.26	0.31	0.30

Source: Elaborated by the authors.

Note. Standard error in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The first relevant observation is the strong explanatory power of the models. While the models that use ROA as the dependent variable present R² between 38 and 43%, the models that use market to book ratio present R² between 9 and 10%. Since the market to book indicator incorporates the impact of investors' perception of the share price of companies, there are several other variables that affect the market to book indicator that are not captured by the variables set in this study, mainly in a period of economic



recession, for instance: the economic development, country's growth perspectives, political environment. Therefore, the models proposed in this study are more robust to test ROA as a dependent variable since this indicator only accounts for the data presented in the companies' financial statements.

The results related to models 2 and 3, reported in Table 7, confirm H1, according to which the maintenance of cash position positively impacts performance, and H2, in which is stated that the sector in which the company operates impacts the relationship between cash position and performance when the ROA variable is tested. These results were not confirmed for the market to book variable.

For the ROA performance indicator, the independent variable z_cash_{t-1} presented statistical significance, confirming the positive and significant relationship between the companies' cash position and performance, which corroborates hypothesis 1. The estimations of the coefficient must be interpreted in terms of deviations from the sector average. Thus, the 0.0057 result for model 2 means that for each standard deviation of *cash / total assets* of the company on top of the sector average, it is expected an increase of 0.57% in the ROA. Although the size and investments control variables do not present statistical significance – which was expected based on the studies conducted by Forti et al. (2011) and Fresard (2010) –, the control variables lagged ROA, leverage, Δ growth, and payout presented the expected signs and statistical significance. The confirmation of the significant and positive relationship between the companies' cash position and operational performance, measured by ROA, is consistent with the results identified by Adjei (2013), Forti et al. (2011), Chang et al. (2017), Chen et al. (2018), Fresard (2010), Pamplona, Silva, and Nakamura (2019), and Pamplona, Silva, Nakamura, and Rodrigues Junior (2019).

When hypothesis 1 was tested using the market to book dependent variable, although the independent variable z_cash_{t-1} presented the expected sign, it was not observed statistical significance in the relationship between cash position and the performance of the companies. In this case, only market to book, leverage, and VarIbov (variation of the São Paulo Stock Exchange index) lagged control variables presented statistical significance and confirmed the expected signs. Variables such as size and Δ growth did not present statistical significance.

Therefore, the results presented in this study confirm H1 – companies that maintain higher cash positions have better operational performance when performance is measured by ROA. The fact that H1 is not confirmed for the market to book variable contradicts the results obtained by Deb et al.



(2017), Forti et al. (2011), Fresard (2010), Kim and Bettis (2013), and O'Brien and Folta (2009). A possible explanation for this divergence is that the mentioned authors used data from companies based in developed countries with mature and healthier markets and business environments. In Brazil, the opportunity cost of maintaining a cash position (discount rate used in valuation models, the weighted average cost of capital) is higher than in developed countries and markets, and, perhaps, for this reason, the benefits of a better operational performance in periods of economic recession do not justify the additional investment needed in cash. Still, the market to book indicator incorporates the market expectations related to the results and future growth of the company, and, in periods of economic recession, the investors' perception of potential for future growth is possibly harmed. Therefore, we believe that, in periods of economic recessions, ROA better reflects companies' operational performance.

In model 3, with the use of ROA, variable z_cash_{t-1} presented significant and positive interaction for the health and public utilities sectors. This confirms H2, according to which there are differences in the intensity of the relationship between cash position and performance of the companies for the sectors considered in the study. However, although the indicators of the relationship between cash position and the company's performance present differences for each of the sectors, statistical significance was not observed for the market to book dependent variable. These results partially confirm the findings obtained by Forti et al. (2011) since those authors found a positive and statistically significant relationship between cash position and ROA indicators for several sectors.

CONCLUSIONS

This study had the objective of analyzing if, during the most recent economic recession that Brazil went through, the cash position of companies had an impact on their operational performance. For that, performance was measured by two different dependent variables, ROA and market to book ratio, in the period between 2013 and 2016, using data regression in a balanced and dynamic panel. We contributed to the existing literature by evaluating the effect of the maintenance of cash position on the performance of Brazilian companies during recession periods. Also, we contributed to the discussion related to the intensity of this effect based on the sector in which the company operates. Several control variables were used according to the



existing literature in order to isolate the specific effects of cash position on the companies' performance.

This study contributed to the literature related to the cash position of companies by confirming that cash position can be used by companies as a financial management tool, with the aim of softening the impacts of potential market downturns, supporting the management of company liquidity and contributing to better operational results.

The results obtained in this study indicate that there is a positive and statistically relevant relationship between cash position and companies' performance when performance is measured by ROA. This indicates that, in periods of economic recession, although, on average, all companies observe deterioration in operational performance, as shown in the descriptive analysis in Table 4, companies that have a higher cash position than their competitors have better operational performance (ROA). More specifically, for each standard deviation of *cash / total assets* of the company above the sector average, it is expected an increase of 0.57% in the ROA. This result may be associated, for instance, with a higher capacity of the company to manage its working capital needs, proceed with planned investments or pursue business opportunities during periods of recession. In addition, it was confirmed that the intensity of this relationship between cash position and performance varies depending on the sector in which the company operates. Regarding the health and public utilities sectors, for each point of variation in the z_cash_{t-1} indicator, the ROA of the companies increases more than the ROA of companies in the reference sector (industry).

It was not found a statistically relevant relationship between cash position and performance when measured by the market to book dependent variable. We believe that as the opportunity cost of maintaining cash position (discount rate used in valuation models, the weighted average cost of capital) is higher than that in developed countries and markets and, perhaps, for this reason, the benefits of a better operational performance in periods of economic recession do not justify the additional investment needed in cash. The uncertainty related to the recession period impacts the market value of the shares, sometimes not in a rational manner, adding to the market to book indicator a series of impacts, making it difficult to capture in the models by the control variables.

Future studies may add macroeconomic factors in the modeling, such as gross domestic product (GDP) growth, unemployment rates, consumer confidence indexes, among others, with the objective of better capturing the variables that can impact the market to book indicator. Also, other alterna-



tive variables to the market to book ratio could be considered, such as ROE, net margin, sales growth, Tobin's Q, dividend yield, and share buyback (Bhagat & Bolton, 2008). The fact that the study focused only on one period of recession is a limitation of this work. Future studies may consider longer periods of other recessions, analyzing the long-term maintenance of cash position. With a larger database, it would be possible to verify if the impact of this variable on performance is different in periods of economic recession and expansion. It would also be interesting to verify the impact on the performance due to capital structure characteristics, considering the sector differences in terms of leverage and financial slack (Campos & Nakamura, 2015). Although only five companies were excluded from the database due to bankruptcy, since we opted for a balanced panel, the survival bias is also a limitation of this study.

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