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ARE ACADEMIC STUDIES RELIABLE IN BRAZIL? FINANCIAL VARIABLES IN AN INFLATIONARY ENVIRONMENT: AN ANALYSIS FROM 2004 TO 2013

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ABSTRACT

After inflation rates' stabilization in Brazil, Monetary Correction for financial data was extinguished. Since then, the distinct reflections of price variations on monetary and non-monetary variables presented on financial statements are no longer considered. From 1995 to 2013, however, the cumulative inflation reaches 226%. Considering this situation, we may ask ourselves about the robustness of empirical analysis in the financial universe, not because of research design, but because of the variables that are present in them: companies' financial data. We compared financial indicators and empirical models built with data adjusted for inflation and original data issued by firms. A database of 143 Brazilian companies traded on Bovespa were adjusted for inflation, from 2004 to 2013, under the precepts of the extinct Monetary Correction. We obtained two different samples: the first one containing financial data adjusted for inflation and the second one corporate data originally released by companies. Statistical tests showed that financial indicators such as ROI, Assets Turnover, Debt and Market-to-book are significantly higher when we do not consider inflation effects.



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In addition, the panel regression models, when adjusted, had higher predictable power (greater R^2) and representative changes of significance on variables and regression coefficients. Results suggest that analysts and investors need to consider the inflation effect when making financial decisions.

Keywords: Inflation; Monetary Correction; Brazilian data

1. INTRODUCTION

Financial statements are one of the main tools we use to evaluate companies and make empirical tests. Bell (1961) states that the underlying capital can only be determined when we measure the current value of the company with perfection, but historical data are not sufficient for this issue. Analyzing a firm at two different times or comparing it to another firm, whose operation began earlier or later, would only be possible with financial values adjusted accordingly.

For Martins (2000) there are only two factors potentially responsible for variations in the measurement of companies' financial results: inflation and cost of opportunity. For these factors, we usually apply simplistic corrections from the methodological point of view, characteristic indicated as an "inexcusable failure" of accounting professionals, according to author's words.

After the The Real Plan stabilization in 1994, Brazilian inflation rates reached stable levels and the law 9.249/95 vetoed the use of any monetary adjustment for financial statements (DOUPNIK; MARTINS; BARBIERI, 1995). After this milestone, studies as the ones made by Bonizio and Vicente (2001), Gabriel, Neto and Corrar (2005), Ambrozini (2006), Oliveira, Marques and Canan (2007) and Moribe, Panosso and Marroni (2008) analyzed some impacts that the end of Monetary correction had on accounting and profitability indicators.

Although some public databases used in several studies offer an adjustment option for inflation, they do not differ "market" variables that are partially adjusted for inflation (such as net income, debt and market value) of non-monetary variables (such as permanent assets). One possible problem may arise exactly from the use of indicators composed by two of these variables, being one "market" adjusted and the other not.

1.1. Study Problem



Since the end of Monetary Correction, inflation rates in Brazil were controlled, but reached a substantial cumulative value of 226% between 1995 and 2004. Under these conditions, it is important to reflect about how financial indicators - composed by financial statements' variables - are impacted, since we no longer have the accounting corrections idealized for significant inflation times.

More than that leads us to a question: *are financial studies [really] reliable in Brazil?*

This study does not intend to discuss any accounting approach, nor will it address in detail the techniques of monetary adjustment. Our main objective is to examine whether the recognition of inflationary effects cause significant differences in financial indicators commonly used in financial studies. Moreover, we aim to analyze if this difference also leads to changes in estimators and significance of statistical models present in empirical studies.

Applying the precepts of the Monetary Correction, accounting data of 143 Brazilian companies traded on BOVESPA were adjusted for inflation, from 2004 to 2013, resulting in two different samples: the first containing adjusted financial data (considering inflation) and the second containing financial statements' data originally released.

For the two samples we estimated financial indicators frequently used in empirical researches, for comparative purposes. Statistical tests suggest financial indicators such as ROI, Assets Turnover, Debt and Market-to-book are significantly higher when we do not consider the effects of inflation.

