Determinants of corporate cash holdings in times of crisis: insights from Brazilian sugarcane industry private firms

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Abstract

The decision-making process regarding cash allocation, especially in times of recession, is somewhat challenging. Thus, the aim of this study is to evaluate the effects of the financial crisis in cash holdings of privately-held firms in the Brazilian sugarcane industry. For this purpose, a unique, hand-collected panel data of 31 firms for the period from 1998 to 2015 was used. The results show that the private firms of the industry maintain higher levels of cash than the average found by studies with Brazilian public companies. Furthermore, between the two dummy variables used, representing the subprime crisis and the most recent economic crisis in Brazil, only the second one was significant. Finally, in order to overcome the adverse conditions of the current Brazilian economic crisis, it was observed an increase in cash holdings, which, in turn, denotes the relevance of precautionary reasons in the understanding of cash management.

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1. Introduction

The initial point of discussion of this work is the argument of irrelevance introduced by Keynes (1936) regarding the issues of investment and financing of an organization in a perfect market. In this context, when in need of funding, firms would only go to the market to raise funds at an affordable rate. Therefore, there would be no need for them to allocate part of their assets to the cash and cash equivalents account, since they would have access to third party capital at a fair price to finance their investment activities (Keynes, 1936).

Nevertheless, the theoretical assumptions proposed by Keynes (1936) would be valid only for organizations with access to perfect capital markets, which is not the case in the Brazilian market. Bearing this in mind, theories begin to emerge in order to understand the behavior of managers in relation to the whole process of the organizations' cash policies decisions.

Consequently, studies related to cash management are recurrent in academic literature, especially due to the fact that companies maintain significant percentage of their assets in cash. These problems are related to the existence of market imperfections, such as informational asymmetry, agency problems, transaction costs and financial constraints (Ferreira and Vilela, 2004; Jensen, 1986; Jensen and Meckling, 1976; Martínez-Sola *et al.*, 2013).

However, most of the efforts on the subject are concentrated on the analysis of large public (Companies listed in stock Exchange) firms (Bigelli and Sánchez-Vidal, 2012; Hall *et al.*, 2014; Steijvers and Niskanen, 2013). These firms, in most cases, have a strong relationship with the capital market, so the demand for cash reserves, for instance, for precautionary reasons are lower than for privately-held firms (Hall *et al.*, 2014). In this sense, Gogineni *et al.* (2012) point out that the fact that private firms do not have access to the capital market makes it more difficult to obtain sources of financing.

Another fundamental difference between them is the ownership structure. While public (listed) companies usually have thousands of shareholders (diffused ownership), privately-held firms have only one or a few shareholders, and they often still belong to a single family, in which the degree of control can be valued by the owners (Bigelli and Sánchez-Vidal, 2012; Gogineni *et al.*, 2012).

Another point highlighted by Gogineni *et al.* (2012) among public and private firms is the level of informational asymmetry between insiders and outsiders. According to the authors, privately-held firms are less transparent to investors, which to a certain extent may aggravate the problems related to adverse selection.

Therefore, the results presented so far in the literature, based mostly on samples of public firms, such as in countries considered more developed and in diversified financial environments cannot be generalized to privately-held firms without contextualization, since they differ in several aspects (Gogineni *et al.*, 2012; Tahir and Alifiah, 2015).

Dahrouge and Saito (2013) also indicate that the amount to be kept in cash is a controversial issue, but of interest to managers. Thus, the existence of market imperfections can result in potential agency problems, coupled with the fact that managers may have the desire to maintain control while avoiding external financing. Therefore, all the decision-making process related to cash management plays a key role in the firms' financial policies (Steijvers and Niskanen, 2013).

In financial crisis scenarios, where access to credit is lower or even the demand for resources is reduced (Carvalhal and Leal, 2013), there is an increase in interest in the effects of such factors on issues related to the financial liquidity of companies. The current recession of the Brazilian economy, started in 2014, affected by not only economic factors, but also political scandals may have greatly influenced the decision-making process related to cash management.

Together with the economic crisis, it is important to bring the context of the sugar cane chain, that suffered a strong crisis from 2008 until the end of 2015, based on the level of debt and the low national and international prices of sugar and ethanol, the major products.

Given all the above, the objective of this article was to evaluate the effects of the financial crisis, as well as the crisis of the sugarcane industry, especially influenced by the control of the gasoline price by the Brazilian Federal Government, on the cash holdings of sugarcane plants and distilleries.

1.1 Aimed contributions

Studying the effects of recessionary periods under huge uncertainties on cash management is important both for corporate finance issues and organization's managerial practices. The context of crisis may suggest, for example, that some factors, which used to be imponderable, can provide opportunities for further studies in order to understand the management practices. Consequently, this whole context offers a valuable opportunity to analyze its effects on cash holdings.

Besides the fact that most of the efforts on this subject focus on public (listed) companies, Tahir and Alifiah (2015) also mention the direction of these studies only at company level. Thus, the authors point out that it is increasingly difficult to ignore the importance of each sector, as well as their specificities in studies on the topic since they can decisively influence the percentages kept in cash by each sector.

Therefore, there is an opportunity to contribute with current literature in understanding the business environment in each sector, especially in the case concerning cash management due to each sector´s characteristics (specificities), which can affect their cash management. Consequently, the results obtained in research in specific sectors can help define the customized cash policies for each sector (Tahir and Alifiah, 2015).

Given the theoretical assumptions listed, and the way in which privately-held firms may be affected differently from listed companies by the aforementioned factors in their cash holdings, this study initially aimed to contribute to the literature on cash management providing evidence on a market which is still obscure in Brazil: the study of privately-held firms.

The importance of private firms is also a relevant factor, given that the number of non-listed companies is much higher, playing an indispensable role in any economy and still employing a higher proportion of the workforce (Gogineni *et al.*, 2012). In addition, the Brazilian market, characterized by Dahrouge and Saito (2013), may further affect the cash management of Brazilian companies, especially those who do not have access to the capital market, due to the high fundraising, higher and inflation rates and costs of capital.

In situations of financial constraints, for example, organizations can allocate a higher percentage of their assets to cash in order to anticipate any adverse situation, as well as to continue with their investment policies. This occurs because financial constraints often make it impossible for Brazilian organizations to raise funds at a rate compatible with their investment projects (Ferreira and Leal, 2011). Evidence shows that when the 2008 economic crisis hit the sugarcane business in Brazil, investments decreased dramatically.

