
INFLUENCE OF ECONOMIC CYCLES ON THE COMPARABILITY AND CONSISTENCY OF ACCOUNTING INFORMATION: EVIDENCE FROM PUBLICLY TRADED COMPANIES IN THE BRAZILIAN MARKET

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ABSTRACT

We analyzed the influence of economic cycles on the comparability and consistency of accounting information for publicly traded companies in the Brazilian market. Our sample consisted of 61 companies that were analyzed in annual periods from 2013 to 2019. We calculated comparability through the similarity of the accounting function of DeFranco, Kothari, and Verdi (2011). To measure consistency, we used the measure adapted from DeFranco et al. (2011), developed by Ribeiro (2014). We measure economic cycles using the model by Bry and Boschan (1971) and the sophisticated model by Harding and Pagan (2002). We analyze the data using panel data regressions. We found that financial statements become more comparable in economic cycles of contraction. However, we find that there is a reduction in the comparability in other economic cycles. Accounting information is more consistent in economic downturn cycles. The other economic cycles are less consistent than the contraction economic cycle. As practical implications, our findings help investors and lenders, since the

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macroeconomic environment can be used as a parameter to understand the behavior of comparability and consistency. Thus, investors will be able to understand the levels of these aspects of accounting information according to each economic cycle to proceed with the decision process between different investment alternatives.

Keywords: economic cycles; comparability; consistency.

INFLUÊNCIA DOS CICLOS ECONÔMICOS NA COMPARABILIDADE E CONSISTÊNCIA DA INFORMAÇÃO CONTÁBIL: EVIDÊNCIAS EM EMPRESAS ABERTAS DO MERCADO BRASILEIRO

RESUMO

O estudo objetiva analisar a influência dos ciclos econômicos na comparabilidade e consistência da informação contábil das empresas abertas do mercado brasileiro. Foram analisadas 61 empresas em períodos anuais de 2013 a 2019. A comparabilidade foi calculada a partir do método de similaridade da função contábil de DeFranco, Kothari e Verdi (2011) e, para mensurar a consistência, recorreu-se à medida adaptada de DeFranco et al. (2011) e desenvolvida por Ribeiro (2014). Os ciclos econômicos foram mensurados por meio da métrica de Bry e Boschan (1971) e sofisticado por Harding e Pagan (2002). Os dados foram analisados por meio de regressões de dados em painel, os quais revelaram que as demonstrações contábeis se tornam mais comparáveis em ciclos econômicos de contração. Há, contudo, redução da comparabilidade nos demais ciclos econômicos, isto é, recessão, recuperação e expansão. As informações contábeis são mais consistentes em ciclos econômicos de contração. Vale ressaltar que os demais ciclos econômicos são marcados pela diminuição do nível de consistência. Como implicações práticas, esses achados podem auxiliar os investidores e credores, uma vez que o ambiente macroeconômico pode ser utilizado como parâmetro para compreender o comportamento da comparabilidade e consistência. Assim, os investidores poderão entender quais são os níveis destes aspectos da informação contábil conforme cada ciclo econômico para proceder ao processo decisório entre diferentes alternativas de investimento.

Palavras-Chave: ciclos econômicos; comparabilidade; consistência.

1 INTRODUCTION

The comparability of accounting information is a qualitative improvement feature that, according to Simmons (1967), enhances the usefulness of financial statements by external users. The Financial Accounting Standards Board (FASB, 2010) defines comparability as an aspect of accounting information quality that enables external users to identify the similarities and differences of at least two companies. It is noteworthy that comparability was at the heart of discussions regarding the implementation of the International Financial Reporting Standards

(IFRS) accounting standard. This is because the financial statements could present a higher level of comparability in an accounting standard based on principles. Thus, it is understood that this standard preserves the economic essence of the legal form of information provided in the financial statements.

Thus, companies that adopt the IFRS standard present more comparable statements than companies adopting the local standard (Barth, Landsman, Lang & Williams, 2012). There is also an increase in the level of comparability of financial statements when standards based on principles are adopted, especially in countries adopting local standards based on rules (Ribeiro, Carmo, Fávero & Carvalho, 2016a). Phenomenon that is due to the possibility that preparers generate accounting information according to the economic essence rather than standards based on specific rules, for example, those arising from tax legislation (Ribeiro, Carmo, Fávero & Carvalho, 2016b). In addition, Cairns, Massoudi, Taplin and Tarca (2011), Yip and Young (2012) and Neel (2017) describe that an international accounting standard adopted by several countries, such as IFRS, is essential to increase the comparability of financial statements.

In this context, it is clear that accounting statements in different countries had an increase in the level of comparability after the adoption of IFRS standards. Information with a higher level of comparability is beneficial to investors, as it is associated with lower levels of information asymmetry (DeFranco, Kothari & Verdi, 2011; Lang, Lins & Maffett, 2012; Brochet, Jagolinzer & Riedl, 2013) and, in turn, influence the increase in capital allocation between different countries (Yip & Young, 2012), in addition to being related to higher levels of precision in analysts' forecasts (DeFranco et al., 2011; Reina, Carvalho, Reina & Lemes, 2019). All of these benefits are related to the ability of more comparable accounting statements to allow the underlying events of a company to be better understood when compared to the underlying events of other companies (Chen, Collins, Kravet & Mergenthaler, 2018).

Based on this evidence, the comparability of accounting information is beneficial to external accounting users. This benefit, however, only occurs when preparers have different accounting choices at their disposal. When there are accounting choices with a certain level of restriction, preparers have difficulty in recognizing the economic event in the accounting statements, making it difficult for investors to compare the accounting statements of different companies (DeFond & Hung, 2003). Thus, when there is the possibility for the preparer to select the way to capture the economic event within a range of accounting choices, it is possible to present financial statements with a higher level of quality to external users.

When accounting choices are maintained over time, it makes accounting information consistent. The consistency of accounting information is one of the aspects, together with the uniformity, that make up comparability (Hendriksen & Van Breda, 1999). Unlike comparability, which allows investors to compare different companies, consistency allows this user to compare the same company over time (CPC-00, 2019; Ribeiro, 2014; Ribeiro, Sousa & Vicente, 2019). Even with the benefits provided by comparability and consistency to external users, company managers can pressure preparers to change accounting choices to manipulate the results and, consequently, achieve personal interests.

