SELIC Rate Effects on Investments by Publicly-Traded Companies: Evidence from Brazil

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Abstract

This study sought to verify the impact of the Special Settlement and Custody System (*Sistema Especial de Liquidação e Custódia* – SELIC) rate on investments made by Brazilian publicly traded companies. The research is based on the assumptions of the Theory of Interest, which postulates that the increase in the monetary interest rate discourages companies from making investments, resulting in a lower generation of wealth and, consequently, retardation in the economic growth of the country. To achieve this objective, data were collected from databases and, with this information, a regression with panel data was performed for a sample of 325 companies listed in Brazil, Bolsa, Balcão [B]^3, the São Paulo stock exchange, in the period from 2013 to 2022, totaling 6,694 observations. The results indicated that the SELIC rate is negatively related to investments made by companies in the period, considering that the basic interest rate takes 6 to 9 months to have effects on aggregate demand. Thus, it appears that the higher the percentage of the interest rate is, the lower are the investments the organizations have undertaken, which is found to meet what the Theory of Interest exposes. In addition, during economic instability, companies tended to reduce capital investments. In theoretical terms, the

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main implications of the research are to expand discussions through the evidence that traditional economic currents are effective in explaining the effects of the basic interest rate on corporate investments and aggregate consumption, including microeconomic groups, such as the capital market, provided that the intrinsic characteristics of the country's economy are considered in empirical explorations. Therefore, the study provides reflections on the behavior of companies in uncertain economic scenarios and the impact of these aspects on corporate investments, which prevalently influence shareholder investment decisions.
Keywords: Corporate Investments; SELIC; Interest Theory; Publicly Traded Companies.

1 Introduction

Corporate investments are related to the physical projects of companies, so that such goods (assets) are intended to maximize productive activities or evolve the current productivity format (Farooq, Tabash, Hamouri, Daniel, & Safi, 2023). In this context, for these authors, and since investments are an important determinant for the companies' financial success, managers need strong motivation to make capital contributions in fixed assets, since asset payback can take place slowly and the chances of insolvency in relation to third party resources increase due to the uncertainty of return.

Thus, in addition to these operational risks, considered tacit within the market, companies need to stick to macroeconomic variables present in the economic environment, since the current financial market system demands that organizations and stakeholders have the ability to deal with frequent fluctuations in the economic scenario (Paredes & Oliveira, 2017). From this perspective, corporate investment decisions are closely linked to the macroeconomic situation of a nation, especially in times of economic volatility, which can systematically affect investment decisions (Farooq et al., 2024).

In the view of Tarkom and Ujah (2023) for financial decisions, strategists and analysts guide their actions and, consequently, their efficiencies by assessing the dynamics of interest rates of the monetary authority and the existing inflation. In this context, Keynes (1936), in relation to the macroeconomic variable object of this study, expresses that the monetary interest rate is a phenomenon influenced by the interaction between the investments made and the offer of money in the economic environment. As a result, in times of financial stress in the market, due to the low circulation of monetary resources and high inflation, the reference rate has a relevant role in the financial balance of the market as a monetary policy mechanism for risk reduction, bringing therefore, vitality for the country's economic development (Sui, Liu, Li, & Zhang, 2022).

However, in what concerns businesses, the complex relationship between inflation and the monetary interest rate plays a significant role in the impact on the reduction of purchasing power, price adjustments, production costs, and fluctuations of fundraising rates in the market (Tarkom & Ujah, 2023), and may influence individuals and the investment policy of companies positively or negatively. In addition, corroborating this view, Alper, Clements and Hobdari (2020) revealed that high interest rates are considered a hindrance to making greater investments, to greater financial inclusion and to economic growth.

In Brazil, the basic interest rate is represented by SELIC, which plays an important role in inflation control (Silva, 2022). In line with this, after the *Plano Real*, specifically in the mid -1990s, the SELIC rate has been used as one of the main monetary stabilization tools. However, an array of scholars claim that high interest rates bring stagnation to the economic environment, are a discouragement to the increase in the number of jobs, among other problems (França, Grasel, & Pereira, 2003; Fonseca, Santos, Pereira, & Camargos, 2019).

In turn, manifesting favorably, some experts claim that this rate is a necessary economic policy tool, as it has as its main objective to control inflation by decreasing credit demand from

people and companies in financial institutions, which ends up valuing the exchange rate, attracting foreign capital and avoiding the removal of investments from the country, inasmuch as it stunts economic growth to a certain extent (França et al., 2003; Attilio, 2020). In this sense, Alshubiri (2022) still specifies that economic instability, a phenomenon that affects the basic interest rate, is considered an opportunity for foreign investors to contribute capital to the country's financial system and thus adapt to this reality.

Thus, although the state uses macroeconomic mechanisms in times of economic uncertainty to protect or balance the economy of the country, companies are not immune to the dangers present in the economic and political environment, such as health crises and natural tragedies, since these risks, whether normal or a set of unexpected adversities, cause weaknesses that can impact employment and production levels, among other factors, which influence investment plans in various negative ways (Souza, Lima, Mariano, Carvalho, & Ribeiro , 2021).

Therefore, although macroeconomic factors are important regarding companies' financing decisions and become relevant to corporate investments, these variables can cause oscillations in how these organizations arrange their capital structure, mainly due to variations in the SELIC rate (Cardoso & Pinheiro, 2020).