The crisis environment can also influence the organization's cash management, since there are fewer investment opportunities and higher market uncertainties (Baum *et al.*, 2006; Nason and Patel, 2016). Despite unfortunate, the crisis scenario allows to deepen the studies on the subject and to shed light on the behavior of organizations and their effects on cash management (Campello *et al.*, 2011; Van Der Stede, 2011).

Manoel *et al.* (2016) mention a peculiar feature of the industry, in addition to the effects caused by the crisis, which enables further exploration of its effects on cash management: the high ownership concentration. In this sense, Steijvers and Niskanen (2013) provide evidence that the ownership structure actually moderates the relationship between the company's management and its cash holdings.

Moreover, according to Neves *et al.* (2014) the Brazilian sugarcane industry demonstrates its strength for the Brazilian economy by producing various forms of sustainable and renewable energy, such as sugar, ethanol and electricity. Consequently, the sector is capable of meeting today's global demand for cleaner and greener energy without compromising the environment and the lives of future generations.

This industry is very sensitive in financing issues, since cash flows are dramatic. Agricultural activities in this industry have a huge initial investment and the first harvest will be taken almost 2 years after planting, and industrial investments due to licenses, complexity and other events may take three years to start running after initial investments were performed. An industry with a crushing capacity of 3 million tons of sugar cane per year will demand an initial investment of around US$ 400 million and cash generation will start only at least two years after the investment (capital expenditure).

Finally, following the evidence obtained by Ozkan and Ozkan (2004), this research also used the Generalized Method of Moments (GMM) for dynamic panel data in order to consider the problems of endogeneity in the empirical analysis of the company's cash management. For the authors, the issue of endogeneity is a relevant factor in studies on the topic since shocks that affect cash reserves may also affect some of the regressors.

2. Hypothesis development

In recent years, the sugarcane industry has been facing one of its worst crises, as mentioned by Neves *et al.* (2014) and Santos *et al.* (2015). This crisis was caused not only by climatic factors, such as the absence of rainfall, especially in 2014 and early 2015, but also the control of gasoline prices by the Brazilian federal government.

The policy of controlling the price of gasoline, according to Sant'Anna *et al.* (2016), occurred in order to control inflation. This policy, however, has resulted in negative consequences for the industry. For Sant'Anna *et al.* (2016), this meant that the price of ethanol needed to be kept low while the production costs were rising 11.5% a year.

Moreover, Neves *et al.* (2014) mention the increase in the indebtedness of the mills and distilleries of the sector, the reduction of the investment opportunities and the narrow or even negative margins of the current investments. In this respect, 62 economic groups either closed down or filed for bankruptcy protection just in the period from January to October, 2014, considerably increasing the number of unemployed workers, especially in the cities of Sertãozinho and Piracicaba, in the State of São Paulo, characterized by its long-time tradition in the sugarcane agro-industry equipment manufacturing.

Consequently, it was expected that the industry recession scenario also affected the firms' cash reserves, since the literature on the theme indicates that in such situations the precautionary reasons are greater, making, therefore, that companies keep higher cash holdings in order to avoid adverse market conditions. Furthermore, Carvalhal and Leal (2013) point out that, during the subprime crisis (2008), the emerging markets, in which Brazil is included, were also affected by lack of credit, confidence and decline in economic activity.

Thus, the aim of this study was to evaluate the effects of the financial crisis, as well as the crisis of the sector, influenced especially by the gasoline price control by the Brazilian federal government and lower international sugar prices, on cash holdings of mills and distilleries of sugarcane industry.

Given all the above, the research hypothesis is:

H_1: there is a positive association between cash holdings in times of economic recession and sector (industry) crisis.

3. Research methodology

In this topic the methodology that conducts all this research is described, as well as the sample used, the proposed model and the operational definition of each variable.

This research used the annual financial statements through a unique, hand-collected panel data set of 31 privately-held firms of the Brazilian sugarcane industry. The data used are nominal and were hand-collected from the websites of the organizations (for the ones that published) and their publications in the Official Journal of the Brazilian Government.

The period analyzed corresponds to the interval between the years of 1998 and 2015, according to the availability of the data of each firm throughout the period. This time interval includes the new technological and market paradigm of the sector that involves the production of sugar, ethanol and energy. In addition, there was a complete deregulation of the sector in 1996/1997, which makes companies less protected to the market fluctuations. Therefore the decision was to start the sampling period from the year 1998. Finally, the use of an 18-year panel allowed to analyze the evolution of the cash levels during that time, as well as to observe their variations and the possible impact factors.

At first the regression model with panel data through a balanced panel was thought as the best method. However, due to the difficulty in accessing information of some variables throughout the period, an unbalanced panel was chosen so that the number of observation would not be reduced. The panel data regression model, composed of a cross section in a time series, allows, according to Wooldridge (2013), to study phenomena that can undergo changes over time and the individual analyzed. Moreover, this model also allows analyzing a greater amount of information, as well as a greater number of degrees of freedom and, consequently, generating better estimation efficiency of the parameters.

Finally Wooldridge (2013) points out that the regression model with panel data allows a greater variability of the data, which in a certain way can contribute to reduce the problems of multicollinearity among the variables used. Thus, due to the use of a sample composed of 31 companies over 18 years, initially 558 observations were obtained.

Given the unavailability of some data for the variables used in the model, 102 observations were removed from the sample. Those with negative Equity were removed, following Bigelli and Sánchez-Vidal (2012) recommendations. Therefore, a final sample of 434 observations for the same 31 companies was used, according to Table 1. The GMM model, which uses a time lag fitted model for the dependent variable, excluded 76 observations; a final sample with 358 observations was available.

The variables used in the model are presented according to a previous suggestion given by the reviewed the literature.

Table 1. Research sample.[1]

1998-2015	Sample	Observations
Total	31	558
(-) Companies with missing values for the variables used		(102)
(-) Companies with Negative Equity		(22)
(=) Final sample used to GMM model	31	434
(-) Time lag (GMM)		(76)
(=) Observations in regression		358

[1] GMM = Generalized Method of Moments.

3.1 Dependent variable

The dependent variable used in this work was the same one suggested and used by Dittmar, Mahrt-Smith and Servaes (2003) and Opler *et al.* (1999). Obtained by the natural logarithm of the value resulting from the sum of the cash and equivalents divided by the total net assets (total assets minus cash and equivalents of cash).