Manipulation strategies have different motivations as their origin, among them, the maximization of the company's economic-financial performance (Schipper, 1989; Martins, Paulo & Monte, 2016) with the purpose of increasing the value of their own remuneration at the end of the year (Holthausen, Larcker & Sloan, 1995; Balsan, 1998; Shuto, 2007). Another motivation concerns deceiving the capital market (Cheng & Warfield, 2005; Scott, 2009). However, earnings management strategies change the way in which economic events are reflected in the accounting statements as there is a decrease in comparability (Sohn, 2016; Sousa, Ribeiro, Vicente & Carmo, 2020). The manager's opportunistic behavior is also detrimental to consistency because the same economic event is recognized differently in different accounting periods.

Although the incentives mentioned above contributed to managers distorting the results of the period, the macroeconomic environment is also a factor constituting an incentive for the adoption of opportunistic actions. As an example, there is the economic cycle, as in periods of economic contraction, managers reduce the use of practices related to earnings management by operations (Paulo & Mota, 2019), which is more persistent over time (Chi, Lisic, & Pevzner, 2011) and, as a result, is more harmful to the comparability and consistency of accounting information (Ribeiro et al., 2019; Sousa et al., 2020). Other studies in different countries allege that, in an unstable macroeconomic environment and with a retraction of economic activity, managers reduce practices related to earnings manipulation (Habib, Bhuiyan & Islam, 2013; Kousenidis, Ladas & Negakis, 2013; Filip & Raffournier, 2014; Cimini, 2015). One justification for this phenomenon is the lower incentive to adopt earnings manipulation practices in periods of economic crisis (Filip & Raffournier, 2014).

Periods of economic crisis are marked by the reduction of companies' operating activities, leading to lower profitability and, consequently, a reduction in amounts received through variable compensation plans that are linked to performance. In addition, the decrease in operating activities often makes companies need financial resources to maintain working capital (Francis, LaFond, Olsson & Schipper, 2004). Because of the need for these resources, companies often resort to loans from financial institutions (Francis et al., 2004). This leads managers to increase the quality of accounting information from the reduction of practices linked to the manipulation of results (Kousenidis et al., 2013), since information with higher quality is linked to a greater probability of success in loan applications and, according to Su, Yang and Dutta (2018), in the lowest cost of the loan obtained. Given this, depending on the macroeconomic cycle, managers may have greater or lesser incentive to change accounting choices to achieve their particular goals.

This change in accounting choices can lead to a decrease in consistency and comparability of accounting information. Since the recognition of economic consequences in financial statements is not adequate when information is manipulated. Furthermore, Ribeiro et al. (2019) and Sousa et al. (2020) describe that there is a difference in the level of comparability and consistency when there was a slowdown in the Brazilian economy. Thus, economic cycles may imply the level of comparability and consistency, as it may serve as a stimulus for managers to misrepresent the information that is present in these accounting statements. Therefore, the objective of this study is based on **analyzing the influence of**

economic cycles on the comparability and consistency of accounting information for publicly traded companies in the Brazilian market.

Comparability and consistency of financial statements help external users' decision-making (Ribeiro et al., 2019), because they compare different investment alternatives to allocate capital, as well as whether to continue or not with the current investment alternative (Healy & Palepu, 2001). Thus, external aspects of the company, such as the macroeconomic crisis, can interfere with the decision-making process of investors, as they encourage the reduction of practices related to the manipulation of results (Kousenidis et al., 2013; Filip & Raffournier, 2014) and, consequently, imply comparability and consistency. From this perspective, this study presents a new perspective by demonstrating how economic cycles can imply aspects that are necessary for decision-making.

The present study presents contributions from the results, regarding that in periods of economic recovery, expansion and recession, financial statements are less comparable and consistent than in economic contraction cycles. This finding contributes to the discussion of the works by Kousenidis et al. (2013), Filip and Raffournier (2014) and Cimini (2015), because in periods of economic contraction, managers increase the quality of accounting statements by reducing earnings management practices. With the reduction of changes in accounting choices to manipulate the results, statements become more consistent. As a portion of comparability is made up of consistency, more consistent information directly impacts the increase in the comparability of financial statements.

This decrease in opportunistic actions by managers may be linked to the fact that, in periods of economic contraction, companies' profitability decreases and results in a negative market reaction in terms of share prices. Thus, managing results in this economic environment is not as effective in maximizing earnings via variable remuneration as in periods of economic growth. Furthermore, in periods of economic contraction, the company increases the probability of needing a loan (Francis et al., 2004), which can also be another factor for managers to increase consistency and comparability of financial statements. Thus, such results contribute to investors and creditors about the level of these aspects of financial statements that help in decision making regarding the allocation of financial resources between different investment alternatives or operation maximization by charging interest, mitigating the risk of default.

2 THEORETICAL FOUNDATION

The set of accounting practices is used by company preparers to adequately represent economic events in financial statements. When this representation is performed properly, it allows external users to analyze the company's economic-financial health (Ge, 2009). Managers, however, can put pressure on preparers to change accounting practices in order to meet their particular goals. Among these objectives, there is an increase in the economic-financial performance of the company's fiscal year (Schipper, 1989) to maximize the value of the remuneration of the executives (Holthausen et al., 1995; Balsan, 1998; Shuto, 2007; Sousa & Ribeiro, 2020) or, deceiving investors (Scott, 2009).

Changes in accounting practices intentionally by managers are known as earnings management. The adoption of practices related to the manipulation of

earnings can impair the proper recognition of economic events in the financial statements (Martins et al., 2016) and, in turn, imply aspects that enhance the quality of the financial statements (Dechow, Ge & Schrand, 2010). Such aspects are important so that external users have access to demonstrations with an adequate level of information (Dechow et al., 2010) to support their decisions.

Managers can use, with greater or lesser intensity, different earnings management practices based on controllable and uncontrollable factors affecting the company. As for the uncontrollable aspects, there is the macroeconomic environment. Paulo and Mota (2019) argue that managers increase or decrease the use of earnings manipulation strategies according to the economic cycle. The authors identified that the management of earnings by operations has an increase in periods of economic expansion and a sharp decrease in periods of economic contraction. Sousa et al. (2020) argue that the manipulation of results involving operational issues is detrimental to the comparability of accounting information.

Other investigations in different countries showed that, in periods of economic crisis, managers reduce the use of practices related to earnings management, see: Habib et al. (2013), Kousonidis et al. (2013), Filip and Raffournier (2014) and Cimini (2015). The difference between the use of earnings manipulation strategies according to the economic cycle can be explained by the consequences that companies suffer in periods of slowdown or even a decline in economic activity in a country. One of these consequences is the decrease in liquidity ratios and other indicators that are crucial to measuring economic-financial health (Brealey & Kaplanis, 2004; Kousenidis et al., 2013).

