IMPACT OF THE CENTRAL BANK OF BRAZIL AUTONOMY ON THE YIELD CURVE STRUCTURE AND RISK PASS-THROUGH

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Abstract

This study examines the impact of the Central Bank of Brazil's autonomy on the yield curve in terms of risk pass-through. Specifically, we investigate the relationship between market uncertainties and the Brazilian nominal forward rates between 3 and 5 years - a proxy for fiscal risk - before and after the Central Bank of Brazil's operational autonomy, which commenced with the implementation of Complementary Law No. 179 in February 2021. The results indicate a decrease in the sensitivity of the yield curve to market uncertainties following the autonomy of the financial authority, suggesting reduced transmission of risk to long-term interest rates.

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1 INTRODUCTION

Central bank independence/autonomy is a concept regarding the extent to which the monetary authority's decisions are independent of political pressures and it is an increasingly relevant and discussed topic in the global economic landscape. Economies worldwide adopted measures to promote the independence of their central financial institutions, recognizing the significance of monetary management free from external influences (Eijffinger and Schaling, 1993; Pollard, 1993). The objective of this paper is to examine whether the autonomy of the Central Bank of Brazil affected the sensitivity of the Brazilian nominal yield curve to changes in risk.

The concept of separating monetary policy from politics has been a topic of study for centuries and has been advocated by various authors. Ricardo (1823) proposed the creation of a national bank by converting the issuing department of the Bank of England into an independent institution. The new entity would have primary responsibility for currency issuance, seeking to stabilize the economy and control inflation. Nordhaus (1975) suggested that electoral cycles often generate economic cycles to stimulate the economy before elections, driving short-term growth to gain voter approval. According to Rogoff (1985), the responsibility of making monetary policy decisions ought to be assigned to autonomous central banks. These institutions must exhibit an intermediate level of commitment that can lend credibility to their monetary targets while retaining some flexibility to accommodate economic shocks.

The central bank independence also generates debates among economists and policymakers. The seminal work by Kydland and Prescott (1977) emphasized that central banks with greater independence could better commit to low inflation targets. Early discussions revolved around the trade-off between inflation and output stability. Alesina and Summers (1993) demonstrated that independent central banks tend to achieve lower inflation without sacrificing output stability.

Advocates of the autonomy emphasize the importance of implementing effective and long-term monetary policies without political pressures, highlighting positive effects in combating inflation and aligning the private sector's expectations (Crowe

and Meade, 2008). Studies have shown an inverse relationship between central bank independence and inflation levels across countries (Eijffinger, Schaling and Hoeberichts, 1998; Crowe and Meade, 2008; Arnone *et al.*, 2009; Fischer, 1995). Cukierman (1992) developed an index of central bank independence and showed that countries with more autonomous central banks experienced better inflation performance. However, other authors note that these effects may not be uniform across all countries, and the practical results may be less clear than what is proposed from a theoretical standpoint (Eijffinger and Schaling, 1993).

The impact of central bank independence can extend beyond inflation. While independence may prioritize inflation control, it can also contribute to stable economic growth by reducing uncertainty. For instance, studies by Bernanke and Mishkin (1997) and Blinder (1998) highlight the positive relationship between central bank autonomy and output stability. Edison and Pauls (1993) argues that Independent central banks influence exchange rate stability, affecting trade and investment. Barth, Caprio, and Levine (2004) discuss the role of central bank independence in maintaining financial stability. Gregora et al (2019) emphasize that a higher degree of independence typically leads to greater predictability in monetary policy, which strengthens market confidence and facilitates the transmission of reference interest rates into the economy.

The autonomy of the central bank is a fundamental characteristic that defines the extent to which the monetary authority operates independently. According to Arnone *et al.* (2009), central bank autonomy differs from central bank independence. Central bank autonomy refers to the operational freedom of the central bank to implement measures without external interference in its day-to-day activities. In contrast, central bank independence denotes a lack of institutional constraints, allowing the central bank to set its own long-term objectives free from political will. Despite this difference, the literature often uses these terms interchangeably (Arnone *et al.*, 2009).

The autonomy of central banks is exemplified by various notable instances worldwide, such as the American Federal Reserve (FED) in 1913, the European Central Bank (ECB) in 1998 with the Maastricht Treaty, the Bank of Japan (BoJ) in 1998, and more recently, the Central Bank of Brazil in 2021. These examples highlight different aspects and outcomes of the autonomy of central banks.