3.2 Independent variables

■ *Subprime and Brazilian market crisis*

Precautionary reasons cause organizations to reserve part of their assets in cash to avoid any adverse situation. Thus, since financial crises represent a trivial factor in the financial decisions of companies and lead firms to a credit crunch in Brazil, according to Carvalhal and Leal (2013), it is expected, therefore, that in such context, companies maintain higher levels of cash.

In addition to the problems related to climate factors and the entire context of the recession of the Brazilian economy, the sugarcane industry has faced one of its worst crises in recent years due to the control of gasoline prices by the Brazilian federal government, according to Santos *et al.* (2015) and Sant'Anna *et al.* (2016) and lower international sugar prices, mainly caused by Brazil, that due to the low prices of gasoline and the difficulties for ethanol to compete, converted more cane to sugar, flooding the sugar market.

Baum *et al.* (2006) also point out that in times of increased uncertainty about the macroeconomic environment, organizations will increase their cash holdings to offset the negative effects of the economic downturn on their cash flows. Consequently, under a low credit access scenario, the marginal benefit of cash reserves may be higher, especially in financially restricted firms (Bliss *et al.,* 2015). Therefore, a positive association between financial crisis contexts and companies' cash reserves is expected.

In order to capture the effect of the financial crisis, two dummy variables were used, with value 1 for the years of 2008 and 2009 representing the subprime crisis, and 0 otherwise. The other one represents the crisis of the sugarcane industry and the Brazilian market, with the value 1 for the years 2014 and 2015, and 0 otherwise.

3.3 Control variables

■ *Liquidity*

Al-Najjar (2013) argues that the cost to convert more liquid assets into cash is lower than other assets. Consequently, companies with a larger number of liquid assets do not have to maintain large cash reserves, since they can, for example, convert these funds into cash when they are needed.

Thus, following Al-Najjar (2013) and Ferreira and Vilela (2004), it is expected a negative association between liquidity and cash reserves. The variable used as a proxy for liquidity was the Current Liquidity, obtained through the division of Current Assets by Current Liabilities.

■ *Size*

In relation to the Size, obtained by the natural logarithm of the Net Assets, a negative association with the cash levels is expected. This expected result is in accordance to the study by Kim *et al.* (1998), Hall *et al.* (2014) and Steijvers and Niskanen (2013), who argue that larger organizations maintain smaller cash reserves.

This fact is consistent with the argument that smaller firms face higher costs to raise funds, and in order to avoid significant transaction costs, they maintain higher cash holdings. Moreover, these companies have a

higher probability of financial difficulty due to the higher degree of informational asymmetry (Ferreira and Vilela, 2004).

■ *Profitability*

For Al-Najjar and Clark (2017), the most profitable institutions are expected to maintain higher cash reserves since, according to the pecking order theory, they are more likely to invest in value-for-money investment projects Net Present Value and can therefore use the resources generated in order to maintain their investment activities.

In addition, Hall *et al.* (2014) mention that the most profitable companies probably have easier access to external financing with a lower cost of funding. Therefore, these companies tend to hold higher cash reserves, to take advantage of these benefits.

In this research as return variable, the Return on Equity (ROE), obtained by the division of Net Income by Equity is used.

■ *Cash generation*

At first, the use of variables related to Cash Flow is considered. However, Brazilian firms were not required to present the Cash Flow Statement prior to 2008. Therefore, the use of a sample period prior to this date made it impossible to use data derived from this financial statement (Brazil, 2007).

Thus, two financial indicators were chosen to be used: the Asset Turnover and the Operating Margin, respectively obtained by dividing the Total Revenue by Net Assets and Operating Income by Total Revenue. The basis for the use of the two variables follows the positioning of the Dupont Model, in which both are used in the financial analysis as indicators of generation and income retention (Assaf Neto, 2014; Ross *et al.*, 2013).

■ *Debt*

The Debt variable was also used in this study, obtained by dividing Liabilities by the sum of Liabilities and Equity. Bigelli and Sánchez-Vidal (2012) still mention that the debt of organizations, provided by bank loans, should lower the financial constraints of privately-held firms in order to serve as a cash substitute. Therefore, a negative association between the level of indebtedness and the cash balance was expected.

■ *Leverage*

Ozkan and Ozkan (2004) argue, in their study, that highly leveraged organizations are more likely to incur financial difficulties. Han and Qiu (2007) complement Ozkan and Ozkan (2004) by mentioning that more leveraged firms may need to accumulate a larger percentage of their assets in cash in order to pay off their debt in the future. Thus, both authors suggest a positive relationship between leverage and cash holdings. The variable used as proxy for Leverage was obtained by dividing Total Debt by Net Asset, following the operational definition suggested by Assaf Neto (2014).

■ *Age*

Al-amri *et al.* (2015) argue that organizations substantially reduce their cash levels throughout their life cycle. The results obtained by the authors corroborate this fact, signaling that mature companies maintain lower cash holdings, since they manage their cash flows better.

Thus, in order to capture the effect of the life cycle on cash management, the natural logarithm of age was used.

■ *International Financial Reporting Standards*

Another topic that has been widely discussed in the Financial and Accounting literature is the adoption of the International Financial Reporting Standards (IFRS). The purpose of establishing a set of international standards was to not only improve the comparability, quality and reliability of information provided to users, but also reduce the cost of preparing the financial statements and provide more timely and accounting relevance (Antunes *et al.*, 2012; Armstrong *et al.*, 2010).

The Brazilian convergence to International Standards, unlike what occurred in most European countries with mandatory adoption in 2005, was held in two stages. The first one started in the beginning of 2008, through Law 11.638/2007, when partial adoption took place. The mandatory adoption, in turn, was in 2010 with the adoption of the full set of IFRS standards for the Consolidated Financial Statements, following the standards issued by the Accounting Pronouncements Committee in Brazil (Antunes *et al.*, 2012).

Due to the aforementioned peculiarities, as well as the discretion in the adoption of IFRS by private firms, a dummy variable was adopted to control the effects of the adoption of the standards, in which the value 1 was assigned from the individual declaration of each company in the preparation of its financial statements, and 0 before this period. Finally, it is important to mention that among the sample used, the year of adoption varied from 2008 to 2011.

■ *Net working capital*

The Current Assets can be easily converted into cash and, thus, are considered as cash substitutes. Therefore, the Net Working Capital (NWC) was also used as a control variable, as suggested by Opler *et al.* (1999) and Bigelli and Sánchez-Vidal (2012). A negative association between NWC and cash reserves was expected.

