Decomposing Nominal and Real Yield Curves: Term Premium Dynamics and Inflation Forecasts in Brazil

Werley C. Cordeiro[1] and João F. Caldeira*[2]

[1]Sicredi Asset Management - Brazil

[2]Department of Economics, Federal University of Santa Catarina, Florianópolis/SC - Brazil

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Abstract

This study employs an arbitrage-free affine term structure model (AFTSM) to jointly estimate nominal and real interest rates, allowing the decomposition of the breakeven inflation rate (BEIR) into inflation expectations and the inflation risk premium (IRP). The methodology provides high-frequency estimates of inflation expectations while accounting for time-varying IRP, which increases with maturity. The findings reveal: (i) a moderate correlation between the IRP and Credit Default Swap (CDS) premiums on Brazilian sovereign debt, and (ii) that breakeven inflation rates adjusted for risk premia enhance the accuracy of inflation forecasts derived from market participant surveys. These results contribute to fiscal risk assessment and offer critical insights into the role of inflation expectations in shaping monetary policy strategies.

JEL classification: C53; E43; G17.

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*Corresponding author. E-mail: emaildocaldeira@gmail.com

1 Introduction

Inflation expectations are crucial for economic policy, serving as a key channel for monetary policy within an inflation-targeting regime, as well as for fiscal policy decisions regarding budgeting and public debt financing. Two well-known measures of inflation expectations are surveys of market participants and the break-even inflation rate (BEIR), the spread between real and nominal yields. While the former may incorporate lack of financial incentives, the latter has the advantage of acting as a real-time measure of inflation expectations (IE).

Examining IE in Brazil is of paramount importance due to the relevance to fiscal and monetary policies. First, inflation-linked bonds (ILBs) played a major role in shaping the nation's debt profile. In 2020, ILBs represented 23% of Brazil's total debt, a proportion that exceeds that of the United Kingdom (22%) and the United States (6%), while remaining second only to Chile (43%) (Velandia-Rubiano *et al.*, 2022). Furthermore, at the end of 2020, Brazil's outstanding stock of tradable ILBs amounted to 221 billion US dollars, ranking it behind the United States (1.5 trillion US dollars), the United Kingdom (612 billion), and France (271 billion). Such significance underscores the importance of monitoring fiscal stability and price levels to maintain fiscal equilibrium and bolster investor confidence.

Second, in March 1999, Brazil adopted an inflation-targeting framework, with the Central Bank of Brazil (BCB) aiming to keep inflation within a tolerance range through the use of the Selic rate, the primary instrument of monetary policy[1]. The Selic rate seeks to influence inflation through various channels, including inflation expectations. Additionally, the BCB's Market Expectations System monitors market expectations regarding key macroeconomic variables, including inflation at multiple horizons ahead, providing crucial inputs for the monetary policy decision-making process. Thus, forward-looking inflation plays a critical role for policymakers in ensuring price stability.

The primary objective of this paper is to decompose the BEIR for the Brazilian economy into inflation expectations and the inflation risk premium, using the approach proposed by Abrahams *et al.* (2016) for joint pricing of nominal and real yield curves. Our hypothesis is that the decomposition of the BEIR can improve market forecasts for inflation and identify correlations with fiscal risk. This paper contributes to the literature in two ways: first, it examines the relationship between the inflation risk premium and Credit Default Swap premia on sovereign Brazilian debt as a proxy for fiscal stability (Fender *et al.*, 2012; Jeanneret, 2018; Rodríguez *et al.*, 2019) and we evaluate IE as a predictor of inflation over horizons relevant to monetary policy. The results suggest that decomposing the BEIR reveals a moderate positive correlation between IRP and CDS, and that IE could improve the accuracy of inflation survey forecasts in Brazil. These findings may imply alternative parameters for policymakers to evaluate fiscal stability in terms of risk premiums, as well as the effectiveness of monetary policy in shaping market expectations.

The structure of this paper is as follows: Section 2 outlines the methodology for jointly pricing nominal and real curves. Section 3 examines the dataset, results, and implications of the findings for fiscal and monetary policy. Finally, Section 4 summarizing the main insights.

[1]See the webpage at:Inflation targeting in Brazil

2 The Joint Model for Nominal and Real yields

Affine term structure models (ATSMs), since Duffee (2002), are the most commonly used class of models in the literature for decomposing interest rates on government bonds. More recently, the approach developed by Adrian *et al.* (2015) has been widely used to decompose interest rates into their components: expectation and forward premium. This section presents an ATMS model specification following the exposition of Abrahams *et al.* (2015) and Abrahams *et al.* (2016).