This is explained by the fact that the basic interest rate is a relevant instrument for determining currency supply and thus for investments, since when the SELIC rate is increased, financial institutions tend to increase their remuneration coming from deposits (deposit spreads), an aspect that decreases the yield of the deposits made and generates withdrawals from funds made by depositors (Alshubiri, 2022; Caetité, Sousa, Savoia, Bucchi, & Garcia, 2022). Thus, with the reduction of sources of resources, credit suppliers give less loans and increase credit restrictions, making the offer of resources more expensive (Alper et al., 2020; Caetité et al., 2022).

Thus, given this context and in view of the relevance or irrelevance of the SELIC rate on possible corporate investments, the following is questioned: What is the impact of the SELIC rate on the investments of publicly traded companies in Brazil? Therefore, the objective of this study is to verify how the SELIC rate affects the levels of investments made by companies with shares traded in the Brazilian Stock Exchange.

This research is motivated by the current macroeconomic scenario, in which a more attractive basic interest rate is evident when compared to the basic interest levels of the economies of other nations in the international context (Attilio, 2020), which may be more attractive to fixed income investors, but is a detrimental aspect to the business investment policy. Thus, this topic gains relevance, since the entire production chain is impacted by raising the SELIC rate, especially making it nonviable for companies to invest in the financial market. In addition, there is a gap in studies that seek to highlight how the companies listed on the stock exchange behave in face of the SELIC rate’s oscillations in relation to the investments made, considering, for that purpose, how the positive and negative variations of macroeconomic factors influence the strategic policy of corporate investments.

Thus, research contributes to bringing current discussions about monetary policy and its impacts on companies, since the need to understand the characteristics of these economic balancing measures can provide strategic insights for managers' financial decision making regarding investments, in order to maximize profits, and consequently, the financial efficiency obtained by companies, aspects that tend to attract investors' interest in stocks. Moreover, impacts on companies with assets traded in the capital market go beyond the purposes of financial variables, as the financial market is sensitive to available information and the expectations of analysts and investors about the performance and opportunity of investment returns (Mendonça & Díaz, 2023). Therefore, a reduction in concerns regarding macroeconomic factors mitigates uncertainty within the market and attracts investors, enabling them to more properly make their contributions to financial assets.

In theoretical terms, research contributes to bringing reflections on the importance of taking into account the macroeconomic characteristics of the Brazilian economy, because, as evidenced in the study results, SELIC negatively influences corporate investments and these effects only occur at least six months after the rate elevation (or decrease), These results also demonstrate the efficiency of the traditional literature to explain this relationship in microeconomic groups, especially the General Theory of Interest. Thus, when considering the economic particularities of Brazil, it is possible to obtain more reliable and appropriate results to the precepts of traditional literature, so that the main implication that the study brings is the need to use lags of at least two or three periods to understand how and at what time the effects of the monetary interest rate on investments occur, or even the performance of companies, which provides empirically subsidized insights so that firms can establish an appropriate hedging policy for times of economic stress, therefore promoting more security to investors and possible interested parties in the company's assets.

2 Theoretical Framework

2.1 Interest Rate

The interest rate can be defined as the cost of obtaining a certain amount of money at a specific time, so that the influence of this rate is not only within the financial market, but also in the decisions related to each individual's expenses in society, as well as in the definitions of investments to be made by companies, which consequently imposes more pronounced consequences for the economy of a country (Omar, 2008; Obinna, 2020). In the view of the Securities Commission [*Comissão de Valores Mobiliários* - CVM] (2019), the referential interest rate or basic interest rate is calculated and used as a reference for operations between financial institutions for one day, commonly called SELIC rate.

In the SELIC rate environment, it is important to highlight the difference between the SELIC target rate and the actual SELIC. The SELIC target is the rate established at the Monetary Policy Committee (*Comitê de Política Monetária* - COPOM) meetings, by which the target rate can last for 45 days, which is how often the COPOM meets, with the objective of limiting the pace of demand growth and curbing the persistence of inflation, as it is essential to control inflation to achieve the goals set by the National Monetary Council (*Conselho Monetário Nacional* - CMN) (Caetano, Silva, & Corrêa, 2011; Vicente, Marins, & Gaglianone, 2022).

In turn, SELIC overnight or de facto is the average rate actually charged in transactions between banks, backed by government securities, whose percentage is a reflection of the momentary conditions of liquidity of the monetary system (offering capital demand). Thus, due to its purpose, this study is limited to the approach of the SELIC overnight, which guides all other financial rates (Caetano et al., 2011).

In this sense, the basic interest rate, SELIC, is used above all as an inflation control mechanism, so that its influence not only falls on this macroeconomic variable, relating and also affecting the levels of employment, exchange rate, monetary flows, corporate investments, interest on public debt, among other variables (Omar, 2008; Feijó, Lamônica, & Bastos, 2016).

At times, in the face of an economically or non-economically adverse scenario, this policy is implemented by the Central Bank (Banco Central - BACEN), more precisely by the Monetary Policy Committee (COPOM), which is responsible for guiding and establishing changes in the SELIC rate, in order to encourage the growth of the country's economy and promote consumption by component agents of society - companies and general population (Fonseca et al., 2019).