2. LITERATURE REVIEW

2.1. Inflation and Financial Results

Before the inflation rates stabilization in Brazil, inflation was a recurring theme in financial papers and also in decision-making business process. The dramatic effect on the economy was an evidence that the role of financial manager had become increasingly important (PUGGINA, 1981).

Grazziotin (1980) conducted a detailed study about the inflation impact in the financial management of working capital, cash, accounts receivable, inventories,



cost of capital and dividends. The author proposed a reflection on the necessary adjustments in an inflationary context, mainly based on the distinction between non-monetary and monetary variables. The need to maintain equity consistency proved to be one of the biggest challenges when maximizing the company's value in uncertain scenarios.

After 1996, Brazil had a less peculiar inflation scenario, where price changes were no longer achieving three digits or more, and Monetary Correction for financial data was extinguished. In this environment, Eid Jr. (1997) developed a work that brought to the Brazilian market theories that were applicable only in stable countries. The work complemented studies developed by Grazziotin (1980) and Puggina (1981). Since that time, studies begin to relate financial management to an inflation environment, no longer conditioned to hyperinflation.

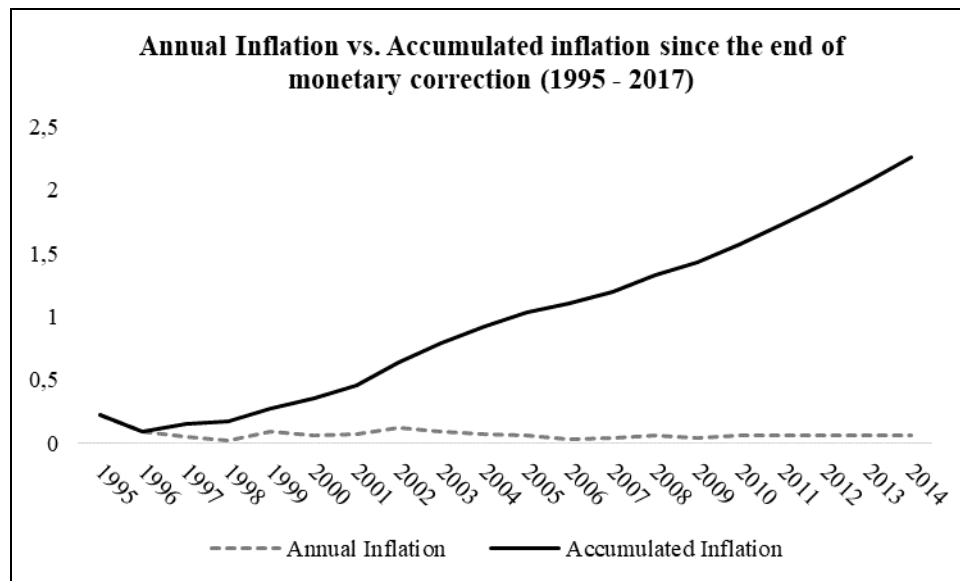


Figure 1: Annual Inflation vs. Accumulated inflation
 Source: own elaboration, with IBGE data (2014).

Some years later authors as Bonizio and Vicente (2001), Gabriel and Corrar Neto (2005), Ambrozini (2006), Oliveira, Marques and Canan (2007) and Moribe, Panosso and Marroni (2008) studied the impact of the end of Monetary Correction on accounting data and profitability indicators in Brazil. There is consensus among all the authors that when we do not consider inflation effects, results can lead us to an overestimation of performance indicators: a significant impact on financial analysis. In Israel, Barniv (1999) examined the value relevance of unexpected inflation-adjusted earnings and historical-cost earnings in the Israel hyperinflationary

environment. Results showed that unexpected inflation-adjusted earnings are value-relevant to investors in their economy.

Kirkulak and Balsari (2009) analyzed the role of incremental information content of inflation-adjusted data in explaining the market value of equity and stock returns in Istanbul. Author's findings showed that inflation adjustment affects financial ratios significantly, which may create different risk assessments for firms.