The price, at time t, of a zero-coupon bond with maturity n is denoted by $P_t^{(n)}$. As is common in Gaussian models for the term structure, it is assumed that the vector of state variables is governed by an autoregressive process of the type VAR(1):

$$X_{t+1} - \mu_X = \Phi\left(X_t - \mu_X\right) + \nu_{t+1}, \qquad \nu_{t+1} \sim \mathscr{N}(0, \Sigma) \tag{1}$$

where the shocks ν_{t+1} are conditionally Gaussian, homoscedastic and independent over time. A single pricing mechanism is introduced to enforce the absence of arbitrage which governs all traded assets:

$$P_t^{(n)} = \mathbb{E}\left\{M_{t+1} P_{t+1}^{(n-1)}\right\}. \tag{2}$$

The stochastic discount factor M_t (pricing kernel) is a function of the short-term interest rate and the risk perceived by the market:

$$M_{t+1} = \exp\left(-r_t - \frac{1}{2}\lambda_t' \lambda_t - \lambda_t' \Sigma^{-1/2} \nu_{t+1}\right), \tag{3}$$

where $r_t = \ln P_t^{(n)}$ denotes the risk-free interest rate that is continuously compounded. In Gaussian ATSMs the log price, $P_t^{(n)}$, of a risk-free discount bond with remaining time to maturity n follows $\log P_t^{(n)} = A_n + B_n^{prime} X_t$ which implies that:

$$r_t = \delta_0 + \delta_1' X_t. \tag{4}$$

The risk market price vector, λ_t, is an essentially affine function of the factors, as in Duffee (2002):

$$\lambda_t = \Sigma^{-1/2}\left(\lambda_0 + \lambda_1 X_t\right), \tag{5}$$

where λ_0 and λ_1 have dimensions $K \times 1$ and $K \times K$, respectively. Further defines:

$$\tilde{\mu} = \left(I_K - \Phi\right)\mu_X - \lambda_0, \tag{6}$$

$$\tilde{\Phi} = \Phi - \lambda_1. \tag{7}$$

These parameters govern the dynamics of the pricing factors under the risk-neutral and feature prominently in the recursive pricing relationships derived below.

Given the above assumptions, it can be shown that interest rates on zero-coupon bonds are affine functions of the factors (Ang & Piazzesi, 2003):

$$y_t^{(n)} = -\frac{1}{n}\left(A_n + B_n' X_t\right), \tag{8}$$

where the coefficients A_n and B_n follow the recursive equations:

$$A_n = A_{n-1} + B_{n-1}'\tilde{\mu} + \frac{1}{2}B_{n-1}'\Sigma B_{n-1} - \delta_0, \quad A_0 = 0 \tag{9}$$

$$B_n' = B_{n-1}'\tilde{\Phi} - \delta_1', \quad B_0 = 0_{K\times 1}. \tag{10}$$

Recently, there has been a growing interest in the literature in recovering expectations about future inflation rates from the nominal and real term structure of interest rates (Abrahams *et al.*, 2016; Breach *et al.*, 2020). Let Q_t be a time price index t and let $P_{t,R}^{(n)}$ be the price in t of an inflation-indexed bond with face value 1, which pays the amount $\frac{Q_{t+n}}{Q_t}$ at maturity, $t+n$. The price of such a title satisfies the following:

$$P_{t,R}^{(n)} = \mathbb{E}_t\left\{\exp\left(-r_t - \ldots - r_{t+n-1}\right)\frac{Q_{t+n}}{Q_t}\right\}. \tag{11}$$

Denote the log-inflation for one period by $\pi_t = \ln\left(\frac{Q_t}{Q_{t-1}}\right)$, therefore:

$$\frac{Q_{t+n}}{Q_t} = \exp\left(\sum_{i=1}^{n}\pi_{t+i}\right). \tag{12}$$

As in the case of nominal bonds, the prices of inflation-indexed bonds are exponentially affine in terms of pricing factors:

$$\log P_{t,R}^{(n)} = A_{n,R} + B_{n,R}' X_t. \tag{13}$$

Thus, one-period inflation is also a linear function of the state variables:

$$\pi_t = \pi_0 + \pi_1' X_t,$$

where π_0 is a scalar and π_1 is a vector of dimension $(K \times 1)$. According to Abrahams *et al.* (2016), it is possible to derive recursions for the prices of inflation-linked bonds by rewriting the equation (11) in terms of the price of another inflation-linked bond traded one period ahead:

$$P_{t,n}^{R} = \mathbb{E}_t\left\{\exp\left(-r_t + \pi_{t+1}\right)P_{t+1,R}^{(n-1)}\right\}. \tag{14}$$

Solving this equation and combining the coefficients, we arrive at the coefficients of Equation (13), which are determined by the following system of equations in differences:

$$A_{n,R} = A_{n-1,R} + B^{\pi\prime}_{n-1,R}\tilde{\mu} + \frac{1}{2}B^{\pi\prime}_{n-1,R}\Sigma B^{\pi}_{n-1,R} - \delta_{0,R}, \quad A_{0,R} = 0 \tag{15}$$

$$B'_{n,R} = B^{\pi\prime}_{n-1,R}\tilde{\Phi} - \delta'_1, \quad B_{0,R} = 0_{K\times 1}. \tag{16}$$

where $\delta_{0,R} = \delta_0 - \pi_0$ and $B^{\pi}_{n,R} = (B_{n,R} + \pi_1)\ \forall n$. Making the parameters referring to the risk market price, λ_0 and λ_1, equal to zero in the systems of equations (9)-(10) and (15)-(16), we obtain the risk-adjusted pricing parameters (makes the mapping of the risk-neutral measure, $\mathbb{Q}$, to the physical measure, $\mathbb{P}$).

