A new economic policy uncertainty index for Brazil

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Abstract This study has created a novel economic policy uncertainty (EPU) index for Brazil by analyzing the frequency of news articles published by the country's major news portals. The measurement proposed here is based on news from different news outlets, unlike the similar index previously available, extracted by a web-scraping procedure. This research also evaluated the role of EPU in its relationship with stock returns in the Brazilian market, comparing the new index with the one previously available. The new measure showed a negative relationship with the return in excess of the risk-free rate, similar to that found using the previously existing index, but with a greater magnitude. Furthermore, the explanatory power of the regression model is substantially greater when the proposed measure is used. In this way, the study contributes not only by deepening the understanding of the relationship between uncertainty and stock returns but also by serving as a methodological subsidy for future research focusing on EPU in the country.

Keywords: Economic policy uncertainty; Measurement; Stock returns.
JEL Code: D8, C43, C8.

1. Introduction

1.1 Context and research problem

Uncertainty has been researched in various disciplines. The concept of uncertainty permeates multiple aspects of social dynamics, both theoretically and practically, and has sparked significant social and scientific interest. In economics, studies aimed at assessing economic policy uncertainty (EPU) are noteworthy. This concept is related to the future ambiguity of government policies and regulatory frameworks (Al-Thaqeb and Algharabali, 2019). Among the various consequences of this type of uncertainty, those affecting stock markets stand out. Several empirical studies have shown that EPU impacts stock returns in multiple markets, including Brazil (Huang and Liu, 2021; Phan et al., 2018; Gea et al., 2021; Quinteiro et al., 2020).

The literature consistently shows a negative relationship between EPU and stock returns (Al-Thaqeb and Algharabali, 2019). This relationship might

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be associated with pessimism in the future expectations of market agents regarding economic policies, leading to a reduction in stock prices (Li et al., 2016). This is especially present in large economies, as observed in various studies in the US (Baker et al., 2016; Brogaard and Detzel, 2015; Rehman et al., 2019) and China (Chen et al., 2017), including efforts to improve measures of this uncertainty in the Asian country (Huang and Luk, 2020; Lee et al., 2023).

Research carried out in Brazil, though limited, seems to confirm the negative relationship between economic policy uncertainty and stock returns, as observed by Gea et al. (2021). Despite this, further investigation is required, especially since research in emerging and developing countries has shown less conclusive results than in developed countries (Rehman et al., 2019).

One way to contribute to this and other lines of research on economic uncertainty is to improve the measurement of EPU, assuming that empirical study results can be sensitive to its operational definition. In Brazil, the nature of the two current indices that quantify economic uncertainty (Baker et al., 2016; Ferreira et al., 2019) suggests the possibility of refinement for a more suitable measurement of EPU. The pioneering instrument by Baker et al. (2016) applied to Brazil measures economic policy uncertainty using only one data source, in this case, news published by the Folha de São Paulo newspaper. In light of the evidence that the extent of news coverage is relevant to the construction of EPU indices (Ghirelli et al., 2019), concentrating on just one source of information can increase noise and reduce the informational content of the EPU measure, thus limiting its usefulness. In turn, the alternative measurement proposed by Ferreira et al. (2019) is restricted to assessing economic uncertainty without incorporating its political dimension, as this study proposes. Thus, the construct measured by Ferreira et al. (2019), although related, differs from what this research seeks to quantify.

This study presents an unprecedented monthly instrument of economic policy uncertainty to improve EPU measurement in Brazil by significantly expanding the information sources used. Specifically, the EPU measure is constructed from three news portals – Folha de São Paulo, G1, and Extra – aiming to better represent the construct, reduce noise, and increase its information content. The new measure will be freely available to all interested parties, encouraging other applications of the data and new scientific research.

To test the contribution offered by the new measure, an empirical investigation of the relationship between EPU and stock returns of 109 companies listed on B3 is presented below, comparing the results with those obtained using the Baker et al. (2016) measure constructed by the authors for Brazil and made available at `https://www.policyuncertainty.com/`.

The results of this study show that economic policy uncertainty can play a fundamental role in Brazilian economic dynamics. The research suggests that two different EPU measures are relevant for explaining variations in stock returns in excess of the risk-free rate in Brazil, with the new index having greater explanatory power for variations in rates of return than the Baker et al. (2016) index, the only one used in Brazil until now.