The variable used to control the effects of cash substitutes was obtained, according to Opler *et al.* (1999) and Gao *et al.* (2013), through the NWC, in which Current Assets were discounted from Current Liabilities and from Cash and Equivalents, and the resulting value was, then, divided by Net Assets.

3.4 Econometric model

Following Ozkan and Ozkan (2004), the GMM estimate for dynamic panel data was used to address the issue of endogeneity. The theoretical assumptions for using this model are that it implicitly assumes that firms can instantly adjust their target cash levels after changes in the firm's specific characteristics or due to random shocks.

Thus, a model that assumes that organizations seek a cash target level was used. Therefore, the percentages of the assets held in cash in a period will also be explained by their decisions taken in previous years.

According to García-Teruel and Martínez-Solano (2008), dynamic panel regressions are characterized by the existence of autocorrelation due to the consideration of the lagged dependent variable as an explanatory variable. The consistency of the estimates of the GMM is subject to an ideal choice of instrument, in which its validity depends on the absence of serial correlation of higher order in the idiosyncratic component of the error term.

Like Ozkan and Ozkan (2004), García-Teruel and Martínez-Solano (2008), the consistency of the estimates for the absence of second-order serial correlation was tested as proposed by Arellano and Bond (1991). In addition to this test, the Sargan Test of excessive identification restrictions, which tests the lack of correlation between the instruments and the residues was used.

Therefore, Equation 1 with the proposed econometric model follows:

$$CASH_{it} = \beta_0 + \beta_1 CASH_{i,t-1} + \beta_2 Subprime\ Crisis_{i,t} + y\beta_3\ Brazilian\ Crisis_{i,t} + \beta_4\ CL_{i,t} + \beta_5\ Size_{i,t} + \beta_6\ ROE_{i,t} + \beta_7\ AT_{i,t} + \beta_8\ OM_{i,t} + \beta_9\ Debt_{i,t} + \beta_{10}\ Lev_{i,t} + \beta_{11}\ Age_{i,t} + \beta_{12}\ IFRS_{i,t} + \beta_{13}\ NWC_{i,t} + u_{i,t} \qquad (1)$$

In which:

- *Cash* = Cash and Equivalents, obtained by the natural logarithm of the sum of the cash and cash equivalents, divided by the Net Assets (total assets minus cash and cash equivalents).
- *Subprime Crisis* = Subprime Crisis, dummy variable that assumes the value 1 for the years 2008 and 2009 and 0 for the remaining sample period.
- *Brazilian Crisis* = Brazilian Crisis, dummy variable that assumes the value 1 for the years 2014 and 2015 and 0 for the remaining sample period.
- *CL* = Current Liquidity, obtained by the division of Current Assets by Current Liabilities.
- *Size* = Size, obtained by the natural logarithm of Net Assets.
- *ROE* = Return on Equity, obtained by the division of Net Income by Equity.
- *AT* = Asset Turnover, obtained by dividing Total Revenue by Net Assets.
- *OM* = Operating Margin, obtained by the division of Operating Income by Total Revenue.
- *Debt* = Debt, obtained by the division of Total Liabilities by the sum of Total Liabilities and Equity.
- *Lev* = Leverage, obtained by the sum of Total Short-Term Debts and Total Long-Term Debt, and the resulting value was divided by Net Assets.
- *Age* = Age, obtained by the natural logarithm of the age.
- *IFRS* = IFRS adoption dummy, in which the value 1 was attributed from the individual declaration of each firm from the adoption of IFRS in the preparation of its financial statements, varying between years 2008 and 2011, and 0 previously.
- *NWC* = Net Working Capital, obtained by subtracting Current Assets by Current Liabilities, and the resulted value divided by Net Assets.
- *u* = Error term.

4. Results

Table 2 shows the Descriptive Statistics of the research sample. All variables were winsorized at 5% level.

Table 2. Descriptive statistics of variables.

Variable	Mean	1st quartile	Median	3rd quartile	Std. dev.
Cash	10.38	1.614	5.592	13.015	0.132
Subprime Crisis	0.106	0.000	0.000	0.000	0.308
Brazilian Crisis	0.092	0.000	0.000	0.000	0.290
Current Liquidity	1.786	0.774	1.253	2.046	2.263
Size	12.515	11.672	12.580	13.325	1.119
ROE	0.377	-0.025	0.084	0.191	8.830
Asset Turnover	0.760	0.486	0.663	0.908	0.498
Operating Margin	0.141	0.005	0.096	0.171	0.850
Debt	0.644	0.522	0.652	0.750	0.156
Leverage	0.068	0.030	0.055	0.091	0.059
Age	3.675	3.466	3.807	4.094	0.660
IFRS	0.369	0.000	0.000	1.000	0.483
NWC	-0.014	-0.136	-0.021	0.080	0.193

In sequence, Figure 1 shows the change in cash levels throughout the period. In addition to the numbers indicated in this Figure, it was found that, on average, organizations of the sugarcane industry maintain 10.38% of their Total Assets allocated in Cash and Equivalents. The value found, therefore, is higher than the average obtained in the works with Brazilian listed companies, such as shown by Dahroug and Saito (2013), which obtained an average of 6.5%.

The higher average for the sample of privately-held firms in this study was as expected, given that private companies may face greater barriers to obtain external funding than those listed on stock exchanges. Thus, due to precautionary reasons, the mills and distilleries maintain higher cash levels. Moreover, the achievement of a higher level of cash reserves is in line with the results obtained by Lee and Powell (2011) because, according to the authors, capital-intensive firms, as observed in the studied sector, maintain higher cash holdings.

Hall *et al.* (2014) still attribute the fact that listed companies maintain lower cash levels given their greater access to the capital market in relation to privately-held firms. Therefore, the results obtained by the authors – that private firms maintain higher levels of cash than those listed – were also obtained in this study.

The mean value found here, however, is misaligned to that obtained by Gao *et al.* (2013) for their sample, since the authors verified that private firms in the US market hold 17.17% of their assets in cash; representing, therefore, a percentage 50% higher than public firms (9.39%). The authors attributed this difference to the major agency problems of listed companies, as well as to the more exacerbated financial constraint of the group of privately-held firms.

Thus, the specific characteristics of each market can explain this difference. These include, for example, the existence of greater investment opportunities for privately-held firms in the US market, the country's own institutional characteristics, and the existence of mechanisms to control the managers opportunistic actions in relation to the problems of agency resulting from the maintenance of higher cash holdings. Moreover, the results found by Kusnadi and Wei (2011) corroborate this fact, since the authors observed that there is a great variation of the cash levels between companies of developed and developing countries.

