

PERSISTENCE, VALUE RELEVANCE, AND ACCRUALS QUALITY IN EXTREME EARNINGS AND CASH FLOW SITUATIONS

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ABSTRACT

Purpose: To analyze the impact of extreme earnings and cash flows on the persistence, value relevance, and accruals quality of Brazilian public firms.

Originality/gap/relevance/implications: The present study contributes to the literature by analyzing extreme earnings and cash flows. Because they change the results of the period in which they occur in an unusual manner, this study suggests that studying their behaviors and impacts on the quality of the information disclosed by companies tends to contribute to optimal decision making in the capital market.

Key methodological aspects: The analyzed sample comprised non-financial public companies traded on the BM&FBovespa stock exchange from 2005 to 2014, with estimates made using quantile regression.

Summary of key results: The main results indicate that cash flows are more persistent than earnings because the accruals component of the latter makes them less persistent. Extreme values of both earnings and cash flows affect the persistence of these variables, with a strong and negative effect on cash flows. Finally, extreme values of accruals negatively affect accruals quality because, compared to moderate quantiles, they significantly alter the standard deviation of extreme quantiles.

Key considerations/conclusions: The presence of extreme values in this study's focus variables negatively influenced market information quality, reducing its predictive power and, consequently, its relevance. Furthermore, controlling for extreme values, it was possible to observe the incremental information content of these two metrics.

KEYWORDS

Value Relevance. Accruals Quality. Extreme Earnings. Extreme Cash Flows. Quantile Regression.

1. INTRODUCTION

The uncertainties inherent to the market as a whole require the investor to seek sufficient information to reduce any risks associated with them. In this sense, accounting information is an essential source of information about companies and their roles in negotiation, with regard to the inputs necessary for estimating future cash flows.

As discussed by Bowen, Burgstahler, and Daley (1987), the information content of cash flows and earnings is an important area of accounting research because it focuses on two issues of fundamental importance for financial statements: 1. it shows the degree to which cash flow data are capable of increasing the usefulness of information provided by the accrual basis, from which financial statements are constructed; and 2. it provides evidence on the extent to which accruals change cash flow data to provide useful information to the capital market (Clubb, 2003, p. 117).

Hendriksen and Van Breda (2012, p. 206) state that “a crucial aspect of research on the impact of accounting earnings on the capital market is the determination of the information content of earnings data.” Accounting information content is supported by a number of attributes, including persistence, accruals quality, and value relevance; quality information is expected to have greater information content and, therefore, to better support the decisions of accounting information users.

However, extreme earnings situations may cause the reported number to have no information content, leading users to turn to other information, with cash flow as a possible substitute. Nonetheless, it is possible that cash flow may also be extreme and uninformative. Thus, Chen and Yang (2003) analyze the incremental content of both accounting measures in situations with extreme values. Their sample comprises 25,993 company-years of data from the NYSE, AMEX and NASDAQ covering the 1989-1997 period. Their results show that extreme values of both earnings and cash flows affect the value relevance of these measures.

Arkadani, Arkadani, and Heyrani (2013) analyze the incremental content of operating cash flows and earnings, in addition to the impact of extreme earnings on this incremental content, in a sample 150 companies traded on the Tehran Stock Exchange from 2006 to 2010. Their findings show that combining earnings and cash flow information results in a higher information content but that extreme values of earnings lead to a loss in information content.

Mostafa and Dixon (2013) also analyze the incremental content of extreme earnings and cash flows. Their sample comprises 1,916 firm-years



traded on the London Stock Exchange from 1995 to 2002. Their evidence suggests that the two measures provide incremental information beyond each other and that this is only the case for extreme earnings when the cash flow is moderate, or vice versa.

In Brazil, Silva Filho (2013) analyzes the persistence and relevance of accruals, in addition to the existence of accruals anomaly in the Brazilian capital market. The sample comprises 139 company-years, from January 1, 1995, to December 31, 2001. The study finds that the persistence of accruals is actually smaller than the cash flow component in explaining earnings in Brazilian companies; that accruals are correctly priced in the market; and that accruals anomaly is not confirmed. However, the relationship of variables with extreme values is not investigated.

Based on the above, the objective of this study is to analyze the impact of extreme earnings and cash flows on the persistence, value relevance, and accruals quality of Brazilian public firms.

This study follows a line of thought proposed by Chen and Yang (2003) and Mostafa and Dixon (2013), bringing to the Brazilian context an analysis of the quality of the numbers reported by companies, controlled by extreme earnings and cash flows.

The studies conducted by Chen and Yang (2003), Mostafa and Dixon (2013), and Arkadani, Arkadani, and Heyrani (2013) all use the ordinary least squares (OLS) method, with a dummy variable to represent extreme values. This article advances this method by using quantile regression, making it possible to control not only extreme values from the previous year, as in the other studies, but also contemporary extreme values. It is thus possible to capture the effect of the previous year's extreme accounting number in the current year's numbers more effectively and to control the effect of outliers, heterogeneity, scale problems, and other econometric issues that cannot be controlled using OLS.

Thus, this study seeks to analyze the impact of these extreme values on the persistence of accounting numbers, then value relevance itself, and, finally, accruals quality. The results corroborate the literature cited above, adding the fact that accruals quality is also negatively affected by extreme values.

The sections that follow include a literature review (2); followed by the methodology (3), which comprises the population and sample (3.1), the measurement of extreme earnings and cash flows (3.2), the value relevance of earnings and cash flows (3.3), and accruals quality (3.4); the results (4); and, finally, the conclusion (5).



2. LITERATURE REVIEW

Accounting is the main source of information for external users interested in a firm, whether to monitor its efficiency or for investment purposes (Beyer *et al.*, 2010). It is therefore critical that the information quality level is sufficient to reliably supply information to users. When investors choose to allocate their available resources available in the capital market, they tend to seek information that will improve their decision process, aiming to identify the best opportunity for the allocation of capital, assuming as a parameter the capacity to generate future returns.

In this context, accounting information is an essential source of information, considering earnings to be a primary source of information and cash flows to be a secondary measure (Arkadani, Arkadani, & Heyrani, 2013; Mostafa & Dixon, 2013). Earnings are considered both a primary measure and a broad measure, comprising two components, namely: 1. operating cash flows (secondary measure); and 2. accruals, a component that contributes to the superiority of earnings over cash flows.

Accruals is an accounting concept used for the accrual basis, which seeks to measure the result in an economic sense, independent of transactions and events (Paulo, 2007). In other words, accruals are components of accounting results that adjust the recognition of the cash flow over time, with the objective of improving the measurement of the firm's economic performance (Paulo, 2007). Accruals are thus all the earnings accounts that are on the profit statement but do not imply a necessary movement of cash (Martinez, 2008). A company's total accruals can therefore be measured as the difference between net earnings and the operating cash flow, thus representing a significant component of corporate earnings.

Earnings have been defined as a central measure in accounting and are considered a "summary" of a company's activities, able to summarize the company's past and present performances and to provide inputs for forecasting future results, which is mainly sought as an efficiency measure, prediction tool, and measure for assessing investment risk. Furthermore, studies such as those by Biddle *et al.* (1995), Francis *et al.* (2003), and Liu *et al.* (2002) have shown that investors are more likely to be guided by this simple measure than any other (Francis *et al.*, 2004; Dechow, Kothari, & Watts, 1998; Lambert, 2004; Arkadani, Arkadani, & Heyrani, 2013; Hendriksen & Van Breda, 2012; Sunder, 2014).