2. Methodology

2.1 New Brazilian economic policy uncertainty index

The research uses Baker et al. (2016) as a methodological starting point to develop the new measure. Thus, the developed index is based on the monthly frequency of news published in different Brazilian newspapers related to EPU from 2017 to 2022. Twitter (currently X) serves as the news extraction platform, similar to Ferreira et al. (2019). This social network stands out as a data collection tool for the proposed study, not only because of its widespread use but also because of how newspapers interact on Twitter. Since the beginning of the 2010s, the major Brazilian newspapers have published links to full articles on their social media portals, allowing this study to be conducted. This interaction also justifies the methodological choice for the time frame, as data became available to operationalize this methodological proposal after this period. This study analyzed over 2 million tweets from the Folha de São Paulo, G1, and Extra portals, selected for their journalistic relevance and scope. The textual data of each article was then extracted using automated web scraping processes.

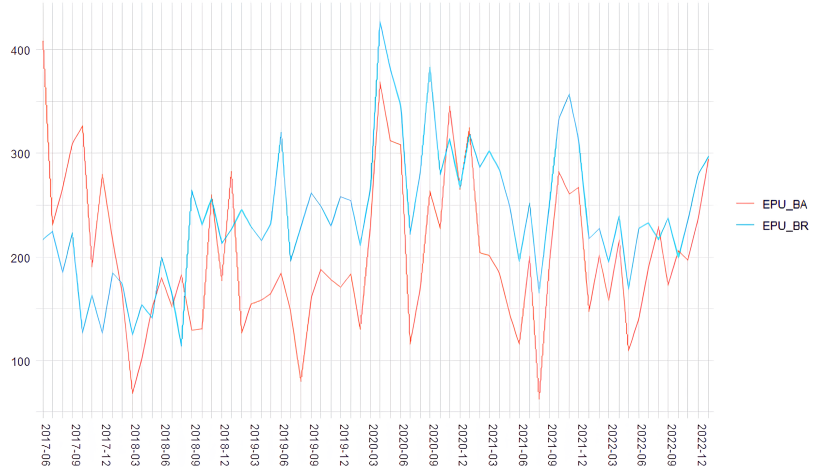
The articles were classified according to the methodological framework described in Baker et al. (2016), filtering out the news in which terms related to uncertainty, politics and economics were found using lexicometric analysis operationalized by the R package `sentometrics` (Ardia et al., 2021).

After extracting and classifying the news stories in terms of their relationship with EPU, they were counted to finalize the structuring of the index. All data processing and analysis were based on the R package, which has a series of commands that optimize a significant part of the process of converting textual data into time series indices and which is based on `https://sentometrics-research.com/sentometrics/articles/applications/epu.html` with more details on `https://github.com/saulobarrosm/epu/blob/main/sentometrics_epu_br.R`. Figure 1 shows the evolution of the new indicator of economic policy uncertainty in Brazil (EPU_BR) and the indicator available at

https://www.policyuncertainty.com/ (EPU_BA) from May 2017 to December 2022. The indices showed a correlation of 0.44 over the entire period. This relatively low correlation suggests that the new indicator is not redundant to the original. The divergence may be primarily due to differences in the algorithm for filtering and interpreting the texts and the greater diversity and quantity of information used in the construction of EPU_BR.

It is also critical to determine whether the new measure can detect clear moments of crisis or increased uncertainty in economic policy during the period under consideration. In this context, the early stages of the COVID-19 pandemic in the first half of 2020 stand out, particularly between February and May. This period has the highest peak of the EPU_BR index. Also noteworthy are the high levels of economic policy uncertainty observed from September to November 2021, which are justified by fears of an economic and political crisis in China as a result of the Evergrande company's possible insolvency, a relaxation of spending ceilings in Brazil, a bill relating to the flow of precatory payments and the emergence of Omicron, a new variant of COVID-19. Overall, the textual analysis shows that the EPU_BR index is highly responsive to news that could significantly impact EPU during the period under consideration.

Figure 1
Economic policy uncertainty in Brazil



Note: EPU_BA corresponds to the index developed by Baker et al. (2016), and EPU_BR indicates the new index developed in this study.

Finally, after the index had been built, the epu package was created in R to facilitate the free dissemination of EPU data. The purpose of the package is to

facilitate data collection not only for the measure created by this research but also for the main indices in the EPU repository (https://www.policyuncertainty.com). The codes for operationalizing the data extractions are in Appendix A of this paper.

