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The Effect of Economic Policy Uncertainty in Brazil on Corporate Investment

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Abstract

Objective: This study investigated the effects of economic policy uncertainty on corporate investments of publicly traded companies listed in Brazil from 2010 to 2020. Uncertainty about economic policy can intensify the value of the option of waiting for new information and cause delays in corporate investments, as suggested by the Real Options Theory.
Method: To analyze this relationship, the System Generalized Method of Moments was used, with panel data for a sample of 153 companies, capable of addressing endogeneity problems caused by data of this nature.
Results: It was found that increases in economic policy uncertainty cause reductions in the volumes of capital expenditures of companies, with persisting effects in at least four future quarters. Moreover, corporate investments were more responsive to general economic uncertainty, as measured by the Economic Uncertainty Index – Brazil (IIE-Br), than to economic policy uncertainty, as measured by the Economic Policy Uncertainty Index (EPU).
Contributions: We confirm that uncertainty in the measured dimensions can delay corporate investments in Brazil. The proposed dynamic model is suitable in predicting firm responses to uncertainty in future periods. This study contributes to a better understanding of the dynamics of corporate investment decisions in Brazil. This information is useful for market analysts in their forecasts, as well as policymakers in developing policies that ensure the balance of such decisions.

Keywords: Political Uncertainty; Economic Uncertainty; Corporate Investments; Financial Decisions; Real Options.

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Introduction

How policymakers' decisions can affect business investments is an issue that has drawn the attention of researchers (Akron et al., 2020; Chen et al., 2020; Gulen & Ion, 2015). These decisions are able to change the business environment and, when there is associated uncertainty, cause an economic slowdown, as they lead firms to delay investments and choose to wait for more concrete information (Bernanke, 1983; Chen et al., 2020; Dixit & Pindyck, 1994; Kang et al., 2014).

According to the Real Options Theory, the opportunity cost of investing in projects in uncertain environments is highly sensitive to the waiting option, which, in turn, is valued by changes in economic conditions that affect the risk of cash flows expected. Thus, uncertainty about future market conditions can have an impact even greater than a change in interest rates (Dixit & Pindyck, 1994). Therefore, it may be of interest to academia and the market to investigate the extent to which uncertainty in economic policy can influence corporate decisions.

Investigations with this theme are made possible due to the development of a new index of political uncertainty proposed by Baker, Bloom and Davis (2016), the so-called Economic Policy Uncertainty Index (EPU). The EPU index seeks to measure the uncertainty generated by government actions that affect the economic environment, and is calculated for several countries, including Brazil. This indicator makes it possible to carry out empirical studies in finance that relate uncertainty to variables at the firm level (Akron et al., 2020; Attig et al., 2021; Schwarz & Dalmácio, 2020).

In the Brazilian context there is also the Economic Uncertainty Index (IIE-Br), with a methodology similar to the EPU, developed by Ferreira, Vieira, Silva and Oliveira (2019), which seeks to measure the level of general economic uncertainty in the Brazilian scenario. This indicator has already been used as a proxy for uncertainty in finance studies (Schwarz & Dalmácio, 2020), and can be an alternative to the use of the EPU, with the possibility of being more responsive to the Brazilian economic scenario, consistent with the way of calculating this metric, which is weighted by more factors that determine corporate decisions (Ferreira et al., 2019).

The relationships between uncertainty about economic policy and the level of corporate investment in other countries have already been investigated (Akron et al., 2020; Chen et al., 2020; Gulen & Ion, 2015; Kang et al., 2014; Wang et al., 2014), confirming that, in general, there is a negative relationship. Furthermore, the effects of uncertainty shocks on investments may persist in the long term (Chen et al., 2020; Kang et al., 2014). Evidence suggests that when firms are in doubt about the costs involved in doing business, which depend on regulations on taxes, interest rates, monetary and exchange rate policies, they can become more cautious in their projects (Kang et al., 2014). Consequently, this may indirectly interfere with the reduction in the level of economic activity.

Despite the convergence between research results in general, some specific characteristics of firms, such as the fact that they are private or state-owned, can lead to obtaining relationships that are different from those expected (Liu & Zhang, 2020). Uncertainty can hasten investments in firms belonging to promising technology segments, such as renewable energy (Liu et al., 2020). Another fact is that we cannot assume that projects are put into practice immediately after the decision to invest. Some investments take time to execute, for example in the energy, aerospace and pharmaceutical industries. Therefore, these firms would have less reason to worry about uncertainty shocks in investments naturally characterized by long maturation periods (Bar-Ilan & Strange, 1996).

The economic dynamics of emerging countries, such as Brazil, can also lead to divergent results from empirical evidence (Schwarz & Dalmácio, 2020). Brazil has experienced a recent context of instability due to political crises, accentuated from 2015, with the political factor overlapping the fiscal one (Gouveia, 2020), associated with corruption scandals, protests and economic recession. This fact led to greater volatility and an increase in the country's EPU index. On the other hand, net investment levels in fixed capital stock formation became negative from 2016 onwards (Souza & Cornelio, 2020). Such evidence indicates that the level of uncertainty of economic policy affects companies' investments in Brazil and gives rise to an empirical test of this relationship.