After discussion of the descriptive statistics, it was verified, at first, whether the variables of the model presented potential problems of collinearity.

When observing Table 3, it was verified that there are no high correlations between the variables used, except for the variables Net Current Capital and Current Liquidity. In addition, Table 4 denotes the Variance Inflation Factor. Through this test, it was verified that no value was above 10, including the two aforementioned variables, which could denote, according to Wooldridge (2013), multicollinearity problems. Consequently, multicollinearity was not a problem in this model.
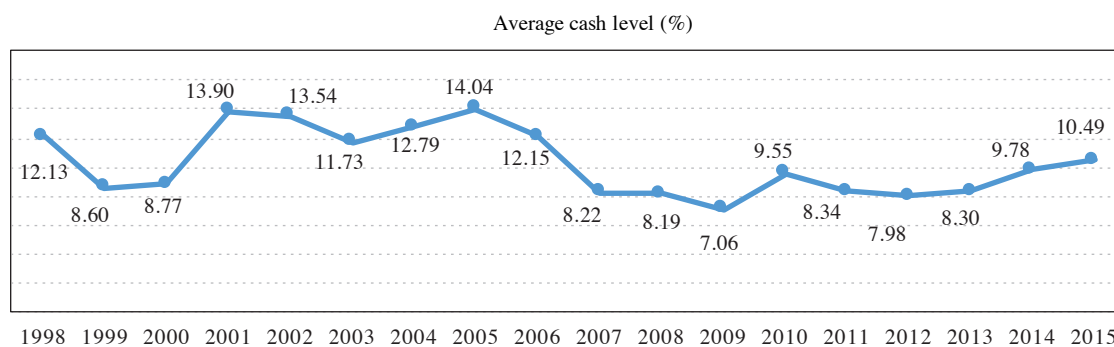

Figure 1. Variation of cash holdings.

The normality of the variables was verified. The results indicated, through the Shapiro-Wilk test, the non-normality of all variables. The normality of the residues did not present normal distribution either.

Considering all these points, Table 5 shows the results obtained by the GMM with standard asymptotic errors, given the problem of heteroscedasticity of the sample.

The results of the Sargan test indicate that the instrument variable (Cash $_{t-1}$) used in the estimation model has no correlation with the error term.

The first result of the model confirms the dynamic behavior of the cash decisions, since the coefficient of the lagged variable of cash is positive and significant at 1%. Consequently, the decision of the cash levels of a certain period is influenced by the percentages of cash held in previous dates. The results are consistent with those obtained by Ozkan and Ozkan (2004) and García-Teruel and Martínez-Solano (2008) indicating that the organizations of the industry, in general, have a target level of cash to be maintained.

Table 3. Correlation matrix of variables.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1 Ln *Cash*	1												
2 *Subprime Crisis*	-0.06	1.00											
3 *Brazilian Crisis*	0.05	-0.11	1.00										
4 *CL*	0.54	-0.09	-0.06	1.00									
5 *Size*	-0.12	0.18	0.34	-0.21	1.00								
6 *ROE*	0.30	-0.06	-0.04	0.23	0.04	1.00							
7 *AT*	0.48	-0.12	-0.13	0.38	-0.59	0.29	1.00						
8 *OM*	0.09	-0.03	0.07	0.18	0.27	0.56	-0.07	1.00					
9 *Debt*	-0.32	0.13	0.05	-0.47	0.11	-0.39	-0.30	-0.27	1.00				
10 *Lev*	0.05	0.05	0.08	-0.08	-0.17	-0.25	0.12	-0.16	0.16	1.00			
11 *Age*	-0.12	-0.02	0.16	-0.06	0.14	0.01	-0.06	0.10	-0.05	-0.05	1.00		
12 *IFRS*	-0.06	0.16	0.42	-0.13	0.66	-0.03	-0.31	0.17	0.08	0.05	0.17	1.00	
13 *NWC*	0.28	-0.08	-0.14	0.72	-0.21	0.25	0.32	0.09	-0.45	-0.31	-0.12	-0.29	1.00

Table 4. Variance Inflation Factor (VIF).[1]

Variables	**VIF**
Subprime Crisis	1.113
Brazilian Crisis	1.313
Current Liquidity	2.578
Size	2.970
ROE	1.979
Asset Turnover	2.146
Operating Margin	1.738
Debt	1.517
Leverage	1.352
Age	1.071
IFRS	2.172
NWC	2.807

[1] Values above 10 indicate potential multicollinearity problems.

Table 5. Generalized Method of Moments cash holdings regression.[1]

Variables	Coefficients	Standard error	Z	*P*-value
Constant	-0.048	0.047	-1.037	0.300
Cash $_{t-1}$ (instrumental var.)	0.220	0.056	3.919	8.91e-05***
Subprime Crisis	-0.235	0.155	-1.513	0.130
Brazilian Crisis	0.406	0.187	2.173	0.029**
Current Liquidity	0.711	0.094	7.566	3.84e-014***
Size	-0.118	0.242	-0.487	0.626
ROE	0.868	0.279	3.110	0.001***
Asset Turnover	0.903	0.296	3.049	0.002***
Operating Margin	-0.273	0.391	-0.698	0.485
Debt	0.118	0.730	0.161	0.872
Leverage	0.267	1.407	0.190	0.850
Age	1.618	1.362	1.188	0.235
IFRS	0.043	0.205	0.210	0.833
NWC	-2.642	0.665	-3.975	7.02e-05***
Observations (n)	358			
Corr (*y,y*)	0.6346			
Sargan test (df)	167.058 (135) with *P*-value (0.0318)			

[1] * = statistically significant at 10%; ** = statistically significant at 5%; *** = statistically significant at 1%.

Concerning the dummy variable representing the Subprime Crisis, there is a negative association, without obtaining statistical significance. Therefore, the coefficient, contrary to the one suggested by the literature, indicates that the effects of this crisis do not seem to have a decisive impact on the cash levels maintained by the mills and distilleries as much as the current crisis of the sector, which Santos *et al.* (2015) characterize as one of the worst which ever took place in Brazil. Thus, the effects of the subprime crisis, *ceteris paribus*, seems to be lower in Brazil, at least in relation to cash management.

In this sense, corroborating the arguments of Santos *et al.* (2015), it was possible to observe a positive association at the level of 5% for the dummy variable representing the current Brazilian and Industry Crisis. Factors such as the absence of rainfall and the control of the price of gasoline by the federal government to control inflation seem to have influenced the cash management of the companies in the industry. For Sant'Anna *et al.* (2016), gasoline price controls adversely affected the sugarcane industry, as gasoline prices were artificially kept below international prices, and ethanol prices, on the other hand, were determined by market.