Dechow, Kothari, and Watts (1998) present a model that explains that earnings are a better measure because they incorporate the negative serial



correlation in cash flow changes. In other words, it becomes a better measure for forecasting future cash flows than current cash flows.

Chan *et al.* (2001) claim that focusing only on analyzing bottom-line earnings, i.e., what is directly observable in the income statement, disregards important information about earnings quality. Income is based on the accrual basis and has two main components: the cash flows component and the accruals component. Each of these components has its own characteristics that add specific – and in this case, complementary – types of information about the results obtained in a given period.

The cash flow is paramount because it constitutes control over the company's cash, and accruals are a key tool of accounting, adding timeliness to the reporting of the company's economic financial situation (Dechow & Schrand, 2004). The cash flow is basically conceptualized as the amount of inflows and outflows of financial resources that a company has within a certain period, i.e., it considers the effective movement of cash and cash equivalents. The main feature of this component is that its measurement involves no estimation because it will effectively be the movement of currency (Paulo, 2007).

Despite being measured more objectively, the cash flow has the weakness of not fully recognizing the economic effects of transactions, which directly affects the competence and timeliness of reported information. Accruals are thus used to try to fill the gap left by measuring cash. For the purposes of calculating the period's result, the total cash flow comprises the sum of the flows recognized in the previous period and received in the current period, plus what is recognized and received in the current period and what is received in the forecast period for recognition in the following period; note that the basis for identifying the cash flow is the current period.

To complement the information provided by cash flows, accruals are adjustments for competence, whose origin is how, when, and how much revenues and costs are recognized, making it possible to respect the main concepts of the accrual basis: revenue recognition and the matching principle. Basically, accruals adjust the recognition of cash flows over time and contribute by recognizing economic transactions in the period's result, even those for which effective cash movements have not been generated, such that the recognition of the event and the economic benefit coincide (Chan *et al.*, 2001; Dechow & Dichev, 2002).

Earnings can best be predicted by accruals, considering earnings to be the sum of cash flows and accruals. Although several studies suggest that the accruals component of earnings is less persistent than the cash flow component, it is considered to be one of the characteristics that improves the



usefulness of accounting information because it is able to report the firm's present and past performances and to provide insights into future performance, based on, for example, an anticipation of future cash inflows and outflows and deferrals (Dechow, 1994; Dechow & Dichev, 2002; Dechow, Sloan, & Zha, 2014).

Accruals have an error term, represented by the residuals of the regressions of variations in the company's working capital, whose standard deviation will determine its quality. Accruals quality is directly related to earnings quality, with regard to persistence; the error process and subsequent correction of accruals create noise in the reported information, decreasing its predictive content.

In short, the greater the error is, the lower the accruals quality. Dechow and Dichev (2002) obtain further evidence that accruals quality is one of the main factors determining earnings persistence and state that the accruals quality measure can be used for different purposes, including tests to obtain the relationship between share prices and earnings. In this sense, Chan *et al.* (2001) conclude that the accruals component tends to have a negative relationship with share market returns. In other words, an increase in earnings accompanied by a high level of accruals suggests low quality, resulting in low future returns.

Lopes and Martins (2012) conclude that the relevance of accounting information, or accounting information content, is in the accrual basis. They also add that accounting information content can be found in accruals because they have the ability to fill the informational gap left by measuring cash flows, recognizing the essence of economic transactions and adding timeliness to the result information.

Hendriksen and Van Breda (2012, p. 206) state that "a crucial aspect of research on the impact of accounting earnings on the capital market is the determination of the information content of earnings data." Because earnings represent the primary measure of corporate profitability for investors, Ardakani, Ardakani, and Heyrani (2013) explain that the emphasis on the study of its information content (earnings and losses) seeks to enable the prediction and evaluation of future earnings and cash flows, as well as dividends and increases in share prices, emphasizing the need to explain its components (operating cash flows and accruals) to help identify any possible transience or instability.

Information quality should be studied through a specific context. According to Dechow, Ge, and Schrand (2010), there is no need to define absolute parameters to define earnings quality, or information quality, nor do they suggest that it is impossible to indicate a single proxy as the best for all



decision-making contexts. With this rationale, the study seeks to analyze information quality based on the specification of each of its components, evaluating the impacts of extreme values on their compositions and seeking evidence on the representativeness of the information for the user.

Seven attributes of accounting information are described in the literature, classified by authors into two groups: accruals quality, persistence, predictability, and smoothness, as accounting-based measures; and value relevance, timeliness, and conservatism, as market-based measures (Francis *et al.*, 2004). This study focuses on persistence, value relevance, and accruals quality.

Persistence is viewed as a desirable attribute because it means that the presented results are recurrent and sustainable across the periods, i.e., not sporadic. The first consequence concerns the predictability of earnings, which is the ability of earnings to predict themselves. This is another desirable aspect of earnings, particularly from the perspective of market regulators and analysts. The consequences of earnings persistence in the capital market are basically the tendency to obtain greater appreciation and future gains as well as a stronger relationship between earnings and share market values. In other words, the greater the persistence is, the stronger the relationship between earnings and share value and the market reaction to variations in the level of the reported results (Dechow, Ge, & Schrand, 2010; Komendi & Lipe, 1987; Collins & Kothari, 1989).

Value relevance is a construct that measures the ability of earnings to explain variations in returns, and it can also be understood as a measure of the usefulness of accounting information in decision making in the capital market. Therefore, the greater the explanatory power of earnings over returns is, the greater the information's relevance, capturing the notion that the earnings are high quality and able to explain the firm's market value and/or the market return (Ewert & Wagenhofer, 2011).

Earnings and cash flows have an incremental relationship in the provision of information, incremental in the sense that they add information to one another, suggesting a better output when they are both considered for decision making, assuming moderate measures. The current literature also suggests that this relationship is more relevant when one of the measures has special or extraordinary items, in which the market will seek another source of information; in this case, cash flows become the main parameter for decision making. However, when cash flows are extreme, the source of information sought will be earnings, be they either extreme or moderate (Cheng & Yang, 2003; Mostafa & Dixon, 2013).



Special, extraordinary or non-recurring items are primarily characterized as items that are infrequently repeated over the course of the company's activities and that therefore change the result of the period in which they occur in an unusual manner. Special items fulfill the objective of portraying an activity in the period, but their predictive power is reduced as a consequence of their lower persistence. Cheng and Yang (2003) give some examples of these items: failed predictions for receivables, earnings from the equity method, restructurings, or unrealized gains and losses that do not represent market changes.

Some of the factors that can influence earnings quality include special items, which generate extreme earnings and cash flows. Mostafa and Dixon (2013) claim that the relationship between earnings and profitability is affected by earnings extremity. Examples of special items include currency conversions, an extraordinary gain, losses from company restructuring, and gains and losses from changes in an accounting standard, which only occurs in the initial adoption period.

Hendriksen and Van Breda (2012) cite the following as examples of extraordinary items: the need to pay overtime in periods of greater activity and the acquisition of raw materials at extremely low prices, extraordinary gain from the early settlement and refinancing of debt, and extraordinary credit from using the right to transfer net operating losses to future periods. In other words, they are events that occur once and are not recurrent.