3. Empirical exercise

The sample contains stocks from 109 Brazilian companies, covering 99.5% of the composition of Ibovespa (B3, 2023) based on the trading session of December 29, 2022, and the portfolio of January 2023, as well as stocks from another 26 companies. Based on the literature and especially following the procedures and variables of Bolton and Kacperczyk (2021), Brogaard and Detzel (2015), and Gea et al. (2021), variants of the following model were estimated:

$$R_{i,t} = \alpha_0 + \alpha_1 \text{EPU}_t + \alpha_2 \text{VOL}_t + \alpha_3 \text{DY}_t + \alpha_4 \text{RBR}_t + \alpha_5 \text{RREL}_t + \alpha_6 \text{GEPU}_t + \varepsilon_{i,t} \quad (1)$$

where the monthly variables are described in Table 1, and $\varepsilon_{i,t}$ represents the idiosyncratic error.

Table 1
Analyzed variables

Variable	Acronym	Operationalization	Source
EPU 1	EPU_BA	Generated from the quantification of news	Baker et al. (2016)
EPU 2	EPU_BR	Own elaboration based on news quantification	This study
Excess return	R	Difference between logarithmic return and Selic	Yahoo Finance
Volatility	VOL	Volatility of the Ibovespa index	Refinitiv Eikon
Annualized dividends	DY	Ratio between dividends paid in the last 12 months and the market value of the Ibovespa index	Refinitiv Eikon
Brazil's country risk	RBR	Brazil risk	Refinitiv Eikon
Average low-risk investment indicator	RREL	Difference between the Selic and its moving average over a 12-month window	Banco Central do Brasil
Global EPU	GEPU	Generated from the quantification of news	Baker et al. (2016)

Table 2 shows descriptive statistics, revealing that, during the sample period, the average monthly return in excess of the risk-free rate was negative (-0.4%). Also noteworthy is the fact that EPU_BR had a lower standard deviation than both EPU_BA and

GEPU, the global EPU index. DY had an average value of 4.05, which indicates an average annualized dividend equivalent to around 4% of Ibovespa's market capitalization over the period studied.

Table 2
Descriptive data

Variables	Mean	SD	Min	Median	Max
R	–0.004	0.134	–2.074	–0.001	1.103
EPU_BA	202.720	72.640	62.590	188.110	407.860
EPU_BR	239.630	63.660	114.010	231.580	426.980
VOL	23.300	9.330	11.490	20.940	43.340
RBR	4.750	0.140	4.480	4.740	5.030
RREL	0.000	0.002	–0.003	0.000	0.004
DY	4.050	3.370	1.490	2.610	13.300
GEPU	239.740	66.250	123.860	235.790	430.270

Note 1: Variables are described in Table 1.
Note 2: Returns data includes 7260 observations from May 2017 to December 2022.

Columns 2 and 4 of Table 3 show the results of multiple regressions with all the proposed variables, similar to the specifications reported by Gea et al. (2021) and Brogaard and Detzel (2015). Columns 1 and 3 show simple regressions with only the EPU indices as independent variables. In the first two columns of Table 7, EPU corresponds to the Baker et al. (2016) index constructed for the Brazilian market (EPU_BA), while in the remaining columns, EPU corresponds to the new index (EPU_BR).

All the regressions indicate a negative relationship between excess returns and economic policy uncertainty, with significant coefficients at the 1% level. The results of the simple regressions suggest that an increase of 1 standard deviation (SD) in EPU_BA ($SD = 72.64$) and EPU_BR ($SD = 63.66$) is associated, respectively, with an expected reduction of approximately 0.94 (-0.00013×72.64) and 1.46 (-0.00023×63.66) percentage points (p.p.) in the excess return on shares. There is even greater sensitivity in the case of multiple regression, including the control variables described above. In these cases, for one standard deviation increase in EPU_BA and EPU_BR, a reduction of 1.31 p.p. (-0.00018×72.64) and 3.5 p.p. (-0.00055×63.66) in the average excess return is estimated, respectively.

A comparative analysis of the models suggests that the sensitivity of the rate of return to the EPU index is significantly higher when using the new measure (EPU_BR). In the case of the multiple regression model, the Baker et al. (2016) measure showed the aforementioned expected drop of 1.31 p.p. (-0.00018×72.64) with a 95% confidence interval from 1.09 (-0.00015×72.64) to 1.53 (-0.00021×72.64). On the other hand, the model with the new EPU index showed the 3.5 p.p. (-0.00055×63.66) expected decrease in excess returns with a 95% confidence interval from 3.12 (-0.00049×63.66) to 3.88 (-0.00061×63.66). Thus, the estimates are statistically different under this confidence level, suggesting that increases in economic policy uncertainty measured by the new EPU index would be associated with a greater reduction in excess returns

in the Brazilian market.