Given these consequences, companies may need to raise financial resources (Francis et al., 2004). In many moments, the contribution of additional financial resources during the economic crisis becomes necessary, considering that the company needs to maintain its cash flow and, thus, "survive" the period of crisis to continue its operations until the moment of the resumption of economic growth. To obtain these resources, companies turn to financial institutions to acquire loans. Kousenidis et al. (2013) mention that for companies to increase the chances of success in acquiring loans, the statements must have quality information. This entire context encourages managers to increase the quality of financial statements, by reducing earnings manipulation practices, to increase the probability of success in obtaining loans (Kousenidis et al., 2013).

Based on this logic, it is understood that the aspects that comprise the quality of financial statements may increase or decrease according to the economic cycle. Among these aspects, there is the comparability of accounting information, which may differ according to the economic cycle, mainly because it is a qualitative characteristic of improvement susceptible to the implications of the level of manipulation of results performed by managers, as described in the articles of Sousa et al. (2020). It is worth remembering that creditors, when carrying out the analysis for granting financial resources, can compare the company's financial statements with those of other companies. In addition, financial institutions can also compare the statements of the same company over a certain period of time.

Although lenders are one of the external users of financial statements, they are not the only ones, as investors also use accounting information to choose the

best investment alternative that maximizes the return on invested capital. But for that, they must compare the information of the different alternatives (companies) to allocate the invested capital (Healy & Palepu, 2001). The process of comparing different capital alternatives does not only occur at the time of resource allocation, since, according to Healy and Palepu (2001), investors also analyze whether it is worth continuing with the capital invested in the same alternative or migrating to another investment alternative.

Thus, comparability in accounting information can help investors' decision-making, with more comparable financial statements being related to lower levels of information asymmetry [see: DeFranco et al. (2011) and Reina et al. (2019)]. Comparability, however, is sensitive to earnings management practices (DeFranco et al., 2011). This logic is complemented by evidence from the study by Sohn (2016), as it showed that earnings management strategies by discretionary accruals imply a decrease in the level of comparability of accounting information. Additionally, Sousa et al. (2020) comments that when managers make income smooth, it reduces the comparability of companies.

From this discussion, it is understood that the use of earnings management strategies is detrimental to the comparability of accounting information and, in turn, impairs the decision-making process of investors. However, as presented above, earnings management practices differ significantly depending on a country's macroeconomic environment. It is noteworthy that, depending on the economic cycle, managers have incentives to increase or decrease the use of earnings manipulation strategies. Thus, the level of comparability may show different behavior according to the economic cycle. This understanding can be corroborated by the evidence from the investigation by Ribeiro et al. (2019), who found evidence of difference in the level of comparability when considering periods in which there was a retraction in Gross Domestic Product (GDP) compared to periods in which there was no retraction. Given this context, the first hypothesis is presented:

H1: The country's economic cycles impact the level of comparability of financial reports.

Investors, when carrying out their decision-making process based on the comparison of different investment alternatives to maximize profitability (Healy and Palepu, 2001), can not only compare different investment alternatives in the same period, but also compare the same investment alternative over time. In this sense, for investors to have quality in their decisions, the accounting information of the same company must be comparable.

Consistent financial statements mean that accounting practices have been maintained over time (Hendriksen & Van Breda, 1999) and that it can be beneficial to investors. This is because these external users can project the company's economic-financial performance in future periods. In addition, more consistent information is related to lower levels of information asymmetry (Reina et al., 2019), as they present greater informational power for investors (Haw, Hu, Lee & Wu, 2012).

Although consistency of information is beneficial to investors, this aspect of accounting information decreases when accounting practices change over time. Such change can be carried out by the preparers with the objective of promoting the recognition of economic events in the financial statements in a more adequate way. Nevertheless, they can be influenced by the company's managers with the purpose of meeting their particular interests.

Earnings management practices through accounting choices can cause the level of consistency to decrease and, therefore, damage the quality of financial statements (DeFranco et al., 2011; Ribeiro, 2014) and, thus, decrease power to assist investors in the decision-making process (Ribeiro, 2014). The implication of changes in accounting choices aimed at meeting earnings management strategies on consistency can be more detrimental than on comparability. Since the reduction in consistency can mitigate investors' ability to assess economic events that are recognized through the financial statements not only in one period or with a pair of companies, as in comparability, but for several consecutive periods. Therefore, it can cause the investor not to adequately assess the company in its decision-making process, or even discard it as an investment alternative for several periods, as they are unable to analyze the consequences of economic events underlying the company in different years.

As earnings management strategies adopted at different levels depend on the economic cycle, as exposed by Kousenidis et al. (2013), Filip and Raffournier (2014), Cimini (2015) and Paulo and Mota (2019), it is understood that the consistency of accounting information can present different levels depending on the economic cycle. In addition, Ribeiro et al. (2019) comment that the consistency of the accounting information presented differences in periods in which there was a retraction of the GDP compared to periods in which there was no retraction in the Brazilian economic activity. This indicates that economic cycles interact with consistency. Given this context, the second hypothesis of this research is presented:

H2: The country's economic cycles impact the level of consistency of financial reporting.

3 METHODOLOGICAL PROCEDURES

3.1 Sample definition and data collection

The population of the study was the companies that traded shares in Brasil, Bolsa Balcão (B3) in the years 2010 to 2019. Thus, following the purpose of the study, the initial sample consisted of 144 companies that, in turn, had the essential information for analyzing the comparability and consistency of accounting information. Soon after, the companies in the initial sample were classified according to their respective sector of economic activity, considering the classification of the North American Classification System (NAICS), at level 2. This classification was necessary because, for purposes of comparability, it is essential to separate companies according to similar economic activities.

Then, only the sectors that had at least four or more companies were selected. The minimum number of companies per sector is necessary, as it avoids increasing degrees of freedom (Ribeiro, 2014). Thus, this restriction means that there are no losses in the calculation of the measure of comparability of companies in a specific sector (Ribeiro, 2014). With this procedure, 70 companies were excluded, as they belong to sectors with less than 4 companies or to the sectors of: management of companies and enterprises, and; institution of credit intermediation and related activities.

