

FUNDAÇÃO GETULIO VARGAS
ESCOLA DE ECONOMIA DE SÃO PAULO

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**WORKING CAPITAL MANAGEMENT: A COMPARATIVE ANALYSIS BETWEEN
THE BRAZILIAN AGRIBUSINESS AND OTHER LISTED COMPANIES**

SÃO PAULO
2016

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Master's Dissertation presented to the Escola de Economia de São Paulo da Fundação Getulio Vargas (FGV's School of Economics of São Paulo), as a requirement for the degree of Master of Finances and Economy.

Field of Knowledge:

Corporate Finances

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RESUMO

O objetivo principal deste estudo é comparar a relação entre o capital de giro e a rentabilidade das empresas do setor de agronegócio em relação às demais empresas. Diferente dos estudos anteriores, a hipótese central buscou investigar se a relação negativa entre o capital de giro e a rentabilidade das empresas se aplica às empresas desse setor e incluiu no modelo tradicional outra variável, a necessidade de capital de giro operacional. Adicionalmente, buscou-se analisar o efeito da sazonalidade trimestral do capital de giro na rentabilidade e o impacto da gestão de capital de giro na rentabilidade das empresas do setor de agronegócios em períodos de recessão econômica. As regressões foram estimadas em bases trimestrais do período de 2007 e 2015. Os resultados encontrados apresentam evidências que sugerem as seguintes conclusões: 1) dada a especificidade do setor de agronegócio, o ciclo de conversão em caixa não explica a relação entre rentabilidade e gestão de capital de giro dessas empresas; 2) Já a necessidade de capital de giro apresenta significância estatística e um investimento adicional dessa variável pode agregar valor às empresas desse setor; 3) a sazonalidade influencia a gestão de capital de giro e a rentabilidade das empresas de agronegócio e pode agregar maior valor nos últimos dois trimestres do ano; e 4) a eficiente gestão do capital de giro em momentos de recessão aumenta a rentabilidade das empresas.

Palavras-chave: capital de giro, rentabilidade, valor, agronegócio, sazonalidade.

ABSTRACT

The main purpose of this study is to analyze the relation between working capital and profitability in the agribusiness sector companies in comparison with other Brazilian listed companies. Differently from the previous studies, the central hypothesis sought to investigate whether the negative relation between the working capital and the profitability of the companies applies to companies in this sector and included another variable in the traditional model, the operating working capital requirement. Additionally, we tried to analyze the working capital quarterly seasonality effect on the profitability and the impact of the working capital management on the profitability of companies of the agribusiness sector in periods of economic recession. The regressions have been estimated on a quarterly basis for the period from 2007 to 2015. The results found present evidences that suggest the following conclusions: 1) given the specificity of the agribusiness sector, the cash conversion cycle does not explain the relation between profitability and management of working capital of these companies; 2) The operating working capital requirement presents statistical significance and an additional investment of this variable can add value to companies of that sector; 3) the seasonality influences the agribusiness companies working capital management and profitability and may add greater value in the two last quarters of the year; and 4) the efficient working capital management in recession times increases the companies profitability.

Key words: working capital, profitability, value, agribusiness, seasonality.

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1 INTRODUCTION

The importance of working capital to the companies has been investigated in a number of studies and in different perspectives in the Corporate Finances literature, since it plays a strategic role on the financial performance and survival of the companies. Several authors researched in this study, including Shin & Soenen (1998), Deloof (2003), Chiou et al. (2006), Garcia-Teruel & Martines-Solano (2007), have shown that an efficient working capital management directly influences on the financial health of the companies and their profitability. Furthermore, Smith (1973) has suggested that many companies go into bankruptcy as a result of the incapacity of their financial managers to appropriately plan and control the current assets and liabilities of the companies, which would be the appropriate management of the working capital.

The working capital management concerns the management of current assets - accounts receivable, stock, cash and short term negotiable bonds - and current liabilities - suppliers and other short-term accounts payable - with the purpose to achieve the company's goals. According to Almeida & Eid (2014), "actually, working capital management has become one of the most important subjects in the companies and many financial officers seek to identify in their specific niches, the main *drivers* and appropriate levels of working capital".

With regard to the working capital levels, the companies might adopt more aggressive policies in its management and keep low levels of current assets as compared to the total assets or may adopt more conservative policies and keep higher levels of current assets. However, as the funds applied in working capital generally have a low profitability, it is of utmost importance to seek the balance between liquidity and profitability. To that regard, according to Lazaridis & Tryfonidis (2006), there is a certain optimal level of working capital requirement which potentially maximizes the results and shall be observed by financial managers in order to create value for shareholders.

The results of the researches described in the bibliographical references of this work come to the conclusion that one of the main working capital factors is the sector where the companies are in and its particularities. Given the relevance of the

agribusiness sector to the Brazilian economy - as per CEPEA (2015) data, the sector responded for approximately 21.5% of the country's GDP in 2015 - this work shall study the companies in that very sector, covering the agricultural and livestock production, inputs supply, production factors and processing and distribution.

Despite researches showing a negative relation between the companies working capital and profitability (Shin & Soene, 1998; Deloof, 2003; Lazaridis & Tryfonidis, 2006), suggesting that the managers may increase the companies profitability and create value for the shareholders reducing working capital levels, there are few empiric studies published concerning Brazilian companies analyzing this relation for different sectors, segregating them in industry, trade and others (Nakamura et al. 2010).

Besides the need for working capital being influenced by factors that affect companies from different sectors, such as the stocks policy, procurement and selling policies and market power (Grupta & Huefner, 1972), there is a big particularity in the agribusiness sector, which is the productive process dependence on seasonal factors and the concentration of income in some months of the year (Bento & Teles, 2013).

Differently from the previous studies, this work seeks to contribute with the literature since it specifically approaches the agribusiness sector, analyzing the impact of working capital management on the profitability of companies in this sector, which is fundamental to the Brazilian economy, in comparison with others Brazilian listed companies. The data have been collected quarterly with the purpose to analyze the seasonality. Other contribution is the analysis of the impact of recession periods on the working capital management of companies in this sector in comparison with others listed companies.

In view of these particularities, companies of that sector are expected to adopt more conservative policies regarding the maintenance of working capital levels in order to avoid a financial setback in moments of low liquidity.

In that sense, this work seeks to find out whether the negative relation between the profitability and the working capital widely evidenced in literature is valid for agribusiness companies as well as whether the variable commonly used to represent the working capital, the cash conversion cycle, also presents a significant statistic for companies in this sector.

Additionally, since several researches have confirmed the influence of particularities of the industrial sector in the determination of the capital sought to analyze the quarterly seasonality effect of working capital management on the profitability of these companies. Finally, the working capital management impact on the profitability of companies in this sector during recession periods shall be analyzed.

This work is structured in five chapters, including this introduction. The theoretical foundation and main points of literature on the different aspects of the working capital are presented in the second chapter. The variables used for the model as well as the methodology applied to analyze the working capital management effect on the profitability of agribusiness companies are outlined in the third chapter. The fourth chapter presents the applied models results and, at last, the fifth chapter presents the final considerations.

2 LITERATURE REVIEW

2.1 Traditional Models

The importance of working capital to the companies has been investigated in a number of studies and in different perspectives in the Corporate Finance literature. Summarily, the concept of working capital is related to the funds required to keep the company's operating cycle, except the cash destined to financial investments (Berke & DeMarzzo, 2014).

The working capital management concerns the management of current assets - accounts receivable, stock, cash and short term negotiable bonds - and current liabilities - suppliers and other short-term accounts payable - with the purpose to achieve the company's goals. In that sense, the working capital management plays a key role in the companies financial performance. Smith (1973) has suggested that many companies go into bankruptcy because of the incapacity of their financial managers to appropriately plan and control the current assets and liabilities of the companies.

In another work, Smith (1980) has emphasized the existing *trade-off* between liquidity and profitability and argued that working capital management plays an important role not only in the profitability and risk of the company, but also in its value.

Concerning the determinants of working capital management, several studies in international literature contribute to the understanding of this process.

Horrigan (1965) has concluded in his studies that factors such as the company's growth, size, leverage and characteristics of the industry are working capital determinants.

By means of a sample of different industries in the period from 1971 to 1978, Nunn (1981) found several working capital management determining factors related to production, sales, accounting methods, competitive presence in the market and factors related to industry.

Hawanini, Viallet & Vora (1986) found a strong, significant and consistent effect throughout the time of factors related to the different industries in the working capital management. According to them, factors such as the technology level applied in the productive process, efficiency level at which the companies manage the operating cycle and the level of sales determine the working capital investment in the various industries. The results also evidenced that there are companies in the various industrial sectors that are reference to the others in the construction of working capital investment policies. The authors analyzed 1,181 American companies grouped in 36 industries, in the period from 1960 to 1979.

Chiou & Cheng (2006) studied the working capital management determinants using different variables, such as the effect on the industry, operating cash flow, indebtedness, growth opportunities, company's performance, age of the company, size and business indicator measured during recession times. The results, from a sample of companies from Taiwan Stock Exchange in the period from 1996 to 2004, show that debt ratio and operating cash flow affect companies working capital management. Furthermore, recognizing the importance of the economic conjuncture over working capital determination, the authors included economic cycles indicators and found a positive relation between the economic cycle indicator during recession periods and the need for working capital.

Afza & Nazir (2008) investigated the working capital determinants of 204 manufacturing companies from Pakistan, of 16 industrial groups, during the period from 1998 to 2006. The results proved that the operating cycle, financial leverage, return over assets and Tobin's Q (relation between the company's market value and the reposition value of its assets) significantly influence the need for working capital.