Delving deeper into the Brazilian case, the autonomy of its central bank is a topic of significant relevance in the country's economic and political context, especially considering the historical trajectory of recent decades. During the 1980s, Brazil faced one of the worst inflation crises in its history. Inflation reached astronomical levels, eroding the population's purchasing power and creating an unstable and unpredictable economic environment. With the introduction of the Real Plan in 1994, a new currency, the real, was implemented, along with a set of economic policies aimed at stabilizing inflation. Despite the plan's success, the Central Bank of Brazil still had limited autonomy.

Discussions surrounding the autonomy of the Central Bank gained increased prominence from the 2000s onward. During this period, there was an increase in transparency and accountability at the BCB. Inflation targets were established, and the Monetary Policy Committee (COPOM) held meetings, making the minutes public (Bogdanski, Tombini and Werlang, 2000). Over the years, the debate about the need for formal autonomy culminated in the approval of Complementary Law No. 179 in February 2021. This measure represented a milestone in the institution's history, as it established the operational autonomy of the BCB, defining fixed 4-year terms for the board, which are not coincident with the term of the Brazilian President. This measure was designed to prevent changes in the executive leadership from directly influencing Central Bank policies. Additionally, the law enhances the institution's transparency and accountability, requiring it to present semiannual inflation and financial stability reports to the Federal Senate.

Given the mentioned case, this study aims to examine the influence of the Central Bank of Brazil's autonomy process on the structure of the yield curve, focusing on verifying the intensity of risk pass-through to the interest rates before and after the

BCB's autonomy. Specifically, we use the forward rate between 3 and 5-year maturity periods from the yield curve, which is a proxy for the country's fiscal risks (Central Bank of Brazil, 2021), in conjunction with measures of equity market uncertainty. The results suggest that the forward rate has become less sensitive to market uncertainties after the central bank's autonomy. This study is significant as it helps to comprehend how central bank autonomy affects financial markets and how risk is transferred to the yield curve depending on the degree of autonomy of the central bank.

This work is structured as follows: section 2 presents the sample and the methodology of the study; section 3 shows the results about the sensitivity of the yield curve to risk after the BCB's autonomy; finally, in section 4, the final considerations are presented.

2 METHODOLOGY AND SAMPLE

In order to conduct the study, quantitative research was performed using variables that reflect risk in the Brazilian market, as well as a variable representing the forward rates of the Brazilian yield curve. An ordinary least squares (OLS) regression with heteroskedasticity and autocorrelation-consistent (HAC) standard errors was conducted to establish the relationship between the variables. Additionally, dummy variables were included to account for the impact of the Central Bank's autonomy. The overall equation employed in the regressions is as follows:

$$Forward\ Rate_{(t)} = \alpha + Risk_{(t)} \, . \, \beta1 + dummy_{(t)} . Risk_{(t)} . \beta2 + \varepsilon_{(t)} \quad (1)$$

To compute the forward rates, the Nelson-Siegel-Svensson model was utilized to construct the yield curve, gathering daily data of the parameters utilized in the parametric model. These parameters were then employed to compute the rate between the 5-year and 3-year vertices of the yield curve (forward rate between 3 and 5 years). The details of the Nelson-Siegel-Svensson model employed can be seen in Val and Araujo (2019). We chose the 3-5 years forward rate because it is a proxy of the Brazilian fiscal risk (Central Bank of Brazil, 2021). This measure is not affected by short-term monetary policy decisions and expresses the slope of the yield curve between medium and long term. A greater slope would indicate an increase in fiscal risk – a greater difficulty in repaying a country's longer-term debt leads to a higher long-term rate relative to medium-term.

As for the independent variables (Risk in equation 1), the selection was designed to embody the uncertainty prevalent in both domestic and global markets while remaining insulated from direct influence by interest rates. In the domestic context, the implied volatility of call options on BOVA11 with a delta of 0.5 and a 1-month expiration was chosen[3]. This choice is based on the idea of BOVA11, a tradable

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[3] Data obtained through the Bloomberg terminal, code 1M_CALL_IMP_VOL_50DELTA_DFLT.

ETF replicating the Bovespa Index as a proxy for the Brazilian stock market, and implied volatility as a measure of future risk expectation perceived by investors[4].