In addition to investment decisions, other firm decisions were also associated with the level of uncertainty in economic policy, such as the amount of receivables (Jory et al., 2020), risk propensity (Tran, 2019; Wen et al., 2020), diversification (Hoang et al., 2021), earnings management (Roma et al., 2020), corporate governance (Ongsakul et al., 2020) and mergers and acquisitions (Sha et al., 2020). It is noteworthy that most of the studies cited above were published between 2019 and 2021, which validates the growing attention given to this research topic and the use of the EPU index as a proxy for uncertainty.

Furthermore, there are few relevant studies in Brazil that have investigated the relationship between EPU and corporate decisions, with emphasis on Schwarz and Dalmácio (2020) and Rosa (2020), who investigated the effect of uncertainty on financial leverage. These characteristics reinforce the opportunity to research the topic in question in Brazil.

Thus, this study raises the following guiding question: **How does uncertainty about Brazilian economic policy affect**

investment decisions of publicly traded companies in Brazil? Therefore, the objective of this work is to investigate the effects of uncertainty about economic policy on investment decisions of publicly traded companies in Brazil from 2010 to 2020.

Using quarterly observations of 153 non-financial firms, from 2010 to 2020, it was shown that economic policy uncertainty, measured by the EPU index, negatively affects firms' investment decisions in Brazil, with persistent and more intense effects verified in at least four quarters thereafter. The results are robust for the alternative measure of economic uncertainty in Brazil, the IIE-Br. To estimate the coefficients, the System GMM model for panel data was used, which is robust to the inherent endogeneity of economic and financial data (Barros et al., 2020). The findings are in the same direction as the theoretical predictions of the Real Options stream.

This is economically relevant as the widespread decision to reduce investment levels in more profitable, long-term assets can lead to an economic recession. Companies become less competitive and stop growing, jeopardizing the supply of goods and employment, in addition to the issue that the low level of investment can affect the renewal of its productive structure, making it outdated.

Thus, this study can contribute in different dimensions, such as: relating the retraction in the level of investments as a response to uncertainty, and not as a manifestation of poor management of free cash flow and unreasonable delays; empirically demonstrate the dynamics of investment decisions of companies listed on the Brazilian stock exchange in response to the environment with a higher level of uncertainty in economic policy; and explain the level of investments based on specific characteristics of the firm and the macroeconomic environment. In addition, the study offers empirical evidence that contributes to a better understanding of the dynamics of corporate investment decisions and that can be useful for market analysts in their forecasts and for government agencies in the elaboration of policies aimed at maintaining the level of economic activity.

2 Theoretical Framework

2.1 Dynamics of Investment Decisions in Environments of Uncertainty

External factors such as uncertainty about future market conditions can alter the balance of agents' investment decisions. The reason for this is, many times, ignored by the traditional conception in environments of certainty in which it is indicated to accept projects with a positive net present value (NPV). However, real investments have characteristics that must be taken into account by the decision maker, such as: (i) Corporate investments are partially or completely irreversible, meaning "sunk costs"; (ii) The degree of unpredictability of the internal rate of return (IRR) of new projects; and (iii) The value of the delay option to wait for better information (wait and see option) (Dixit & Pindyck, 1994). Such characteristics may discourage investment decisions at the present time due to speculative and/or precautionary factors.

Similar to the financial market, firms have a "call option" when they have funds to invest in real assets. This gives them the right, but not the obligation, to acquire (or invest in) an asset at some point of their choosing. However, when the decision on an irreversible investment is made, the firm carries out its call option and, thus, gives up on the holding option value and market timing (Dixit & Pindyck, 1994). With this dynamic of environments with some degree of uncertainty, the irreversibility characteristic of real investments intensifies the value of the waiting option (Bernanke, 1983), as the timing of the investment, the most opportune moment to invest, could maximize the project's gains. Therefore, investment decisions in environments of uncertainty must consider the opportunity cost of keeping the call option "alive" (Dixit & Pindyck, 1994).

The approach emphasized by Dixit and Pindyck (1994) is called Real Options Theory and suggests that uncertainty about economic policy slows down investments, as it increases the opportunity cost of the trade-off between keeping capital for speculation and/or precaution, or invest in the present date, renouncing the resources that could be useful to resist the most uncertain moment. In this sense, at a time of high uncertainty, generalized choices for the wait option could contribute to a slowdown in the economy (Kang et al., 2014).