Some examples of extraordinary earnings items are long- and short-term accruals that refer to gains and losses from financial investments, adjustment of foreign currency conversion, losses related to restructuring the company, recognizing changes in market value (when selling shares), or isolated gains and losses related to the impacts of changes in accounting standards (Cheng *et al.*, 1996; Christensen *et al.*, 2005 apud Mostafa & Dixon, 2013). It is worth considering that extraordinary items contribute to the emergence of extreme values that consequently contribute to reducing the persistence of the company's earnings components, particularly accruals, which are the portion of earnings directly affected by extraordinary items.

The reduced persistence of extreme values creates the assumption that they are less informative than moderate values (Ali, 1994; Nissim & Penman, 2001; Dechow & Ge, 2005). Cheng and Yang (2003) corroborate this thinking, claiming that studying the information content of cash flows without controlling for extremes does not provide satisfactory results.

There has been ample discussion on the concept of accounting information quality, but no consensus has been reached. The characteristics and

changes of the environment in which a company operates influence the manner in which decisions are made, particularly macroeconomic aspects (Houqe, Kerr, & Monem, 2015). In other words, the level or parameters that would characterize quality information changes, or adjusts, to the environment in which it is being analyzed. Therefore, comparing the results of studies conducted in developed and emerging countries, divergences and peculiarities are likely to be observed.

3. METHODOLOGY

3.1. Population and Sample

This study's sample came from all non-financial companies that traded their securities or had their securities traded at least once on the BM&FBovespa stock exchange from 2004 to 2014; thus, the study effectively analyzed the 2005-2015 period. The need for 2004 data stems from the use of a return variable.

The initial period of 2005 was chosen because there were already a good number of Brazilian companies voluntarily disclosing their Cash Flow Statements (CFSs) in Brazil, given that disclosing CFSs became mandatory in Europe that year. Companies that did not present sufficient data to calculate the variables used and presented throughout the methodology were excluded, in addition to any financial companies because they have specific accounting regulations. The data were obtained through Economática[®].

The data were processed in four stages, namely: 1. measurement of extreme earnings and cash flows, which, based on the method used by Mostafa and Dixon (2013), separates values considered extreme from those considered moderate; 2. analysis of earnings and cash flow persistence, with the objective of observing the impact of extreme values on each measure through dummy and interaction variables; 3. analysis of value relevance, seeking evidence of the market reaction to these items; 4. and, finally, analysis of accruals quality, as an additional assessment of the information content.

3.2. Measurement of Extreme Earnings and Cash Flows

Extreme earnings and cash flows were measured by separating the data into deciles, based on the earnings index divided by the asset at the beginning

of the period and operating cash flow divided by the asset at the beginning of the period. According to Mostafa and Dixon (2013), (a) negative indicators were separated from positive indicators, and (b) positive indicators were separated into nine deciles. Companies with indicators located in deciles 3 to 8 were considered to have moderate earnings/cash flows, whereas the others were considered to have extreme indicators. This work was performed for each year of the study sample.

3.3. Value Relevance of Earnings and Cash Flows

First, earnings and cash flow persistence were analyzed, measured by a model in which the variables of interest (earnings or cash flow) are explained by themselves but with a temporal lag. To analyze earnings persistence, the model by Dechow and Dichev (2002) was used; this model decomposes earnings into its cash flow and accruals components. It is expected that α_1 will be less than α_2 , indicating that accruals are less persistent than the cash flow component.

$$NE_{it+1} = \alpha_0 + \alpha_1 ACCRUALS_{it} + \alpha_2 OCF_{it} + \alpha_3 EXT_ACC_{it} + \alpha_4 EXT_ACC * ACC_{it} + \alpha_5 EXT_OCF_{it} + \alpha_6 EXT_OCF_{it} * OCF_{it} + \varepsilon_{it} \quad (1)$$

where:

NE_{it+1} is the value of the net earnings variable of company i in year $t+1$;

$ACCRUALS_{it}$ is the value of the total accruals variable of company i in year t , calculated by the difference between net earnings and the operating cash flow (OCF) in year t ;

OCF_{it} is the value of the operating cash flow of company i in year t ;

EXT_ACC and EXT_OCF are dummy variables that take the value of 1 when operating cash flow/accruals are considered extreme and 0 otherwise;

$EXT*ACC_{it}$ is the interaction variable between accruals and the extreme dummy variable;

$EXT*OCF_{it}$ is the interaction variable between the cash flow and the extreme dummy variable; and,

ε_{it} is the regression error.

The variables used in the model were not weighted by the total assets at the beginning of the period to maintain data heterogeneity due to the use of quantile regression.

By way of comparison, the same analysis was performed with the cash flow (operating), according to Equation 2:

$$OCF_{it+1} = \alpha_0 + \alpha_1 OCF_{it} + \alpha_2 EXT_OCF_{it} + \alpha_3 OCF * EXT_OCF_{it} + \varepsilon_{it} \quad (2)$$

where:

OCF_{it+1} is the value of the operating cash flow variable of company i in year $t+1$;

OCF_{it} is the value of the operating cash flow variable of company i in year t ;

EXT_OCF_{it} is a dummy variable that takes the value of 1 when the operating cash flow is considered extreme and 0 otherwise;

$OCF * EXT_OCF_{it}$ is the interaction variable between the operating cash flow and the extreme dummy variable; and,

ε_{it} is the regression error.

The de facto analysis of the value relevance of the two variables of interest in this article, namely, earnings and cash flow, was given by Equation 3:

$$Ret_{it+1} = \alpha_0 + \alpha_1 \Delta E_{it} + \alpha_2 \Delta OCF_{it} + \alpha_3 E_{it} + \alpha_4 OCF_{it} + \alpha_5 \Delta E * Extreme E_{it} + \alpha_6 \Delta OCF * Extreme CF_{it} + \alpha_7 * Extreme E_{it} + \alpha_8 OCF * Extreme CF_{it} + \varepsilon_{it} \quad (3)$$

where:

Ret_{it+1} is the share return in period $t+1$ in relation to t ;

ΔE_{it} is the variation in net earnings in relation to period $t-1$;

ΔOCF_{it} is the variation in the operating cash flow in relation to period $t-1$;

E_{it} is the net earnings in period t ;

OCF_{it} is the cash flow in period t ;

Extreme is a dummy variable that takes the value of 1 when the value is considered extreme and 0 when it is considered moderate;

$\Delta E * Extreme_{it}$, $\Delta OCF * Extreme_{it}$, $E * Extreme_{it}$, and $OCF * Extreme_{it}$ are interaction variables between the earnings and cash flow variables and the extreme dummy; and

The ExtremeE and ExtremeCF dummies refer to extreme earnings and extreme cash flows, respectively, defined from the methodology described in the previous subsection.

The expected result is that extreme values will have a negative impact on the information content of earnings. With regard to cash flows, when there are extreme values of earnings, it is expected that there will be a posi-

tive impact on the information content of cash flows because earnings will be theoretically less persistent and consequently less informative.

3.4. Accruals Quality

The last part of this study's analysis used the model by Dechow and Dichev (2002), adapting it for extreme earnings and cash flow situations, according to the previous section.

Equation 4 presents Dechow and Dichev's (2002) model:

$$\Delta WC_{it} = \alpha_0 + \alpha_1 OCF_{it-1} + \alpha_2 OCF_{it} + \alpha_3 OCF_{it+1} + \varepsilon_{it} \quad (4)$$

where:

ΔWC is the variation in working capital of company i from year t to year $t-1$; and

OCF is the operating cash flow of company i in years $t-1$, t , and $t+1$.