3 Data and Results

We use end-of-month values from 2006:01 to 2024:12 for a total of $T = 228$ monthly observations. In the estimation, a cross-section of $N_N = 11$ one-month excess holding period returns for nominal rates with maturities $n = 6, 12, 24, \ldots, 120$ months and $N_R = 9$ excess returns on NTNB$'$s with maturities $n = 24, \ldots, 120$ months was used. The Selic rate serves as the nominal risk-free rate. The price index Q_t, used to calculate NTNB$'$ payouts, is the IPCA index, which is available from IBGE[2].

3.1 In-Sample Analysis

Following Abrahams *et al.* (2016), Adrian *et al.* (2015), Joslin *et al.* (2011), and Wright (2011), we calculate principal components from yields to use as pricing factors in the model. Specifically, two sets of principal components are considered. First, $K_N = 3$ principal components are extracted from nominal yields with maturities $n = 6, 12, 24, \ldots, 120$ months. Then, additional factors are obtained as the first $K_N = 2$ principal components from the residuals of regressions of NTNB$'$ yields with maturities $n = 24, \ldots, 120$ months on the K_N nominal principal components. This orthogonalization step reduces unconditional collinearity among the pricing factors. In total, $K = K_N + K_R = 5$ model factors are used, as shown in Figure 1.

We show the results in-sample in Table 1. In the context of nominal yield pricing errors, the observed mean values exhibit a progression from negative to positive as maturities extend, implying a potential increase in pricing discrepancies over time horizons. The standard deviation demonstrates fluctuations, with reduced variability at intermediate maturities and slightly elevated dispersion at shorter and longer maturities. Skewness transitions from positive to negative as maturities increase, indicating a shift in the directional bias of errors. Kurtosis measures further reveal varied distributions, with certain maturities exhibiting sharper peaks, suggesting higher concentrations of errors, whereas others approximate more normalized distributions.

Regarding real yield pricing errors, the mean values oscillate between negative and positive without a clear trend, underscoring the absence of a consistent directional pattern. The standard

[2]See the webpage at: IBGE - Extended National Consumer Price Index

Figure 1: **Pricing factors: observed time series**

Note: This figure plots the time series of the factors of our model. These are the first three principal components extracted from the cross-section of end-of-month observations of nominal yields of maturities $n = 6, 12, 24, \ldots, 120$ months. The fourth and fifth factors are the first two principal components extracted from the cross-section of orthogonalized real yields of maturities $n = 24, \ldots, 120$, the residuals from regressing real yields on the first three principal components of the nominal yield curve.