In order to gauge uncertainty in the global financial markets, the VIX, commonly referred to as the "fear index," has been selected for this purpose. The VIX measures the expectation of future volatility in the US stock market and is globally recognized as an indicator of risk aversion. Similar to the implied volatility of BOVA11 options, the VIX is a "non-interest" variable, thus providing aninterest-independent measure of uncertainty.

To account for the impact of the Central Bank's autonomy, dummy variables were introduced. These variables were activated on February 25, 2021, when the Central Bank's operational autonomy took effect. A corresponding dummy variable was created for each independent variable previously mentioned. The "Dummy Vol BR" variable remains at zero prior to autonomy and subsequently aligns with the implied volatility of BOVA11. Similarly, the "Dummy VIX" maintains a value of zero before the Central Bank's autonomy and subsequently corresponds to one after that date.

In accordance with the specified variables and definitions, the regressions were performed using the following equation:

$$Forward\ Rate_{(t)} = \alpha + Vol\ BR_{(t)}.\beta 1 + dummy_{(t)}.Vol\ BR_{(t)}.\beta 2 + VIX_{(t)}.\beta 3 + dummy_{(t)}.VIX_{(t)}.\beta 4 + \varepsilon_{(t)} \tag{2}$$

The sample of this study covers 12 months, with 6 months before and 6 months after the date of the Central Bank's operational independence. This window was chosen to minimize the influence of external events that could affect the study variables while ensuring a sufficient sample size for econometric analysis. We also employ a different window for robustness: we adopt for "before the autonomy" the window of 6 months before the Senate's autonomy approval and for "after the autonomy" 6 months after the date that autonomy came into effect (see more details in the Results Section).

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[4] The Bovespa Index (IBOVESPA) is the main stock index in the Brazilian market.

Also for robustness, variables were incorporated into the model to account for a directional influence of market uncertainty on the slope of the yield curve. The rationale behind this is based on the observation that abrupt fluctuations in market indices result in a heightened level of volatility, but the impact on the yield curve can vary depending on the direction of these movements. Considering this, the daily return of the Bovespa Index and the S&P 500 Index were used, reflecting this direction in the Brazilian and American markets, respectively.

With the incorporation of the directional factor, the resulting equation for the regressions will be as follows:

$$Forward\ Rate_{(t)} = \alpha + Vol\ BR_{(t)}.\beta1 + dummy_{(t)}.Vol\ BR_{(t)}.\beta2 + Ret\ Ibov_{(t)}.\beta3 + VIX_{(t)}.\beta4 + dummy_{(t)}.VIX_{(t)}.\beta5 + Ret\ SP_{(t)}.\beta6 + \varepsilon_{(t)} \tag{3}$$

Some preliminary adjustments were made in the database. National holidays in Brazil and the United States were excluded, leaving only the days when both markets were open. Furthermore, the values for the Vol BR and VIX variables were divided by 10,000. This division was undertaken with the sole objective of standardizing the data, given that the dependent variables predominantly fall within the range of 0 to 100 basis points. This standardization process aims to facilitate the comprehension and interpretation of the regression coefficients.

3 RESULTS

After completing all necessary adjustments, OLS HAC-adjusted regressions were conducted to mitigate the impact of heteroskedasticity and autocorrelation. A regression was initially conducted using only the Vol BR variable, representing the implied volatility of the Brazilian market, as the independent factor. Subsequently, as each new variable was added, a new regression was carried out to understand the effect of adding each independent variable to the model. The results were compiled in Table 1. The values represent the coefficients of each variable with their respective significance levels.

Table 1 — Regression Results of 3-5 Year Forward Rates *versus* Market Risks (Equation 1 and 2)

| | Dependent variable: Forward Rate | | | |
	(1)	(2)	(3)	(4)
const	0.0008	0.0033***	0.0026	0.0028*
	(0.0018)	(0.0013)	(0.0016)	(0.0016)
Vol BR	2.8413***	2.3873***	1.8076**	1.5402
	(0.7896)	(0.5665)	(0.8161)	(1.0304)
Dummy Vol BR		-1.3094***	-1.1311***	-0.2656
		(0.2537)	(0.3101)	(1.1947)
VIX			0.8549	1.0618
			(1.0165)	(1.1693)
Dummy VIX				-1.0055
				(1.1978)
Observations	252	252	252	252
R^2	0.1932	0.4943	0.5010	0.5032
Adjusted R^2	0.1900	0.4902	0.4950	0.4952
Residual Std. Error	0.0025 (df=250)	0.0019 (df=249)	0.0019 (df=248)	0.0019 (df=247)
F Statistic	12.9497*** (df=1; 250)	15.9940*** (df=2; 249)	10.3065*** (df=3; 248)	8.6482*** (df=4; 247)
AIC	-2311.4964069417074	-2427.200786556552	-2428.5846309619187	-2427.679419855788
BIC	-2304.4375487666844	-2416.6124992940177	-2414.466914611873	-2410.0322744182313