Evidence of these statements can be found in conjunction analyzes of the Brazilian economy, for example. Souza and Cornelio (2020) demonstrated that net investments in fixed capital stock formation in Brazil became negative from 2016 onwards, an unprecedented level in the historical series since 1947, which means that gross investment in this period was lower than necessary to make up for the depreciation. The analysis of the historical series of net investments and capital stock shows a sharp drop in capital investment levels from 2014 onwards, which coincides with the increase in levels of uncertainty in the country's politics and economy (Gouveia, 2020). Only at the beginning of 2020 did net investments become positive again, meaning increases in the stock of fixed capital (Souza & Cornelio, 2020).

In this way, it is possible to work with the theoretical hypothesis that the level of uncertainty about the economic policy of a country can impact the real investments of firms in that economy, particularly in the case of countries with a more volatile domestic economic and financial environment, such as Brazil.

2.2 Uncertainty of Economic Policy

Before Baker et al. (2016), who published the first

working paper in 2013 (Baker et al., 2013), it was a challenge to find an appropriate measure of policy uncertainty. General uncertainty was represented by a range of proxies, such as the dispersion of analysts' forecasts, stock price volatility, political and geopolitical risks (Akron et al., 2020; Gulen & Ion, 2015). The uncertainty index created by Baker et al. (2016), initially for the United States, has its measurement based on three underlying components: (i) quantification through textual analysis of journalistic coverage of uncertainty related to economic policy; (ii) definitions of federal tax code provisions to expire in future years; and (iii) the dispersion between individual economic analysts' forecasts.

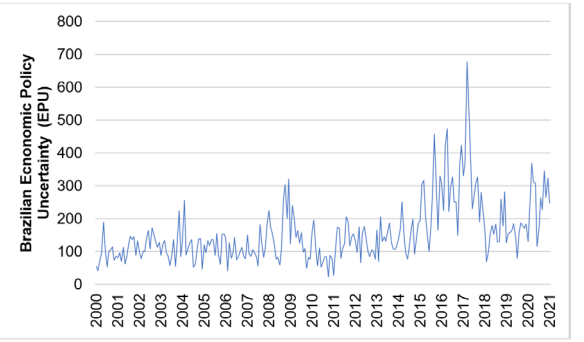
There have already been recent criticism regarding its representativeness (Suh & Yang, 2021), however it is possible to observe the impact of the index, from the first publication in 2013, on the frequency of scientific publications related to uncertainty about economic policy, which increased from 7 publications in 2013 to 356 publications in 2020, according to data from the Science Direct platform (2021) (https://www.sciencedirect.com).

In 2021 the index is officially calculated for 26 countries, including Brazil, in addition to a global index. For most countries, the index is calculated only with component (i) of journalistic media, and may also be called newspaper-based EPU. The EPU index for Brazil uses archives from the newspaper Folha de São Paulo since 1991 and standardized procedures to build an index of political uncertainty comparable with other newspaper-based EPU from other countries (Baker et al., 2016).

In the Brazilian context, there is the Economic Uncertainty Index – Brazil (IIE-Br) from the Getúlio Vargas Foundation (FGV), developed by Ferreira et al. (2019) with a methodology similar to the EPU of Brazil. However, the authors expanded the range of journalistic media used by Baker et al. (2016), for the six most read newspapers in the country, and added another weighting component represented by the dispersion of analysts' forecasts on three economic variables: the basic interest rate (Selic); the inflation index (IPCA); and the exchange rate (PTAX), retrieved from the Focus Bulletin of the Central Bank of Brazil (Ferreira et al., 2019).

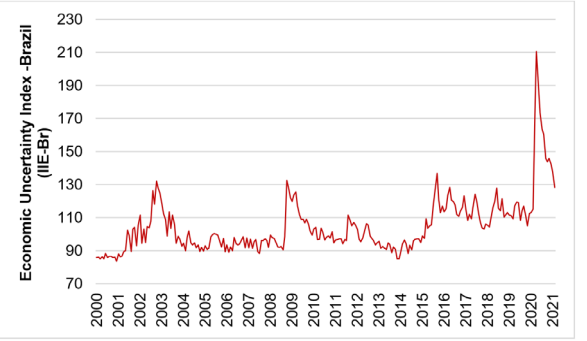
The graphs with the evolution of the historical series of the two indices are presented below: The series presented from 2000 to March 2021 have a high correlation, although some differences can be observed regarding their responsiveness in some moments of the economy. For example, the EPU reached its historic peak in 2017, a period marked by the outbreak of scandals involving political actors, the freezing of public spending and the highlight of the Lava Jato operation. In turn, the IIE-Br reached its peak during the beginning of the COVID-19 crisis, a moment of uncertainty regarding the maintenance of the level of employment and household consumption. Despite the differences, both indicators have their average increased from 2015, a year marked by the accentuation of successive political crises in the country, where the series permanently shifted to a higher range. For the econometric analysis of this work, both indices presented will be used as a proxy for uncertainty in determining the capital expenditure levels of listed firms in Brazil.

Figure 1: Historical series of the EPU Brazil index developed by Baker et al. (2016)



Source: Data available at https://www.policyuncertainty.com/.