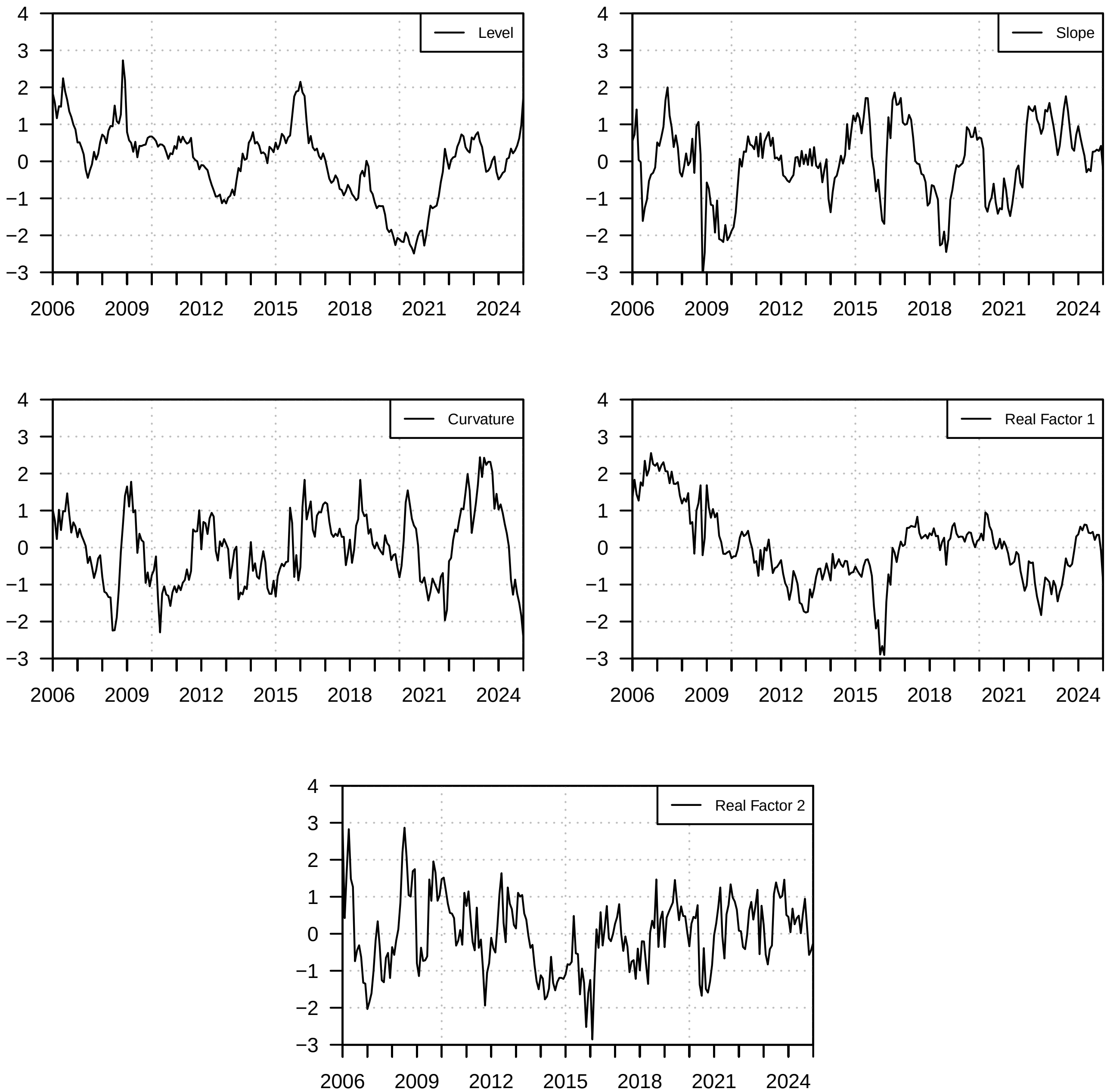


Table 1: **Fit Diagnostics**

Note: This table summarizes the time series properties of the pricing errors implied by the model. "mean", "std", "skew", and "kurt" refer to the sample mean, standard deviation, skewness, and kurtosis of the errors. Panel 1 and Panel 2 reports properties of the nominal and real yield pricing errors, respectively. The sample period is 2006:01–2024:12.

	Maturities						
	12	18	24	36	48	60	120
Panel 1: Nominal							
mean	−0.032	−0.012	−0.002	0.003	0.013	0.028	0.087
std	0.182	0.134	0.090	0.092	0.124	0.129	0.104
skew	0.774	0.409	−0.149	−0.330	−0.529	−0.345	0.247
kurt	3.431	3.547	3.336	2.471	2.778	3.119	3.241
Panel 2: Real							
mean	−0.041	0.001	0.027	0.014	−0.010	−0.018	0.029
std	0.446	0.267	0.168	0.075	0.116	0.126	0.057
skew	0.029	0.299	0.389	−0.067	−0.205	−0.381	0.598
kurt	2.731	3.916	5.007	4.448	3.365	4.062	4.304

deviation reflects a marked decrease with increasing maturities, pointing to diminished volatility in longer-term errors. The skewness metric encompasses a range from near symmetry to more pronounced asymmetry, illustrating variability in error distributions across different maturities. Similarly, kurtosis unveils sharper peaks at mid-range maturities, signifying higher concentrations of errors, contrasted with flatter distributions observed at the shorter and longer ends of the maturity spectrum.

We provide detailed results of risk neutral yields and term premiums for nominal and real yields in Figures 2, 3, and 4, focusing specifically on maturities of five years. This choice reflects the average maturity observed in Brazilian Public Debt during the analyzed sample period[3]. Notably, the five-year horizon emerged as the empirical upper limit for maturity within this dataset, making it a representative benchmark for analysis.

Figure 2 exhibits the decomposition of the nominal yield curve at five-year maturities spans the period from January 2006 to December 2024, offering insights into nearly two decades of economic and financial dynamics. The observed nominal yield, represented by the solid black line, is the sum of its components: the risk-neutral yield (blue line) and the term premium (orange line). The black line exhibits significant fluctuations tied to key events, such as sharp declines during the 2008–2009 financial crisis and movements around 2020 reflecting the COVID-19 pandemic and monetary easing. The risk-neutral yield remains relatively stable, representing the expectation-driven component of nominal yields, while still responding to macroeconomic trends like monetary