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

Examining the values in table 1, we can see that in all regression models, the Dummy Vol BR variable remained negative, with statistically significant values in models (2) and (3). Notably, the sum of Vol BR and Dummy Vol BR is positive, which maintains economic coherence, as higher values of risk are expected to lead to a higher forward rate (fiscal risk). However, with Dummy Vol BR being negative, this indicates that the sensitivity of the yield curve to market uncertainties has decreased after the autonomy of the Central Bank of Brazil, resulting in less risk transmission to the long-term yields.

In regression (4), all variables lose significance. Nonetheless, a consistent pattern of negative values for the dummy variables and a positive sum persists, indicating a certain degree of coherence. When compared with model (3), it is apparent that the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) values are higher, while the adjusted R² is nearly identical.

The models were modified by incorporating returns from the Bovespa and S&P 500 indices to account for the directional impact of market risk. Table 2 shows the results.

Table 2 — Regression Results of 3-5 Year Forward Rates *versus* Market Risks and Equity Market Returns from the Ibovespa Index and S&P 500 (Equation 3)

	Dependent variable: Forward Rate			
	(1)	(2)	(3)	(4)
const	0.0005	0.0031**	0.0023	0.0024
	(0.0019)	(0.0013)	(0.0018)	(0.0018)
Vol BR	2.9685***	2.4640***	1.8125**	1.5593
	(0.8157)	(0.5756)	(0.8257)	(1.0377)
Ret Ibov	0.0219**	0.0125	0.0100	0.0103
	(0.0095)	(0.0083)	(0.0089)	(0.0090)
Dummy Vol BR		-1.2977***	-1.0903***	-0.2582
		(0.2535)	(0.3135)	(1.1937)
VIX			0.9886	1.1791
			(1.0895)	(1.2230)
Ret SP			0.0095	0.0086
			(0.0155)	(0.0156)
Dummy VIX				-0.9691
				(1.2000)
Observations	252	252	252	252
R^2	0.2041	0.4978	0.5058	0.5078
Adjusted R^2	0.1977	0.4917	0.4957	0.4957
Residual Std. Error	0.0024 (df=249)	0.0019 (df=248)	0.0019 (df=246)	0.0019 (df=245)
F Statistic	7.0397*** (df=2; 249)	11.7878*** (df=3; 248)	7.5478*** (df=5; 246)	6.8268*** (df=6; 245)
AIC	-2312.906553932596	-2426.9605542509885	-2426.988199775021	-2426.0119021513315
BIC	-2302.318266670062	-2412.842837900943	-2405.811625249952	-2401.3058985387515
Note:				*p<0.1; **p<0.05; ***p<0.01

After analyzing the results, it is apparent that a behavior similar to the one previously observed has been identified. The Dummy Vol BR variable remains negative in the regressions, with statistical relevance in the first models. Additionally, the sum of Vol BR and Vix with their respective dummies remains positive, maintaining the coherence between higher risk and a steeper yield curve. It is also noticeable that the adjusted determination coefficient slightly improved among the different regression models.

In order to conduct an additional robustness test, a "lag" effect in the activation of the dummy variables was introduced. The dataset was divided into two segments. The initial segment incorporates information from the six months leading up to the Brazilian Senate's approval of the bill conferring autonomy to the central bank on November 3, 2020. The subsequent segment encompasses data from the six months after the implementation of autonomy on February 25, 2021. This method engendered a temporal interval between the two scrutinized periods as opposed to an abrupt transition on a singular date. This "lag" effect is represented in figure 1:

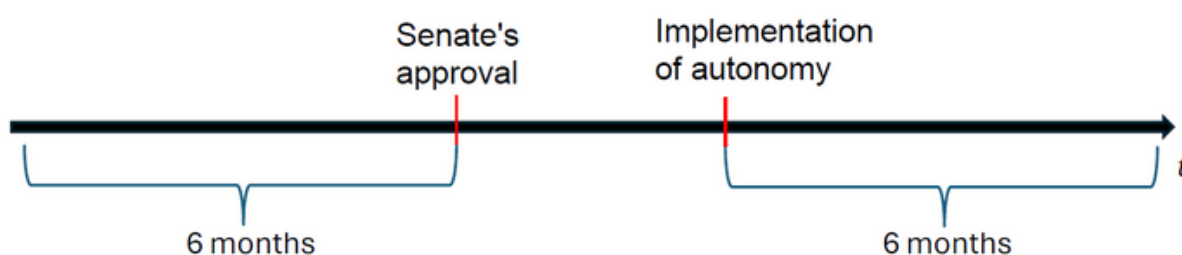Figure 1 — Data window used for robustness tests.

Table 3 shows the results after this temporal division.

Table 3 — Regression Results of 3-5 Year Forward Rates *versus* Market Risks and Equity Market Returns from the Ibovespa Index and S&P 500, including a time lag to activate the dummy variables.

	Dependent variable: Forward Rate			
	(1)	(2)	(3)	(4)
const	-0.0017	0.0056***	0.0058***	0.0059***
	(0.0016)	(0.0011)	(0.0018)	(0.0018)
Vol BR	4.1440***	2.2626***	2.3765***	2.1381***
	(0.5562)	(0.3820)	(0.4331)	(0.5029)
Ret Ibov	0.0375***	0.0160**	0.0135**	0.0141**
	(0.0115)	(0.0067)	(0.0068)	(0.0067)
Dummy Vol BR		-2.1581***	-2.2018***	-1.0936
		(0.2221)	(0.2836)	(0.8829)
VIX			-0.1965	0.0110
			(0.8376)	(0.9085)
Ret SP			0.0056	0.0042
			(0.0093)	(0.0093)
Dummy VIX				-1.3205
				(0.9881)
Observations	252	252	252	252
R^2	0.4522	0.8224	0.8229	0.8252
Adjusted R^2	0.4478	0.8203	0.8193	0.8209
Residual Std. Error	0.0027 (df=249)	0.0015 (df=248)	0.0016 (df=246)	0.0015 (df=245)
F Statistic	28.2083*** (df=2; 249)	64.9841*** (df=3; 248)	50.9948*** (df=5; 246)	42.3828*** (df=6; 245)
AIC	-2260.3581854720837	-2542.209951917625	-2538.8886114384813	-2540.1307476524703
BIC	-2249.7698982095494	-2528.0922355675793	-2517.7120369134127	-2515.4247440398904

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

As seen in previous regressions, it is possible to observe that the general pattern of the coefficients remained the same. The coefficients of the Dummy Vol BR variable remained negative in the regressions, maintaining statistical significance in models 2 and 3. The sum of the Vol BR and VIX variables with their respective dummies also remains positive, maintaining previously observed coherence.

With this temporal adjustment, it is noticeable that the adjusted R² coefficient increased significantly, and the AIC and BIC indicators improved. This could indicate that the market would take some time to assimilate the effects of risk transfer in the yield curve after the autonomy of the Central Bank of Brazil. The period between the bill's approval by the Senate, its passage through the House of Representatives, and its consolidation may have influenced market pricing.

4 **CONCLUSION**

Central bank autonomy has been a topic of global interest and is expected to continue stimulating discussions among authors worldwide. This study focuses on the impacts of the autonomy process of the Central Bank of Brazil on the structure of the Brazilian yield curve, particularly from the perspective of risk pass-through. Specifically, we focus on the 3-5 years forward rate that can be viewed as a proxy of fiscal risk.

For this study, daily data on the parameters of the Nelson-Siegel-Svensson model were collected to construct the yield curve, along with variables indicating uncertainty and risk in both domestic and global markets. The results indicate a lower risk transfer to long-term interest rates after the establishment of the autonomy. This can suggest that the financial authority's autonomy process mitigated the sensitivity of the Brazilian yield curve to local risks and uncertainties, which is a positive outcome for the Brazilian economy.

This study highlights the potential benefits that the independence process of central banks can foster in an economy. By mitigating the risk pass-through to the yield curve, this autonomy can contribute to a more stable economic environment and strengthen investor confidence. These insights can be valuable for policymakers as they navigate the complexities of economic governance and financial regulation.

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