According to the theory presented by Dechow and Dichev (2002): (i) accruals are temporary adjustments that delay or anticipate the recognition of realized cash flows, plus an estimation error term; (ii) accruals are negatively related to current cash flows and positively related to past and future cash flows; and (iii) the error term (regression residual) captures the extent to which accruals are connected to cash flow realizations, and it can be used as a measure of accruals and earnings quality.

The lower the standard deviation of each quantile's residuals is, the better the information quality. It is thus expected that companies with less extreme (moderate) earnings will have accruals with higher quality; that is, it is expected that quantiles 10, 20, and 90 will have higher standard deviations of residuals than quantiles 30 through 80.

3.5. Quantile Regression

Quantile regression is still rarely used in accounting research in Brazil, and therefore, it warrants slightly more specific attention in this article. In OLS estimation, there are typically problems with the (non)normal distribution of residuals. Bearing this issue in mind, Koenker and Bassett (1978) developed the estimation of linear models based on quantiles, a semi-parametric form of estimation that gives greater robustness to the analysis of the results.

To estimate the equation, it is necessary to choose a quantile that is conditioned to the dependent variable (Y), given an x as a linear function of the form $Q(Y|x) = x'\beta(\tau)$, where $\beta(\tau)$ is represented by a vector of coefficients. It is thus possible to estimate $\beta(\tau)$, finding the $\hat{\beta}(\tau)$ that minimizes $\min_{\beta \in R^m} \sum_{i=1}^n \rho_{\tau}(y_i - x_i'\beta)$ (Koenker & Bassett, 1978).

One of the advantages (Coad & Rao, 2008; Wu & Liu, 2009; Ohlson & Kim, 2015) of using quantile regression – in addition to not assuming the normality of the residuals – is that it is possible to estimate regressions without “correcting” the problem of outliers because quantiles are not very sensitive to them; in contrast, OLS regression has a high sensitivity to extreme data because it is a conditional mean.

Another common problem in accounting and finance research is data heterogeneity, which leads to heteroscedasticity. In quantile regression, this heterogeneity is a good characteristic because the results can be better explored through data analysis.

An example of how much better the results can be analyzed by using robust regressions, such as quantile regression and the Theil-Sen estimator, rather than OLS with its different adjustments and assumptions, is the article published by Ohlson and Kim (2015). Using models for accounting information quality that are similar to those used in this article, these authors show that the model estimated using OLS fares worse, in most experiments, than the robust models. Furthermore, the process of data winsorization, which is very common in the accounting and financial field, reduces the possibility of exploring extremes, which is the main focus of this study.

4. RESULTS

To better analyze the impact of extreme values in the study variables, the models were estimated using quantile regression. Following the method proposed, the quantiles at the extremities were analyzed as extreme, whereas the central quantiles were analyzed as moderate. Furthermore, the variables were not weighted by the total assets of the previous periods to preserve data heterogeneity, which is not a problem for estimation using quantile regression. Quantiles 10, 20, and 90 were considered extreme, whereas quantiles 30 to 80 were considered moderate.

Table 1 presents the outputs of Equation 1 for the persistence of the earnings components. Based on the underlying theory, it is expected that the accruals component will have a smaller coefficient than the cash flow com-

ponent. Additionally, with regard to the interaction variables of the extreme dummies and the components, it is expected that they will present lower coefficients than the isolated components because the theory indicates that extreme values tend to further reduce the persistence of the results due to their transience.

Model (1) was estimated using a total of 2,484 observations. Analyzing the extreme quantiles (10, 20, and 90), it was found that accruals are more persistent than cash flows in the lower quantiles whereas the expected result was observed at the upper extreme because cash flows are significantly more persistent than the accruals component. In the intermediate or moderate quantiles (30 to 80), the accruals component was found to actually have less persistence than cash flows, except for quantile 50.

The analysis of the interaction variables of the earnings components and the extreme dummies aimed to determine whether there is a change in the coefficients of persistence when there are extreme values. With regard to the lower extreme quantiles, the signs of the coefficients switched to negative, indicating that there would be a reduction in persistence, which is more accentuated in accruals and only significant in the latter. With regard to the upper extreme, the coefficients behaved similarly and were both significant. With regard to the moderate quantiles, accruals once again had their persistence negatively and significantly affected; the cash flow presented significance only in quantiles 30 and 70 but with positive signs, contrary to expectations.

(Table 1)

RESULTS OF MODEL 1 - EARNINGS PERSISTENCE

Quantiles	Const	ACC	OCF	EXT_ACC*ACC	EXT_OCF*OCF
10	-8917	0.2632	0.0099	-0.2592	-0.014
p-value	0.089	0.088	0.888	0.093	0.842
20	-2395	0.1718	0.0767	-0.1679	-0.008
p-value	0.191	0.001	0.002	0.002	0.735
30	-8378	0.0907	0.7544	-0.0867	0.084
p-value	0.489	0.011	0.000	0.015	0.000
40	-2726	0.0835	0.2693	-0.0856	-0.0136
p-value	0.829	0.025	0.000	0.021	0.422
50	-519.634	0.7781	0.3639	-0.0996	0.0201
p-value	0.964	0.022	0.000	0.003	0.194

(continue)

(Table 1 (Conclusion))**RESULTS OF MODEL 1 - EARNINGS PERSISTENCE**

Quantiles	Const	ACC	OCF	EXT_ACC*ACC	EXT_OCF*OCF
60	295.08	0.0867	0.4277	-0.1119	0.0142
p-value	0.979	0.007	0.000	0.001	0.335
70	2389.675	0.0808	0.5145	-0.1056	0.0547
p-value	0.766	0.001	0.000	0.000	0.000
80	11109.68	0.1117	0.5905	-0.1361	0.0146
p-value	0.088	0.000	0.000	0.000	0.095
90	41510.62	0.1234	0.7093	-0.1471	-0.0286
p-value	0.000	0.000	0.000	0.000	0.056

Note: The isolated dummies were removed from the model due to multicollinearity.

Source: Elaborated by the authors.

Figure 1 shows the behavior of the main variables of interest estimated from Model 1. The dotted lines represent the coefficient of the model estimated using OLS and, therefore, unchanged over the quantiles; the thinner dotted line is the limits defined by the confidence interval of the coefficient using OLS, which means that the variables have different behaviors in quantile regression when their coefficients exceed the limits of this interval.