Figure 2: Historical series of the IIE-Br index developed by Ferreira et al. (2019)



Source: Data available at https://www.policyuncertainty.com/.

2.3 Prior Empirical Evidence and Hypothesis Development

Akron et al. (2020) highlighted two possible reasons why firms tend to reduce their investments in more uncertain times: the unpredictability of the internal rate of return for approving projects; and increased financial risk and equity risk premium, which can raise attractiveness rates, leading to the postponement of investments for a less uncertain period. Another characteristic is the irreversibility of investments, which can generate preventive delays due to political uncertainty (Chen et al., 2020; Gulen & Ion, 2015; Wang et al., 2014).

Some of this evidence has led researchers to empirically investigate this relationship. Gulen and Ion (2015) identified a strong negative relationship between political uncertainty and the level of corporate investment. Wang et al. (2014) showed that when the level of political

uncertainty is higher, firms tend to reduce their investments. However, some individual characteristics of firms and industry can modify these negative effects of uncertainty, such as greater profitability, higher level of self-financing and not being state-owned (Wang et al., 2014). Other studies also included individual characteristics that could influence the results. Liu et al. (2020), for example, stated that firms belonging to the renewable energy subsector tend to promote investments at more uncertain times.

The effect of uncertainty about economic policy on investment decisions may be persistent for future periods. Chen et al. (2020) showed that the EPU index has a negative and persistent effect, in up to four years, on the capital investments of Australian firms. Gulen and Ion (2015) found that this effect can persist for up to eight quarters and be progressively more intense over the first four to five quarters.

Such characteristics may also have an indirect effect on cash availability and corporate dividend policy. It would be intuitive to think that managers could direct the resources generated in the free cash flow to increase cash available or distribute them in dividends, when there are no investment opportunities. However, some authors attribute this effect as a consequence of high uncertainty scenarios (Attig et al., 2021; Duong et al., 2020).

Based on these discussions, the following research hypothesis is proposed, following Akron et al. (2020), Baker et al. (2016), Chen et al. (2020), Gulen & Ion (2015), Sha et al. (2020) and Wang et al. (2014):

H1: *Brazilian companies reduce their investment levels in response to greater uncertainty about economic policy.*

3 Methodology

3.1 Sample and Specification of Models

The level data of the analyzed firms come from a sample of 153 publicly traded non-financial companies listed on Brasil Bolsa Balcão – B3 (the Brazilian stock exchange), out of a total of 309, from 2010 to 2020, from the fourth quarter 2010 to the third quarter 2020, the latest data available at the time of extraction. The time window is justified by the introduction of international accounting standards (IFRS) in Brazilian corporate law from 2010. Financial Sector companies were excluded due to differences in their equity structure and, from the resulting universe (309), 149 were excluded for disclosing uncovered liabilities at some point in the sample period, and another 7 with other missing data in the analyzed quarters, consistent with previous studies (Schwarz & Dalmácio, 2020). Such data were filtered and extracted from the Economatica® database (economatica.com). Data on uncertainty in both economic policy and the economy in Brazil come from the Economic Policy Uncertainty Index portal (policyuncertainty.com). Other data were extracted from the System of Quarterly National Accounts – SCNT, from the Brazilian Institute of Geography and Statistics – IBGE (ibge.gov.br) and from the Central Bank of Brazil (dadosabertos.bcb.gov.br).

Estimates were applied with models for panel data, due to the characteristics of the collected data that are available in several sampling units over time (Wooldridge, 2019). Following Akron et al. (2020) and Kang et al. (2014), the system modeling of the Generalized Method of Moments (GMM), developed by Blundell, Bond and Windmeijer (2001), was applied, as it is capable of addressing any existing endogeneity problems, particularly in company variables, such as financial data (Barros et al., 2020). The models can be specified as follows:

$$Capex_{i,t+l} = \beta_1 Capex_{i,t+l-1} + \beta_2 Capex_{i,t+l-2} + \lambda LNEPU_t + \delta Firm_{i,t} + \omega Macro_t + dIndustry_i + \eta_i + v_{i,t} \quad (1)$$

The subscript characters i and t indicate the i-th company in the t-th quarter and $l \in \{0, 1, 2, 3, 4\}$ represents the quarter lead of the dependent variable in relation to the independent variables. The terms $\eta_i + v_{i,t}$ form the model's composite error, indicating unobserved heterogeneity (firm fixed effects) and random error, respectively. The β_n are the estimated parameters of the lagged values of the dynamic dependent variable Capex. λ represents the parameter of the explanatory variable of political and economic uncertainty, which assumes the EPU and IIE-Br, alternatively. δ, ω, d are respectively parameter vectors of the control variables for corporate investment: firm-level ($Firm_{i,t}$), macroeconomic level ($Macro_t$) and economic sector ($Industry_i$). $Firm_{i,t}$ is the set of firm-level control variables for corporate investment, which includes: Return on Assets (ROA); Natural logarithm of Net Operating Revenue (SIZE); Market-to-Book (MTB); Net Working Capital over Total Assets (NWC); Leverage (LEV); and a dummy for whether the company pays dividends or not (DDIV). $Macro_t$ is a macroeconomic level control that includes: quarterly GDP change (ΔGDP); $Industry_i$ represents dummy variables to control for industries fixed effects, classified according to the B3 segmentation. Such variables were included following previous studies (Akron et al., 2020; Duong et al., 2020; Gulen & Ion, 2015; Schwarz & Dalmácio, 2020).