Corroborating this statement, in periods when monetary policy mechanisms (credit channels, asset value, exchange rate, inflation expectations and interest rates) lose strength, an increase in the basic interest rate is required, since BACEN, as a federal agency created to execute monetary policy, needs this mechanism to fulfill some of its main responsibilities, such as ensuring the sustainability of the purchasing power of the official currency and the consistent and efficient functioning of the financial system in Brazil (Barboza, 2015; CVM, 2019).

Thus, considering that the SELIC rate has been the main mechanism for controlling monetary policy since the implementation of the *Plano Real* in 1994, it is considered one of the main factors slowing down Brazil's growth, since, even with reductions over time, the monetary interest rate is still at high levels and, depending on the economic context, it experiences increases that exceed the decreases obtained at the beginning, which shows that the basic interest rates of the Brazilian economy are well above international standards, when compared to the percentages set by other countries (França et al., 2003; Attilio, 2020).

Naturally, it is known that one of the main functions of the BACEN is to act in controlling the country's inflation and, in this sense, the relatively high levels of the basic interest rate, historically observed in Brazil, are often justified by the presidents of the BACEN as necessary to keep the general price levels of the economy under control.

Figure 1 allows us to visualize the role of the SELIC rate in combating inflation increases over the period from 2013 to 2022 and how the rate presents high levels, even in moments that are not so economically critical, showing, on average for the period, a rate of 8.92 % per year.

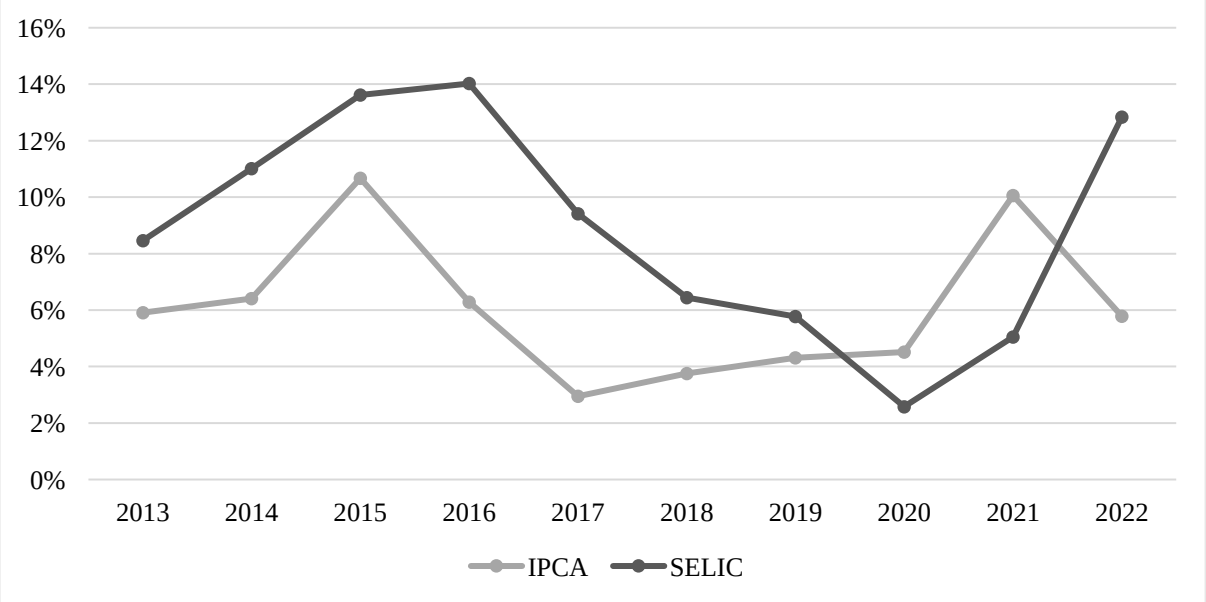

Figure 1 - Behavior between the SELIC rate and inflation
Source: Prepared by the authors (2023).

In contrast to this behavior of the basic interest rate in recent years, the general theory on the relationship between interest rates and investments, as set out by Keynes (1936), suggests that decreases in the monetary interest rate stimulate corporate investments, since companies feel more inclined to invest due to the lower cost of obtaining third-party capital, which ends up providing a better cost-benefit ratio when investing in assets (Benedictow & Hammersland, 2020; Peng & Thibodeau, 2020).

However, Chetty (2007) states that a lower monetary interest rate leads to a reduction in financial expenses related to the assets acquired, making third-party capital less costly and/or

more valuable to retain resources and postpone investments that can be made. As an explanation for this behavior, keeping constant the factors that impact investments (inflation, exchange rate, source of financing, among others), including cash flow expectations, this author states that, when the percentages of revenues and profits obtained in relation to the investments (capitalization rate) made are small, due to the appreciation of assets, the stimulus to investments caused by a low reference interest rate does not materialize in practice.

Furthermore, in the view of Bokpin (2009), regarding the influence of macroeconomic variables, expectations of an increase in the monetary interest rate positively influence companies to replace long-term debt with short-term debt, given the unpredictability of future political and economic scenarios, which can affect the reference interest rate and, therefore, the cost of this capital throughout the contract. In other words, in the event of changes in monetary policy, such as an increase or decrease in interest rates, a recession, or an economic expansion, companies tend to adjust their capital structure in favor or against future fluctuations in the monetary authority's interest rate (Bokpin, 2009; Mokhova & Zinicker, 2014).