Another aspect very discussed in the Corporate Finance literature concerns the optimal level of working capital of the companies and, consequently, its impact on the company's profitability.

Shin & Soenen (1998), Deloof (2003) and Lazaridis & Tryfonidis (2006) found a negative and significant relation between the working capital management, and the company's profitability, concluding that reducing the working capital to a reasonable minimum is a way to create value for the shareholders. The first researchers used a sample of 58,985 companies from the United States during the period from 1975 to 1994. The second one used a sample of 1,009 big Belgium

companies during the period from 1992 to 1996. And lastly the third researchers studied a sample of 131 companies of Athens stock exchange in the period from 2001 to 2004.

Garcia-Teruel & Martinez-Solano (2007) developed the first empiric study analyzing the existing relation between working capital management and small and medium companies profitability, using a sample of 8,872 companies in Spain in the period from 1996 to 2002. As per the authors, for most of these companies the current assets represent nearly the total assets and their current liabilities are their main external financing sources, since they have difficulties to have long term in the capital market. Therefore, working capital management for these companies is all the more important. The evidences of the study suggests that the managers can create value to the company by reducing the number of days of accounts receivable and stock. Similarly, the reduction of the cash conversion cycle can improve the companies profitability.

Analyzing the company value under an aspect other than the profitability and its relation with the working capital management, Faulkender & Wang (2006) have developed a methodology, also used by Kieschnick et al. (2009), estimating the company's value as the additional value perceived by the market, measured by the share return excess in the fiscal year as compared to its *benchmark* return. The authors studied how North American companies shareholders perceived the value of additional investment in working capital and found evidences that, on average, the additional value invested in working is worth less than a monetary unit sustained in cash.

More recently, Enqvist et al. (2014) they analyzed the impacts of the economic cycles in the relation between working capital and the company's profitability, using a sample of companies from Finland stock exchange, for a period of 18 years, from 1990 to 2008. The study found evidences that the working capital management is relatively more important in moments of low economic growth than in moments of expressive growth. This survey also found out a negative and significant relation between the companies profitability, measured by the return over the assets, and the cash conversion cycle, in line with several other studies of the aforementioned literature.

In the Brazilian context, the literature on working capital management is still limited. The works researched refer to working capital aspects related to their determinants, to the use of commercial credit and on the impact on the company's value.

Nakamura & Palombini (2010) investigated the determining working capital management factors in the Brazilian market, using a sample of 93 public companies during 32 quarters in the period from 2001 to 2008. The results presented evidences that the debt level, the company's size and the growth rate may affect the working capital management.

In another work, Nakamura et al. (2010) analyzed the influence of working capital management over the profitability, using a sample of 109 listed companies of the Brazilian market in the period from 2000 to 2008, on a quarterly basis. The results found suggest that the companies with higher gross profitability present lower levels of working capital, measured by the cash conversion cycle. Furthermore, they state that the results indicate that companies that are more aggressive in their working capital management tend to achieve a higher profitability, thereby balancing the negative effects of the practices of aggressive policies, such as for instance, the liquidity risk.

With regard to *trade credit*, Sheng et al. (2013) examined the payable accounts management of 265 companies from the Argentinian, Brazilian and Mexican stock exchanges, in the period from 1994 to 2009, with the purpose to identify whether the trade credit is used as a replacement for bank credit in periods of crisis in Latin America. The replacement hypothesis was confirmed by the smallest companies in the three economies. The authors evidenced that such confirmation cannot be generalized to all companies in the analyzed countries, since in periods of crisis the companies from Brazil and Argentina tend to use more commercial credit whereas companies from Mexico use their cash reserves.

Finally, Almeida & Eid (2014) analyzed the existing relation between working capital and the company's value, by means of Brazilian companies listed on BM&FBovespa in the period from 1995 to 2009. The authors found out that, in average, by increasing the level of investment in working capital the company's value is reduced. They have also tested whether the increase of financial leverage with the purpose to finance the additional investment in working capital reduces the

company's value, however no statistical evidences have been found for such hypothesis.

2.2 Studies applied to agribusiness

The results of the researches described in the bibliographical references of traditional studies found out that one of the main working capital factors is the sector where companies are in and its particularities.

In preliminary studies, Gupta (1969) & Gupta & Huefner (1972) analyzed the divergences of the financial ratios average between the industries and found out that there are differences of leverage, liquidity, profitability and activity between manufacturing companies operating in different industries and size levels. On the other hand, the studies of Nunn (1981), Hawawini et al. (1986), Kieschnick et al. (2006), Afza & Nazir (2008) & Nakamura et al. (2010) suggest that the working capital management practices are different between the industries.

Regarding the agribusiness sector, some studies have been made in recent years under different aspects, given its relevance to the national economy.

Bressan et al. (2009) analyzed the determinants of Brazilian agribusiness public companies indebtedness, according to the model proposed by Rajan & Zingales (1995). For such purpose, they used a sample of 35 companies of this sector listed in the BM&FBovespa in the period from 1999 to 2005. The study found out that the variables proposed under Rajan & Zingales (1995) model - assets tangibility, growth opportunity, size and profitability - have also been significant to explain the indebtedness of agribusiness companies.

Bonacim et al. (2009) studied the relation between the level of debt and the assets structure of 36 Brazilian listed companies in the agribusiness sector, in the period from 1997 to 2007. The central hypothesis verified whether there was equality between the assets tangibility of the companies in this sector with high and low leverage level. The survey results found an alternation in the correlation between the variables and the hypothesis was rejected, suggesting that the changes occurred in the leverage - mainly the search for financings guaranteed by chattel mortgage of fixed assets - generate variations in the companies tangibility.

In the article of Hall et al. (2013) the impact of the subprime crisis on the Brazilian agribusiness listed companies was assessed, using a sample of 72 companies in the period from 2005 to 2010. The results show that the agribusiness sector sustained a great impact with the crisis, mainly due to the increase in indebtedness and resulting cost of the debt, however, the sector showed signs of recovery already in the second year after the 2008 crisis. Another fact highlighted by the authors is that most of the net negative results presented by these companies in the period of crisis was a consequence of the losses incurred with the derivative instruments commonly used by the companies in this sector to mitigate their exposure concerning the commodities price and the exchange rate.

More recently, Hartman (2016) analyzed the determinants of the Brazilian agribusiness companies capital structure. For that purpose, a sample of 56 companies in the period from 2005 to 2014 was used. The survey results proved that the companies of this sector significantly depend on third parties capital, counting on a long term financing similar to the short term one. With respect to the capital structure determinants, the profitability, size, tangibility, liquidity, growth, type of capital and shareholding control factors showed some influence.

Under the optics of the seasonality of the agribusiness, Bento & Teles (2013) point out that the agricultural production presents specificities due to the great dependence of climate factors, luminosity and temperature. These factors end up influencing the agricultural production and the agribusiness productive chain, which presents limitations at certain times of the year.

Concerning the surveys on working capital management in companies of the agribusiness sector, few empiric studies have been found.

Baig (2009) prepared a comparative study on the working capital management practices in different companies of the agribusiness sector, including cooperatives, private companies and Multinational Corporation. In accordance with the author, the agribusiness companies, regardless of the size, need to control and monitor their working capital more efficiently, since its current assets represent a large proportion as compared to the total assets (around 60%), i.e., they are an important source of short term financing, these companies have less liquidity, greater volatileness in their cash flows and reliance in their short term debt (Peel at al, 2000 in Baig, 2009). Furthermore, evidences suggest that many of these companies make

decisions subjective to the modern approaches concerning the working capital management to create value to the company.

In accordance with Beierlein et al. (2013), the biggest concern of agribusiness companies managers is the liquidity. To properly ensure liquidity, the managers shall monitor their net working capital, verified by the difference between the current assets and liabilities. An inadequate working capital management will bring payment problems to the companies concerning current and emergence expenses, other than taking advantages of unexpected business opportunities.

Some Brazilian works referred to concern individual aspects of working capital management, such as e.g., a case of working capital management in irrigated fruit production companies in São Francisco Valley (Oliveira et al., 2008). This study compared the working capital management practices of two companies, showing that one of them had an unsatisfactory situation, with negative indicators with regard to the net current capital, need for working capital investment and balance in treasury.

Regarding the studies on the existing relation between working capital management and the agribusiness companies value and profitability, no empiric study nationally published has been found.

Therefore, the central research hypothesis of this work seeks to explore whether the negative relation between the profitability and the working capital level widely evidenced in the international academic literature is valid for agribusiness companies. Furthermore, if the variable commonly used to represent the working capital, the cash conversion cycle, also shows a statistical significance for the companies in this sector.

Additionally, since several surveys have proved the influence of specificities of the industrial sector on the determination of the working capital and that the productive process of the companies in the sector studied, the agribusiness, depends on seasonal factors, we tried to analyze the working capital quarterly seasonality effect on the companies profitability. Finally, considering that previous studies pointed out the influence of economic recession periods on the Finnish companies working capital management (Enqvist et al., 2014) and strong influence of the 2008 crisis on the result of the Brazilian agribusiness companies (Hall et al.

2013), the working capital management impact on the profitability of companies in this sector during recession periods shall be analyzed.

The Table 1 presented below contains a summary of the independent variables, the hypothesis, and the results achieved in the aforementioned traditional surveys seeking to analyze the relation between the working capital management and the company's profitability.