The firm-level and macroeconomic explanatory and control variables are detailed below.

3.2 Description of Variables

Figure 3 below shows a summary of the variables used in the models. The dependent variable in this study is represented by investments in permanent assets, or Capital Expenditures, divided by total assets. Due to its possible dynamic effect, that is, direct influence of its past values on its present value (Barros et al., 2020), two lags

of this variable were included as explanatory variables, in order to test this effect. According to Barros et al. (2020), the omission of the lagged term of a dynamic variable can bias the other estimated coefficients, suggesting that the estimation of static models may not be adequate. The authors also emphasize that other delays, in addition to the first one, may be relevant to solve the dynamic behavior of y.

Figure 3: Variables inserted in the regression models

Explanatory Variables	Description	Expected Signal	Previous Evidence
LNEPU	Natural logarithm of the weighted average of the three months of each quarter of the EPU Brasil index.	(-)	Akron et al. (2020); Duong et al., 2020; Gulen & Ion (2015); Schwarz & Dalmácio (2020)
LNIEE	Natural logarithm of the weighted average of the three months of each quarter of the IIE Brazil index.	(-)	
ROA	Ratio of operating earnings before interest and taxes to total assets.	(+)	
SIZE	Natural logarithm of net operating revenue*.	(-)	
MTB	Market-to-Book Index. Ratio between market value and book value of equity.	(+)	
NWC	Net working capital, measured by the difference between current assets and current liabilities, divided by total assets.	(-)	
LEV	Ratio between total gross debt and total assets.	(-)	
DDIV	Dummy that takes the value 1 if the company pays dividends in the period or 0 otherwise.	(-)	
GDP	Quarterly variation of GDP in relation to the quarter of the previous year.	(+)	
Industry	Industry Dummies.	-	

* Note: logarithmic transformation of net operating revenue was used as a proxy for firm size, since total assets, normally addressed to this proxy, did not meet the stationarity premise in Fischer's unit root test. Source: Elaborated by the authors.

To represent uncertainty, two metrics were used, the first being the EPU indicator by Baker et al. (2016) for Brazil, and the second, the IIE-Br by Ferreira et al. (2019). It is expected that the second alternative indicator can capture the relationship between general economic uncertainty and the level of capital expenditures with greater intensity, since its media component is broader than EPU, and its dispersion component of the analysts' forecast market comprises determinant variables for investment decisions, namely, the basic interest rate, inflation and exchange rate.

In this study, the weighted average of the three months of each quarter of the uncertainty indices was calculated, assigning greater weight to the last month of the quarter, as the most recent level of uncertainty may have a greater impact (Schwarz & Dalmácio, 2020):

$$Uncertainty_t = \ln((3.EPU_m + 2.EPU_{m-1} + EPU_{m-2})/6) \quad \text{or} \quad \ln((3.IIEBr_m + 2.IIEBr_{m-1} + IIEBr_{m-2})/6) \quad (2)$$

Firm-level variables were winsorized at the 1st and 99th percentiles in order to limit the effect of outliers, with the exception of the DDPA variable, which is a dummy variable.

3.3 Model Validation

According to Roodman (2009), both the System estimator and the Differences estimator of the GMM are useful for some situations: 1) "short panel", when T<N; 2) linear functional relationship; 3) the dependent variable is dynamic, depending on its past values; 4) the independent variables are not strictly exogenous, which means that they are correlated with past variables and with the error term; 5) individual fixed effects; 6) heteroscedasticity and autocorrelation within the sample group, but not between them. The assumption of the exogeneity of the regressors is one of the most important in order to make valid inferences about the causality between the variables. Particularly in research in Finance, it is common to find data that violate this assumption, due to the existence of omitted variables, measurement errors of the included variables and/or simultaneity between dependent and independent variables and the very dynamic nature of financial data, which can generate feedback of the response variable to the regressors and which still often result in short panels, causing the so-called dynamic endogeneity (Barros et al., 2020). As a result, the traditional Ordinary Least Squares (OLS), Fixed Effects (EF) and Random Effects (EA) estimators may be inconsistent.

With the GMM there is the possibility of mitigating endogeneity, introducing the first differences of the regressors, which are considered sequentially exogenous, as instrumental variables of the model, since $E[x_{i,t-1}(\eta_i+v_{i,t})]=0$ (Barros et al., 2020). This condition will be ensured if the hypothesis of non-stationarity of the regressors is rejected. The estimation also depends on the absence of second-order serial correlation of the residues and on the validity of these instruments.