Examined the value relevance of inflation-adjusted and historical cost amounts in a hyperinflationary economy (Zimbabwe). Authors concluded that inflation gains and losses can provide incremental information content beyond that provided by historical cost amounts.

In addition to previous work, this study aims to analyze the impact of not considering the effects of inflation on financial statement indicators, using a greater number of financial indicators and empirical models built with these financial variables.

2.2. Monetary Correction: Income or Expense?

When Monetary Correction was still in force, inflation effects were indirectly considered by registering them in a single account named *Monetary Correction*, which can be creditor or debtor. The technique consists in the restatement of fixed assets and shareholders' equity, both non-monetary items.

If a company had more value on equity than fixed assets, will have an inflationary loss, while another that has higher fixed assets in relation to equity will have inflationary a gain. These so called "gains" and "losses" do not represent an income or an expense, but rather an indirect setting to consider inflationary effects on monetary accounts.

Imagine, for example, two fictitious Brazilian companies that had the same total equity in 2004, but different levels of immobilization compared to its equity. Let's consider the accumulated inflation between 2004 and 2014, approximately 62% (IPCA):

Table 1: two fictitious Brazilian companies

Company 01	
<i>Monetary Assets</i>	<i>Monetary Liabilities</i>
\$ 20.000	\$ 15.000
<i>Fixed Assets</i>	<i>Fixed Assets</i>



\$ 25.000	\$ 30.000
Company 02	
Monetary Assets	Monetary Liabilities
\$ 5.000	\$ 18.000
Fixed Assets	Fixed Assets
\$ 40.000	\$ 27.000

Applying the Monetary Correction principles not on the exercise, but on the period (2004 – 2014), we then would have:

Table 2: Applying the Monetary Correction

Company 01:	Company 02:
Fixed Assets = \$ 25.000 x 62% = \$ 15.500	Fixed Assets = \$ 40.000 x 62% = \$ 24.800
Equity = \$ 30.000 x 62% = \$ 18.600	Equity = \$ 27.000 x 62% = \$ 16.740
Monetary Correction = -\$ 3.100 (Debt)	Monetary Correction = \$ 8.060 (Credit)

Note that companies that maintain liquid resources in larger quantities has more monetary loss when facing a high inflation environment. This characteristic was also studied by Blejer (1979). The author examined the relationship between changes in inflation rates and the demand from companies for cash (high liquidity assets). Contrary to the Falls and Natke (1996) findings, his research suggests that financial risk due to high inflation has a negative effect on the demand for money. The positive effect exerted on the same variable, which happens when companies increase the liquidity of its assets in order to hedge risk, was not strongly significant.

3. METHODOLOGY

3.1. Sample Construction

This work aims to analyze the importance of inflation on indicators extracted from financial statements, often used to analyze the financial situation of companies and in academic research.

Therefore, we've obtained a sample of non-financial Brazilian companies, from 2004 to 2014. Economática database provided, at the time of data collection, quotations from a total of 2611 companies, of which 677 were Brazilian companies traded on BOVESPA.

We've selected a sample of 150 non-financial Brazilian companies based on market liquidity during the period. From this sample were excluded companies that had, in some moment, negative shareholders' equity and companies that for some reason did not present data available throughout some time of the sample horizon.

This sample allows us to analyze a period of high inflation, which was at lower levels from the year following the end of the sample (2014). Brazil, as pointed by

Lopes (2006), provides an excellent laboratory for testing accounting information because of idiosyncrasies caused by a contracting environment, being one of them arrangements related to inflation adjustment.

As our main objective is to evaluate the impacts of accumulated inflation in a stable environment, the period from 2004 to 2014 is considered a sample cut that reflects the interest of research particularly well.