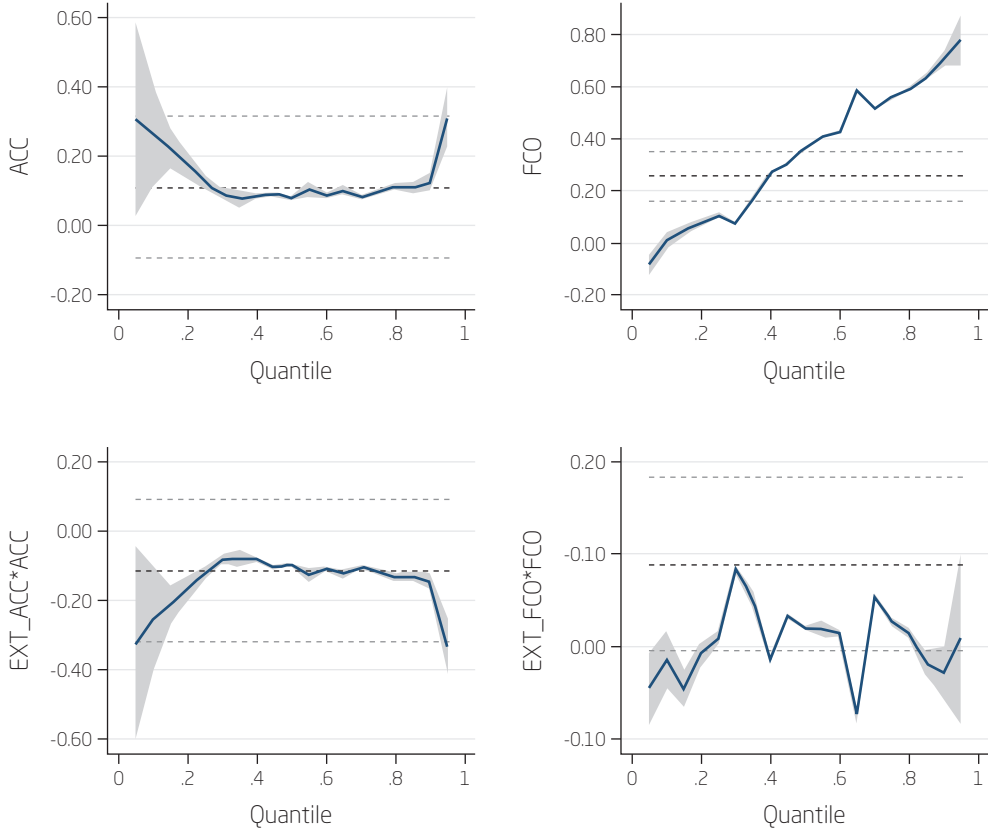
With regard to the ACC variable, the behavior approaches the OLS coefficient in the intermediate quantiles and approaches the upper limit in quantiles considered extreme in this study (10, 20, and 90). A similar trajectory is observed in the EXT_ACC*ACC variable when the extreme dummy is added to the analysis; it differs only in the direction of the coefficients, tending toward the lower limit of the OLS confidence interval with the presence of extremes.

With regard to the OCF variable, the coefficients are located beyond the confidence interval of the coefficient using OLS, coinciding only approximately with the coefficient of quantile 40. The coefficients increase from the lower to the upper quantiles, showing that the higher the cash flow component, the greater its influence in increasing earnings persistence.

Finally, in the graph of the cash flow variable controlled by extremes (EXT_OCF*OCF), it is possible to observe a volatile behavior of the coefficients, mainly along the lower limit of the OLS confidence interval. Extreme values thus affect cash flows more significantly than accruals because they are more persistent, which corroborates the literature.

(Figure 1)

GRAPH OF THE ACC, OCF, EXT_ACC*ACC, AND EXT_OCF*OCF VARIABLES (MODEL 1)



Note: The isolated dummies were removed from the model due to multicollinearity.

Source: Elaborated by the authors.

Table 2 presents the results of the cash flow persistence model, which is estimated using a total of 2,064 observations. In general, all coefficients are significant, except for the EXT_OCF*OCF variable in quantiles 30, 80, and 90. The signs presented by the coefficients suggest that extreme values only affect cash flow persistence in the upper quantiles (70 through 90), with the others corroborating this component's characteristic of being naturally more persistent.

(Table 2)

RESULTS OF MODEL 2 - CASH FLOW PERSISTENCE

Quantiles	Const	OCF t-1	EXT_OCF*OCF
10	42366.65	-0.1422	0.336
p-value	0.000	0.000	0.000
20	831.0736	0.1616	0.2534
p-value	0.968	0.000	0.000
30	-10118.8	0.8156	0.0515
p-value	0.873	0.000	0.499
40	28156.81	0.8306	0.1042
p-value	0.018	0.000	0.000
50	9581.71	1.01	0.0261
p-value	0.372	0.0000	0.043
60	20848.99	1.0803	0.0464
p-value	0.001	0.000	0.000
70	-70911.4	1.2529	-0.091
p-value	0.000	0.000	0.000
80	102156.6	1.3062	-0.1225
p-value	0.141	0.000	0.142
90	323441.6	1.3248	-0.0436
p-value	0.009	0.000	0.768

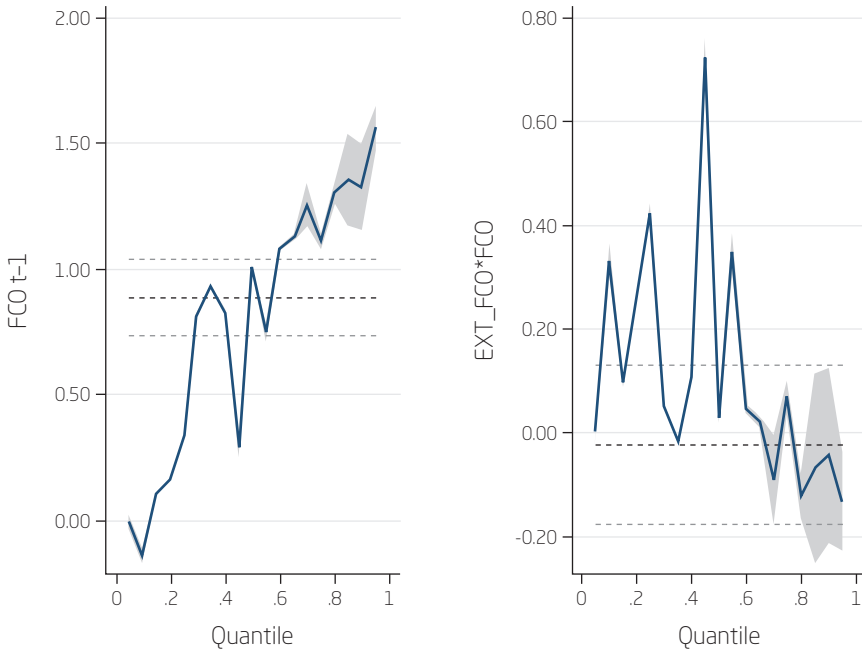
Note: The isolated dummies were removed from the model due to multicollinearity.

Source: Elaborated by the authors.

Figure 2 shows the graphs of the variables of interest estimated by Model 2 for cash flow persistence. The main inference concerns the EXT_OCF*OCF interaction variable because it presents high volatility in the presence of extreme values, with an emphasis on the negative values of coefficients in the upper quantiles. This observation corroborates the behavior of this variable presented by the previous model, in which the more extreme the cash flow measure is, the greater its negative effect on both earnings and cash flow persistence over time.

(Figure 2)

RESULTS OF MODEL 2 - OCF T-1 AND OCF*EXT_OCF VARIABLES



Note: The isolated dummies were removed from the model due to multicollinearity.

Source: Elaborated by the authors.

With regard to the results of Model 3 (presented in Figure 3), used to analyze the impact of extreme values on value relevance, i.e., to observe the actual impact on share return, it was expected that extreme values would have a negative impact on the information content of earnings. With regard to cash flows, it was expected that there would be a positive impact on the information content of cash flows because earnings will theoretically be less persistent and consequently less informative. The model was estimated using 1,387 observations.