Thus, the consistency of this estimator is conditioned to the fulfillment of some assumptions: Multicollinearity tests (VIF statistic) (Wooldridge, 2019), stationarity of variables (Fisher unit root test), absence of second-order serial correlation in the residuals (Arellano & Bond, 1991), instrument exogeneity (Sargan/Hansen) (Arellano, 2002) and the Hansen difference test (DIF-Hansen) will be performed to validate the model in question (Roodman, 2009).

4 Presentation and Analysis of Results

4.1 Summary Statistics

The average quarterly CAPEX of the companies in the sample corresponds to 1.5% of their total assets, with a standard deviation of 1.8% and a maximum of 11.2%. It is observed that there are companies that did not make investments in some quarters since the minimum is equal to 0. The average EPU was 181.82 (ln: 5.203) and 108.85 (ln: 4.690) for the IIE-Br. Furthermore, it is shown

that the EPU has greater volatility in the distribution, since its standard deviation is greater (Table 1).

Table 1: Summary Statistics of the variables inserted in the regression models

Variable	Obs	Mean	StandDev.	CV	Minimum	Maximum
CAPEX	6159	0.015	0.018	1.187	0.000	0.112
LNEPU	6400	5.203	0.445	0.086	4.281	6.249
LNIIEBr	6400	4.690	0.149	0.032	4.455	5.222
ROA	6400	0.019	0.023	1.213	-0.052	0.104
SIZE	6400	12.93	2.96	0.229	0.000	17.600
MTB	5691	1.964	2.030	1.033	0.161	11.509
NWC	6400	0.174	0.187	1.070	-0.231	0.752
LEV	6400	0.277	0.170	0.616	0.000	0.687
DDIV	6400	0.346	0.476	1.375	0.000	1.000
ΔGDP	6400	0.005	0.033	6.773	-0.109	0.057

Note: Obs.: observations. StandDev: Standard deviation. CV: coefficient of variation. Source: research results.

The companies in the sample, on average, present growth opportunities of around 1.96 times the book value of their equity, as evidenced by the MTB index. The average size of these companies, represented by their net operating revenue, was R$412.5 million (ln: 12.93), their operating profitability was 1.9% per quarter on average, their average net working capital corresponded to 17.4% of their total assets and had an average debt of 27.7% in relation to total assets (Table 1). On average, the quarterly GDP showed a positive variation of 0.05% in the analyzed period (2010 to 2020), indicating that the economy offered favorable investment opportunities.

The result of the VIF statistic, of 1.22 for the EPU model and 1.39 for the model with the IIE-Br, indicate that problems with multicollinearity do not significantly affect the models. The interpretation of the estimated coefficients and the relationship between the variables will be presented below:

4.2 Effects of Uncertainty on Economic Policy on Corporate Investments

Initially, it should be noted that the level of statistical significance adopted for interpreting the results in this research was 10%. For validation of the GMM, the Autocorrelation AR(1) and AR(2) tests in Arellano & Bond's (1991) idiosyncratic error term allowed to identify negative and significant first-order autocorrelation and non-significant second-order autocorrelation, as expected. It was verified in the Hansen test that the null hypothesis of validity of the instruments was not rejected. Furthermore, the null hypothesis for the validity of the system GMM was not rejected in the Dif-Hansen test compared to the GMM-Dif, attesting to the adequacy of the estimator.

Table 2 presents the estimated results for Eq. (1). Columns 1 to 5 of the table include alternative estimates for the model considering l ∈ {0, 1, 2, 3, 4}. This allowed testing the effect of explanatory and control variables for 4 subsequent quarters, in addition to the current quarter.

The first estimation suggests that, ceteris paribus, an increase in uncertainty about economic policy leads to a reduction in the investment level of the observed companies, simultaneously. This means that the investment level of these companies responds negatively to the current uncertainty. The found coefficient of -0.0014 was significant. This indicates that a 1% increase in LNEPU generates a reduction of 0.014% in the ratio between Capex for the quarter and total assets.

The results also revealed that there is a persistent and significant influence of the EPU for investments in future dates, in t+2, t+3 and t+4. The coefficient with the greatest impact of the LNEPU variable (-0.0019) is that of estimation 3, compared to the other estimates in table 2.

Interestingly, we identified a positive and significant relationship of economic policy uncertainty to investment levels in three subsequent quarters (estimation 4). However, for the subsequent quarter, this impact remained negative and significant. As previously argued, some specific characteristics of firms can lead to significant results that differ from the expected relationships (Wang et al., 2014; Liu et al., 2020). The companies selected for this study may have these characteristics, whose analysis is beyond the scope of this research. Furthermore, the economic dynamics of countries like Brazil can lead to different results (Schwarz & Dalmácio, 2020). New studies may emphasize these characteristics.