For comparison purposes, we adjusted the original base according to the principles of Monetary Correction, in force until the year 1995. We applied the general price index to correct non-monetary items, which are, fixed assets and equity:

$$E_{A_{i,t}} = (E_{O_{i,t}} - NI_{O_{i,t}}) \times F_t$$

$$FA_{A_{i,t}} = FO_{A_{i,t}} \times F_t$$

$$NI_{A_{i,t}} = NI_{O_{i,t}} + \left[(FA_{A_{i,t}} - FA_{O_{i,t}}) - (E_{A_{i,t}} - E_{O_{i,t}}) \right]$$

Where:

E_0 ; NI_0 and FA_0 correspond respectively to shareholders' equity, net income and fixed assets not adjusted for inflation (originally issued) for each company (i) at each observed year (t);

E_A ; NI_A and FA_A correspond to shareholders' equity, net income and fixed assets adjusted for inflation, under the precepts of Monetary Correction.

F is our correction factor. IPEAD (Federal University of Minas Gerais) offers monthly a table containing a factor based on IPCA that update assets quoted in currencies from previous periods, translated into the corporate values for the same time analysis (end of 2014).

With these settings, we started working with two financial statements' samples, the first of corporate data officially released by companies, and the another one based on the assumptions of monetary correction.

3.2. "Market adjusted" and monetary variables

We define as real assets and liabilities, or non-monetary accounts, those whose current value also changes when price level floats, that is, financial accounts

that keeps its purchasing power under an inflationary environment (GRAZZIOTIN, 1980).

After the year of 1995, considering the inflation stabilization in Brazil, Monetary Correction, which allowed the accounting recognition of inflationary effects, was extinguished. Since that time, financial statement variables are no longer adjusted and the balance sheets of companies do not account for inflation.

However, monetary accounts can be viewed as partially adjusted by the “market”, since they incorporate in their value the effects of inflation every year. Note, before any further analysis, we may have a problem combining variables of these two groups together in any analysis.

Even when we look at a stable environment in terms of inflation in Brazil, between the years of 2004 and 2014, the cumulative inflation in Brazil reaches a representative value of 226%. Market adjusted variables reflect it in a sensitive way. The non-monetary indicators - that since the end of Monetary Correction do not incorporate the effects of inflation on their value – do not incorporate the variation in the same intensity.

4. RESULTS

The next table shows the results of paired mean tests for financial indicators relating accounts considered as "market adjusted" with non-monetary accounts. We found that p-values has α less than zero for all indicators, allowing the rejection of the null hypothesis (H_0), that the medium does not differ significantly:

Table 3: shows the results of paired mean tests for financial indicators

Indicator	<i>Mean Diff. Test</i>		P-Value	<i>Normality Test P-Value</i>	
	Original Mean	Adjusted Mean		Original Indicator	Adjusted Indicator
ASSETS	0,4288	0,3646	0,000***	0,9452	0,2610
TURN	0,0570	0,0392	0,005***	0,0553	0,5346
ROA	0,9930	0,8582	0,000***	0,8459	0,1675
MKT BOOK	0,2844	0,2461	0,000***	0,2461	0,5436

*Significant at 10%; **Significant at 5%; ***Significant at 1%.

Even though inflationary variations in Brazil have been stable during our sample period, accumulated inflation presents significant differences in financial indicators commonly used in financial research.

The following graphs demonstrate the behavior of financial indicators (Assets Turnover, Market-to-book, ROA, Debt/ Total Assets), comparatively for adjusted and non-adjusted indicators, based on the monetary correction principles. All indicators combine variables that are automatically “market” adjusted with variables that would be impacted by monetary correction adjustments:

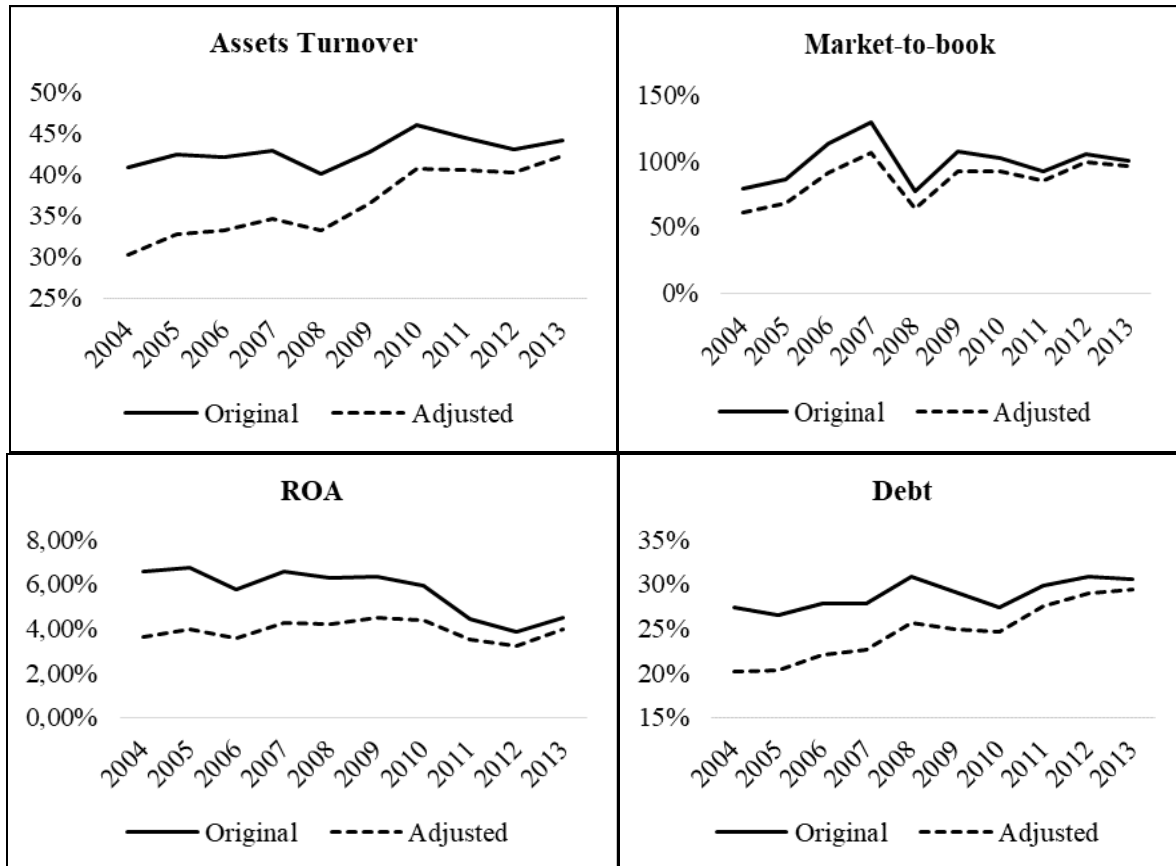


Figure 2: graphs demonstrate the behavior of financial indicators
 Source: own elaboration, with Economática data.

The graphs represent the behavior of four financial indicators, being Assets Turnover, Market-to-book, ROA and Debt, on average, for the sample. The behavior of inflation-adjusted financial variables is compared to original indicators, originally issued by companies traded on BOVESPA.

Overall, it is clear that all indicators estimated based on original values (not-adjusted since the end of monetary correction) are significantly higher than those adjusted by inflation.

- **Assets Turnover:** The *Assets Turnover* corresponds to revenue from sales divided by total assets of each company for each period. The assets turnover estimated with original data indicates that the sample companies had higher

efficiency using its assets to generate revenue than when we analyze the same indicator adjusted.

Our objective is not to draw any conclusions about capital structure or market value of companies, but rather to use variables that are consensually influential in both to test the effect of the accumulated inflation on empirical models containing financial variables extracted from the balance sheets, that no longer adjust the accounts by inflation since the extinction of monetary correction in Brazil.