2.2 Interest Theory and the Relationship with Investments

In order to achieve greater capitalization, nations whose currencies are not at the top of the monetary trading hierarchy, normally present in emerging markets such as Brazil, are forced to raise interest rates or open the capital market to new investors, consequently bringing about a more liberal fundraising policy (Andrade & Prates, 2013; Kaltenbrunner, 2015).

Therefore, it is important to consider the relevance of the monetary interest rate in relation to investment decisions, since, in Keynes' view, companies can only project the return on their investments through yield, an aspect that is based on expectations and not on precise projections, which are influenced by macroeconomic variables, such as interest and inflation rates (Feijó et al., 2016). When analyzing the necessary return estimates, it is important for companies to also consider the effects of inflation on possible returns, so that they can project rates within a more accurate reality (Hannsgen, 2006).

In the Brazilian context, it is important to analyze the scope of the inflation target, since, according to Altunbaş and Thornton (2022), this regime concerns the adequacy of the country's monetary policy, especially the interest rate, with the aim of achieving a pre-defined inflation rate, which is communicated in advance. In addition to this fixed percentage, it is worth noting that there is a tolerance percentage, both upward and downward. Thus, if inflation is not at the fixed point or within the specified tolerance margins, this can be a good tool to signal to the public that inflation is not being perfectly controlled by the implemented monetary policy, which can provide important insights into investment decisions (Ehrmann, 2021), whether corporate or general population.

In this sense, return expectations and inflation are impacted by the economy's fixed basic interest rates, given that this is a macroeconomic mechanism to balance consumption and productivity, since the basic interest rate, SELIC, is set by the Central Bank based on external factors, which either incentivizes investments in consumer markets or makes them nonviable (Feijó et al., 2016).

Confirming these statements, França et al. (2003) and Alshubiri (2022) state that raising the basic interest rate, with the aim of stabilizing the country's monetary system, brings some harm to the Brazilian economy, since high interest rates make economic growth nonviable, make the economic environment static, raise unemployment levels and increase the cost of public debt in relation to the Gross Domestic Product (GDP). In contrast, raising the reference interest rate can encourage the interest of foreign investors, who take advantage of exchange rate stabilization measures, which aim to increase the value of the local currency (in this case, the Brazilian Real) against other currencies (Harvey, 2019; Attilio, 2020).

Therefore, this entire context derives from the discussion that Keynes brings in his theory about interest rates and their impacts on the market and society. From this perspective, Keynes states, in his seminal work entitled: The General Theory of Employment, Interest and Money (1936), that an increase in the basic interest rate discourages investments, which ends up causing a delay in the generation of wealth in all sectors, despite stabilizing the exchange rate and, therefore, attracting foreign capital and avoiding the flight of internal capital.

In other words, with the increase in the monetary interest rate, i.e. SELIC, companies want to decrease their debt in face of the increased cost to obtain credit (Durante, Ferrando, & Vermeulen, 2022). Thus, they reduce their access to the resources needed to invest in the production of products or goods, which generates discouragement of investments that could contribute to the maximization of production, provide more generation of wealth and more currency in circulation (Keynes, 1936). Also, for Keynes (1936). When the basic interest rates are equal to or close to the highest marginal efficiency rate of a given investment, which is the return on the respective asset compared to the incurred cost, there is no relevant cost-benefit ratio that justifies performing this operation, causing in other words, disinterest in the respective investment.

This dynamic of the basic interest rate also impacts unemployment, given that for Keynes (1936), when goods or products fail to be made, and therefore, when wealth fails to be generated, it is not possible to create currency for investments and for society to consume according to their needs, and as a result, there is no need for an increase in the amount of labor. This thinking is ratified in the study of Nader (2018), in which this author states that the entrepreneur determines the maximization of operating results by defining production, prices, and profits to be achieved, which will be specified in face of effective demand.

In contrast, increasing the basic interest rate offers no incentive for companies to transform their own financial resources into investments (preference for profit retention) and/or tend to make companies acquire less financing for such purpose (Wray , 2006; Feijó et al., 2016, 2020), bringing negative impacts on production and unemployment levels (Keynes, 1936). Thus, due to the low attractiveness of using their own resources, given that retention provides more financial security for companies, this generates the need for onerous capital acquisition, which is obtained through financing from financial institutions. However, in situations of elevation of the monetary interest rate, the cost of getting resources from banks is higher, making it impossible to obtain external capital (Wray, 2006; Caetano et al., 2011; Dang, Pham, & Tran, 2020).

Thus, it is important to note that not only interest rates tend to impact business investment levels, but also that the negative effects of economic instability play an important role in this negative scenario, which are usually fought through a strategic policy of macroeconomic variables, such as the basic interest rate. Ratifying this thought, Bindra et al. (2024) argue that economic uncertainty is a remarkable factor that contributes to the decrease of corporate investments, as firms choose to postpone investments in times of imbalance in the macroeconomic scenario.

In this sense, França et al. (2003), Farooq, Ahmed and Khan (2021), Bishnoi and Garg (2022) discussed the relevance and impact of monetary interest rates on investments, revealing the result that was proposed by Keynes (1936), thus highlighting a negative relationship between investments and the basic interest rate. Therefore, motivated by these findings, a negative relationship between investments and the SELIC rate is proposed, in light of the Keynesian theoretical approach to interest, so that the hypothesis to be answered in this study is presented.