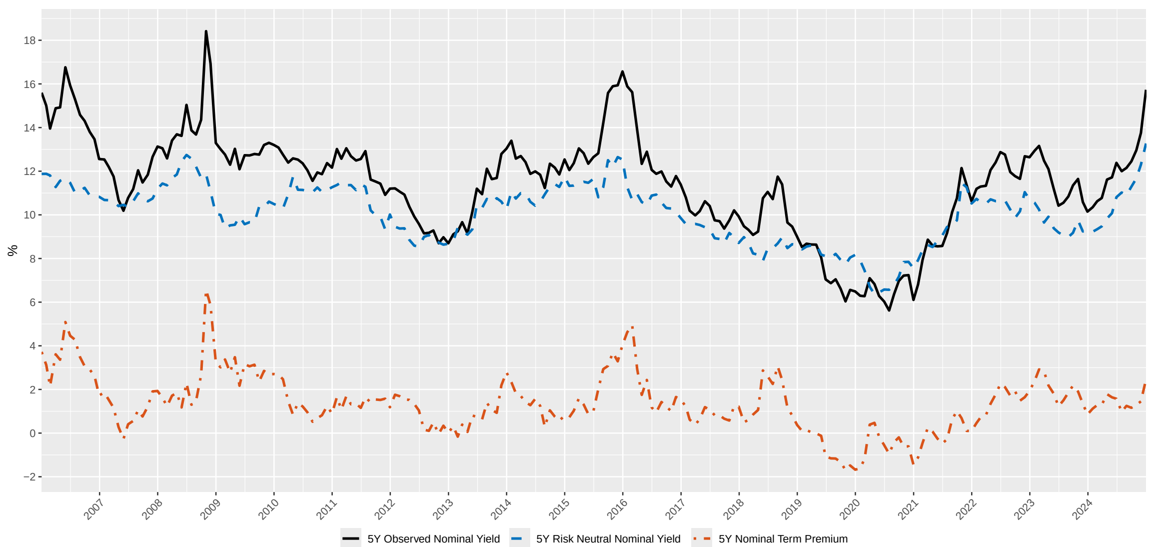
[3]See the webpage at: Brazilian National Treasury - Monthly Debt Report

policy adjustments.

In contrast, the term premium captures the additional risk compensation required by investors and exhibits notable volatility, including negative values in the mid-2010s that may reflect investor confidence during stable economic conditions. The term premium also fluctuates more sharply after 2020, aligning with increased uncertainty, policy adjustments, and inflationary pressures. This decomposition clarifies how shifts in expectations and risk compensation drive the overall behavior of nominal yields.

Figure 2: **Nominal Term Premium**

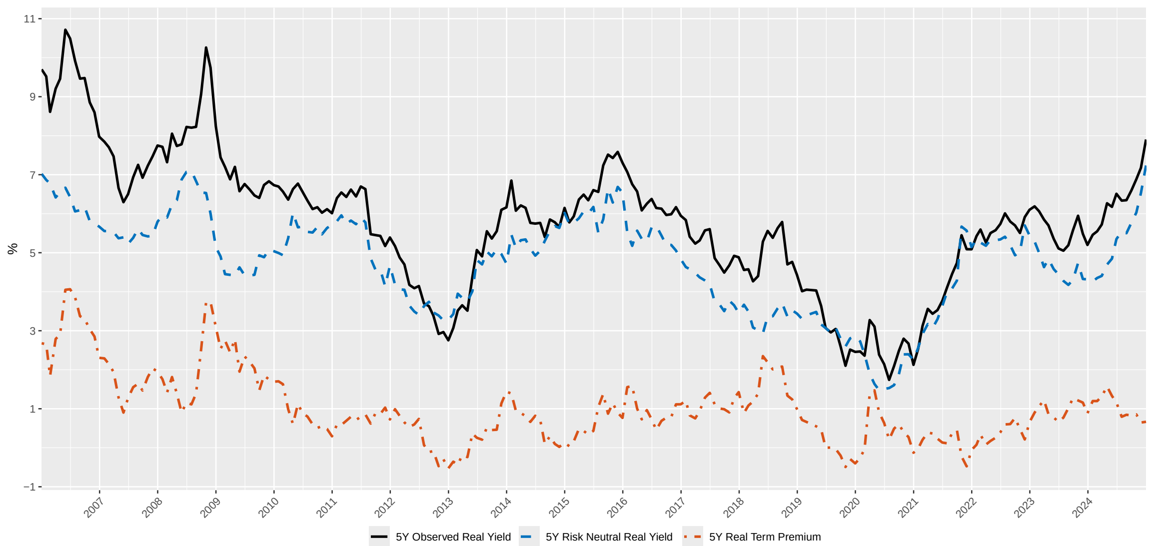
Note: This figure provides time series plots of the decomposition of the observed nominal yield curves in risk-neutral yield and yield term premium at five-year maturity.



The decomposition of the real yield curve at five-year maturities, as shown in Figure 3, follows a similar structure to the nominal yield decomposition. The risk-neutral real yield (blue line) remains relatively stable throughout the period when compared to the observed real yield (black line), which exhibits more pronounced fluctuations over time. In contrast, the real term premium (orange line) demonstrates significant volatility, contributing to the variability observed in the black line. This analysis enhances the understanding of the factors influencing real yields, complementing the nominal yield decomposition by emphasizing inflation-adjusted returns and the dynamics of associated risk compensation.

Figure 3: **Real Term Premium**

Note: This figure provides time series plots of the decomposition of the observed real yield curves in risk-neutral yield and yield term premium at five-year maturity.