- **ROA:** *Return on assets* demonstrates if a firm is being effective in implementing its assets. The also called ROA is one of the most common indicators on fundamental analysis of investment. As in the work of Gabriel, Neto and Corrar (2005), original values indicated a higher ROA than when we look at adjusted data. The effects of inflation are not considered; the analysis signals the company's operation as more profitable than actually is.
- **Market-to-book:** The market-to-book indicator is the ratio between market and book value of a company and is also used as a growth opportunity proxy. The non-adjusted market-to-book suggests that the sample companies are priced as having many growth opportunities (more than one) in the majority of the sample. However, after the indicator was adjusted, only during the year of 2007 the indicator modestly exceeds the value of one. The effect of inflation, when not considered, also causes the false impression that the market is evaluating companies as prone to growth, or above their book value.
- **Debt:** Debt corresponds to the total gross debt divided by total assets, for each firm in each period. The original indicator suggests that companies have higher debt than when we analyze the same indicator, but adjusted.

The four indicators mentioned are frequently used not only to study the economic and financial performance of companies, but as part of finance empirical models.

On the next session, we estimated some statistical models that contains these indicators, based on previous academic papers. Our objective is to find out if not considering the effects of inflation on financial statements can cause impacts that go beyond individual indicators analysis, affecting coefficients

magnitude and significance of variables in our models. The regressions were estimated with original financial statements' data and then with inflation adjusted data, for comparative purposes.

4.1. Capital Structure

Six factors are common in studies that address capital structure decisions of companies over some perspective: profitability, risk, size, composition of assets and growth. Based on previous works as Toy et al. (1974), Ferri and Jones (1979), Titman and Wessels (1988) and Klock Thies (1992), recent studies such as Perobelli and Fama (2003), Nakamura et al. (2007), Brito, Corrar and Batistella (2007) and Gonçalves and Bispo (2012) use regression models that contain these variables in their definition.

Based on these studies, we estimated the following panel data model:

$$DEBT_{i,t} = \beta_0 + \beta_1 Profit_{i,t} + \beta_2 Risk_{i,t} + \beta_3 Size_{i,t} + \beta_4 FixedAssets_{i,t} + \beta_5 Growth_{i,t} + \alpha_i + u_{i,t}$$

Where: *DEBT* is the ratio between total debt and total assets; *Profit* is the total revenue divided by total assets; *FixedAssets* is the total amount of fixed assets related by total assets and *Growth* is a proxy for growth opportunities, represented by the market-to-book value of the companies.

The panel data regression has been estimated with the two samples: first with original data, and then with adjusted data, considering the precepts of the Monetary Correction.

The results are presented in the table below:

Table 4: shows the results of paired mean tests for financial indicators

Variables	Coeff. (Std. Error)		Effect
	Original	Adjusted	
Profitability	-0,0529*** (0,0136784)	-0,0473*** (0,0120281)	- 12% Remains significant
	0,0113* (0,0059856)	0,0083 (0,0059856)	- 36% Loses significance
Risk	0,0145** (0,0072379)	0,0211*** (0,0068808)	+ 46 % Increases significance
	-0,0410* (0,0296546)	-0,1767*** (0,0231159)	+ 331 % Increases significance
Fixed Assets	-0,0183** (0,0081444)	-0,0204*** (0,007162)	+ 11% Increases significance
			+ 165% Increases the predictive power
R ²	0,0987	0,2612	

*Significant at 10%; **Significant at 5%; ***Significant at 1%.

When the model is estimated with adjusted data, there is a substantial increase on its predictive power: R² increases 165%. The coefficient magnitude also changes: the variables *Size*, *Fixed Assets* and *Growth* explained *Debt* variation more intensively, as they have a higher statistical significance. *Profitability* variable was already significant at 1% level, but lost a little intensity on its coefficient. Finally, the *Risk* variable lost significance in determining the debt level of companies in our sample.