H1: The SELIC rate is negatively related to investments made by companies.

3 Methodological Aspects

3.1 Data and Sample

The data used in this research were collected from the financial statements of Brazilian publicly traded companies, specifically the balance sheet and the cash flow demonstration in the Economática® database. In addition, SELIC rate data was collected from the BACEN database. Thus, these data were collected for the period from the first quarter of 2013 to the last quarter of 2022, which totaled 40 quarters analyzed.

Thus, the survey features a short and unveiled panel, since the number of companies is greater than the number of years analyzed and not all companies were present in all the quarters analyzed, respectively. It is noteworthy that the financial data was updated by the National Average Consumer Price Index (*Índice Nacional de Preços ao Consumidor Amplo* - IPCA). Thus, the final sample of this research consisted of 325 companies, totaling 8,500 observations, distributed in nine sectors, as evidenced in Table 1.

Table 1
Sample frequencies used in this research

Sectors	Number of Companies	Percentage
Cyclic Consumption	90	27.69 %
Industrial Goods	60	18.46 %
Public Utility	51	15.69 %
Basic Materials	31	9.54 %
Non-Cyclic Consumption	30	9.23 %
Health	24	7.38 %
Information Technology	19	5.85 %
Petroleum, Gas and Biofuels	12	3.69 %
Communications	8	2.46 %
Total	**325**	**100.00 %**

Source: Prepared by the authors

Initially, the survey would consist of all companies with stock in active negotiations listed in [B][3], totaling 397 companies listed on the stock exchange. However, the "financial" and "others" sectors have been excluded and do not compose this sampling, as they are composed of enterprises that have a different operational dynamics and organizations that have participation in other companies (holdings, for example), which ends up not reflecting the operational reality of the majority of the sample.

3.2 Selected Variables

The variables were selected according to related studies. However, it is intended to advance in the literature of the area with the insertion of variables not yet studied on the theme. Thus, in Table 2, the factors that aim to explain the behavior of investments in Brazilian publicly traded companies are highlighted.

Table 2
Variables used in the study

Proxies	**Definition**	**Expected Signs**	**Previous Studies**
Liquid Purchases of Permanent Assets	Cash generated (or consumed) by purchases (or sales) of fixed	Dependent variable	-

	assets divided by the total asset		
SELIC Rate	Basic interest rate	-	França et al. (2003); Farooq et al. (2021); Tarkom and Ujah (2023).
Size	Natural Logarithm of Total Assets	+	Cardoso and Pinheiro (2020); Durante et al. (2022); Tarkom and Ujah (2023).
Economic and Political Instability	Assignment of 1 for quarters impacted by economic instability in Brazil (2014 to 2019) and 0 for the others	-	Fonseca et al. (2019); Cardoso and Pinheiro (2020); Souza et al. (2021).
Return on Assets (ROA)	Profit before interest, taxes, depreciation and amortization (EBITDA) divided by the total asset	+	Fazzari, Hubbard and Petersen (1988); Farooq et al. (2021); Adapted from Li et al. (2022).

Source: Prepared by the authors (2023).

The variable Fixed Assets Net Purchases (*Compras Líquidas de Ativos Permanentes* - CLAP) is measured by the sum of the purchases of permanent assets and the subtraction of sales of permanent assets, resulting in the net value of purchases (or sales) of these assets, which was divided by the total asset. Thus, the research proposes to advance methodologically by bringing a more specific variable (CLAP) to the evidence of investment dynamics by the companies listed in [B][3], since previous research used macroeconomic factors to represent investments in fixed assets, such as Gross Fixed Capital Formation (*Formação Bruta de Capital Fixo* - FBCF), so that this indicator includes investments related to state-owned companies, which are not part of the scope of this research.

Thus, this research uses a regression model in which the dependent variable has an accounting-financial nature and highlights the balances of values related to purchases and sales of permanent assets contained in the cash flow demonstration (*Demonstração dos Fluxos de Caixa* - DFC) of publicly traded companies. CLAP is understood to be more accurate in demonstrating the investments and divestments made within the capital market, enabling, more incisively, the visualization of how publicly traded companies are impacted in face of interest rate fluctuations.

In addition, based on the studies by França et al. (2003), Farooq et al. (2021) and Tarkom and Ujah (2023), the SELIC rate is used as an explanatory variable in relation to the oscillations of investments made by the companies. In Brazil, monetary policy is executed by the Central Bank through important financial instruments, namely: collection of compulsory deposits; open market operations (purchase and sale of federal government securities); bank rediscount policies or liquidity loans; and definition of the basic interest rate. Although these instruments - individually or jointly - are used as proxies on empirical studies to measure the impact of monetary policy on the economy, this study specifically focuses on the basic interest rate. Of course, it is important to highlight that other monetary policy instruments play a key role in the amount of money available in the country, but the choice of SELIC is due to its most direct influence on other economy interest rates.

In addition, control proxies were allocated to the model, which are the size of the companies (Cardoso & Pinheiro, 2020; Durante et al., 2022; Tarkom & Ujah, 2023): the dummy proxy that represents the period of political and economic instability in Brazil (Fonseca et al., 2019; Cardoso & Pinheiro, 2020; Souza et al., 2021); and the profitability proxy, which is the Return on Assets (ROA) (Fazzari et al., 1988; Farooq et al., 2021; Adapted from Li et al. 2022).