The decomposition of the five-year breakeven inflation rate isolates its components into expected inflation and the inflation risk premium. The BEIR, depicted as the solid black line in Figure 4, represents the differential between nominal and real yields, incorporating market expectations regarding future inflation and the compensation required to account for inflation-related uncertainties. Throughout the period under analysis, the BEIR displays variations influenced by economic and financial conditions.

Expected inflation, represented by the dashed blue line, reflects the model-implied market forecasts concerning inflation over the five-year horizon. This component captures systematic expectations about inflation dynamics during the studied period, remaining less variable compared to the overall BEIR.

The inflation risk premium, the difference between BEIR and IE, depicted by the dashed orange line, represents the additional yield demanded by investors to account for uncertainties associated with future inflation. This component exhibits higher variability, particularly during periods of heightened uncertainty, such as after 2020. The decomposition facilitates an understanding of the contributions of both inflation expectations and risk compensation to the evolution of the BEIR over time.

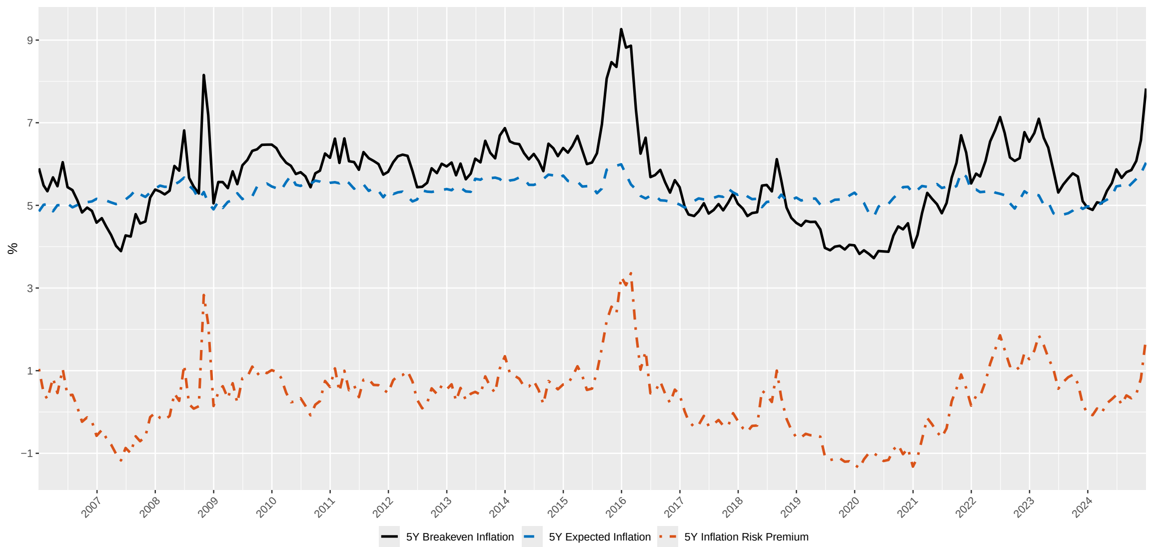
In the next two sections, we will examine in greater detail two outcomes of the model: the inflation risk premium and inflation expectations.

3.2 Inflation Risk Premium and Credit Default Swap

The inflation risk premium compensates investors for potential losses in purchasing power due to unexpected inflation, making it a critical component of asset pricing, especially in uncertain economic environments. Similarly, Credit Default Swaps protect against default risk by transferring

Figure 4: **BEIR Decomposition**

Note: This figure shows the decomposition of breakeven inflation rates, the spread between real and nominal yields, into the model-implied expected inflation and the inflation risk premium. The panels show this decomposition at five-year maturity.



credit risk from the buyer to the seller. Unstable economic and political conditions may amplify both inflation and credit risks, and also rising inflation may increase the IRP as investors seek higher returns, while diminished real debt repayments may elevate CDS premiums. This interplay reflects the connection between inflation expectations, inflation risk premium, credit risk, and political-economic uncertainty. We follow Fender *et al.* (2012), Jeanneret (2018), and Rodríguez *et al.* (2019), who suggest that the CDS premiums on sovereign debt serve as a proxy for fiscal stability.