This exclusion was necessary, because companies in the business and enterprise management sector were not considered to compose the sample, as they are companies that manage other companies that, in turn, have different activities, that is, they cannot be compared [see: Francis, Pinnuck and Watanabe (2014)]. Companies corresponding to the credit intermediation institution sector and related activities present operating activities very different from companies in other sectors, as well as some companies (banks) are governed by specific rules of the Central Bank of Brazil, a regulatory body that allows accounting choices more restrictive than companies in other sectors, see Sousa and Ribeiro (2020).

From these procedures, comparability and consistency of accounting information of the remaining 74 companies belonging to 10 sectors was measured. This conjecture had the maximum possible number of 1,824 observations, and the initial sample had 1,776 observations, once the information referring to 48 observations was not found. Later, the data were subjected to the Hadi test (1992). Test that aims to identify discrepant data that may distort the results and, consequently, the interpretation of results regarding the studied phenomenon. The Hadi test (1992) identified 661 observations as outliers, which were excluded from the sample due to the possibility of distorting the results of the multivariate regression models. It is noteworthy that among the data identified as outliers, it is noteworthy that all data corresponding to 13 companies were outliers. Thus, the final sample had 1,115 observations with 61 companies, distributed in 8 sectors.

The economic-financial variables used to analyze comparability and consistency were collected from the Economática® database between 2010 and 2019 in quarterly periods. Information regarding GDP variation was collected through the database of the Institute for Applied Economic Research (IPEA). The analysis period comprises quarterly periods, from the first quarter of 2014 to the fourth quarter of 2019, since to calculate the measure of comparability and consistency of accounting information, it was necessary to use 16 quarters, that is, the previous 15 quarters plus the current one.

To calculate comparability, we used the metric developed by DeFranco et al. (2011) in Appendix A. For the consistency measure, we used the metric from the study by Ribeiro (2014), which is an adaptation of the comparability metrics by DeFranco et al. (2011). All details about the consistency calculation are presented in Appendix B. Another metric used was the algorithm developed by Bry and Boschan (1971) and modified by Harding and Pagan (2002) to measure the four economic cycles (recovery, expansion, recession and contraction). Details regarding the calculation of this algorithm are provided in Appendix C.

3.2 Variables, econometric models and data processing

The dependent and independent variables used in the multivariate regression models are shown in Table 1.

Table 1
Variables used in research

Dependent Variables			
Variable	Description	Operationalization	References
Comparability (COMP)	Individual Comparability when considering the median with industry peers	$Earnings_{it} = \alpha_i + \beta_i Return_{it} + \varepsilon_{it}$	DeFranco et al. (2011)
Consistency (CONS)	Average Individual Consistency	$Earnings_{it} = \alpha_i + \beta_i Return_{it-1} + \varepsilon_{it-1}$	DeFranco et al. (2011) and Ribeiro (2014)
Independent variables			
Variable	Description	Operationalization	References
Recovery Economic Cycle (CYCLE_Recovery)	Measure the periods that are of economic recovery cycle	$\{[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \text{ e } [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]\} \text{ e } \{[(y_{t-y} - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \text{ e } [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]\}$	Bry e Boschan (1971) e Harding and Pagan (2002)
Expansion Economic Cycle (CYCLE_Expansion)	Measure the periods that are of economic expansion cycle	$\{[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \text{ e } [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]\} \text{ e } \{[(y_{t-y} - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \text{ e } [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]\}$	Bry e Boschan (1971) e Harding and Pagan (2002)
Recession Economic Cycle (CYCLE_Recession)	Measure the periods that are of economic recession cycle	$\{[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \text{ e } [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]\} \text{ e } \{[(y_{t-y} - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \text{ e } [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]\}$	Bry e Boschan (1971) e Harding and Pagan (2002)
Contraction Economic Cycle (CYCLE_Contraction)	Measure the periods that are of economic contraction cycle	$\{[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \text{ e } [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]\} \text{ e } \{[(y_{t-y} - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \text{ e } [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]\}$	Bry e Boschan (1971) e Harding and Pagan (2002)
Debt (DEBT)	Measure that corresponds to the participation of third parties in the amounts allocated to the companies' assets	$(Current Liabilities + Non-Current Liabilities / Total Assets) * 100$	DeFond and Jambalvo (1994), Marra, Mazzola and Prencipe (2011), Rodrigues, Melo and Paulo (2019)
Degree of Operational Leverage (DAL)	Measure that represents an operational performance measure of the company's cost structure	$Gross Profit / (Gross Profit - Selling and Administrative Expenses)$	Sohn (2016), Francis, Hanna and Vincent (1996), Ribeiro et al. (2016a) and Ribeiro et al. (2016b)

Market to Book (MB)	Variable that measures the expected growth of the business for the market	Market Value/Accounting Equity	Lee, Li and Yue (2006), Mcvay, Nagar and Tang (2006); Ribeiro (2016a) and Ribeiro (2016b)
Revenue Growth (GREV)	Measure regarding the company's revenue growth	$((\text{Net Revenue for the year}_t / \text{Net Revenue for the year}_{t-1}) - 1) * 100$	Baptista (2008), Hochberg (2011), Zhang (2012) e Melo (2015)
Size (SIZE)	Total assets of each company transformed to its logarithmic base	Natural Logarithm of Total Assets	Watts and Zimmerman (1986), Doyle, Ge and McVay. (2007), Ribeiro (2016a) and Ribeiro (2016b)
SECTOR	Industry variable for each company based on NAICS level 2 classification	Dummy variable that represents the sectors of economic activity of each company: auxiliary transport activities; construction of buildings; electricity, gas and water companies; real estate; food industry; transport equipment industry; steel and basic industry of other metals, and; telecommunications. It is noteworthy that the companies in the auxiliary transport activities sector were used as a reference dummy.	Bagnoli and Watts (2010)

Source: own elaboration (2020)

The dependent variables are the comparability and consistency of accounting information, and the independent variables are divided into two groups (interest and control). The variables of interest are the four economic cycles – recovery, expansion, recession and contraction. The control variables concern economic-financial indices pointed out in the literature as factors controlling the level of comparability and consistency of companies, as well as the dichotomous variables used to control sectors.

Data analysis was performed using panel data regression. But to carry out such an analysis, it is necessary to validate some assumptions such as normality, multicollinearity and heteroscedasticity. As the final sample is composed of more than 100 observations, the sample tends to data normality, according to the Central Limit Theorem. Another assumption corresponds to data multicollinearity. For this, we used the Spearman correlation test and the Variance Inflation Factor (VIF).