Table 1 - Summary of the Independent Variables, hypotheses and results of the literature review

Researchers	Independent Variable - Proxies Profitability	Independent Variables	Results	
			Coefficient signals	Statistic Significance
Shin & Soenen (1998)	Operational Income + Depreciation/Total Assets	Net Trade Cycle	-	Yes
		Current liquidity	-	Yes
		Debt	-	Yes
		Growth in Sales	+	Yes
Deloof (2003)	Gross Operating Profit/Total Assets - Financial Assets	Company Size	+	Yes
		Growth in Sales	+	Yes
		Debt	-	Yes
		Fixed Financial Asset	+	Yes
		Days of Accounts Receivable	-	Yes
		Days of Inventory	-	Yes
		Days of Accounts Payable	+	Yes
		Cash conversion cycle	-	Yes
Lazaridis & Tryfonidis (2006)	Gross Operating Profit/Total Assets - Financial Assets	Fixed Financial Asset	+	Yes
		Financial Debt	-	Yes
		Company Size	+	Yes
		Days of Accounts Receivable	-	Yes
		Days of Inventory	-	No
		Days of Accounts Payable	+	Yes
		Cash conversion cycle	-	Yes
Faulkender & Wang (2006)	Excess of Share return/Market Value	Cash holdings	+	Yes
		Cash holdings variation	+	Yes
		Interest Expenses	-	Yes
		Total Cash Net Assets	-	Yes
		Dividends paid	+	Yes
		Leverage Level	-	Yes
		Net Financing	+	Yes
		EBIT	+	Yes
		P&D Expenses	+	Yes
		Cash * Var. Value in Cash	-	Yes
Garcia-Teruel & Martinez-Solano (2007)	Return on Total Assets	Size of the Company	+	Yes
		Growth in Sales	+	Yes
		Debt	-	Yes
		Growth of the Economy	+	Yes
		Days of Accounts Receivable	-	Yes
		Days of Inventory	-	Yes
		Days of Accounts Payable	-	Yes
		Cash conversion cycle	-	Yes
Nakamura et al. (2010)	Gross profitability/Total Assets - Financial Assets	Size of the Company	+	Yes
		Growth in Sales	+	Yes
		Days of Accounts Receivable	-	No
		Days of Inventory	-	Yes
		Days of Accounts Payable	-	No
		Cash conversion cycle	-	Yes
		Working Capital Request	-	No

Almeida & Eid (2014)	Excess of Share return/Market Value	Value in Cash	+	Yes
		Value in Cash Variation	+	Yes
		EBIT	+	Yes
		Total Cash Net Assets	+	Yes
		Interest Expenses	+	Yes
		Dividends paid	-	Yes
		Leverage Level	-	Yes
		Net Financing	+	Yes
		Net Working Capital	+	Yes
		Var. Net Working Capital	+	Yes
	Net Working Capital* Var CCL	-	Yes	
Enqvist et al. (2014)	Gross Operating Profit Logarithm	Current liquidity	+	Yes
		Debt	-	No
		Growth in Sales	-	Yes
		D1 (Dummy Recession)	-	Yes
		D2 (Dummy Growth)	+	No
		Days of Accounts Receivable	-	No
		Days of Inventory	-	Yes
		Days of Accounts Payable	-	Yes
		Cash conversion cycle	-	Yes
		D1 * Days Accounts Receivable	-	Yes
		D2 * Days Accounts Receivable	-	No
		D1 * Days of Inventory	-	Yes
		D2 * Days of Inventory	-	No
		D1 * Days Accounts Payable	+	No
		D2 * Days Accounts Payable	+	No
D1* Cash conversion cycle	-	Yes		
D2* Cash conversion cycle	-	No		

Source: Self prepared

3 METHODOLOGY

3.1 Sample

This survey used as sample the companies listed in the BM&FBovespa, classified as active, in the period from 2007 to 2015. The data have been extracted from the *software* Economática in par values and on a quarterly basis, totalizing, therefore, 36 quarters.

The distinction of the Brazilian companies listed and belonging to the agribusiness was based on the classification of the Brazilian Confederation of Agriculture and Livestock (CNA) considering as companies of this sector those contained in the subdivisions below: “a) agriculture and livestock production; b) sector supplying inputs and production factors; c) processing and distribution sector.” (Bressan et al., 2009). Following this definition, the stock exchange classification sectors fitting into the agribusiness chain have been related. The table below presents these sectors and the respective subsectors and economic segments.

Table 2 - Economic Sectors Classified as Agribusiness

Economic sector	Subsector	Segment
Cyclical Consumption	Fabrics, Clothing and Footwear	Footwear Fibers and Fabrics Clothing
	Trade	Fabrics, Clothing and Footwear
Non Cyclical Consumption	Processed Food	Sugar and Alcohol
		Meat and Byproducts
		Various Food Dairies
	Agriculture and Livestock	Agriculture
Basic Materials	Wood and Paper	Paper and Cellulose Wood
	Chemicals	Fertilizers and Defensives

Source: Self prepared with data from BM&FBovespa

The choice of the analysis period - 2007 to 2015 - is due to the fact that most companies classified in the agribusiness sector have done their initial public offering

in 2006 and mainly 2007. According to the information contained in the BM&FBovespa website, the year 2007 saw the highest number of initial public offers, totaling 64 offers.

Initially the data from 385 active public companies in the period have been extracted. Reproducing the variables treatment proposed by Deloof (2003) and also used for later works, due to the specific nature of its activities, the companies from the "Public Utility" sector have been excluded from the sample, which include segments such as electric power, water and sewage and "Financial and Others", which consists of the segments of banks and financing companies, insurance companies, insurance brokers, real state exploration and others. The companies with missing data for the dependent and interest variables as well as the companies with atypical values for the gross operating profit over the assets (e.g. over 600%) and cash conversion cycle (e.g. cycles over 3,700 days referring to more than 10 years) have been eliminated. These exclusions totaled 184 companies. Therefore, the final sample took into account data from 201 companies, where 47 have been classified as agribusiness, after 36 consecutive quarters of observations. The detailed relation of the companies considered in the final sample is presented in Appendix I.

It is worth highlighting that in the data verification to calculate the variables, a lack of data in certain periods for some companies was noticed, as a result of the non publication of financial statements for that period or a deficiency at Economática's data base.

3.2 Definition of Variables and Model Specification

This section presents the definitions and the justifications of the dependent, independent and control variables used in the survey hypothesis as well as the specification of the econometric model adopted.

3.2.1 Dependent Variable

As provided in the literature review, the surveys on the impact of working capital management on companies profitability have used several measures as dependent variables, including return on assets, operating profit plus depreciation divided by the total assets, gross operating profit divided by the total assets less the financial asset, net operating profit divided by the total asset less the financial asset, gross operating profit logarithm and as a *proxy* to measure the value added to the company, the measure of excess of share return as compared to its *benchmark*.

As the purpose of this study is to analyze the working capital management operating effect relation on the profitability of agribusiness companies, as profitability measure we have used a variable in accordance with Deloof model (2003), the operating profit (RENT), verified by the total sales less the cost of products sold divided by the total assets less the financial assets, to control the size effect and purge the effects of participation in other companies.

The profitability calculation based on the shares market value, as used by Faulkender & Wang (2006), Kieschnick et al. (2012) et almeida & Eid (2014), has been discarded since most shares of agribusiness companies have a low trade volume, many of them with a liquidity rate below 0.1%.

3.2.2 Independent Variables

3.2.2.1 Variables of Interest

In accordance with the model applied by Deloof (2003), this study also used the cash conversion cycle (CCC) and its components, number of days of accounts receivable (PMR), number of days of inventory (PME) and number of days of accounts payable (PMP), as *proxies* for the measurement of the working capital management.

The cash conversion cycle, used in several previous studies as detailed in the literature review, measures the time between the paying the input and receiving the sales of the finished. The longer this cycle is, the higher the working capital investment (Deloof, 2003). This variable is calculated by the sum of the number of

days of accounts receivable and inventories less the number of days of accounts payable.

The number of days of accounts receivable represents the period necessary to convert accounts receivable from cash sales. This variable is calculated dividing the accounts payable receivable by the sales and multiplying by 365.

The number of days of inventory represents the period of transformation of the raw material into finished product for sale. Its calculation is by the division of the supply balance by the goods costs and then multiplied by 365.

The number of days of accounts payable is the period between the inputs purchase and the payment. This variable is calculated dividing the accounts payable balance by the goods costs and multiplying by 365.

Given the particularities of the agribusiness sector, whose productive process depends on seasonal factors and with an income concentrated in a few months of the year, and its dynamic, the average of the cash conversion cycle of companies in this sector is higher, and might not have a significance as compared to the profitability. In that sense, differently from the previous studies, this one chose to add another variable to measure the working capital management, the operating working capital (CGO), resulting from the difference between the operating current assets and the operating current liabilities. In accordance with Braga and Marques (1995), the working capital requirement, also known as working capital investment, has a direct relation with the level and the variations of the sales volume, which are motivated by the seasonality of the sector the company works or by changes of economic scope. This variable was also used as working capital measurement in the works of Chiou & et al. (2006), Nazir & Afza (2008) & Nakamura et al. (2010). For the present study the working capital need variable was standardized, being divided by the total assets less the financial assets, as displayed in the work of Nakamura et al. (2010).

3.2.2.2 Control Variables

Some control variables have also been included in the model, also in line with the methodology adopted by Deloof (2003), such as the company's size, sales growth, debt and number of fixed assets as compared to the total assets.