As a result, gasoline has become more efficient than ethanol, since ethanol presents a higher consumption per mile than gasoline, causing the price of ethanol to become too expensive. According to Sant'Anna *et al.* (2016), all the context mentioned above was responsible for the crisis in the sector, so that the results obtained here still indicate that the crisis in the sector positively affected, *ceteris paribus*, the cash levels maintained by the companies analyzed.

A possibility to obtain a positive coefficient would be due to an apparent reduction of the credit supply during the years 2014 and 2015. For Bliss *et al.* (2015), this occurs because, in financial crisis situations, there may be a strong reduction in the supply of credit, or even an increase in the cost of funding. However, Bliss *et al.* (2015) emphasize, in their work, that periods of crisis are not only associated with credit shortage. Therefore, there may also be a shock in the demand for financing due to the whole context of market uncertainties.

As a result, the whole environment of uncertainty and crisis in Brazil caused managers to increase the average level of cash, aiming to overcome the problems caused by the credit crunch and reduced investment opportunities. Consequently, the precautionary reason proved to be of great value in understanding the cash management of privately-held firms of the Brazilian sugarcane industry, which in turn, was also obtained by Trejo-Pech *et al.* (2015).

In their study, Trejo-Pech *et al.* (2015), made use of a sample of agribusiness companies listed on the US stock market during the period from 1970 to 2012. The results obtained by them showed that precautionary reasons are essential for the management of the cash of agribusiness companies, since cash is needed to quickly execute their growth opportunities, as well as limit the transaction costs related to obtaining resources from third parties.

Despite not only the positive and significant association with this variable, but also the average cash level higher than that found by Dahroug and Saito (2013) for the Brazilian listed companies, the maintenance of an average cash level of 10.38% as a concern was mentioned. This is due to the fact that the cases of companies that went bankrupt or went into bankruptcy process are high in the sector, and the maintenance of lower cash balances compared, for example, to that found by Gao *et al.* (2013) of 17.17% for their sample of privately-held firms, may be contributing decisively to the crisis in the sector.

Thus, given the maintenance of lower percentages of the assets in cash, the organizations may face greater difficulties in obtaining resources from third parties. Moreover, companies with low cash levels during times of crisis may be more susceptible to failure. In this context, the market may interpret lower levels as precursors of bankruptcy, and maintaining larger cash holdings may signal the availability of resources needed to pursue the organization's investment activities.

Consequently, companies could maintain higher cash holdings so that, even in periods considered 'normal', they could take advantage of possible investment opportunities that, without the maintenance of higher reserves, would be impossible, due to the difficulty of access to resources at an affordable cost that did not prevent the realization of their projects.

Regarding smaller and younger companies, factors that previous studies indicate that would play a relevant role in determining cash levels, especially for privately-held firms, had not significant results. It was expected that both Size and Age were negatively associated with cash, however, only the first one got a negative, but nonetheless, insignificant association. Specifically for Size, Trejo-Pech *et al.* (2015), in a study with agribusiness firms, obtained the same negative association, with statistical significance, though.

As noted by the regression results, there is a substitution effect between NWC and the dependent variable at the 1% level. This negative association had already been expected because of the assumptions of Opler *et al.* (1999), Ozkan and Ozkan (2004), which signal the lower cost of converting non-cash net assets into cash in relation to other assets. Therefore, the presence of more liquid assets allows companies to maintain lower percentages of their assets in cash.

The Leverage, according to Steijvers and Niskanen (2013) can also act as a substitute for cash reserves. Thus, the authors suggest a possible negative relationship between leverage and cash, counteracting the positive association suggested by Han and Qiu (2007) and Ozkan and Ozkan (2004). However, the results signaled a positive association and yet without statistical significance.

Like Leverage, the Debt variable, according to Bigelli and Sánchez-Vidal (2012) could also serve as a substitute for cash. However, it also presented a positive association without the achievement of significance, contradicting, therefore, the assumptions signaled by the authors.

The profitability variable used (*ROE*), on the other hand, confirms the theoretical assumptions of Al-Najjar and Clark (2017) and Hall *et al.* (2014), in which the most profitable companies are expected to maintain larger cash balances. Given that, it was obtained a positive association between the ROE and cash levels at the level of 1%. Furthermore, the positive and significant influences of the Asset Turnover (*AT*), Return on Equity (*ROE*) and Current Liquidity (*CL*), at 1%, demonstrate the importance of financial management for companies in this sector, whose results may suggest an integrated analysis of these dimensions.

It was noted that the greater availability of resources in the mill's cash flow depends on the ability of these companies to generate income from their assets (*AT*) and to manage resources and leverage on a competitive basis to shareholders (*ROE*). Moreover, the positive and significant effect of liquidity also includes the importance of financial freedom in managing working capital and demonstrates that there is no tradeoff between liquidity and profitability for the sector, bearing in mind that the greater availability of cash is a function of higher levels of profitability and liquidity.

Nevertheless, it is possible to associate to this analysis the negative and significant impact of the indebtedness in the cash, which shows that companies with higher cash levels use this internal resource primarily to use third-party capital to meet capital demands, which brings the behavior of these companies closer to Pecking Order Theory. Finally, Operating Margin and IFRS were not significant determinants in the cash holdings.

In order to make the results, which were obtained through regression of the model of the GMM, more robust, the database was also analyzed by means of the Panel Data Regression Model. This procedure was carried out due to the fact that one criticism of the GMM (Johnston and Dinardo, 1997) is that it removes part of the sample used which, in turn, is already limited in this study. Therefore, the non-significance obtained for some of the model variables, especially for the variable representing the subprime crisis, which had a *P*-value of 0.13, could be due to the limited sample size used.

Thus, it was carried out the following test model specification: Welch test (4.5e-028), Breusch-Pagan (3.1e-063) and Hausman (3.0e-019) so that their results indicated the best fit of the Fixed Effects model to the database used. Considering all these points, the Fixed Effect Regression Model with Robust Standard Errors (due to the heteroscedasticity problem) was also used. The results obtained, as well as the signs, in turn, were similar. The only items that diverged were the significance levels of the ROE and Asset Turnover, which were previously significant at the 1% level, and were now at 5% and 10% respectively. In specifically addressing the variable representing the subprime crisis, it continued to be non-significant and with the same coefficient, so that the new p value obtained was 0.49. Consequently, the results reached in this model corroborate the previous ones.