Furthermore, data were subjected to the Breush-Pagan (BP) test to assess whether the data present problems related to heteroscedasticity and to the Wooldridge test to identify the presence of first-order serial autocorrelation. Such tests evidenced that the multivariate regression models have the problem of

heteroscedasticity and serial autocorrelation. To correct this problem, these models were estimated with clustering in individuals.

After checking these assumptions, the panel data estimation method of the multivariate models was chosen. As there is control by the sector of economic activity in the regression models, the fixed-effect estimation was discarded. Furthermore, as the final sample is unbalanced, random effect estimation is not fully efficient. In this sense, the estimation of panel regression was performed using the pooled method.

4 PRESENTATION AND DISCUSSION OF RESULTS

At first, data were subjected to descriptive data analysis, presented in Table 2.

Tabela 2
Descriptive statistics

Variables	Mean	Standard deviation			Minimum	Maximum	Obs
		O	B	W			
COMP	-2,563	2,318	2,130	1,521	-13,909	-0,330	1.115
CONS	-0,598	0,643	0,507	0,450	-3,802	-0,001	1.115
DEBT	53,887	17,247	18,156	4,527	9,173	93,725	1.115
DAL	1,741	1,473	1,131	1,209	-4,692	9,515	1.115
MB	1,397	0,915	0,976	0,400	0,968	5,925	1.115
GREV	1,908	19,718	5,658	19,234	-92,608	101,624	1.115
SIZE	15,971	1,254	1,371	0,173	12,191	18,654	1.115

Note: O = Overall; B = Between; W = Within; Obs = Observations.
Source: research data (2020)

The comparability of accounting information had a mean value of -2.563 throughout the analyzed period, which is similar to the findings of other studies, such as those by DeFranco et al. (2011), Fang, Li, Xin and Zhang (2012), Sohn (2016) and Ribeiro et al. (2016a). However, comparability differs when discriminating different economic cycles. This is because it presented a mean value of -2.67 in the economic recovery cycle; -3.08 in the economic expansion cycle; -2.72 in the recession economic cycle, and; -2.22 in the economic contraction cycle. Given these results, it is understood that there may be a significant difference between the levels of comparability according to the economic cycle, with the lowest levels of comparability being related to the economic cycle of expansion and the highest levels to the economic cycle of contraction.

The Kruskal-Wallis test showed a Chi-square of 57.782 at 5% significance, representing that at least one of the economic cycles presents a significant difference compared to the other economic cycles. With this result, the Wilcoxon test was applied to check for a difference between the level of comparability according to economic cycles. The comparability in the economic recovery cycle is significantly higher than the levels of comparability in the economic expansion cycle ($z = 3.091$; $p\text{-value} < 0.002$) and lower than the levels of comparability in the economic contraction cycle ($z = -5.929$; $p\text{-value} < 0.000$).

The levels of comparability in the economic expansion cycle, in addition to being lower than the levels of this measure in the economic recovery cycle, are also lower than the levels of comparability in periods of economic contraction ($z = -5.782$; p -value < 0.000). The comparability levels in the economic recession cycle are significantly lower than the comparability levels in the economic contraction cycle ($z = -2.396$; p -value < 0.016). With these results, it appears that the highest levels of comparability occurred at the time of contraction of the Brazilian economy, and the lowest levels of this qualitative characteristic of improvement occurred in periods of economic expansion.

With regard to accounting information consistency, it can be seen that throughout the period this aspect had a mean value of -0.598 , a finding that is different from that presented by Ribeiro et al. (2019) and Reina et al. (2019). Despite this, consistency differs when segmented by economic cycles, as in the recovery cycle it had a mean value of -0.636 . The level of consistency showed a mean value of -0.694 in the economic expansion cycle, -0.577 in the economic recession cycle and -0.541 in the economic contraction cycle. Similar to comparability, it is understood that the consistency of accounting information can also have a lower mean value in times of economic recession and contraction. With the purpose of verifying this understanding, the test of means was carried out to check for a significant difference in the consistency of the accounting information according to the different economic cycles.

The Kruskal-Wallis test evidenced a difference in at least one of these groups compared to the others, given that this test presented a Chi-square of 9.608 and p -value < 0.022 . Therefore, the Wilcoxon test was applied with the purpose of checking for differences, and what is the difference in consistency between the different economic cycles. This test suggested that the level of consistency in the economic recovery cycle is only lower than the level of consistency in the economic contraction cycle ($z = -2.640$, $p < 0.0083$), with no significant difference from the levels of consistency of the other economic cycles. The other findings elucidated that the other tests between pairs of economic cycles did not identify a significant difference between levels of consistency. Thus, such findings may suggest that, in economic recovery cycles, there may be a decrease in consistency compared to the level of consistency of other economic cycles.

It is noteworthy that regarding the distribution of observations according to the economic cycle, it is listed that 40.44% observations comprise the economic cycle of contraction. The economic recovery cycle concentrates 30.58% observations in these studies. Finally, 15.17% and 13.18% observations are allocated to periods that undertake economic cycles of expansion and recession, respectively. Results that are in accordance with the analysis of Paulo and Mota (2019), in which the economic cycle that had more observations corresponded to the contraction. One justification for these findings is the decline in the Brazilian economic activity in the 2010s, which was significantly lower than the average economic growth of the previous decade (Institute for Applied Economic Research - IPEA, 2020).

Later, the Spearman correlation test (not shown) was run in order to present the correlation levels of the variables. The results indicated that they indicated that all correlation coefficients were less than 0.70 . In a complementary analysis, data were subjected to the VIF test, which revealed that all results were less than five.

With these results, based on the suggestion of Fávero and Belfiore (2017), it was possible to rule out problems related to multicollinearity in multivariate analysis.