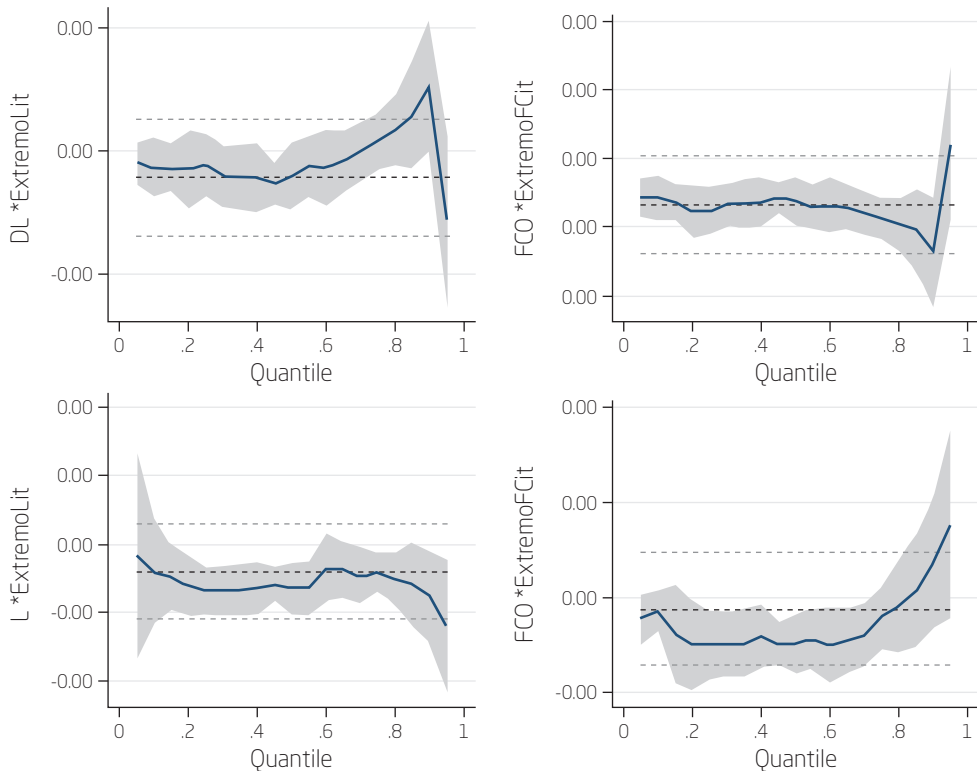
In general, it was found that both earnings and cash flow information have an influence on market returns. With regard to cash flows, it was observed that when they were moderate, they were actually more informative than earnings; however, if they were extreme, they had a more pronounced negative impact than earnings. Furthermore, there was some evidence that information from the two metrics was incremental because they presented opposite signs for the coefficients of the $\Delta E_ExtremeE$ and $\Delta OCF_ExtremeCF$ variables, with an emphasis on moderate quantiles 40 and 50.

Figure 3 illustrates the trajectories of the estimated coefficients of Model 3's variables of interest, namely: $\Delta NE*ExtremeE$, $\Delta OCF*ExtremeOCF$, $NE*ExtremeE$, and $OCF*ExtremeOCF$. With regard to interactions with net earnings ($\Delta NE*ExtremeE$ and $NE*ExtremeE$), the coefficients approximate that estimate using OLS, with greater distances from the center line observed at the extremities and the most significant differences at the upper end (quantile 90), demonstrating that extreme values actually change the relationship between earnings and share returns.

With regard to the cash flow interaction variables ($\Delta OCF*ExtremeOCF$ and $OCF*ExtremeOCF$), there is a behavior similar to that observed in the earnings variables, with respect to the proximity of the OLS coefficient line for most quantiles, and distortions at the upper end of both (quantile 90). However, the lines point in opposite directions, illustrating the predicted relationship that the value relevance of cash flows increases when earnings are extreme.

(Figure 3)

RESULTS OF MODEL 3 - $\Delta NE*EXTREMEE$, $\Delta OCF*EXTREMEOCF$, $NE*EXTREMEE$, AND $OCF*EXTREMEOCF$ VARIABLES



Source: Elaborated by the authors.

Finally, Table 4 presents the results of Dechow and Dichev's (2002) accruals quality estimation model, which is estimated using a total of 1,053 observations. It was expected that accruals would be negatively related to current cash flows and positively related to past and future cash flows and that the standard deviations of the residuals, calculated per quantile, would be higher in the extreme quantiles and lower in the moderate quantiles.

Analyzing the signs of cash flows, it was found that the lower extreme quantiles of past cash flows presented signs that were contrary to those expected, with significance, whereas current cash flows were not significant. With regard to future cash flows, positive signs were observed, as expected, but with no significance.

(Table 4)

RESULTS OF MODEL 4 - DECHOW & DICHEV'S MODEL (2002)

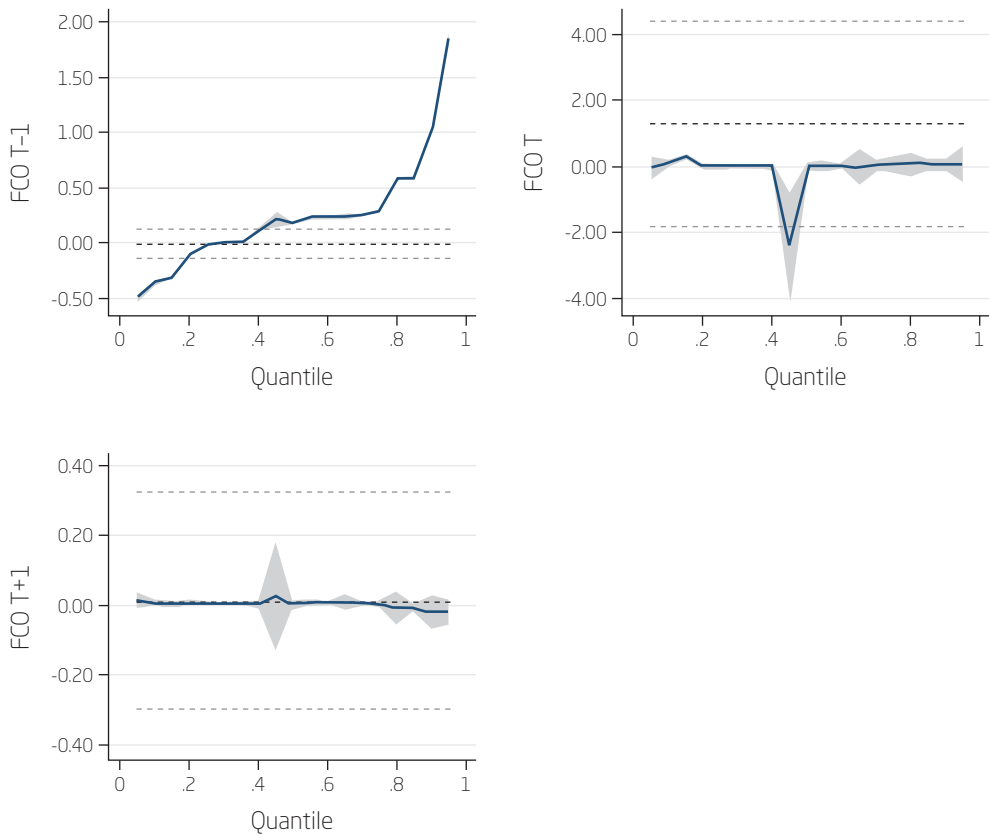
Quantiles	Const	OCF T-1	OCF T	OCF T+1
10	-68166.8	-0.3561	0.1137	0.0082
p-value	0.254	0.000	0.637	0.73
20	-36964.5	-0.1023	0.0273	0.0057
p-value	0.54	0.000	0.91	0.812
30	-8333.97	0.0001	-0.0197	0.0041
p-value	0.753	0.978	0.853	0.694
40	22888.05	0.118	-0.0113	0.0024
p-value	0.457	0.000	0.927	0.844
50	52711.34	0.1784	-0.0041	0.001
p-value	0.088	0.000	0.973	0.934
60	71121.79	0.2285	-0.0034	0.007
p-value	0.003	0.000	0.972	0.468
70	179182.7	0.2547	0.0235	0.0046
p-value	0.018	0.000	0.938	0.878
80	263563.8	0.5815	0.0465	-0.0087
p-value	0.145	0.000	0.949	0.904
90	251459.9	0.9888	0.0442	-0.0174
p-value	0.128	0.000	0.947	0.793

Source: Elaborated by the authors.