Finally, another factor that could influence the results of this study is inflation. Curtis *et al.* (2017) demonstrated that inflation is an important determinant of the company's cash holdings. The Brazilian economy is denoted by high inflationary levels (Dahrouge and Saito, 2013), but the results obtained, through the National Extended Consumer Price Index, by including this variable as a control, was significant in neither model. Therefore, it was decided not to consider inflation in the model.

5. Conclusions

Many of the efforts made on the cash literature so far are focused on public companies, and only at company level. Thus, the specificities of privately-held firms (like ownership structure, level of information asymmetry and access to sources of financing), as well as the peculiar characteristics of each sector, Manoel *et al.* (2016) mention, in particular, the high shareholder concentration of the Brazilian sugarcane industry. It means that the studies carried out so far cannot be generalized to other companies without proper contextualization.

The decision-making process in relation to the total levels of assets held in cash by firms is challenging, especially in times of crisis. Thus, this study analyzes the effects of the Subprime and the Brazilian market

crises on the cash levels of the sugarcane industry, through a unique, hand-collected sample of privately-held firms.

Studies that analyze the cash management of firms in this sector may be decisive for understanding such an important item of financial management. Furthermore, the lack of an appropriate cash management may have contributed incisively, *ceteris paribus*, in the cases of bankruptcy and bankruptcy processes of these firms in Brazil. This research can contribute for decision makers to adopt more specific management policies, according to their peculiarities, especially when forecasting periods of economic recession, aiming to emerge stronger in troubled times like the ones analyzed.

Likewise, the mills and distilleries that are able to strengthen their cash holdings at a time prior to recessions may take advantage of future investment opportunities, which in turn, would not be possible in cases of lack of internal resources in a timely manner. This fact takes place because of the characteristics of the Brazilian market – see Lozano and Caltabiano (2014), such as low access to credit and dependence on the banking system with one of the highest real interest rates in the world, meaning that resources obtained from financing are not considered as ideal substitutes compared to those generated internally.

Companies that survive the crisis periods may also suffer in subsequent years since the funds inflow of in cash can take a long time, depending on the financial receipt cycles. As a result, the delay in rebuilding cash reserves at pre-recession levels may cause firms to increase their debt levels, especially short-term debt at high interest rates. Consequently, it further compromises the future performance of the industry, as well as worsens the quality of the debt structure.

Aiming to make the results obtained more robust, this research also controlled for endogeneity problems, because of its possible existence in studies on cash management. For better understanding, see Ozkan and Ozkan (2004). Thus, the empirical results obtained in this study corroborate the previous studies regarding the fact that private firms maintain higher percentages of their assets in cash than public ones. This result can be attributed to easier access by listed companies to sources of financing, even in a context of financial constraint. Thus, as a precaution, the companies of the industry maintain larger cash holdings.

In relation to the two dummies representing the Subprime and Brazilian Crises, only the second one was statistically significant with a positive coefficient. The first one, on the other hand, was not significant and did not show the expected positive sign. Evidence obtained also suggests that companies with higher NWC have lower cash levels, given their greater convertibility in cash. Finally, the Current Liquidity, Asset Turnover and ROE variables were also significant in the understanding of the cash management, in which all three had a positive association at the 1% level.

Regarding the limitations of this study, in addition to the restricted number of the sample, it was also mentioned the quality of the financial statements, especially for the period prior to the adoption of IFRS, since, not infrequently, the disclosed information complied with current legislation, but without providing additional information. Therefore, the non-significance results obtained by some of the control variables of the model, as well as the *P*-value (0.13) of the variable representing the subprime crisis may be due to these limitations. However, the results obtained using the Model of Fixed Effect Regression with Robust Standard Errors were also similar to those obtained through GMM. Consequently, one of the limitations of GMM, specifically regarding the reduction of the already limited sample number, was not significant in the results presented previously.

Furthermore, on account of the difficulty of accessing the explanatory notes, the research was unable to include more variables in order to expand the understanding on the theme. Thus, the inclusion of variables on a possible relationship of the company with a single bank, the number of board members, mechanisms of corporate governance, the existence of an external chief executive officer, as well as proxies related to the investment opportunities could not be performed either.

Despite all these limitations, this research is still relevant, since the results obtained here in a single context of the Brazilian economy can serve as a basis for future research. Thus, expanding the scope of this study to public companies of the sugarcane industry in Brazil is a natural way. Consequently, with the development of research in this scope, new studies can compare their results with those obtained here, in order to expand the understanding on cash holdings. Studies comparing cash management in companies from the world's leading sugarcane producers such as China, India, Australia and Thailand can also be of great value to the cash management literature. The research also offers some insights for financial managers, being this an important managerial implication.

References

Al-Amri, K., M. Al-Busaidi and S. Akguc. 2015. Conservatism and corporate cash holdings: a risk prospective. *Investment Management and Financial Innovations* 12(1): 101-113.

Al-Najjar, B. 2013. The financial determinants of corporate cash holdings: evidence from some emerging markets. *International Business Review* 22(1): 77-88.

Al-Najjar, B. and E. Clark. 2017. Corporate governance and cash holdings in MENA: evidence from internal and external governance practices. *Research in International Business and Finance* 39(1): 1-12.

Antunes, M.T.P., M.C.P. Grecco and H. Formigoni. 2012. Mendonça Neto. A adoção no Brasil das normas internacionais de contabilidade IFRS: o processo e seus impactos na qualidade da informação contábil. *Revista de Economia e Relações Internacionais* 10(20): 5-19.

Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economics Studies* 58(2): 277-297.

Armstrong, C.S., M.E. Barth, A.D. Jagolinzer and E.J. Riedl. 2010. Market reaction to the adoption of IFRS in Europe. *The Accounting Review* 85(1): 31-61.

Assaf Neto, A. 2014. *Finanças Corporativas e Valor*. 7th ed. Atlas, São Paulo, Brazil.

Baum, C.F., M. Caglayan, N. Ozkan and O. Talavera. 2006. The impact of macroeconomic uncertainty on non-financial firms' demand for liquidity. *Review of Financial Economics* 15(4): 289-304.

Bigelli, M. and J. Sánchez-Vidal. 2012. Cash holdings in private firms. *Journal of Banking and Finance* 36(1): 26-35.