In accordance with Kieschnick et al. (2006), the company's size may influence the working capital efficiency, since big companies require higher investments in working capital due to the high level of sales. On the other hand, big companies may use their bargaining power and extend the deadlines with their suppliers, thereby reducing their working capital investment. The company size variable (TAM) was verified by sales logarithms (Defoof, 2003).

Another factor that can influence the working capital management is the sales growth (Nunn, 1981). As per Kieschnick et al. (2006), the expectation with the sales growth influences the working capital investment and also its cash conversion cycle, e.g. increasing the supply in the expectation of a future growth. To measure this variable (VEND) we have used the sales variation from one year to another divided by the sales of the previous year, in line with Deloof (2003) and Nazir & Afza (2008).

The debt level of the companies also has an influence on the working capital management. Previous studies carried out by Chiou et al. (2006) and Nazir & Afza (2008) found out a negative relation between the debt level variable and the variable representing the working capital management. According to Nakamura & Palombini (2012), this evidence suggests that companies with a high level of debt choose a more efficient working capital management in order to prevent the new issuance of debts and shares. The debt level variable (DIV) was calculated dividing the total financing (short and long term) by the total assets, following Deloof (2003).

Another control variable used by Deloof (2003) and also considered in this study is the ratio between fixed assets (investments) and total assets. If significant, this ratio may influence the company's working capital performance. This variable (INV) was measured by the division of the investments by the total assets.

It is expected that, during recession periods, as the companies present a slower growth, problems occur in the management of accounts payable and increases in supplies, resulting in an increase of the need for working capital. In that sense, Chiou et al. (2006) recognized the importance of the economic conjuncture

and included economic cycles indicators in their studies on working capital determinants, finding a positive relation between the economic cycle indicator during recession periods and the need for working capital.

Similarly, Enqvist (2014) found an increase in the significance of the relation between the cash conversion cycle and the profitability during recession periods, indicating that to deal the increasing challenges imposed by such periods, the working capital management is more significant as compared to the profitability. In this study, the economic cycles have been related to the irregular fluctuations in the economic activity, measured by the country's economic growth, from 1990 to 2008, segmenting these data into 5 years periods and inferring growth and recession situations.

To capture the influence of the economic environment, more specifically the recession periods, the series of Economic Cycles Indicators of the Economic Cycles Dating Committee (CODACE), created by the Brazilian Institute of Economics of Fundação Getulio Vargas, has been used. This indicator is meant to establish a reference of the economic cycles, marking the pos and downs of the country production. The series demonstrates to the probability of recession (0% or 100%) month to month, since January 1996. That way, we used a dummy variable (referred to in the model as "rec") to indicate the periods with 100% probability of recession. The quarters identified as recession have been: Q/4 2008, Q/1 2009, Q/2, Q/3 and Q/4 2014 and Q1 to Q4 2015.

3.2.3 Descriptive statistics

The Table 3 below demonstrates to the descriptive statistics of the variables covered in this study, considering the period of study of 36 quarters (from January 2007 to December 2015).

	Mean	Median	Minimum	Maximum	Std. Deviation
RENT	0,173	0,123	-0,661	2,324	0,174
TAM	13,099	13,083	5,717	19,636	1,965
VEND	0,362	0,473	-0,992	60,227	1,323
DIV	0,241	0,216	0,000	3,814	0,231
INV	0,033	0,001	-0,006	0,988	0,110
CCC	250,872	143,751	-3.675,687	3.844,745	429,676
PMR	164,876	104,338	0,000	2.462,975	198,445
PME	199,599	117,816	0,000	3.771,179	279,236
PMP	116,403	71,800	0,000	4.207,562	189,358
CGO	0,133	0,141	-4,466	0,827	0,314

Source: Self prepared

From the analysis of the descriptive statistics provided in Table 3 for Brazilian public companies contained in the sample for the period from 2007 to 2015, prepared with Economática software data, we observe that the average gross profitability is 17.3% whereas the median is 12.3%. The cash conversion cycle (CCC) has an average of 250.9 days. This value is considerably higher than the average of this same variable found for Belgian companies (44.5 days), small and medium Spanish companies, (76.3 days), companies listed in Athens stock market (189 days) and companies listed in Finnish stock market (108.8 days), as presented in the works of Deloof (2003), Garcia-Teruel & Martinez-Solano (2007), Lazaridis and Tryfonidis (2006) & Enqvist (2014) respectively. The average of days of accounts receivable, days of inventory and days of accounts payable is 164.9 days, 199.6 days and 116.4 days, respectively, also presenting higher values as compared to the aforementioned works. However, one can notice a high standard deviation for these variables. On the other hand the variable operating working capital (CGO) presents an average of 13.3% and median of 14.1%. On average, 24% of the assets of the companies of the

sample are financed by the debt and the ratio between the permanent assets and total assets represents low significance, on average 3.3%.

Table 4 presents the correlation matrix between the values considered in the model. There is negative relation between the gross profitability and the variables measuring the working capital management: cash conversion cycle (CCC), number of days of accounts receivable (PMR), number of days of inventory (PME), number of days of accounts payable (PMP) and the need for working capital (CGO). As per Deloof (2003), this relation is consistent with the fact of that the period between inputs purchase and selling the goods may be too long and the reduction of this period may increase companies profitability. In that same line, Garcias-Teruel and Martinez-Solano (2007) observe that this negative correlation indicates that a reduction of the cash conversion cycle is associated with higher profitability, what may justify the effect of a more efficient working capital management on the companies profitability.

Still as per Deloof (2003), the negative relation between the number of days of accounts payable and profitability is consistent with the fact of that less profitable companies tend to extend the payment of their accounts. Another explanation is that the companies delay to pay their accounts, since they do not receive financial incentives by means of discounts to make the payments to their suppliers.

The control variables company size (TAM) and sales growth (VEND) are positively correlated with the profitability (RENT), in consonance with the fact that bigger companies have more economies in scale, with the dilution of their fixed costs and the expectation with sales growth brings new revenues to the company, causing an increase in profitability. Inversely, the variables debt level (DIV) and permanent assets investment (INV) are negatively correlated to the profitability.

Table 4 - Correlation Matrix between Variables

	RENT	TAM	VEND	DIV	INV	CCC	PMR	PME	PMP	CGO
RENT	1,000									
TAM	0,140	1,000								
VEND	0,127	0,082	1,000							
DIV	-0,090	0,050	-0,001	1,000						
INV	-0,112	-0,149	-0,001	-0,063	1,000					
CCC	-0,207	-0,140	-0,161	-0,008	0,009	1,000				
PMR	-0,267	-0,188	-0,228	-0,003	0,018	0,767	1,000			
PME	-0,243	-0,174	-0,190	-0,014	-0,007	0,845	0,612	1,000		
PMP	-0,166	-0,133	-0,149	-0,006	-0,013	-0,222	0,194	0,203	1,000	
CGO	-0,057	0,058	-0,008	0,059	-0,049	0,361	0,246	0,223	-0,235	1,000

Source: Self Prepared

With the purpose to test multicollinearity problems between variables, the VIF - *Variance Inflation Factors* - method was used. These factors demonstrate how much of the variance of an estimator is burdened by the presence of collinearity with the other regressors contained in the model. As per Gujarati (2006) VIF values higher than 10 indicate that the variable is highly collinear.

To analyze the existence of heterocedasticity in the models a White (1980) test was carried out for all regressions

Finally, to verify which would be the most indicated model between the fixed effect and the random effect, the Hausman test was carried out. This test indicates, rejecting its null hypothesis that the model estimators with random effect are consistent and efficient, that the fixed effect model is consistent and that, therefore the estimators have no bias.

3.2.4 Specification of the Model

As previously reported, the central purpose of this research is to find out whether the negative relation between the profitability and the working capital widely evidenced in literature is valid for agribusiness companies as well as whether the variable commonly to represent the working capital, the cash conversion cycle, also presents a significant statistic for companies in this sector.

Therefore, to test this hypothesis, the methodology developed by Deloof (2003), whose purpose is to analyze the existing relation between working capital management and companies profitability has been used, adding the agribusiness *dummy* variable to distinguish the companies from this sector, as outlined in equation (1).

Besides the cash conversion cycle used as an efficiency gauge for the working capital management, the equations (2), (3) and (4), also include its main components represented by the number of days of accounts receivable, number of days of inventory and number of days of accounts payable, to verify whether the results presented are aligned with the existing researches in literature (Deloof, 2003) and whether these variables present significance when applied to the agribusiness companies.

In accordance with Enqvist et al. (2014), a company can minimize its cash conversion cycle by optimizing its main components in an independent way. E.g., the accounts payable may represent a source of financing for the company, extending the payment deadline with the suppliers and consequently reducing the cash conversion cycle and improving the working capital management efficiency. Due to this influence of the components of the cash conversion cycle in the working capital management efficiency and following models in the literature (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Garcia-Teruel & Martinez-Solano, 2007; Nakamura et al., 2010; Enqvist, 2014) we chose to analyze these variables - the cash conversion cycle and its 3 components - in an independent way.

$$(1) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CCC}_{i,t} + \beta_6 \text{agro_CCC}_{i,t} + \varepsilon_{i,t}$$

$$(2) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{PMR}_{i,t} + \beta_6 \text{agro_PMR}_{i,t} + \varepsilon_{i,t}$$

$$(3) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{PME}_{i,t} + \beta_6 \text{agro_PME}_{i,t} + \varepsilon_{i,t}$$

$$(4) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{PMP}_{i,t} + \beta_6 \text{agro_PMP}_{i,t} + \varepsilon_{i,t}$$

We shall highlight that to analyze whether the interest variables also had statistic significance for agribusiness companies and what is the relation between them and the profitability, the equations (1) to (4) included in the variables model interact the working capital *proxies* (CCC, PMR, PME and PMP) with agribusiness companies *dummy*.