Figure 4, in turn, plots the behavior of Model 4's variables. The coefficients of the cash flow quantiles in period t-1 are very different from the

coefficient estimated using OLS, showing a positive relationship with the independent variable above the median, which strengthens above quantile 70, approximately. The others are close to zero, illustrating the lack of significance demonstrated by the estimated coefficients.

(Figure 4)
**RESULTS OF MODEL 4 - GRAPHS OF THE OCF_{T-1} ,
 OCF_T , AND OCF_{T+1} VARIABLES**



Source: Elaborated by the authors.

With regard to the analysis of accruals quality via the standard deviation of residuals, it is found that the expected results are corroborated. Standard deviations are higher numbers in extreme quantiles than in moderate quantiles, suggesting that extreme quantiles have lower accruals quality and

are therefore less informative. To test whether the difference between the variances of the extreme and non-extreme groups is significant, Levene's test was performed.

(Table 5)

STANDARD DEVIATIONS OF THE RESIDUALS OF MODEL 4 AND LEVENE'S TEST FOR HOMOGENEITY OF VARIANCES

Quantiles	Standard Deviation of Residuals
10	1,891,135
20	547,023.3
30	10,039.96
40	628,116.4
50	950,351.6
60	1,217,891
70	1,358,724
80	3,101,239
90	5,271,172
Levene's test*	Ratio > 1**
	p-value 0.0556

* Levene's test performed between two groups (extreme and non-extreme). ** Ratio < 1 and Ratio = 1 data not tabulated because they were not significant (p-values of 0.944 and 0.111, respectively).

Source: Elaborated by the authors.

Based on Levene's test, there was a significant difference between the variances of the standard deviation groups of the extreme and non-extreme quantiles, given a p-value of 0.0556 for the null hypothesis that the test ratio is greater than 1, i.e., they are different.

5. CONCLUSION

This study aimed to analyze the impact of extreme earnings and cash flows on the persistence, value relevance, and accruals quality of companies with shares listed on the Brazilian capital market. Taking the study by Mostafa and Dixon (2013) as a foundation, earnings, accruals, and cash flow



information were separated into moderate and extreme groups, identified by dummy variables, to obtain evidence regarding whether the presence of values considered to be extreme influenced the value relevance of accounting information in the Brazilian capital market.

The main results indicated that cash flows are more persistent than earnings. This result corresponded to the theoretical expectations that, due to the presence of accruals, earnings tend to be less persistent because accruals reflect the economic effects of variations in assets and liabilities that tend to not be constant over time. Regarding to the presence of extreme values, they were found to affect both earnings and cash flow persistence but with a more pronounced negative impact on cash flows. This finding suggests that, ultimately, extreme values negatively interfere in earnings quality because they may reduce its predictive power, given the increase in volatility caused by the reduction in persistence, particularly in the presence of negative extreme values.

Moreover, with further analysis, it was possible to observe that this behavior allows the information of these two metrics to be incremental with respect to the information content of companies in the capital market. In other words, it was found that both earnings and cash flow information affect share market returns. With regard to cash flows, when they are moderate, they are actually more informative than earnings; however, if they are extreme, they have a stronger negative impact than earnings. This evidence thus shows that extreme values actually change the relationship between earnings and share returns.

With regard to accruals quality, extreme values were found to negatively affect this measure because, compared to moderate quantiles, they significantly alter the standard deviation level of extreme quantiles. Thus, it is found that extreme values once again play a negative role in this earnings component, suggesting that these extreme values should be treated when using earnings and their components for estimating future results, future cash flows, and any performance measures that use earnings or their components as an estimator.

However, the evidence obtained and presented here is limited to the companies considered in the sample and the period analyzed, i.e., it cannot be generalized to all companies listed on the market, given that the sample used, although representative, is not probabilistic.



PERSISTÊNCIA, VALUE RELEVANCE E QUALIDADE DOS ACCRUALS EM SITUAÇÕES DE LUCROS E FLUXOS DE CAIXA EXTREMOS

RESUMO

Objetivo: Analisar o impacto dos lucros e fluxos de caixa extremos na sua própria persistência, *value relevance* e na qualidade dos *accruals* das empresas com ações negociadas no Brasil.

Originalidade/lacuna/relevância/implicações: O estudo contribui analisando os lucros e fluxos de caixa extremos. Por alterarem de modo não típico o resultado do período em que ocorrem, sugere-se que o estudo dos seus comportamentos e impactos na qualidade das informações divulgadas pelas empresas tende a contribuir com a tomada de decisões ótimas no mercado de capitais.

Principais aspectos metodológicos: Analisou-se uma amostra das empresas de capital aberto negociadas na BM&FBovespa durante o período de 2005 a 2014, com estimações realizadas por meio de regressão quantílica.

Síntese dos principais resultados: Os principais resultados apontaram que os fluxos de caixa são mais persistentes que os lucros, este sendo menos persistente dado o seu componente “*accruals*”. Tem-se que os valores extremos, tanto dos lucros quanto dos fluxos de caixa, afetam a persistência de tais variáveis, de efeito mais acentuado negativamente nos fluxos de caixa. E por fim, acerca da qualidade dos *accruals*, observou-se que valores extremos de *accruals* afetam negativamente essa medida, pois altera significativamente o patamar do desvio padrão dos quantis extremos, em comparação aos quantis moderados.

Principais considerações/conclusões: Observou-se que a presença de valores extremos das variáveis foco desta pesquisa influencia negativamente na qualidade das informações no mercado, reduzindo seu poder preditivo e conseqüentemente, sua relevância; além de que foi possível observar que as informações dessas duas métricas são incrementais no que tange ao conteúdo informativo, quando há o controle dos itens extremos.

PALAVRAS-CHAVE

Value Relevance. Qualidade dos *Accruals*. Lucros Extremos. Fluxos de Caixa Extremos. Regressão Quantílica.

PERSISTENCIA, VALUE RELEVANCE Y LA CALIDAD DE LOS ACCRUALS EM SITUACIONES DE LUCROS Y FLUJOS DE CAJA EXTREMOS

RESUMEN

Objetivo: Analizar el impacto de los beneficios y flujos de caja extremas en su propia persistencia, value relevance y la calidad de las acumulaciones de las empresas con acciones negociadas en la bolsa de valores brasileña.

Originalidad/laguna/relevancia/implicaciones: El trabajo contribuye analizando los beneficios y flujos de caja extremas. Ellos alteran los resultados en el período en que ocurren, en esos casos se sugiere el estudio del comportamiento y los impactos en la calidad de las informaciones difundidas por las empresas han tendido a contribuir con la tomada de buenas decisiones en la bolsa de valores.