It is worth noting that, due to the high number of outliers in the sample, the variables Liquid Purchases of Permanent Assets (*Compras Líquidas de Ativos Permanentes* - CLAP),

Size and Profitability (ROA) were Winsorized at the 1 % level, in order to reduce the disparities above and below the upper and lower limits of the quartiles, respectively.

3.3 Econometric Model

The regression model for panel data was used as a statistical analysis method, given that the aim is to analyze not only the variation between the cross-section units, but also how this dynamic occurs in the temporal dimension. For Gujarati and Porter (2011, p. 588), panel data provide "more informative data, greater variability, less collinearity between variables, more degrees of freedom, and greater efficiency", in addition to being more suitable for verifying behavior over time. Thus, with the variables and method defined, the estimated model is presented:

$$CLAP_{it} = \alpha + \beta_1 SELIC_{it} + \beta_2 SELICi_{t-1} + \beta_3 SELIC_{it-2} + \beta_4 SELIC_{it-3} + \beta_5 Size_{it} + \beta_6 Instab_{it} + \beta_7 ROA_{it} + \mu_{it} \quad (1)$$

Where each variable refers to company i in period t, with CLAP referring to Liquid Purchases of Fixed Assets; α is the constant term; β_1, β_2, β_3, β_4, β_5, β_6, and β_7 refer to the angular coefficients of the explanatory variables; SELIC is the basic interest rate in the current period ($SELIC_t$) and lagged by one, two and three quarters ($SELIC_{t-1}$, $SELIC_{t-2}$ e $SELIC_{t-3}$, respectively); Size is the natural logarithm of the companies' total assets; Instab refers to the dummy for the quarters impacted by the economic and political instability that lasted between 2014 and 2019; ROA is the Return on Assets, calculated by the ratio between EBITDA and total assets; and μ is the regression error term.

With the econometric model defined, the regression model estimates for panel data were prepared, which are the Pooled Ordinary Least Squares (POLS), Fixed Effects (FE) and Random Effects (RA) models. After the calculations, tests were performed to identify which model is most appropriate to represent the data collected: Chow's F test, Breusch-Pagan's Lagrange multiplier (LM), and Hausman's test. In addition, tests were performed to identify the efficiency of the regression model by verifying compliance with the existing assumptions regarding normality, homoscedasticity, and absence of autocorrelation of the residuals, using the Shapiro-Francia, Breusch-Pagan and Durbin-Watson tests, respectively. In addition, the Variance Inflation Factor (VIF) test was performed to identify whether there is the presence of multicollinearity between the explanatory variables.

In order to analyze the behavior of the variables, descriptive analyses of the variables used in this study were performed. Stata® software, version 14, was used to perform the descriptive analyses and regression for panel data, as well as the tests to select the most appropriate model and the assumptions involved.

4 Analysis and Discussion of the Results

4.1 Descriptive Analysis

Table 3 presents the descriptive statistics of the variables used in the analysis of this study.

Table 3
Descriptive statistics of the variables

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
Investment	8.500	0.012	0.020	-0.047	0.126

SELIC	8.500	8.750	4.010	1.900	14.150
Size	8.500	15.258	1.759	11.170	19.310
ROA	8.500	0.021	0.033	-0.121	0.122

Source: Research data (2023).

It can be seen that capital investments represent, on average, just over 1 % of the amounts invested in the companies' total assets, and it is possible to observe, through the standard deviation, that there is a marked variation in the behavior of the variable between companies. Thus, the investment values confirm that, in general, the companies made frequent contributions to their assets, even if they were low in relation to the companies' total assets. This behavior can be explained by the size of the companies, which, on average, are not small, as well as the fact that some sectors require more investment in technology than others (the Communications sector, for example), which can influence and justify this fluctuation in investments.

Regarding the SELIC rate, it can be noted that the average behavior was relatively high when compared to the rates practiced in developed economies. However, it would be necessary to analyze other factors, for example, the real interest rate of the Brazilian economy (discounting inflation), the neutral basic interest rate, considered the one that neither stimulates nor discourages the economy, among other factors, which are not included in the scope of this research. Furthermore, the high standard deviation stands out, given that the monetary interest rate, SELIC, had a sharp fluctuation (volatility) during the years 2013 to 2022, as it was a time when the economic system was impacted by two relevant events: political and economic instability (between 2014 and 2019) and the Covid-19 pandemic (in the years 2020 and 2021).

In addition, companies presented an average profitability of 2 %, but this is characterized by volatility between companies or sectors, as visualized through the standard deviation. This can be explained by the economic crisis, as well as by the negative effects of the Covid-19 pandemic, which affected companies in general, especially those companies that were financially restricted and/or that were in sectors that were not considered as part of essential activities during the health crisis.

4.2 Regression Analysis for Panel Data

The Chow F test, the Breusch-Pagan LM test, and the Hausman test were performed to determine which model (POLS, fixed effects or random effects) would be most appropriate for analyzing the data. Thus, the Chow F test indicated that the fixed effects model is the most appropriate for performing the analysis. After this, the Breusch-Pagan LM test was performed and the results demonstrated the preference for the random effects model. Finally, the Hausman test, used to define whether the fixed or random effects model is the most appropriate, found that the fixed effects model is the most appropriate for analyzing the results.