The dependent variable in this regression model (RENT) is the gross profitability divided by the total assets less the financial assets of the company *i* during the quarter *t*. The independent variables are: TAM_{*i,t*} which is the size of company *i* in quarter *t*; VEND_{*i,t*} which is the company's sales growth *i* in the quarter *t*; DIV_{*i,t*} which is the company's debt level *i* in the quarter *t*; INV_{*i,t*} representing the investment in permanent assets; PMR_{*i,t*} representing the number of days of accounts receivable; agro_PMR_{*i,t*} which is the number of days of accounts receivable of agribusiness companies; PME_{*i,t*} representing the number of days of inventory; agro_PME_{*i,t*} which is the number of days of inventory of agribusiness companies; PMP_{*i,t*} representing the number of days of accounts payable; agro_PMP_{*i,t*} which is the number of days of accounts payable of agribusiness companies; and at last CCC_{*i,t*} representing the company's cash conversion cycle *i* in a quarter *t*, agro_CCC_{*i,t*} which is the agribusiness companies cash conversion cycle.

Given the particularities of the agribusiness sector, in accordance with the provisions of item 3.2.2, this study chose to add another variable to measure the effect of the working capital management on the profitability of these companies, the operating working capital (CGO_{*i,t*}), as per equation (5). In accordance with Fleuriet et al. (1978), the need for working capital constitutes an important variable for the analysis of the financial situation of a company, since it represents parts of the assets and liabilities directly bound to the company's operations, being therefore a function of the type of activity of the company.

$$(5) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CGO}_{i,t} + \beta_6 \text{agro_CGO}_{i,t} + \varepsilon_{i,t}$$

The conversion into cash (CCC), used by the Dellof model (2003) and several other works, is expected to have no statistical significance which interacted with the dummy of agribusiness companies. Furthermore, it is expected that the variable added to the model, need for working capital (CGO), when interacted with the agribusiness *dummy*, be positively related to the profitability and statistically significant, indicating that the efficient working capital management can increase the profitability and add value to the agribusiness companies.

In consonance with the specificities of the sector, which concentrates the revenue in a few months during the year, whereas the distribution of production costs occurs in all months, we sought to analyze in the second hypothesis whether there was a quarterly seasonality effect on the working capital on the profitability of companies in the agribusiness sector. I.e., if there are periods when the working capital management is more important.

According to the work of Ferreira & Pimentel (2014), it has been found out that the seasonality influences the profitability of the companies analyzed and affects the sectors in a different way. The sample used 381 Brazilian public companies in the period from 2000 to 2012.

In that same line, Bento & Teles (2013) say that the seasonality existing in the agricultural production mainly due to climate factors affect the production of these companies and the productive chain around them. Therefore, the offer and the results concentrate on a certain time of the year, in the harvest periods, which start about the end of the fourth quarter, extending up until the end of the first and start of the second quarter.

Another evidence of this prescription concentration in the periods of harvest can be noticed in the highest liquidity of commodities futures in the stock exchanges of Brazil and New York.

In the proposed model, represented by equations (6) and (7), the first quarter was used as a reference for the *dummies* variables indicating the seasonality and interacted with the variables representing the working capital efficiency (cash

conversion cycle and need for working capital) of the agribusiness companies. I.e., in the equations below, there was the interaction of three variables: agribusiness dummy, quarter dummy and interest variable (CCC and CGO).

$$(6) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CCC}_{i,t} + \beta_6 \text{agro_CCC}_{i,t} + \beta_7 \text{tri2_CCC}_{i,t} + \beta_8 \text{tri3_CCC}_{i,t} + \beta_9 \text{tri4_CCC}_{i,t} + \beta_{10} \text{tri2_agro_CCC}_{i,t} + \beta_{11} \text{tri3_agro_CCC}_{i,t} + \beta_{12} \text{tri4_agro_CCC}_{i,t} + \varepsilon_{i,t}$$

$$(7) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CGO}_{i,t} + \beta_6 \text{agro_CGO}_{i,t} + \beta_7 \text{tri2_CGO}_{i,t} + \beta_8 \text{tri3_CGO}_{i,t} + \beta_9 \text{tri4_CGO}_{i,t} + \beta_{10} \text{tri2_agro_CGO}_{i,t} + \beta_{11} \text{tri3_agro_CGO}_{i,t} + \beta_{12} \text{tri4_agro_CGO}_{i,t} + \varepsilon_{i,t}$$

Since the mean concentration of revenues of the agribusiness companies occurs in the first quarter of the year, whereas the costs are distributed throughout the year, it is expected that an efficient working capital management be more significant for these companies and, therefore, more important in the fourth quarter, which is the period before the revenues.

Finally, to test the hypothesis of the impact of recession periods on working capital management, we used the model adopted in the work of Enqvist et al. (2014), which analyzed the impact of the working capital management on the profitability of Finnish companies in different economic cycles. For that purpose, variables interacting the recession dummy with the variables representing the agribusiness companies working capital efficiency have been added to the model – equations (8) and (9).

$$(8) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CCC}_{i,t} + \beta_6 \text{agro_CCC}_{i,t} + \beta_7 \text{rec_CCC}_{i,t} + \beta_8 \text{rec_agro_CCC}_{i,t} + \varepsilon_{i,t}$$

$$(9) \text{ RENT} = \beta_0 + \beta_1 \text{TAM}_{i,t} + \beta_2 \text{VEND}_{i,t} + \beta_3 \text{DIV}_{i,t} + \beta_4 \text{INV}_{i,t} + \beta_5 \text{CGO}_{i,t} + \beta_6 \text{agro_CGO}_{i,t} + \beta_7 \text{rec_CGO}_{i,t} + \beta_8 \text{rec_agro_CGO}_{i,t} + \varepsilon_{i,t}$$

The working capital management for the agribusiness companies is expected to be more important, i.e., positively relate to the profitability, in moments of economic recession as compared to other companies, since these companies tend to keep a higher level of liquidity in times of crisis due the seasonality of their revenues and to the various weather related factor they are subject to, such as draughts, frost, excessive rain, lower prices due the excessive international offer, port strikes, among other factors.

The Table 3 presents a summary of the explanatory variables used in each hypotheses and the expected effect on companies profitability.

Table 3 - Explanatory variables and the expected effect on the profitability

Hypothesis	Independent Variables	Expected Effect on the Profitability	
H1	TAM _{i,t}	Size of the Company	+
	ΔVEND _{i,t}	Sales Growth	+
	DIV _{i,t}	Debt	-
	INV _{i,t}	Investment	+
	PMR _{i,t}	Days of account receivable	+
	PME _{i,t}	Days of Inventory	+
	PMP _{i,t}	Days of account payable	-
	CCC _{i,t}	Cash Conversion Cycle	-
	CGO _{i,t}	Operating Working Capital	-
	agro_CCC _{i,t}	Cash Conversion Cycle - Agro Companies	not significant
	agro_PMR _{i,t}	Days of account receivable - Agro Companies	not significant
	agro_PME _{i,t}	Days of Inventory - Agro Companies	not significant
	agro_PMP _{i,t}	Days of account payable - Agro Companies	not significant
	agro_CGO _{i,t}	Operating Working Capital - Agro Companies	+

H2	TAM _{i,t}	Size of the Company	+
	ΔVEND _{i,t}	Sales Growth	+
	DIV _{i,t}	Debt	-
	INV _{i,t}	Investment	+
	CCC _{i,t}	Cash Conversion Cycle	-
	CGO _{i,t}	Operating Working Capital	-
	agro_CCC _{i,t}	Cash Conversion Cycle - Agro Companies	not significant
	agro_CGO _{i,t}	Operating Working Capital - Agro Companies	+
	tri2_agro_CCC _{i,t}	Q/2 - CCC - Agro Companies	not significant
	tri3_agro_CCC _{i,t}	Q/3 - CCC - Agro Companies	not significant
	tri4_agro_CCC _{i,t}	Q/4 - CCC - Agro Companies	+
	tri2_agro_CGO _{i,t}	Q/2 - CGO - Agro Companies	not significant
	tri3_agro_CGO _{i,t}	Q/3 - CGO - Agro Companies	not significant
	tri4_agro_CGO _{i,t}	Q/4 - CGO - Agro Companies	+
H3	TAM _{i,t}	Size of the Company	+
	ΔVEND _{i,t}	Sales Growth	+
	DIV _{i,t}	Debt	-
	INV _{i,t}	Investment	+
	CCC _{i,t}	Cash Conversion Cycle	-
	CGO _{i,t}	Operating Working Capital	-
	agro_CCC _{i,t}	CCC - Agro companies	not significant
	agro_CGO _{i,t}	CGO - Agro companies	+
	rec_CCC _{i,t}	CCC - Recession	-
	rec_agro_CCC _{i,t}	CCC - Recession - Agro Companies	+
	rec_CGO _{i,t}	CGO - Recession	-
	rec_agro_CGO _{i,t}	CGO - Recession - Agro Companies	+

Source: self prepared

4 ANALYSIS OF THE RESULTS

This section presents the results of the models proposed above. At first, in item 4.1, the results found in the regression equations (1) to (5), intended to analyze the effect of working capital management on the profitability of agribusiness companies are analyzed, comprising the sample of public companies in BM&FBovespa in the period from 2007 to 2015 on a quarterly basis.