Principales aspectos metodológicos: Há sido analizada uma muestra de empresas con negociación en la BM&FBovespa en el periodo que va de 2005 a 2014, con estimaciones realizadas por medio de regresiones cuantilicas.

Síntesis de los principales resultados: Los principales resultados apuntan que los flujo de caja son más persistentes que los beneficios, que es menos persistente ya que tiene um componente “accruals”. Los valores extremos, tanto los beneficios y los flujos de caja, afectar a la persistencia de estas variables, con efecto negativo más intenso en el flujos de caja. Después de todo, la calidad de los “accruals” són negativamente afectadas por los valores extremos porque se cambia el nivel de la desviación estándar de los cuantiles extremos, en comparación a los cuantiles moderados.

Principales consideraciones/conclusiones: Se han observado que la presencia de valores extremos de las variables foco de esta investigación influyen negativamente la calidad de las informaciones de mercado, reduziendo el poder predictivo, así como su significacion; además fué posible observar que las informaciones de esas dos mediciones són solamente incrementales com respecto al contenido informativo, cuando hay control de los elementos extremos.

PALABRAS CLAVE

Value Relevance. Calidad de los *Accruals*. Lucros Extremos. Flujos de Caja Extremos. Regresion Cuantilica.

REFERENCES

- Arkadani, S. S., Arkadani, M. D., & Heyrani, F. (2013). The Impact of High Earnings on the Informational Content of Cash Flows in the Listed Companies on Tehran Stock Exchange. *Internacional Journal of Academic Research in Accounting, Finance and Management Sciences*. 3(4), 215-223. DOI: 10.6007/IJARAFMS/v3-i4/393.
- Beyer, A., Cohen, D. A., Lys, T. Z., & Walther, B. R. (2010). The financial reporting environment: Review of the recent literature. *Journal of Accounting and Economics*, 50, 296-343. DOI: 10.1016/j.jacceco.2010.10.003.
- Chan, K., Chan, L. K. C., Jegadeesh, N., & Lakonishok, J. (2001). Earnings quality and stock returns: The evidence from accruals. *Social Science Research Network*.
- Cheng, C. S. A., & Yang, S. S.M. The incremental information content of earnings and cash flows operations affected by their extremity. (2003). *Journal of Business Finance and Accounting*. 30(1/2), 73-116. DOI: 10.1111/1468-5957.00484.
- Clubb, C. Discussion of the incremental information content of earnings and cash flows from operations affected by their extremity. (2003). *Journal of Business Finance & Accounting*, 30(1/2), 117-124. DOI: 10.1111/1468-5957.00001.
- Coad, A., & Rao, R. (2008). Innovation and firm growth in high-tech sectors: A quantile regression approach. *Research policy*, 37(4), 633-648. DOI: 10.1016/j.respol.2008.01.003.
- Dechow, P. M. (1994). Accounting earnings and cash flows as measures of firm performance: the role of accounting accruals. *Journal of Accounting and Economics*. 18(1) & (2), 3-42. DOI: 10.1016/0165-4101(94)90016-7.
- Dechow, P. M., & Dichev, I. D. (2002). The quality of accruals and earnings: the role of accrual estimation errors. *The Accounting Review*. 77(4), 35-59. DOI: 10.2308/accr.2002.77.s-1.35.



- Dechow, P. M., & Ge, W. (2005). The persistence of earnings and cash flows and the role of special items: implications for the accrual anomaly. *Review of Accounting studies*, 11, 253-296. DOI: 10.2308/accr.2002.77.s-1.35.
- Dechow, P. M., Ge, W., & Schrand, C. (2010). Understanding earnings quality: a review of the proxies, their determinants and their consequences. *Journal of Accounting and Economics*, 50, 344-401. DOI: 10.1016/j.jacceco.2010.09.001.
- Dechow, P. M., Kothari, S. P., & Watts, R. L. (1998). The relation between earnings and cash flows. *Journal of Accounting and Economics*, 25, 133-168. DOI: 10.1016/S0165-4101(98)00020-2.
- Dechow, P. M., Richardson, S. A., & Sloan, R. G. (2008). The persistence and pricing of the cash component of earnings. *Journal of Accounting Research*, 46, 537-566. DOI: 10.1111/j.1475-679X.2008.00283.x.
- Dechow, P. M., & Schrand, C. M. (2004). *Earnings quality*. Charlottesville (Virginia): CFA Institute.
- Dechow, P. M., & Sloan, R. G., Zha, J. (2014). Stock prices and Earnings: A history of research. *The annual review of financial economics*, 6, 343- 363. DOI: 10.1146/annurev-financial-110613-034522.
- Hirshleifer, D., Hou, K., & Teoh, S. H. (2009). Accruals, cash flows, and aggregate stock returns. *Journal of Financial Economics*, 91, 389-406. DOI: 10.1016/j.jfineco.2007.11.009.
- Ewert, R., & Wagenhofer, A. (2011). Earnings quality metrics and what they measure. *Social Science Research Network*. DOI: 10.2139/ssrn.1697042.
- Francis, J., Lafond, R., & Olsson, P. M., Schipper, K. (2004). Costs of equity and earnings attributes. *The Accounting Review*, 79(4), 967-1010. DOI: 10.2308/accr.2004.79.4.967.
- Holthausen, R. W., & Watts, R. L. (2001). The relevance of the value-relevance literature for financial accounting standard setting. *Journal of Accounting and Economics*, 31, 3-75. DOI: 10.1016/S0165-4101(01)00029-5.
- Houque, M. N., Kerr, R., & Monem, R. (2015). Business strategy, economic growth, and earnings quality. *Social Science Research Network*.
- Koenker, R., & Bassett, G. (1978). Regression Quantiles. *Econometrica*, 46, 33-50. DOI: 10.2307/1913643.
- Kormendi, R., & Lipe, R. (1987). Earnings innovations, earnings persistence, and stock returns. *Journal of Business*, 60(3), 323-345.
- Lambert, R. A. (2004). Discussion of analysts' of non-recurring items in street earnings and loss function assumptions in rational expectations tests on financial analysts' earnings forecasts. *Journal of Accounting and Economics*, 38, 205-222. DOI: 10.1016/j.jacceco.2004.11.001.



Martinez, A. L. (2008). Detectando Earnings management no Brasil: estimando os accruals discricionários. *Revista de Contabilidade & Finanças*, 19(46), 7-17.

Mostafa, W., & Dixon, R. (2013). The impact of earnings extremity on information content of cash flow. *Review of Accounting and Finance*, 12(1), 81-104. DOI: 10.1108/14757701311295845.

Nissim, D., & Penman, S. H. (2001). Ratio analysis and equity valuation: from research to practice. *Review of Accounting Studies*, 6, 109-154. DOI: 10.1023/A:1011338221623.

Ohlson, J. A., & Kim, S. (2015). Linear valuation without OLS: the Theil-Sen estimation approach. *Review Accounting Studies*, 20, 395-435. DOI: 10.1007/s11142-014-9300-0.

Wu, Y., & Liu, Y. (2009). Variable selection in quantile regression. *Statistica Sinica*, 19, 801-817.

Paulo, E. (2007). *Manipulação das informações contábeis: uma análise teórica e empírica sobre os modelos operacionais de detecção de gerenciamento de resultados*. Tese de Doutorado, Universidade de São Paulo (USP), São Paulo, SP.