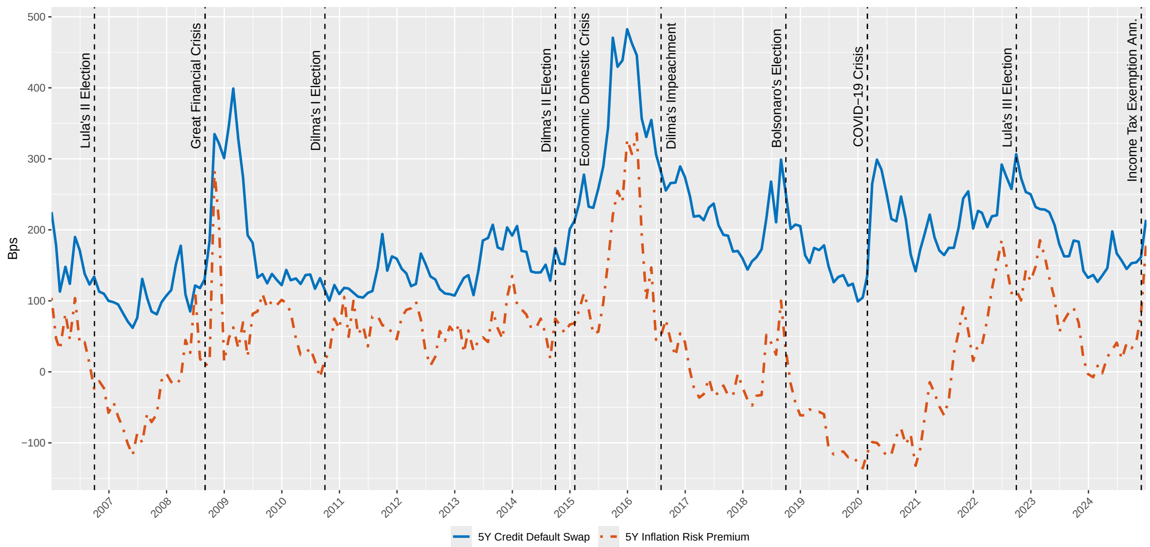
The Figure 5 illustrates the historical relationship between Brazil's 5-Year Credit Default Swap, represented by the solid blue line, and the 5-Year Inflation Risk Premium, represented by the dashed orange line, over the period from 2006 to 2024. The vertical axis, labeled in basis points (Bps). We also highlights significant political and economic events in Brazil with vertical dashed lines, providing contextual markers to interpret the behavior of these metrics.

The CDS and the IRP exhibit notable spikes during periods of political and economic instability. For instance, the Great Financial Crisis (2008), Dilma's Impeachment (2016), and the Lula's Election (2022) correspond to heightened volatility in both metrics. Similarly, during Bolsonaro's Election (2018), the CDS shows a marked increase, reflecting investor concerns about fiscal stability and political uncertainty, marked by antagonism toward the Workers' Party. The IRP also fluctuates during this period, indicating inflation-related apprehensions tied to Bolsonaro's economic policies and their potential impact on long-term inflation expectations.

The alignment and divergence between the CDS and IRP provide insights into the interplay between credit risk and inflation expectations. Political events, such as Lula's Elections (2006 and 2022) and Bolsonaro's Election (2018), demonstrate how shifts in governance influence market sentiment. Additionally, fiscal measures like the Income Tax Exemption Announcement (2024) appear to impact IRP, reflecting market perceptions of inflationary pressures. This analysis underscores

Figure 5: **Brazil Credit Default Swap and Inflation Risk Premium**

Note: The chart shows Brazil's 5-Year Credit Default Swap (CDS) and Inflation Risk Premium (IRP) trends from 2006 to 2024. Key political and economic events are marked, with CDS spikes during crises, while IRP fluctuates moderately, reflecting inflation risks.



the influence of political and economic events on sovereign creditworthiness and inflation risk.

3.3 Out-of-Sample Analysis

In inflation forecasting, we use model-implied inflation expectations as predictors, representing breakeven inflation rates adjusted for risk premia. For instance, the 12-month maturity is used to predict inflation 12 months ahead, and so forth. The same approach applies to unadjusted breakeven inflation, which also serves as a predictor of future inflation. In addition, BEIR and IE forecasts are combined with the Focus survey. Forecasts are performed over horizons ranging from 12 to 36 months, with forecasting errors computed using overlapping observations.

Table 2 presents out-of-sample results, utilizing an 11-year "learning period" from January 2006 to December 2015, and forecasts spanning the period from December 2016 to December 2024. The 12-month-ahead forecast includes 97 observations, the 18-month-ahead forecast includes 91 observations, the 24-month-ahead forecast includes 85 observations, and the 36-month-ahead forecast includes 73 observations. "EI" refers to model-implied inflation expectations derived in Section 2, representing breakeven inflation rates adjusted for risk premia. "BEIR" uses unadjusted breakevens as predictors of future inflation, while the Focus survey consists of forecasts from market participants compiled by the Brazil Central Bank. "Focus + EI" and "Focus + BEIR" calculate weighted forecasts for $t + 1$ based on individual model errors in t. Forecasts are conducted over horizons ranging from 12 to 36 months, with forecasting errors computed using overlapping observations.

Table 2: **Mean Absolute Relative Error in Inflation Projections**

Note: This table presents a comparison of the mean absolute error (MAE) in inflation forecasting (IPCA) for competing models relative to the Focus benchmark model, so values greater than 1 indicate worse forecasting performance compared to the Focus model. The "EI" is the model-implied inflation expectations derived in Section 2, representing breakeven inflation rates adjusted for risk premia, "BEIR" takes unadjusted breakevens as a predictor of future inflation, and Focus survey represents forecasts from market participants compiled by the Brazil Central Bank. "Focus + EI" and "Focus + BEIR" calculate weights forecasts to $t+1$ based on individual model errors in t. Forecasts are performed over horizons from 12 to 36 months, and forecasting errors are computed using overlapping observations. The panel reports out-of-sample results, utilizing an eleven-year "learning period" from 2006:01 to 2016:12 and forecasting over the period 2017:12 to 2024:12. The smallest values are in bold.