These point estimates suggest that the sensitivity of excess returns to variations in economic policy uncertainty is substantially greater when using the new index. To statistically formalize this comparison, we implemented Wald-type tests for the equality of coefficients using standard errors clustered by company in order to make the tests asymptotically robust to arbitrary forms of heteroscedasticity and time dependence of the model's errors (Weesie, 1999). The results suggest rejection at the 1% significance level of the null hypothesis that the coefficients of the different EPU measures are equal, considering either the simple ($\chi^2_1 = 42.79;\ p < 0.01$) or multiple ($\chi^2_1 = 200.51;\ p < 0.01$) regressions. In the same vein, we observed that the 95% confidence intervals of the coefficients estimated for EPU_BR do not overlap with the confidence intervals associated with EPU_BA – the lower limits of the former are greater than the upper limits of the latter.

There was also a significant difference in the explanatory power of the models evaluated. When we used EPU_BR instead of EPU_BA, the adjusted coefficient of determination (R^2) went from approximately 0.58% in the simple regression and 3.98% in the multiple regression to approximately 1.51% and 6.94%, respectively. To test this difference statistically, we used the procedures outlined in Ohtani (2000), running R^2 difference tests using bootstrapping, as seen in Berghman et al. (2013) and Doucé et al. (2015). In the case of this research, the results reveal significant differences at the 1% level between the R^2s in all comparisons. In the same vein, the η^2 statistic was computed for each explanatory variable, corresponding to the percentage of the variation in the dependent variable explained by the given explanatory variable after removing the variation explained by all other regressors (Kline, 2013). Considering the models with all the controls, the estimated η^2 is approximately 4% for EPU_BR and 1% for EPU_BA, with no overlap between the estimates of the respective confidence intervals at the 95% level. These results suggest that the new index is better able to explain the variation of excess returns in the Brazilian context.

Taken together, the results suggest that the new measure is better suited to capturing economic policy uncertainty and assessing its possible consequences, which can be explained by the expansion of the information set used, eliminating dependence on just one data source.

The results are particularly useful given that high levels of EPU marked the time frame of this analysis, caused above all by the crisis associated with the COVID-19 pandemic. Therefore, the index may be suitable for analysis under usual conditions and in situations of more acute uncertainty.

Table 3
Relationship between excess return and EPU

	EPU_BA – Baker et al. (2016)		EPU_BR – new index	
	Reg 2	**Reg 1**	**Reg 2**	**Reg 1**
Intercept	0.02300***	–0.65300***	0.05200***	0.06200
	(0.00400)	(0.06900)	–0.00400	(0.83300)
EPU	–0.00013***	–0.00018***	–0.00023***	–0.00055***
	(0.00001)	(0.00002)	–0.00001	(0.00003)
VOL		–0.00030		0.00070***
		(0.00020)		(0.00020)
RBR		0.12600***		–0.00500
		(0.01300)		(0.01400)
RREL		–2.65000**		4.25800***
		(0.97500)		(0.98800)
DY		–0.00700***		–0.00900***
		(0.00060)		(0.00060)
GEPU		0.00050***		0.00050***
		(0.00003)		(0.00003)
R^2 *adjusted*	0.00580	0.03980	0.01510	0.06940
N	7193	7193	7193	7193

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are described in Table 1. Regressions were estimated using pooled ordinary least squares. Standard errors clustered by company are shown in parentheses below the coefficients.

4. Conclusion

The empirical results presented here align with both the international and Brazilian evidence, showing a negative relationship between EPU and rates of return. Furthermore, we find that the new index has greater power to explain variations in rates of return than the index created by Baker et al. (2016), available at `https://www.policyuncertainty.com/` and, until then, the only one used in Brazil. Therefore, it is plausible that the procedures proposed here are suitable for measuring economic policy uncertainty in the country, thus suggesting the new measure as a convenient indicator in light of the econometric analyses performed in this research.

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A. EPU data extraction procedures

```r
# Required packages
library(devtools)

# Install epu package
devtools::install_github("saulobarrosm/epu")

# Load epu package
library(epu)

# Extract EPU data from different countries
epu_data <- get_EPU()
```