The item 4.2 exposes the result of equations (6) and (7) testing the second hypothesis previously indicated, with the purpose to identify whether there is a

quarterly seasonality effect of the working capital on the agribusiness companies profitability.

Finally, in item 4.3, are analyzed the results of equations (8) and (9) and intended to analyze the impact of the working capital management at moments of economic recession.

All the regressions equations were estimated based on fixed effects models, using as dependent variable - profitability - the gross operating income, measured by the total sales less the costs of products sold divided by the total assets less the financial assets. The statistic significances of the estimators are indicated with asterisks, where ***, ** and * represent significance at 1%, 5% and 10% respectively.

In accordance with the data presented in Table 5, we can notice that the VIF value of all variables of the model are under 10, indicating that there are no multicollinearity issues between them.

The White test has indicated the existence of heterocedasticity from the analysis of p-values under 5%. Therefore, it was necessary to adjust the standard error of the regressions by means of robustness procedures with regard to heterocedasticity.

The Hausman test was applied to the models described above and the results found in all of them (*p-value under 0.01*) rejected the null hypothesis (H_0), as exception of the equation (7), presented a high p-value. Thus, the data in panel methodology was used with fixed effects for all the models considered, with exception of model (7) where the random effect methodology was used.

Table 5 – Multicollinearity Analysis: VIF

Variable	VIF	Tolerance
TAM _{i,t}	1,090	0,920
ΔVEND _{i,t}	1,070	0,933
DIV _{i,t}	1,010	0,991
INV _{i,t}	1,030	0,971
CCC _{i,t}	8,530	0,117
PME _{i,t}	8,020	0,125
PMP _{i,t}	2,520	0,396
CGO _{i,t}	1,210	0,829

Source: self prepared

4.1 Effects of the Working Capital on the Profitability of Agribusiness Companies

Table 7 presents the result of the regressions intended to analyze the effect of working capital management on agribusiness companies. Initially, we used the concepts of cash conversion cycle (CCC) and its components - days of accounts receivable (PMR), days of inventory (PME) and days of accounts payable (PMP) - to measure the working capital level, following the models adopted in the works of Deloof (2003), Lazaridis & Tryfonidis (2006), Garcia-Teruel & Martinez-Solano (2007) and Nakamura et al. (2010).

With the purpose to analyze whether these variables also had statistic significance for agribusiness companies and what is the relation between them and the profitability, the equations (1) to (4) included in the variables model interact the working capital *proxies* (CCC, PMR, PME and PMP) with agribusiness companies *dummy*.

After that, in order to analyze if another variable also used to measure the working capital management presented statistic significance for agribusiness companies, the operating working capital (CGO) has been added to model 5, measured by the difference between the operating current assets and the operating current liabilities divided by the total assets less the financial assets, and its interaction with the agribusiness companies *dummy*.

Table 7 - Result of the regressions (1) to (5): Effect of the working capital management on the company's profitability

	Model 1	Model 2	Model 3	Model 4	Model 5
Independent Variable Working Capital Management					
CCC	-3,04e-05***				
agro_CCC	-1,54e-05				
PMR		-0,000162***			
agro_PMR		-5,86e-05			
PME			-3,43e-05*		
agro_PME			-1,50e-05		
PMP				-0,000111**	
agro_PMP				0,000109**	
CGO					-0,159***
agro_CGO					0,188***
Control Variables					
TAM	0,0658***	0,0681***	0,0676***	0,0710***	0,0772***
VEND	-0,00117	0,0125***	0,0119***	0,0107***	0,00442
DIV	-0,0568	-0,0646	-0,0611	-0,0636	-0,0665
INV	-0,0412	-0,0202	-0,0262	-0,0138	-0,0150
Constant	-0,638***	-0,699***	-0,693***	-0,736***	-0,801***
No. Comments	5.821	5.869	5.869	5.731	5.995
R² Adjusted	0,275	0,248	0,254	0,258	0,271

Source: self prepared

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% respectively.

In line with previous researches (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Garcia-Teruel & Martinez-Solano, 2007; Nakamura et al., 2010; among others) the results found from the analysis of the coefficients of variables CCC, PMR, PME, PMP and CGO, that are negative and statistically significant, suggest that companies with lower level of capital present a better profitability.

However, analyzing the coefficients of these variables when interacted with the agribusiness companies *dummy*, the variable CCC, PMR and PME, represented in models (1) to (4) respectively, despite presenting negative signs, except for the PMP, have no statistical significance, suggesting that these variables cannot explain the impact of working capital management on the agribusiness companies. The positive and statistically significant signal of the variable PMP interacted with the agribusiness company's *dummy*, in contrast with the result found in Deloof's (2003) model, suggests that the extension of the period for payment of the accounts of these companies positively influence its profitability.

On the other hand, the variable included in model (5), operating working capital (CGO), presents a positive coefficient and is highly significant statistically. I.e., in accordance with the initially expected, the result found suggests that the need for working capital other than better explaining the working capital management of agribusiness companies increases the company's profitability with the additional investment in operating working capital.

It is understood that this evidence helps to understand the importance of an efficient working capital management of agribusiness companies. Since most companies from this sector face difficulties inherent to their activities, such as harvest breaks resulting from weather changes, lower commodities prices, unfavorable exchange rate, revenues seasonality and high indebtedness to finance their investments and production costs, the results found in model (5) suggest that companies from this sector can maximize their revenues by means of a more conservative working capital management, ensuring a higher liquidity reserve.

The control variable company size (TAM) presented a positive and statistically significant signal in the 5 models presented above. These results confirm those proposed in the studies of Deloof (2003) and Lazaridis & Tryfonidis (2006), indicating that companies of bigger size count on higher profitability. The variable sales growth (VEND) presented a positive signal and statistical significance in the models (2), (3) and (4). In a similar way and as evidenced in the results of the research of Shin and Soenen (1998) and Deloof (2003), the sales growth causes an increase of the companies profitability.

On the other hand, the control variable debt level (DIV) presented negative signals but without statistical significance in the 5 models. Although the negative signal indicates that the profitability of the companies decreases with an increase of the debt level, in line with the research of Deloof (2003), given the statistic insignificance, it is not possible to infer this result in the studied sample. The variable investment in fixed asset (INV), in contrast with the result demonstrated by Deloof (2003), did not present a statistic significance in the 5 models, suggesting that the participation in other companies does not affect the profitability of the companies of the sample. It is understood that this result can be confirmed with the insignificance of the average ratio between the permanent assets and the total assets of the companies of the sample (3.3%) and low correlation previously presented between

this variable and the profitability, of 11.2% whereas for Deloof (2003) this variable presented a correlation of 30.6% with the profitability of the sample studied.

4.2 Influence of the seasonality on the working capital management agribusiness companies

The Table 8 presents the results found in the regressions (6) and (7) that seek to test the hypothesis that the seasonality has an influence on the working capital management of the agribusiness companies favorable to their profitability. In models (6) and (7) dummies variables representing the quarters have been included, using the first quarter as a reference and their interaction with the working capital level variables (CCC and CGO) and agribusiness companies dummy.

In these models it was chosen to use only working capital CCC variables, which is a measure traditionally known and used in several studies (Deloof, 2003; Lazaridis e Tryfonidis, 2006; Nakamura et al., 2010) and the CGO variable, that presented greater statistical significance to describe the relation between the working capital management and the agribusiness companies profitability.

The results found in the model (6) favor the second hypothesis of this study. The coefficient of the variable *agro_CCC* interacted with the quarters are positive and highly significant in statistic terms in the third and fourth quarters. This result suggests that the seasonality influences the working capital management in agribusiness companies and can add more value in the two last quarters of the year (third and fourth quarters). A viable explanation can be the fact of that this period includes the period between harvests that in Brazil is from July to September and the start of the main harvest from October to March (Santos et al., 2007 in Bento & Teles, 2013). This period sees the highest investments in production and is right before the concentration of the revenues. Thus, the results obtained suggest that the efficient allocation of funds in the third and fourth quarters become crucial.

Table 8 - Result of the regressions (6) to (7): Effect of the seasonality of the working capital management on the company' profitability

	Model 6	Model 7
Independent Variable Working Capital Management		
CCC	-2,44e-05**	
<i>agro_CCC</i>	1,53e-06	
tri2_CCC	-6,81e-05***	
tri3_CCC	-3,50e-05*	
tri4_CCC	4,75e-05	
tri2_CCC_agro	1,70e-05	
tri3_CCC_agro	7,78e-05***	
tri4_CCC_agro	0,000211**	
CGO		-0,184***
<i>agro_CGO</i>		0,123***
tri2_CGO		0,00398
tri3_CGO		0,0364
tri4_CGO		0,0446
tri2_CGO_agro		0,0325
tri3_CGO_agro		0,0619
tri4_CGO_agro		0,140
Control Variables		
TAM	0,0644***	0,0727***
VEND	0,0208***	0,00476
DIV	-0,0632	-0,0661
INV	-0,0203	-0,0186
Constant	-0,653***	-0,742***
No. Comments	5.731	5.995
R² Adjusted	0,275	0,282

Source: self prepared

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% respectively.

4.3 Impact of the working capital management in moments of economic recession

The last models (8) and (9), presented in Table 9, aim to analyze the impact of the working capital management on the profitability of agribusiness companies in moments of economic recession. For that purpose, as previously described in the model specifications, included the variables of interaction between *agro_CCC* and *agro_CGO* and a *dummy* indication of the economic recession.