The results regarding the Breusch-Pagan and Wooldridge test indicated that the two regression models present residual heteroscedasticity and first-order serial autocorrelation, respectively. To correct these problems, multivariate regressions were estimated by clustering individuals. Multivariate regressions are shown in Table 3:

Table 3
Multivariate analysis of the comparability and consistency of accounting information

Variables	Model 1		Model 2	
	Comparability		Consistency	
	Coef.	Estat T	Coef.	Estat T
CYCLE_Recovery	-0,8445	-4,40***	-0,1412	-2,99***
CYCLE_Expansion	-1,2013	-5,56***	-0,2447	-3,89***
CYCLE_Recession	-0,5946	-4,48***	-0,0874	-2,40**
DEBT	-0,0133	-1,36	-0,0062	-1,87*
DAL	0,1275	2,17**	0,0375	1,50
MB	0,1747	1,35	0,2907	5,15***
GREV	-0,0025	-1,02	0,0003	0,41
SIZE	0,4602	2,63**	0,0557	1,04
Intercept	-10,9712	-4,49***	-1,8568	-2,50**
Sector Control	Yes		Yes	
R ²	0,3927		0,1884	
Test F	21,87***		3,95***	
Root MSE	1,8188		0,5834	
Observations	1.115		1.115	
Assumptions of Multivariate Regressions				
	Chi-square/ F	p-valor	Chi-square / F	p-valor
Breusch-Pagan	573,11	0,000	1051,91	0,000
Wooldridge	85,910	0,000	58,883	0,000

Note: *significance at the 10% level; ** significance at the 5% level, and; ***significance at the 1% level. Regressions were estimated from the regression by estimating pooled clustered in individuals. Control was performed by economic activity sector (by means of dummy variables), when considering the sector of auxiliary transport activities. The multivariate models also absorbed the CYCLE_Contraction variable (dummy variable) as a reference for the other economic cycles.

Source: research data (2020)

In Model 1, the results indicated that the comparability of accounting information shows a significant decrease in economic cycles of expansion, recession and recovery in relation to economic contraction cycles. These findings confirm H1, because economic cycles influence the level of comparability of financial statements. These findings complement discussions present in some studies that dealt with the impact of the macroeconomic environment on the quality of accounting information.

Among these works, there is the one by Paulo and Mota (2019), as they report that in economic recovery cycles, managers do not increase or decrease the use of earnings management practices. Thus, in economic recovery cycles, there are no changes in the level of quality of financial statements. Despite this, the results of Model 1 do not converge with what was discovered by Paulo and Mota (2019), since there is a reduction in comparability in economic recovery cycles.

This result can be justified from the perspective that, with the process of economic recovery activity, managers predict an increase in the company's profitability and possible investor enthusiasm for future gains with the increase in stock prices, as the cycle after economic recovery cycle is the economic boom cycle. This scenario is conducive to increasing managers' earnings in terms of variable remuneration through bonuses (generally linked to the company's economic and financial performance in the year) and stock options, which is a factor that leverages actions that manipulate the practices of earnings management to maximize these types of remuneration. Opportunistic behavior that undermines comparability, as accounting choices do not adequately reflect economic events in financial statements (Sohn, 2016; Sousa et al., 2020).

As for the behavior of comparability in the economic expansion cycle, it is noted that it shows a decrease compared to the economic contraction cycle. This finding contributes to the discussion of Filip and Raffournier (2014) and Cimini (2015), since in non-crisis economic periods there is a decrease in the quality of accounting information due to the opportunistic actions of managers. The reduction in comparability in economic expansion cycles can be justified not only by the increased use of discretionary accruals, but also by the increased manipulation of earnings through operational activities. This is because this last type of manipulation presents a significant increase in expansion cycles (Paulo and Mota, 2019).

With regard to the behavior of comparability in the economic recession cycle, it appears that there is a decrease in relation to the levels found in periods of economic contraction. This result is in line with what was presented by Paulo and Mota (2019), since the quality of accounting information decreases according to increasing opportunistic practices by managers in periods of economic recession. It is noteworthy that, when verifying the coefficients of each variable referring to economic cycles in Model 1, the reduction in comparability in economic recession is less intense than in economic expansion and recovery. This behavior may be due to the reduction in the opportunistic behavior of the manager who predicts the economic contraction in future periods, a cycle that is marked by the reduction in profitability and operating levels of most companies.

The decrease in economic activity in economic contraction cycles has the consequence of reducing companies' profitability rates. Context that, according to Francis et al. (2004), increases the probability of obtaining loans to supply working capital. This need makes managers reduce opportunistic actions, since, in order to obtain loans with lower rates and interest, they need to present financial statements with higher levels of comparability, as discussed by Su et al. (2018). In addition, manipulating the results in periods of contraction may not be so interesting for the manager, because the remuneration is generally linked to the profitability indices and there is a reduction in the value of the shares, making the stock options not exercisable. This entire context can be a justification for

comparability to present significant gains in relation to other economic cycles, above all, the economic expansion cycle.

In summary, based on the results presented in Model 1, it can be seen that, in economic contraction cycles, the financial statements become more comparable than in periods of other economic cycles (recovery, expansion and recession). Result contributes to the investigation of Kousonidis et al. (2013), since, in the economic contraction, managers may have more incentive to reduce the level of manipulation of results to preserve, or even increase the quality of financial statements due to the need for financial resources. It is worth remembering that this incentive can be leveraged in markets with few companies and that it is not spread (Habib et al., 2013). In other words, because the shareholding composition of publicly-held companies in the Brazilian market is not, in general, dispersed, it may be a factor that encourages managers to increase the quality of accounting information in periods of economic contraction.

Regarding the results of Model 2, consistency of accounting information, in economic cycles of recovery, expansion and recession, is lower than in periods of economic contraction. Thus, it appears that economic cycles influence the level of consistency of accounting information, validating H2, and shows that managers change accounting choices, with greater or lesser intensity, according to the economic environment.

In the economic recovery cycle, there is a decrease in the level of consistency compared to periods of economic contraction. This result is at odds with Paulo and Mota (2019), since there are changes in the level of information quality in times of economic recovery. As well as comparability, consistency of accounting information also shows a decrease in economic recovery in relation to the contraction cycle. This is harmful to investors, because when the economy outlines an increase in economic activity, towards economic expansion, managers increase the changes in accounting choices, making the financial statements less consistent.

Regarding the level of consistency in economic expansion cycles, it is noted that there is a reduction in consistency in relation to periods of economic contraction. A justification for this finding corresponds to the logic that, in economic expansion periods, managers increase the use of earnings manipulation practices through accounting choices. This is because, in times of non-crisis, managers have more incentives to meet particular purposes (Filip & Raffournier, 2014). Purposes that are linked to increasing their own remuneration, from the increase in performance indices, and/or increase in share prices, since in periods of economic expansion, the market is not consumed by the uncertainty of expectations of future periods, but for the possible euphoria of earnings prospects.

In periods of economic recession, there is a decrease in the level of consistency compared to contraction cycles. This is detrimental to the quality of accounting information and investors' decision-making when analyzing a company's financial statements over time to choose the best investment alternative.