In the fourth quarter, the impact is on the reduction of investments, evaluating the sign and intensity of the uncertainty variable (-0.0018,). This implies that economic policy uncertainty delays firms' investments in the long run. Such results are consistent with previous international studies (Akron et al., 2020; Chen et al., 2020; Gulen & Ion, 2015; Kang et al., 2014) and confirm the research hypothesis. However, EPU has a lesser negative impact on investments in Brazil, compared to the international context (Gulen & Ion, 2015).

Furthermore, it was verified that the impact of the first and second delays of the dependent variable was positive and significant. This reinforces the recursive effect of the dependent variable and that the inclusion of more lags can help in its prediction in some cases (Barros et al., 2020). The results of the impacts of the control variables are partially consistent with the expected relationships.

ROA had no effect on Capex. Company size (SIZE) had a positive and significant effect on investments in estimates

Table 2: Economic Policy Uncertainty and Corporate Investment

	$Capex_{i,t+0}$ (1)	$Capex_{i,t+1}$ (2)	$Capex_{i,t+2}$ (3)	$Capex_{i,t+3}$ (4)	$Capex_{i,t+4}$ (5)
$Capex_{i,t+t-1}$	0.2254***	0.2290***	0.1635***	0.1906***	0.1658***
$Capex_{i,t+t-2}$	0.1281***	0.1185***	0.0703**	0.0834**	0.0820**
LNEPU	-0.0014**	-0.0007	-0.0019***	0.0013**	-0.0018***
ROA	0.0403	-0.0047	-0.0285	0.0221	0.0110
SIZE	0.0005	0.0002	0.0002	0.0012**	0.0009**
MTB	0.0004*	0.0006**	0.0009**	0.0008***	0.0008**
NWC	-0.0091**	0.0049	-0.0084*	-0.0055	-0.0041
LEV	0.0019	0.0080	-0.0093	-0.0122	-0.0109
DDIV	0.0002	0.0000	0.0013**	-0.0021***	-0.0001
△GDP	0.0184**	0.0122	0.0093	0.0458***	0.0137
Constant	0.0095	0.0063	0.0205	-0.0079	0.0102
Wald χ^2	1744.57***	1229.00***	923.00***	1137.20	1067.16
AR(1)	-5.51***	-5.69***	-5.63***	-5.46	-5.90
AR(2)	-1.42	-1.1	-0.56	-0.64	-1.18
Hansen	121.55	125.72	114.78	111.39	103.35
Dif-Hansen	13.28	6.69	12.62	7.61	8.76
Obs.	5193	5185	5181	5050	4911
Groups	153	152	152	151	151
Instruments	129	126	123	120	117

Notes: ***for significance level at 1%; **5%; *10%. %. The CAPEX variables in t, LEV and LNAT were considered as base instruments of the GMM. The other regressors were assumed to be sequentially exogenous instruments. Definition of variables in Figure 3. AR(1): Arellano and Bond's ar1 autocorrelation test. AR(2): Arellano and Bond's ar2 autocorrelation test. Hansen: Hansen test to verify the assumption of exogeneity of the instruments. Dif-Hansen: Hansen Difference Test to verify the validity of the subset of instruments. All models are controlled by industry dummies. Source: Research results.

4 and 5 only, and the MTB indicator, which represents growth opportunities, had a positive and significant effect on all estimates. This indicates that the impact of these indicators will have an effect on corporate investments in subsequent quarters. Such effects are consistent with the fact that firms with more growth opportunities invest more. On the other hand, the results for size were contrary to the expected sign, which would be consistent with the idea that mature firms in their life cycle invest proportionally less than smaller and early-stage firms (Akron et al., 2020; Gulen & Ion, 2015). In this case, the results showed that size, represented by revenue, has a positive impact on the future investment volume of firms in the sample analyzed in Brazilian companies.

The NWC showed a negative and significant relationship with the level of investments in estimates 1 and 3. This suggests that, as companies allocate more long-term resources to current assets, the resources invested in permanent assets are smaller.

Leverage (LEV) had no significant effect on any of the estimates. The fact that the company pays dividends or not (DDIV) has shown to influence investments, with alternating effects between estimates 3 and 4. The results showed that there is a positive effect on investments in the second quarter and becomes negative in the third quarter.

Regarding macroeconomic control, a positive and significant effect was obtained for the GDP variation in the current Capex (estimation 1) and three quarters ahead (estimation 4).

Table 3 presents the estimated results for Eq. (1), considering the alternative explanatory variable of Economic Uncertainty (IIE-Br) which measures the uncertainty of the economy in general. It was observed that the effects of this variable are not significant only for investments in the following first quarter (estimation 2).

It was noticed that the model that presents the coefficient for the variable LNIIEBr with the greatest impact is that of estimation 4 (-0.0113), compared to the other estimates for the same variable in table 3. This leads

to the understanding that firms respond negatively to their investment decisions in the face of increased general economic uncertainty. And the impact of this is reflected more intensely in the reduction of capital expenditures in the subsequent third quarter. This result, in particular, is in conflict with the result in Table 2, where the effect of uncertainty on Capex was positive.