In addition to the tests related to the suitability of the best model for analyzing the data, tests were performed to verify whether the model used met the assumptions of multiple linear regression. Initially, the Shapiro-Francia test was performed, which indicated that the residuals do not have a normal distribution. Next, the Breusch-Pagan test was performed, revealing that the errors do not have a homogeneous distribution. Finally, the Durbin-Watson test was performed and the results showed that the error terms are autocorrelated.

Given the presence of heteroscedasticity and autocorrelation in the residuals, the Newey-West correction was performed using robust covariance matrices for a more consistent estimation of the standard errors. Furthermore, the absence of multicollinearity was verified through the Variance Inflation Factor (VIF) test, since no variable presented a VIF greater than 10. Table 4 presents the results of the estimated regression model. It is worth noting that, given

the time lags applied, there was a decrease from 8,500 to 6,694 observations in the regression model.

Table 4
Results of the regression model estimation for panel data

Variables	Robust Fixed Effects		
	Coef.	**t**	**P>|t|**
SELIC$_t$	0.0001	0.60	0.551
SELIC$_{t-1}$	-0.0001	-0.60	0.551
SELIC$_{t-2}$	-0.0004	-2.94	0.004***
SELIC$_{t-3}$	-0.0004	-3.84	0.000***
Size	0.0010	0.73	0.468
Instability	-0.0022	-3.79	0.000***
ROA	0.0189	1.84	0.067*
Constant	-0.0080	-0.41	0.682
Observations		6.694	
Prob > F		0.000***	
R² overall		2.66 %	
R² between		5.06 %	
R² within		1.91 %	
Chow Test			
F(5):		6.21	
Prob> F:		0.000***	
Breusch-Pagan Test			
Chi²(5):		2167.34	
Prob> Chi²:		0.000***	
Hausman Test			
Chi²(3):		34.8	
Prob> Chi²:		0.000***	

Note: *p<0.1. **p<0.05. ***p<0.01

Source: Research data (2023).

It is important to highlight that, according to Bogdanski, Tombini and Werlang (2000), a study that is part of the BACEN working paper series, the transmission of the effects of monetary policy in the aggregate demand channels occurs between 6 and 9 months, an argument that justified the need to perform lags of at least three time stages in the SELIC rate. As specified by these authors, it was possible to verify in the results of the regression model that, given the lack of significance in the SELIC in $_t$ and $_{t-1}$, the interest rate does not tend to have immediate effects and does not impact business investments in the first three months after its change, taking, on average, two to three quarters (between 6 and 9 months), from its increase or decrease, to affect the corporate investment policy and aggregate demand.

According to the fixed effects model, the SELIC revealed a negative and significant coefficient at the 1 % level for lags of 2 and 3 quarters (SELIC$_{t-2}$ and SELIC$_{t-3}$, respectively), with a 99 % confidence level, in relation to the investments made. Thus, the higher the SELIC rate during the period analyzed, the lower the investments made by companies. This result is in line with the market behavior in relation to the increase in the basic interest rate, since its increase increases the cost of obtaining third-party capital, provided by financial institutions, necessary for investments and tends to cause companies to retain financial resources instead of

investing them in their businesses, negatively impacting the entire productive sector and, therefore, making investments in assets and labor unfeasible for the generation of wealth (Wray, 2006; Telles, Palludeto, & Reydon, 2016).

For Keynes (1936), the relationship between investments and the monetary interest rate is negative, which is seen as a classic behavior within the market. In this sense, this asymmetrical connection presented between the variables can be explained by the forms of financing of companies, which are separated into two sources: internal and external. For Farooq et al. (2021), when there is an increase in interest rates and they are high, external financing, through the acquisition of expensive capital becomes costly, causing firms to not acquire external resources and, thus, investment levels are reduced. Furthermore, for these authors, with the increase in the interest rate, companies prefer to invest more in financial assets instead of investing resources in fixed assets.

This behavior can also be explained by the increase in opportunity cost, since, in the case of relative inertia in revenues from investments, the increase in interest rates tends to make investment more expensive, so that investors with low economic capacity are limited and see that the cost versus benefit is not interesting, thus opting for retaining profits. Therefore, the lack of interest in onerous capital, caused by the increase in interest rates (Obinna, 2020), causes firms to retain profits to improve their financial health or to finance investments, a strategy that is implemented as a risk mitigator (Feijó et al., 2016).

The ROA variable showed statistical significance (at the 10 % level and with 90 % confidence) and a positive relationship with corporate investments, so there is evidence that the companies analyzed have been using internal resources as an important source of financing for investments. For Farooq et al. (2023), the positive link between profitability and investments is due to the fact that companies with higher profit retention and financial reserves have more resources to make capital expenditures (investments) and, in addition, are more inclined to invest in new business options.

In this scenario, tax benefits, for example, can help these companies have more internal resources, by maximizing operational profitability, to make investments or reinvestments, especially in times when the economy is unstable. In this way, these incentives act as motivators for firms to maintain their investments (Bindra et al., 2024), since these actions promoted by the state aim to mitigate part of the negative effects of new investments, which sometimes appear as “gambling”, or of unfavorable economic times, so that firms can invest, generate wealth and contribute positively to the country's growth.