From these results, it can be seen that, in economic cycles of recovery, expansion and recession, the consistency of accounting information is lower than in periods classified as economic contraction cycles. Results that contribute to studies by Kousenidis et al. (2013), Habib et al. (2013) and Filip and Raffournier

(2014), because, in times of economic contraction, financial statements have a higher level of quality and, in turn, result in an increase in their information capacity for external users. This consistency behavior may come from the decrease in the use of earnings manipulation strategies by managers. This is because statements with higher quality levels increase the probability of acquiring loans from financial institutions, as explained by Francis et al. (2004).

5 FINAL CONSIDERATIONS

The study aimed to analyze the influence of economic cycles on comparability and consistency of accounting information of publicly traded companies in the Brazilian market. The results suggest that comparability and consistency of accounting information show a significant decrease in periods of economic cycles of recovery, expansion and recession compared to economic contraction periods. These results implied the acceptance of the two hypotheses developed in this study, as they revealed that economic cycles influence comparability and consistency of accounting information.

Such findings are not limited to the validation of hypotheses, as they contribute to the literature and accounting practice. Regarding comparability, our findings generate contributions to the studies of Kousenidis et al. (2013), Filip and Raffournier (2014) and Cimini (2015). This is because the authors mention that, in economic contraction periods, managers make fewer intentional changes in accounting choices with the purpose of meeting particular purposes. For this reason, in economic contraction cycles, financial statements are more consistent and more comparable in relation to other economic cycles.

The decrease in the intentional alteration of accounting choices in periods of economic contraction can be caused by a reduction in the company's profitability and a drop in stock prices. This means that earnings management is not as efficient in increasing the remuneration of managers, since, generally, bonuses are based on economic-financial profitability indices. Furthermore, with the fall in stock prices, stock options are not exercisable. Another contributing factor to the increase in comparability and consistency is that many companies may need financial resources from financial institutions. Therefore, managers tend to present more comparable and consistent statements to increase the probability of success in the operation with lower costs and interest rates, as discussed by Francis et al. (2004) and Su et al. (2018).

In practical terms, our results also present contributions, given that in periods of slowdown in the Brazilian economy, companies present more comparable financial statements. This can serve as a warning to external users of accounting information, given that managers have more incentives to manipulate results, especially those of operational origin in times of economic expansion, see Paulo and Mota (2019). Thus, it can reduce comparability and affect the decision-making process of these users, given that Sousa et al. (2020) explain that comparability decreases as managers manipulate the results.

Furthermore, investors especially should also be on the alert. Once managers can take advantage of the euphoria of the economic expansion cycle and the increased perspective of these external users, regarding the increased perspective of increasing the company's profitability, to employ opportunistic

practices aimed at maximizing private purposes. This warning is useful for creditors, as in the expansion cycle, financial statements become less consistent and comparable, which can lead to wrong decisions regarding the amount that can be loaned to the company.

Like any work, this study also has limitations. One of them corresponds to the non-use of accounting policies that imply comprehensive results. Another limitation corresponds to considering the economic cycle based on the GDP variation, without considering other aspects that are related to macroeconomic policy, for example, the interest rate, exchange rate, as well as political noise that can impact the market and, likewise, in the economy of a country. In view of this, it is suggested that future investigations address the implications of management of operating earnings on comparability and consistency, as well as the impact of macroeconomic determinants on the level of these aspects relating to the quality of financial statements.

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APPENDIX A

To determine the measure of comparability, we used the similarity of the accounting function developed by DeFranco et al. (2011). The first step was to estimate the accounting function of each company. For this, the following equation was estimated, considering a time series of 16 quarters (4 years), that is, the current period added to the last 15 quarters:

$$Earnings_{it} = \alpha_i + \beta_i Return_{it} + \varepsilon_{it} \quad (1)$$

Where: $Earnings_{it}$ corresponds to the quarterly net income at the end of the year divided by the market value at the end of the year of company i in period t , ε ; $Return_{it}$ refers to the quarterly stock return of company i in period t , calculated from the closing price of shares, adjusted for earnings and splits.

The second equation was used to estimate the parameters of the individual functions, where, considering the results obtained in Equation 1, the Expected Earnings [$E(Earnings)$] of the companies were projected, as shown below:

$$E(Earnings)_{iit} = \hat{\alpha}_i + \hat{\beta}_i Return_{it} \quad (2)$$

Where: $E(Earnings)_{iit}$ is equal to the net profit over the expected market value of company i with the parameters of company i in period t , and; $Return_{it}$ corresponds to the quarterly share return of company i in period t , calculated from the closing price of common shares, adjusted for earnings and splits.

From this, Equation 3 was used in order to calculate the Expected Earnings of a company using the estimators of other companies in the same sector.

$$E(Earnings)_{ijt} = \hat{\alpha}_i + \hat{\beta}_i Return_{it} \quad (3)$$

Where: $E(Earnings)_{ijt}$ is the net income divided by the expected market value of company i with the parameters of company j in period, and; $Return_{it}$ corresponds to the quarterly share return of company i in period t , calculated from the closing price of shares, adjusted for earnings and splits.

Equation 4 measures the average distance of the results obtained through Equation 2 and Equation 3. That is, it calculates the comparability of the company with each of its peers in the same sector.

$$Comp_{ijt} = -\frac{1}{16} \sum_{t-15}^t |E(Earnings_{iit}) - E(Earnings_{ijt})| \quad (4)$$

Where: $Comp_{ijt}$ represents the measure of relative individual comparability of company i based on company j in period t ; $E(Earnings)_{iit}$ corresponds to the net profit over the expected market value of company i with the parameters of company i in period t , and; $E(Earnings)_{iji}$ = net profit over the expected market value of company i with the parameters of company j and the return of company i in period t .

Comparability concerns the distance between the accounting functions of a pair of companies. Thus, two companies will be more comparable the closer the result from Equation 4 is close to zero. It is worth remembering that, in order to obtain the curve of comparability upwards, as well as to facilitate the graphical visualization and its interpretation, the result obtained in Equation 4 was multiplied by -1.

Later, DeFranco et al. (2011) highlights that, in order to calculate the comparability of each company, it is necessary to measure the mean values levels of comparability of companies in relation to their sector peers. However, to mitigate the effects of companies with comparability levels well below the mean value of other companies making up the same sector, an adaptation of the original metrics proposed by DeFranco et al. (2011). Adaptation that refers to not considering the level of comparability of each company in their respective periods from the mean comparability value of the company itself in relation to each pair of companies in the same sector, but considering the median. Thus, this distortion prevented the companies' comparability level from being distorted due to the existence of companies with different comparability levels in relation to the sector.