Table 9 - Result of the regressions (8) to (9): Impact of the economic recession in the relation between the working capital management and the profitability of the company

	Model 8	Model 9
Independent Variable Working Capital Management		
CCC	-2,49e-05**	
agro_CCC	-2,46e-05	
rec_CCC	-1,52e-05***	
rec_agro_CCC	2,42e-05*	
CGO		-0,120**
agro_CGO		0,171**
rec_CGO		-0,0877***
rec_agro_CGO		0,0574**
Control Variables		
TAM	0,0713***	0,0782***
VEND	0,0106***	0,00396
DIV	-0,0627	-0,0610
INV	-0,0113	-0,00474
Constant	-0,740***	-0,819***
No. Comments	5.731	5.995
R² Adjusted	0,259	0,281

Source: self prepared

Note: ***, ** and * indicate statistic significance at 1%, 5% and 10% respectively.

According to the results found for the models (8) and (9), the coefficient of the variable intended to evaluate the interaction between the agribusiness companies working capital - represented by the cash conversion cycle and the operating working capital - in moments of economic recession presented a positive signal and statistic significance, being according to the expected and aligned with Enqvist's (2014) work.

This result suggests that the working capital management for agribusiness companies, in moments of economic recession, is positively related to the profitability differently from the other companies, indicating that the companies from this sector tend to keep a higher liquidity level in times of crisis due to the seasonality of their revenues subject to weather conditions, as aforementioned.

5 CONCLUSIONS

The main purpose of this study is to analyze the relation between working capital and profitability in the agribusiness sector companies. Differently from the previous studies, the central hypothesis sought to investigate whether the negative relation between the working capital, measured by the cash conversion cycle and its components, and the company's profitability applies to the companies of that sector and included another variable in the traditional model, also used to measure the working capital management, the operating working capital. Additionally, we tried to analyze the working capital quarterly seasonality effect on the profitability and the impact of the working capital management on the profitability of companies of the agribusiness sector in periods of economic recession.

To test the aforementioned hypothesis, a sample of public companies listed in the BM&FBovespa during the period from 2007 to 2015 has been used, with the data grouped on a quarterly basis following the panel methodology, with a total of 201 companies. All the regressions used as dependent variable the gross operating profit adjusted by the total assets less the financial assets.

The results found from the analysis of the coefficients of variables CCC, PMR, PME, PMP and CGO, that are negative and statistically significant, suggest that companies with lower level of capital present a better profitability, in line with previous researches (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Garcia-Teruel & Martinez-Solano, 2007; Nakamura et al., 2010; among others). However, analyzing the coefficients of these variables when interacted with the agribusiness companies dummy, it is noticed that, despite presenting negative signs, they have no statistic significance, suggesting that these variables cannot explain the impact of the working capital management on the agribusiness companies. On the other hand, it is possible to notice that the variable included in model (5), need for working capital (CGO), presents a positive coefficient and is highly significant statistically, suggesting that the need for working capital, other than better explaining the working capital management of the agribusiness companies, increases the company's profitability with additional investment in operating working capital.

The results found in the regressions testing the second hypothesis suggest that due to the seasonality, the working capital management can add value to the company in the two last quarters of the year, suggesting that in that period, which is

the one right before the concentration of the revenue, the efficient allocation of the funds is of utmost importance.

Finally, the results of the last regressions, which tried to analyze the impact of economic recessions on the working capital management and the profitability of agribusiness companies, found out a positive and statistically significant signal in the variable working capital of the agribusiness companies interacted with the variable economic recession, suggesting that the maintenance of a higher liquidity level in moments of crisis may increase the companies profitability.

It is understood that the evidences found helps to understand the importance of an efficient working capital management of agribusiness companies. Since most companies from this sector face difficulties inherent to their activities, such as harvest breaks resulting from weather changes, lower agricultural commodities prices, unfavorable exchange rate, revenues seasonality and high indebtedness to finance their investments and production costs, the results found suggest that companies from this sector can maximize their revenues by means of a more conservative working capital management, ensuring a higher liquidity reserve.

However, it is worth highlighting that the results from this study shall be considered with some care given the limitations of the sample size, the reduced number of public agribusiness companies and the limited data base extracted for the software Economatica with some missing values. For future works, it would be recommendable to use a longer time horizon, since most agribusiness companies opened their capital from 2007 on; a larger number of companies from this sector, not only the public ones but also the other companies from this sector with disclosed financial information; as well as testing new variables in order to improve the significance of the models, such as, e.g., other variables to determine the working capital or other response variables, such as return over the assets.

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APPENDIXES

Appendix I - Final Sample Companies Details

Company Name	Code	Economic Sector	Subsector	Agribusiness
Alpargatas	ALPA4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Biosev	BSEV3	Non Cyclical Consumption	Processed Foods	Yes
BRF SA	BRFS3	Non Cyclical Consumption	Processed Foods	Yes
Buettner	BUET4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Cambuci	CAMB4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Cedro	CEDO4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Celul Irani	RANI3	Basic Materials	Wood and Paper	Yes
Cia Hering	HGTX3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Cosan	CSAN3	Non Cyclical Consumption	Processed Foods	Yes
Cosan Ltd	CZLT33	Non Cyclical Consumption	Processed Foods	Yes
Coteminas	CTNM4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Dohler	DOHL4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Duratex	DTEX3	Basic Materials	Wood and Paper	Yes
Eucatex	EUCA4	Basic Materials	Wood and Paper	Yes
Excelsior	BAUH4	Non Cyclical Consumption	Processed Foods	Yes
Fer Heringer	FHER3	Basic Materials	Chemicals	Yes
Fibria	FIBR3	Basic Materials	Wood and Paper	Yes
Forno de Minas	FOMS3	Non Cyclical Consumption	Processed Foods	Yes
Grendene	GRND3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Guararapes	GUAR3	Cyclical Consumption	Trade	Yes
Ind Cataguas	CATA4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
JBS	JBSS3	Non Cyclical Consumption	Processed Foods	Yes
Josapar	JOPA3	Non Cyclical Consumption	Processed Foods	Yes
Karsten	CTKA4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Klabin S/A	KLBN4	Basic Materials	Wood and Paper	Yes
Laep	MILK33	Non Cyclical Consumption	Processed Foods	Yes
M.Diasbranco	MDIA3	Non Cyclical Consumption	Processed Foods	Yes
Marfrig	MRFG3	Non Cyclical Consumption	Processed Foods	Yes
Melhor SP	MSPA4	Basic Materials	Wood and Paper	Yes
Minerva	BEEF3	Non Cyclical Consumption	Processed Foods	Yes
Minupar	MNPR3	Non Cyclical Consumption	Processed Foods	Yes
Nutriplant	NUTR3	Basic Materials	Chemicals	Yes
Oderich	ODER4	Non Cyclical Consumption	Processed Foods	Yes
Pettenati	PTNT4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Pomifrutas	FRTA3	Non Cyclical Consumption	Agriculture and Livestock	Yes
Santanense	CTSA3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Sao Martinho	SMT03	Non Cyclical Consumption	Processed Foods	Yes
SLC Agricola	SLCE3	Non Cyclical Consumption	Agriculture and Livestock	Yes
Springs	SGPS3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes

Suzano Hold	NEMO5	Basic Materials	Wood and Paper	Yes
Suzano Papel	SUZB5	Basic Materials	Wood and Paper	Yes
Teka	TEKA4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Tereos	TERI3	Non Cyclical Consumption	Processed Foods	Yes
Tex Renaux	TXRX4	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
V-Agro	VAGR3	Non Cyclical Consumption	Agriculture and Livestock	Yes
Vulcabras	VULC3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Wembley	WMBY3	Cyclical Consumption	Fabrics, Clothing and Footwear	Yes
Aco Altona	EALT4	Industrial Goods	Machines and Equipment	
Aliperti	APT14	Basic Materials	Siderurgy and Metallurgy	
All Norte	FRRN5B	Construction and Transport	Transport	
Altus S/A	ALTS11	Industrial Goods	Services	
Ambev S/A	ABEV3	Non Cyclical Consumption	Beverages	
Anima	ANIM3	Cyclical Consumption	Various	
Arezzo Co	ARZZ3	Cyclical Consumption	Trade	
Arteris	ARTR3	Construction and Transport	Transport	
Azevedo	AZEV4	Construction and Transport	Construction and Engineering	
B2W Digital	BTOW3	Cyclical Consumption	Trade	
Bardella	BDLL4	Industrial Goods	Machines and Equipment	
Baumer	BALM4	Industrial Goods	Machines and Equipment	
Bic Monark	BMKS3	Cyclical Consumption	Trips and Leisure	
Biommm	BIOM3	Non Cyclical Consumption	Health	
Bombril	BOBR4	Non Cyclical Consumption	Products of Personal Use and Cleaness	
BR Pharma	BPHA3	Non Cyclical Consumption	Trade and Distribution	
Braskem	BRKM5	Basic Materials	Chemicals	
CCR SA	CCRO3	Construction and Transport	Transport	
Conc Rio Ter	CRTE3B	Construction and Transport	Transport	
Contax	CTAX3	Industrial Goods	Services	
Cremer	CREM3	Non Cyclical Consumption	Health	
Cristal	CRPG5	Basic Materials	Chemicals	
Csu Cardsyst	CARD3	Industrial Goods	Services	
Cyrela Realt	CYRE3	Construction and Transport	Construction and Engineering	
Dasa	DASA3	Non Cyclical Consumption	Health	
DHB	DHBI4	Industrial Goods	Transportation Material	
Dimed	PNVL3	Non Cyclical Consumption	Trade and Distribution	
Direcional	DIRR3	Construction and Transport	Construction and Engineering	
Dtcom Direct	DTCY3	Industrial Goods	Services	
Dufry Ag	DAGB33	Cyclical Consumption	Trade	
Ecorodovias	ECOR3	Construction and Transport	Transport	
Elekeiroz	ELEK4	Basic Materials	Chemicals	
Embraer	EMBR3	Industrial Goods	Transportation Material	
Estacio Part	ESTC3	Cyclical Consumption	Various	
Estrela	ESTR4	Cyclical Consumption	Trips and Leisure	
Eternit	ETER3	Construction and Transport	Construction and Engineering	