Economic instability was significant at the 1 % level, with a 99 % confidence level and a negative relationship with investments. Therefore, during the period of political and economic fragility, which lasted between 2014 and 2019, companies were motivated to reduce their investments. This result corroborates the findings of the study by Souza et al. (2021), who stated that the productive sector in Brazil makes fewer investments during periods of crisis, since the rise in exchange rates, inflation, and other macroeconomic factors causes investment decisions and planning to be affected by risk and economic instability. In addition, the size variable did not show statistical significance for the sample and time period analyzed.

Thus, it is noteworthy that the hypothesis stated by Keynes (1936) is corroborated in the period and for the sample of this study, since the relationship presented, between the SELIC rate and corporate investments, is consistent with what was proposed by this author. Therefore, it was possible to corroborate H1, in line with what was presented by Keynes (1936), França et al. (2003), Farooq et al. (2021) and Bishnoi and Garg (2022).

5 Final Considerations

The objective of this research was to verify the impact of the SELIC rate on investments by publicly traded companies in Brazil. Thus, data were extracted from the Economática® database between the first quarter of 2013 and the fourth quarter of 2022, referring to accounting information, whereas the SELIC rates were collected from the Central Bank database in the analyzed period. Then, as a research method, a regression for panel data was performed.

The results showed that, given the high average and the increases observed in the period studied, due to economic fluctuations, the SELIC rate has an asymmetric relationship with the investments made by companies listed on [B]^3, thus revealing that the higher the basic interest rate, the lower the investments made by publicly traded companies. Thus, this finding is in line with what was exposed by Keynes (1936) in his general theory of interest rates, showing that, in times of adaptation of macroeconomic tools to the economic scenario, such as the increase in the monetary interest rate, companies reduce their contributions to capital expenditures. However, it is worth noting that these negative effects on corporate investment policies do not happen immediately, as they take 6 to 9 months to reach the macroeconomic scenario, as verified by the lags of two and three time stages (two and three quarters, respectively) inserted in the regression model.

Thus, this time gap in the effects of the basic interest rate on the macroeconomic scenario can be explained by the fact that these economic policies do not immediately affect the components of society – general population and companies – since the general population for example, gradually stop allocating money to banks and also start to withdraw their resources from financial institutions, given that, when the SELIC rate increases, banks tend to increase their remuneration derived from deposits made by individuals, causing these agents to move away from bank deposits in view of the lower returns. Consequently, credit institutions are left without enough money to offer, which causes loans and financing to become more expensive, especially for companies. Normally, this entire chain of events does not happen immediately, so that the market and the economy are not negatively affected quickly, justifying this delay of 2 to 3 quarters for business investments to be harmed.

It should be noted that the analysis has limitations, since not all factors that influence investments are known or included in the analysis, given that these variables are mixed and influence investments in an aggregate manner, which makes it difficult to differentiate what is in fact influenced by the basic interest rate and what is affected by other unknown variables or those not included in the regression model. In other words, the SELIC explains part of this behavior, while the other part can be explained by other unknown factors or those not included in the analysis, which end up being allocated to an error in the model.

In line with this scenario, endogenous factors may even be contributing to companies having positive results (profits) and, therefore, being able to maintain their investments, since ROA showed a positive relationship with investments. In other words, better payment conditions for third-party resources, tax benefits and advantages, among other beneficial aspects, especially in unstable times experienced by companies, such as the political and economic crisis and Covid-19, can reduce the negative effects of reduced revenues and even reduce expenses, whether financial or operational, incurred in the period, enabling these companies to have positive results, and therefore, be able to make more investments with their own resources.

Furthermore, it was observed that in times of economic instability, such as the political and economic fragility experienced between 2014 and 2019, companies were inclined to reduce the volume of investments, so that the instability variable showed a negative relationship with the investments made during the period. Thus, it is understood that companies seek to retain more equity or take fewer external resources, given the unpredictability of the future, especially in economically critical moments, in order to protect themselves from economic fluctuations in the medium and long term, which impact consumption and can make unnecessary the

investments that were made, thus not obtaining the expected returns from the contributions to the respective assets.

Regarding the limitations of the study, it was not possible to include a variable to understand the impacts of Covid-19 on companies' investments, as the model was poorly specified with the inclusion of the respective variable. Therefore, it is suggested that future research include a binary variable to capture the effects of the health crisis on investments, as well as a test for two dependent samples, so that it can be seen how investments behaved before and during the pandemic, making it possible to see whether the pandemic period was a time when companies took advantage of low interest rates to raise external resources, and thus maximize their capital investments, taking into account that essential sectors had a visible expansion due to the greater demand for medical products and services, telecommunications services, food products, among others.

This study contributes in a practical way with important reflections for managers and stakeholders in general, providing information that highlights, especially in times of fluctuation in the economic scenario, the importance of both managers and shareholders weighing their decisions, since it is not always possible to visualize all the factors that contribute to the maximization or reduction of corporate investments, which have effects on the value added to companies, so that failure to consider them can cause losses for companies and investors. Furthermore, the study provided pertinent insights into a topic whose literature is not so extensive in Brazil, since the results were shown to be convergent with one of the main economic trends, which highlights the importance of discussing the exploration of effective hedging policies, especially in unstable economic times, so that companies are not overly affected by monetary policy tools, which seek to stabilize the economy, and do not harm their expansion and results maximization strategies, which are affected by investments and by investors' perception of whether the company's assets are investments with positive return prospects.

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