However, it is noted that the intensity of the coefficients for the IIE-Br is greater than for the EPU. This implies that investments respond more intensely to the variation in the level of uncertainty in the economy, measured by the IIE-Br, than to the variation in the level of uncertainty of the economic policy measured by the EPU. Increased newspaper coverage and the dispersion component of market analysts' forecasts may contribute to this, making investment decisions more responsive to the IIE-Br.

Therefore, it can be inferred that political and economic uncertainties can cause delays in corporate investments, with greater intensity perceived in future quarters.

5 Concluding Remarks

This work examined the effects of uncertainty about economic policy, measured by the Economic Policy Uncertainty Index – EPU, on corporate investments in a sample of publicly traded companies in Brazil in the period from 2010 to 2020. The system GMM estimator was used to mitigate possible common endogeneity problems in financial data. With this, we build evidence capable of answering the question of how the uncertainty of the Brazilian economic policy affects the investment decisions of publicly traded companies in Brazil. We confirm a negative effect on capital expenditures. Furthermore, we show that this effect is simultaneous and can be progressively intensified in future quarters. The evidence is in line with previous studies, showing that the uncertainty-investment relationship in Brazil adheres to the channel of real options (Chen et al., 2020; Gulen & Ion, 2015; Wang et al., 2014).

As an alternative to the EPU, the Economic Uncertainty

Table 3: Economic Uncertainty and Corporate Investment

	$Capex_{i,t+0}$ (1)	$Capex_{i,t+1}$ (2)	$Capex_{i,t+2}$ (3)	$Capex_{i,t+3}$ (4)	$Capex_{i,t+4}$ (5)
$Capex_{i,t+l-1}$	0.2208***	0.2251**	0.1606***	0.1898***	0.1549***
$Capex_{i,t+l-2}$	0.1248***	0.1130**	0.0669**	0.0840**	0.0773**
LNIIEBr	-0.0083***	0.0029	-0.0064**	-0.0113***	-0.0056**
ROA	0.0395	-0.0016	-0.0283	0.0196	0.0110
SIZE	0.0004	0.0001	0.0003	0.0011**	0.0009**
MTB	0.0004**	0.0006**	0.0009**	0.0008***	0.0008**
NWC	-0.0094**	0.0049	-0.0083*	-0.0067	-0.0038
LEV	0.0028	0.0093	-0.0085	-0.0136	-0.0093
DDIV	0.0003	0.0001	0.0015**	-0.0020***	0.0001
△GDP	-0.0023	0.0239**	0.0112	0.0127	0.0184*
Constant	0.0429**	-0.0112	0.0397**	0.0530***	0.0264*
Wald χ^2	1757.01***	1117.45***	1024.93***	1058.26***	1131.28***
AR(1)	-5.45***	-5.72***	-5.62***	-5.59***	-5.91***
AR(2)	-1.34	-1.02	-0.45	-0.51	-1.13
Hansen	119.79	124.87	112.39	107.98	101.35
Dif-Hansen	13.4	5.06	14.2	8.84	7.17
Obs	5193	5185	5181	5050	4911
Groups	153	152	152	151	151
Instruments	129	126	123	120	117

Notes: ***for significance level at 1%; **5%; *10%. The CAPEX variables in t, LEV and LNAT were considered as base instruments of the GMM. The other regressors were assumed to be sequentially exogenous instruments. Definition of variables in Figure 3. AR(1): Arellano and Bond's ar1 autocorrelation test. AR(2): Arellano and Bond's ar2 autocorrelation test. Hansen: Hansen test to verify the assumption of exogeneity of the instruments. Dif-Hansen: Hansen Difference Test to verify the validity of the subset of instruments. All models are controlled by industry dummies.
Source: Research results.

Indicator – Brazil (IIE-Br) was used, with which investment levels were more responsive. Thus, it has been documented that political and economic uncertainties, in general, negatively affect corporate investment. This strengthens the evidence for this relationship, as the results are robust for different metrics.

Thus, this research suggests that the IIE-Br may be a more appropriate indicator to explain the allocation of resources resulting from financial decisions in Brazil. To corroborate these results, it is suggested that this relationship be tested with other firm-level variables in the Brazilian scenario in future studies. This study was limited in the number of companies considered, compared to similar studies in other countries. Therefore, the conclusions are restricted to this sample cut. It is suggested that further studies seek to expand the analyzed period and the number of companies, in addition to the inclusion of moderating factors related to existing heterogeneities in the characteristics of firms (Wang et al. 2014), such as their financial position, ownership structure, industry, regulation, among others that can change the direction of results or intensify them. It is also opportune that new studies verify the effect of different dimensions of uncertainty, in addition to general political and economic ones.

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