Bliss, B.A., Y. Cheng and D.J. Denis. 2015. Corporate payout, cash retention, and the supply of credit: evidence from the 2008-2009 credit crisis. *Journal of Financial Economics* 115(3): 521-540.

Brazil. 2007. Lei n° 11.638, de 28 de dezembro de 2007. Altera e revoga dispositivos da Lei no 6.404, de 15 de dezembro de 1976, e da Lei no 6.385, de 7 de dezembro de 1976, e estende às sociedades de grande porte disposições relativas à elaboração e divulgação de demonstrações financeiras. Brasília, 2007. Avalaible at: http://tinyurl.com/o3fgkfv.

Campello, M., E. Giambona, J.R. Graham and C.R. Harvey. 2011. Liquidity management and corporate investment during a financial crisis. *Review of Financial Studies* 24(6): 1944-1979.

Carvalhal, A. and R.P.C. Leal. 2013. The world financial crisis and the international financing of Brazilian companies. *Brazilian Administration Review* 10(1): 18-39.

Curtis, C.C., J. Garín, and M.S. Mehkari. 2017. Inflation and the evolution of firm-level liquid assets. *Journal of Banking and Finance* 81: 24-35.

Dahrouge, F.M. and R. Saito. 2013. Políticas de cash holdings: uma abordagem dinâmica das Empresas Brasileiras. *Revista Brasileira de Finanças* 11(3): 343-373.

Dittmar, A., J. Mahrt-Smith and H. Servaes. 2003. International corporate governance and corporate cash holdings. *The Journal of Financial and Quantitative Analysis* 38(1): 111-133.

Ferreira, E.J. and R.P.C. Leal. 2011. Cash holdings of Brazilian and US firms: size and industry effects. *Journal of International Finance and Economics* 11(1): 75-84.

Ferreira, M.A. and A.S. Vilela. 2004. Why do firms hold cash? Evidence from EMU countries. *European Financial Management* 10(2): 295-319.

Gao, H., J. Harford and K. Li. 2013. Determinants of corporate cash policy: insights from private firms. *Journal of Financial Economics* 109(3): 623-639.

García-Teruel, P.J. and P. Martínez-Solano. 2008. On the determinants of SME cash holdings: evidence from Spain. *Journal of Business Finance and Accounting* 35(1-2): 127-149.

Gogineni, S., S.C. Linn and P.K. Yadav. 2012. Evidence on the determinants of cash holdings by private and public companies. Working Paper. University of Oklahoma, Norman, OK, USA.

Hall, T., C. Mateus and I.B. Mateus. 2014. What determines cash holdings at privately held and publicly traded firms? Evidence from 20 emerging markets. *International Review of Financial Analysis* 33(3): 104-116.

Han, S. and J. Qiu. 2007. Corporate precautionary cash holdings. *Journal of Corporate Finance* 13(1): 43-57.

Jensen, M. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76(2): 323-329.

Jensen, M. and W. Meckling. 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3(4): 305-360.

Johnston, J. and J. Dinardo. 1997. Econometric methods. McGraw Hill Higher Education, California, CA, USA.

Keynes, J.M. 1936. *The general theory of employment, interest and money*. Harcourt Brace, London, UK.

Kim, C., D.C. Mauer and A.E. Sherman. 1998. The determinants of corporate liquidity: theory and evidence. *Journal of Financial and Quantitative Analysis* 33(3): 335-359.

Kusnadi, Y. and K.C.J. Wei. 2011. The determinants of corporate cash management policies: evidence from around the world. *Journal of Corporate Finance* 17(3): 725-740.

Lee, E. and R. Powell. 2011. Excess cash holdings and shareholder value. *Accounting and Finance* 51(2): 549-574.

Lozano, M.B., and S. Caltabiano. 2014. Cross institutional cash and dividend policies: focusing on Brazilian firms. *Applied Economics* 47(3): 239-254.

Manoel, A.A.S., J.P.A. Eça, and M.B.C. Moraes. 2016. Custo do capital próprio em Empresas Brasileiras do setor sucroenergético: um estudo considerando a adoção das normas internacionais de contabilidade. *Revista Universo Contábil* 12(2): 117-137.

Martínez-Sola, C., P.J. García-Teruel and P. Martínez-Solano. 2013. Corporate cash holding and firm value. *Applied Economics* 45(2): 161-170.

Nason, R.S. and P.C. Patel. 2016. Is cash king? Market performance and cash during a recession. *Journal of Business Research* 69(10): 4242-4248.

Neves, M.F., R.B. Kalaki, V.G. Trombin and J.M. Rodrigues. 2014. Sugarcane industry development analysis from the perspective of agro-industrial system quantification. *Research in Agriculture* 1(2): 42-57.

Opler, T., L. Pinkowitz, R. Stulz and R. Williamson. 1999. The determinants and implications of corporate cash holdings. *Journal of Financial Economics* 52(1): 3-46.

Ozkan, A. and N. Ozkan. 2004. Corporate cash holdings: an empirical investigation of UK companies. *Journal of Banking and Finance* 28(9): 2103-2134.

Ross, S.A., R.W. Westerfield, and J.F. Jaffe. 2013. *Corporate finance*. 10th ed. McGraw-Hill, New York, NY, USA.

Sant'anna, A.C., A. Shanoyan, J.S. Bergtold, M.M. Caldas, and G. Granco. 2016. Ethanol and sugarcane expansion in Brazil: what is fueling the ethanol industry? *International Food and Agribusiness Management Review* 19(4): 163-182.

Santos, G.R., E.A. Garcia and P.F.A. Shikida. 2015. A crise na produção do etanol e as interfaces com as políticas públicas. *Radar: Tecnologia, Produção e Comércio Exterior* 1(39): 27-38.

Steijvers, T. and M. Niskanen. 2013. The determinants of cash holdings in private family firms. *Accounting and Finance* 53(2): 537-560.

Tahir, M.S. and M.N. Alifiah. 2015. Corporate cash holding behavior and financial environment: a critical review. *International Journal of Economics and Financial Issues* 5(1): 277-280.

Trejo-Pech, C.O., M.A. Gunderson, T.G. Baker, A.W. Gray and M.D. Boehlje. 2015. Assessing cash holdings in agribusiness. *International Food and Agribusiness Management Review* 18(4): 85-104.

Van Der Stede, W.A. 2011. Management accounting research in the wake of the crisis: some reflections. *European Accounting Review* 20(4): 605-623.

Wooldridge, J.M. 2013. *Introductory econometrics: a modern approach*, 5th ed. South Western, Nashville, TN, USA.