APPENDIX B

In order to check comparability over time, the consistency aspect was used, which refers to a measure of comparability from the thesis of Ribeiro (2014), which is an adaptation of the similarity model of the accounting function by DeFranco et al. (2011). This measure was used in the study to analyze the effect of economic cycles when considering the comparison of financial statements of the same company in different years.

The consistency measure was chosen in view of the practical implications and progress in the discussion of the topic, since, depending on the economic cycle, there may be incentives for managers to manipulate the results more or less through accounting choices [see Kousenidis et al. (2013), Filip and Raffournier (2014), Cimini (2015), Paulo and Mota (2019) and Ribeiro et al. (2019)]. Thus, depending on the economic cycle, there may be greater or lesser incentive for managers to change the way they recognize economic events. Regarding changes in accounting practices depending on the economic moment, the statements can be directly impacted, as they can present a greater or lesser level of consistency. Thus, the economic cycle may be related to changes in the level of consistency of accounting information.

The calculation of the consistency measure basically follows the same logic demonstrated in the comparability measure. However, it presents an adaptation regarding the comparison parameter. Since the return of a company lagged in a quarter was used, as shown in Equation 5.

It is noteworthy that the measure of consistency contained in the thesis of Ribeiro (2014) and followed in other studies, such as Reina et al. (2019) and Ribeiro et al. (2019), was adapted by replacing the variable size (total assets) with market value. This adaptation provided the possibility of recognizing the proportion of net income in relation to the company's value determined by the capital market, since participants in this market consider the unaccounted amounts (generally intangible) in the financial statements as an asset that will provide inflows of cash in future years. Similarly, the market also recognizes potential liabilities that may also not be being accounted for. All this understanding refers to the logic described in DeFranco et al. (2011).

The second adaptation of the measure by Ribeiro et al. (2014) corresponds to the change in the period for calculating the time series to measure the parameters obtained through Equation 1, going from 12 to 16 periods, as described in DeFranco et al. (2011). Thus, Equation 5 is shown below, which was used to calculate the consistency of accounting information.

$$Earnings_{it} = \hat{\alpha}_i + \hat{\beta}_i Return_{it-1} \quad (5)$$

Where: $Earnings_{it}$ is equal to the expected net profit of company i with the parameters of company i in period t ; and $Return_{it-1}$ = quarterly share return of company i in period $t-1$, calculated from the closing price of common shares, adjusted for earnings and splits, referring to the previous quarter.

Using Equation 6, consistency of accounting information was measured for each company per quarter. In this sense, consistency concerns the mean distance of the functions obtained through Equations 2 and 5. Therefore, for a company's accounting information to be consistent over a given period of time, the closer the results of Equation 2 and Equation 5, the greater the consistency of the company's information.

$$CONS_{iit} = -\frac{1}{16} \sum_{t-15}^t |(Earnings_{iit}) - (Earnings_{iit-1})| \quad (6)$$

Where: $CONS_{iit}$ corresponds to the measure of relative individual consistency of company i based on company i in period t ; $Earnings_{iit}$ refers to the expected net profit of company i with the parameters of company i in period t ; $Earnings_{iji}$ is equal to the expected net profit of company i with the parameters of company i in period $t-1$.

The consistency measure differs from the comparability measure, in which the first is measured by taking into account the same company over a period of time and the second is calculated based on the mean value of distances of different companies. Therefore, through Equation 6, the consistency measure of each company was found.

APPENDIX C

A country's macroeconomic activity varies over time. Schumpeter (1939) described that this macroeconomic activity is cyclical and is repeated in cycles. These economic cycles are divided into four stages, namely, recovery, expansion, contraction and recovery (Schumpeter, 1939). Two of these stages, recovery and expansion, comprise the ascending phases of a country's economic activity. The recession and contraction phases, on the other hand, lead to economic activity reduction.

However, it is necessary to distinguish the ascending, recovery and expansion phases, from the point that differentiates the descending, recession and contraction phases. For this, as presented by Schumpeter (1939) and operationalized by Paulo and Mota (2019), this point of separation between two phases (ascending or descending) of economic activity, gives the balance point between these two macroeconomic cycles, which corresponds to the mean percentage change in quarterly GDP for the period analyzed. Balance point that, based on the logic of Backus and Kehoe (1992) and Stock and Watson (1999), gives the trend of economic activity in a country and, thus, allows to measure which is the phase of the economic cycle for each quarterly period. Thus, in ascending (descending) phases, quarterly GDP changes below the quarterly GDP average throughout the period were classified as a recovery (contraction) phase, while quarterly GDP changes above the quarterly GDP average throughout the lapse analyzed were classified as expansion phase (recession). In Figure 1, this process regarding the classification of economic cycles for each quarterly period is illustrated.

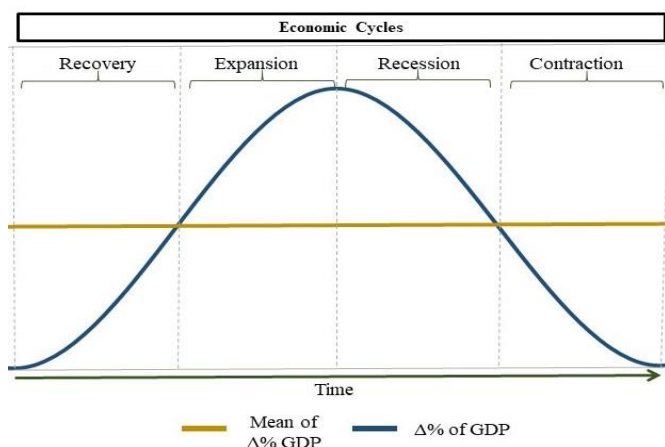


Figure 1 – Economic cycles according to Schumpeter (1939)

In order to define economic cycles, the metric of Claessens, Kose and Terrones (2012) was used. The authors mention that the metric used derives from the algorithms developed by Bry and Boschan (1971) and later improved by Harding and Pagan (2002). Following this reasoning, Claessens et al. (2012) describe that the aforementioned algorithm, consisting of two equations, manages to measure the peak and trough periods of the economic cycle. Such a measurement is necessary to distinguish ascending economic activity (from the trough to the peak) from the descending phases (from the peak to the trough).

The algorithms employed by Claessens et al. (2012) is used in similar study on economic cycles, such as Paulo and Mota (2019), as shown in Equation 7 and Equation 9.

$$[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] e [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]$$

(7)

$$[(y_t - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] e [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]$$

(8)