Even	EVEN3	Construction and Transport	Construction and Engineering	
Evora	PTPA4	Basic Materials	Packings	
Eztec	EZTC3	Construction and Transport	Construction and Engineering	
Ferbasa	FESA4	Basic Materials	Siderurgy and Metallurgy	
Fibam	FBMC4	Basic Materials	Siderurgy and Metallurgy	
Fleury	FLRY3	Non Cyclical Consumption	Health	
Forja Taurus	FJTA4	Industrial Goods	Machines and Equipment	
Fras-Le	FRAS3	Industrial Goods	Transportation Material	
Gafisa	GFSA3	Construction and Transport	Construction and Engineering	
Gerdau	GGBR4	Basic Materials	Siderurgy and Metallurgy	
Gerdau Met	GOAU4	Basic Materials	Siderurgy and Metallurgy	
Gol	GOLL4	Construction and Transport	Transport	
GPC Part	GPCP3	Basic Materials	Chemicals	
Grazziotin	CGRA4	Cyclical Consumption	Trade	
Haga S/A	HAGA4	Construction and Transport	Construction and Engineering	
Helbor	HBOR3	Construction and Transport	Construction and Engineering	
Hercules	HETA4	Cyclical Consumption	Domestic Utilities	
Hoteis Othon	HOOT4	Cyclical Consumption	Hotels and Restaurants	
Hypermarcas	HYPE3	Non Cyclical Consumption	Various	
Ideiasnet	IDNT3	Information Technology	Programs and Services	
Inds Romi	ROMI3	Industrial Goods	Machines and Equipment	
Inepar	INEP4	Industrial Goods	Machines and Equipment	
Invepar	IVPR4B	Construction and Transport	Transport	
lochp-Maxion	MYPK3	Industrial Goods	Transportation Material	
Itautec	ITEC3	Information Technology	Computers and Equipment	
Jereissati	MLFT4	Telecommunications	Fixed Telephony	
JHSF Part	JHSF3	Construction and Transport	Construction and Engineering	
JSL	JSLG3	Construction and Transport	Transport	
Kepler Weber	KEPL3	Industrial Goods	Machines and Equipment	
Kroton	KROT3	Cyclical Consumption	Various	
La Fonte Tel	LFTE4	Telecommunications	Fixed Telephony	
Le Lis Blanc	LLIS3	Cyclical Consumption	Trade	
Linx	LINX3	Information Technology	Programs and Services	
Localiza	RENT3	Cyclical Consumption	Various	
Locamerica	LCAM3	Cyclical Consumption	Various	
Log-In	LOGN3	Construction and Transport	Transport	
Lojas Americ	LAME4	Cyclical Consumption	Trade	
Lojas Hering	LHER4	Cyclical Consumption	Trade	
Lojas Marisa	AMAR3	Cyclical Consumption	Trade	
Lojas Renner	LREN3	Cyclical Consumption	Trade	
Lopes Brasil	LPSB3	Construction and Transport	Construction and Engineering	
Lupatech	LUPA3	Industrial Goods	Machines and Equipment	
Magaz Luiza	MGLU3	Cyclical Consumption	Trade	
Magnesita SA	MAGG3	Basic Materials	Various materials	
Mangels Indl	MGEL4	Basic Materials	Siderurgy and Metallurgy	

Marcopolo	POMO4	Industrial Goods	Transportation Material	
Metal Iguacu	MTIG4	Basic Materials	Packings	
Metal Leve	LEVE3	Industrial Goods	Transportation Material	
Metalfrio	FRIO3	Industrial Goods	Electric Equipment	
Metisa	MTSA4	Industrial Goods	Machines and Equipment	
Mills	MILS3	Construction and Transport	Construction and Engineering	
Minasmaquinas	MMAQ4	Industrial Goods	Trade	
Mrs Logist	MRSA3B	Construction and Transport	Transport	
MRV	MRVE3	Construction and Transport	Construction and Engineering	
Multiplus	MPLU3	Cyclical Consumption	Various	
Mundial	MNDL3	Cyclical Consumption	Fabrics, Clothing and Footwear	
Nadir Figuei	NAFG4	Cyclical Consumption	Domestic Utilities	
Natura	NATU3	Non Cyclical Consumption	Products of Personal Use and Cleaness	
Nortcquimica	NRTQ3	Non Cyclical Consumption	Health	
Odontoprev	ODPV3	Non Cyclical Consumption	Health	
OGX Petroleo	OGXP3	Oil, Gas and Biofuels	Oil, Gas and Biofuels	
Oi	OIBR4	Telecommunications	Fixed Telephony	
P.Acucar-Cbd	PCAR4	Non Cyclical Consumption	Trade and Distribution	
Panatlantica	PATI4	Basic Materials	Siderurgy and Metallurgy	
Paranapanema	PMAM3	Basic Materials	Siderurgy and Metallurgy	
PDG Realt	PDGR3	Construction and Transport	Construction and Engineering	
Pet Manguinh	RPMG3	Oil, Gas and Biofuels	Oil, Gas and Biofuels	
Petrobras	PETR4	Oil, Gas and Biofuels	Oil, Gas and Biofuels	
Petrorio	PRIO3	Oil, Gas and Biofuels	Oil, Gas and Biofuels	
Plascar Part	PLAS3	Industrial Goods	Transportation Material	
Portobello	PTBL3	Construction and Transport	Construction and Engineering	
Positivo Inf	POSI3	Information Technology	Computers and Equipment	
Pq Hopi Hari	PQTM4	Cyclical Consumption	Trips and Leisure	
Profarma	PFRM3	Non Cyclical Consumption	Trade and Distribution	
Qgep Part	QGEP3	Oil, Gas and Biofuels	Oil, Gas and Biofuels	
Qualicorp	QUAL3	Non Cyclical Consumption	Health	
Quality Soft	QUSW3	Information Technology	Programs and Services	
RaiaDrogasil	RADL3	Non Cyclical Consumption	Trade and Distribution	
Randon Part	RAPT4	Industrial Goods	Transportation Material	
Riosulense	RSUL4	Industrial Goods	Transportation Material	
RodobenYesob	RDNI3	Construction and Transport	Construction and Engineering	
Rossi Resid	RSID3	Construction and Transport	Construction and Engineering	
Sansuy	SNSY5	Basic Materials	Various materials	
Saraiva Livr	SLED4	Cyclical Consumption	Media	
Sauipe	PSEG4	Cyclical Consumption	Hotels and Restaurants	
Schulz	SHUL4	Industrial Goods	Machines and Equipment	
Senior Sol	SNSL3	Information Technology	Programs and Services	
Ser Educa	SEER3	Cyclical Consumption	Various	
Sid Nacional	CSNA3	Basic Materials	Siderurgy and Metallurgy	

Somos Educa	ABRE11+SEDU3	Cyclical Consumption	Media	
Sondotecnica	SOND5	Construction and Transport	Construction and Engineering	
Springer	SPRI3	Cyclical Consumption	Domestic Utilities	
SPturis	AHEB5	Cyclical Consumption	Trips and Leisure	
Sultepa	SULT4	Construction and Transport	Construction and Engineering	
Technos	TECN3	Cyclical Consumption	Fabrics, Clothing and Footwear	
Tectoy	TOYB4	Cyclical Consumption	Trips and Leisure	
Tegma	TGMA3	Construction and Transport	Transport	
Tekno	TKNO4	Basic Materials	Siderurgy and Metallurgy	
Telef Brasil	VIVT4	Telecommunications	Fixed Telephony	
Tim Part S/A	TIMP3	Telecommunications	Mobile telephony	
Time For Fun	SHOW3	Cyclical Consumption	Trips and Leisure	
Totvs	TOTS3	Information Technology	Programs and Services	
Trevisa	LUXM4	Construction and Transport	Transportation	
Trisul	TRIS3	Construction and Transport	Construction and Engineering	
Triunfo Part	TPIS3	Construction and Transport	Transportation	
Tupy	TUPY3	Industrial Goods	Transportation Material	
Unicasa	UCAS3	Cyclical Consumption	Domestic Utilities	
Unipar	UNIP6	Basic Materials	Chemicals	
UYesinas	UYES5	Basic Materials	Siderurgy and Metallurgy	
Vale	VALE5	Basic Materials	Mining	
Valid	VLID3	Industrial Goods	Services	
Viavarejo	VVAR11	Cyclical Consumption	Trade	
Vitalyze.Me	VTLM3	Non Cyclical Consumption	Products of Personal Use and Cleanness	
Weg	WEGE3	Industrial Goods	Machines and Equipment	
Wetzel S/A	MWET4	Industrial Goods	Transportation Material	
Whirlpool	WHRL4	Cyclical Consumption	Domestic Utilities	
Wilson Sons	WSON33	Construction and Transport	Transport	
WIm Ind Com	SGAS4	Industrial Goods	Trade	

Source: self prepared with data from Economática *software*