4.2. Market Value of Shares

In order to analyze now the impacts considering a model focus on market values, we estimated the market value of companies, based on the following model:

$$MARKET\ VALUE_{i,t} = \beta_0 + \beta_1 Income_{i,t} + \beta_2 Debt_{i,t} + \beta_3 Risk_{i,t} + \beta_4 Size_{i,t} + \beta_5 Profitability_{i,t} + \alpha_i + u_{i,t}$$

Where: *MARKET VALUE* is the natural logarithm (ln) of the total market value of companies; *Income* is the net income divided by total assets; *Debt* is the ratio between total debt and total assets; *Risk* is the standard deviation of stock returns; and *Profitability* is the net income divided by total assets.

Table 5: results generated by original and adjusted data

Variables	Coeff. (Std. Error)		Effect
	Original	Adjusted	
Income	-1,0003	1,6534**	Change in the signal Becomes significant + 107%
	(0,6468516)	(0,7444751)	
Debt	1,7845***	3,5978***	Remains significant - 556%
	(0,4202005)	(0,4202005)	
Risk	-0,1260***	-0,0195	Loses significance + 21%
	(0,0393952)	(0,0328931)	
Size	0,3897***	0,4715***	Remains significant + 335%
	(0,0416187)	(0,0384305)	
Profitability	0,5340	2,3249***	Becomes significant + 120%
	(0,4611)	(2,324869)	
R ²	0,2172	0,4778	Increases the predictive power

*Significant at 10%; **Significant at 5%; ***Significant at 1%.

Comparing the results generated by original and adjusted data we can notice an improve on the model predictive power: 120% increase in the R². It is expected that profitability indicators (as *Income* and *Profitability*) to be positively related with market value: companies that are more profitable should have significantly higher market value. The regression containing original data presents the two variables as not significant when explaining the market value changes of companies. *Profitability* showed a sign contrary to expectations. When we analyze adjusted data instead, the

two variables become significant in explaining the market value of companies and reveal the expected relationship with the dependent variable of our regression, that is, positive.

The *Risk* variable lost significance, while *Debt* and *Size* remains significant at 1% level, but presents substantial increase in the magnitude of their coefficients.

The recognition of inflationary effects on the variables that composed our models suggests that considering inflation, separately for i) variables that automatically adjust price increases, which are market variables, and ii) variables that were manually adjusted when the Monetary Correction were still in course in Brazil, lead us to more reliable models, of greater economic and statistical significance.

5. CONCLUSION

After the stabilization of the Real Plan, the Law 9,249/ 95 vetoed the use of any monetary adjustment for financial statements in Brazil. Since then, data from financial statements do not have a formal adjust that consider the impacts of price changes in monetary and non-monetary assets or liabilities. Although controlled annually, in the years that follow the extinction of monetary correction, inflation reaches a representative cumulative value: 226%.

Researches and financial analysis have as object of study the financial statements issued by companies, often comparing the evolution of indicators constructed with financial data from different companies during large time horizons. It is necessary to have values measured accurately in order to generate robust and reliable results.

We construct two different samples: one composed by financial statements' data originally issued by companies and the other one by financial indicators adjusted based on the precepts of the extinct Monetary Correction.

First, our study compared financial indicators frequently used on research and financial evaluations, made with the two different databases (containing original and adjusted variables). Second, we compared panel regression models estimated with



original and adjusted variables, looking for changes in coefficients and predictive power of the models.

As in Kirkulak and Balsari (2009), our results suggest that it is essential to consider inflation effects on accounting variables, even in a stable inflation scenario, because accumulated inflation acts differently on variables that automatically incorporate price changes in their value (market adjusted accounts).

Original financial indicators were significantly higher when compared to adjusted ones, which can lead to wrong conclusions about Assets Turnover, ROA, Growth Opportunities (Market-to-Book) and Debt Level, especially when we analyze samples that cover long periods.

Even more highlighting, panel data regression indicated substantial changes on the coefficients and predictive power of models frequently used on financial studies. The adjusted data led us to results of greater economic significance and reliability.

When analysts or investors analyze accounting data to make decisions, it is essential that inflation-adjusted data is also considered, so that financial indicators are not distorted.

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