	Horizons			
Model	n = 12	n = 18	n = 24	n = 36
Focus	1.996	2.138	2.207	2.397
EI	1.104	1.153	1.149	1.023
BEIR	1.143	1.257	1.235	1.071
EI + Focus	1.030	**0.991**	**0.940**	**0.879**
BEIR + Focus	1.034	1.031	1.002	1.142

Each model's performance is benchmarked against the Focus model, which is presented in absolute values, while all other models reflect relative errors. This structure allows for a thorough comparison of methodologies and highlights the strengths and limitations of each approach. The Focus model serves as the baseline, presenting MAE values that consistently increase with longer forecasting horizons. Starting at 1.996 for the 12-month horizon and climbing to 2.397 for the 36-month horizon, the model exhibits declining predictive accuracy over time.

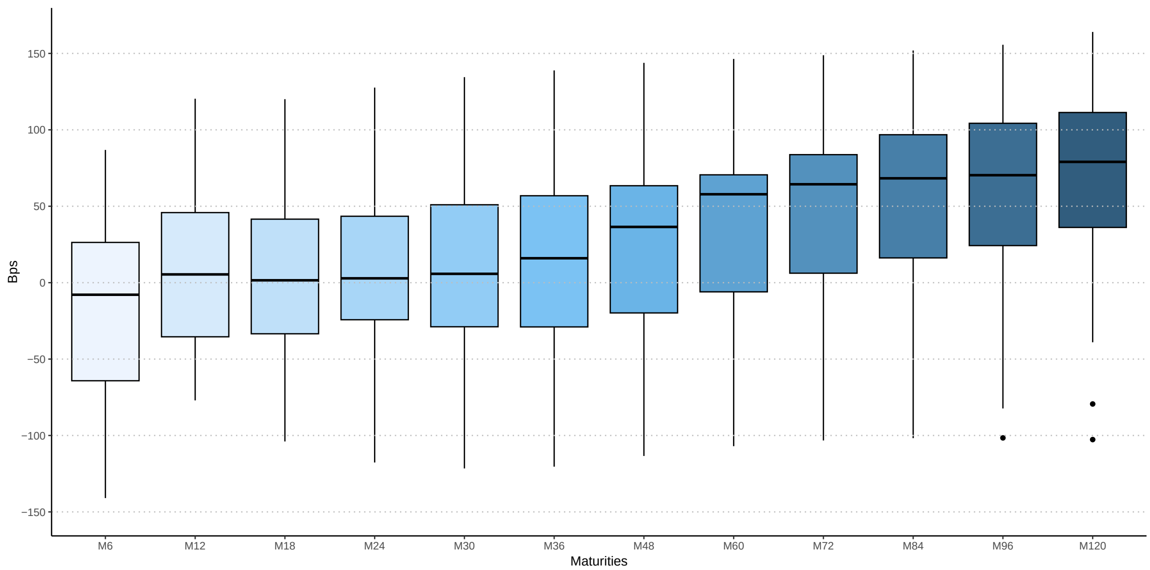
The EI model and the BEIR model both exhibit relative MAE values greater than 1, which means they perform worse than the Focus benchmark. However, when comparing EI and BEIR directly, EI demonstrates slightly better performance across all horizons. For instance, at the 12-month horizon, EI's relative MAE value is 1.104, compared to BEIR's 1.143. This pattern persists across the longer horizons, with EI showing smaller errors than BEIR (e.g., 1.023 vs. 1.071 at the 36-month horizon). The relatively lower MAE values for EI suggest that adjustments for inflation risk premia enhance its forecasting accuracy more effectively than BEIR, which does not account for IRP. While both models underperform compared to Focus, EI consistently outperforms BEIR, indicating it benefits more from incorporating adjustments to reflect market premiums.

The BEIR+Focus model shows a mixed performance, with relative MAE values hovering around 1.034 (12 months) and reaching 1.142 (36 months). While this combination provides marginal improvements over BEIR alone, it struggles to consistently outperform Focus, particularly in longer horizons. This underscores the comparative weakness of BEIR's methodology even when integrated with survey-based predictions.

Among the combined models, EI+Focus demonstrates the highest accuracy, with relative MAE values consistently below 1. These values steadily decrease from 1.030 at the 12-month horizon to 0.879 at the 36-month horizon, making EI+Focus the only model to outperform Focus across all horizons. A possible explanation for this improvement is that we were able to remove the IRP, which is typically positive and increases with maturity, see Figure 6. By integrating EI's adjustments for IRP with the Focus survey, it potentially aligns theoretical frameworks with market forecasters, contributing to enhanced forecasting accuracy.

Figure 6: **Inflation Risk Premium Across Maturities**

Note: The chart illustrates the inflation risk premium across maturities (M6 to M120) in basis points (bps), highlighting its time-varying nature and rising trend for longer maturities within the observed period.

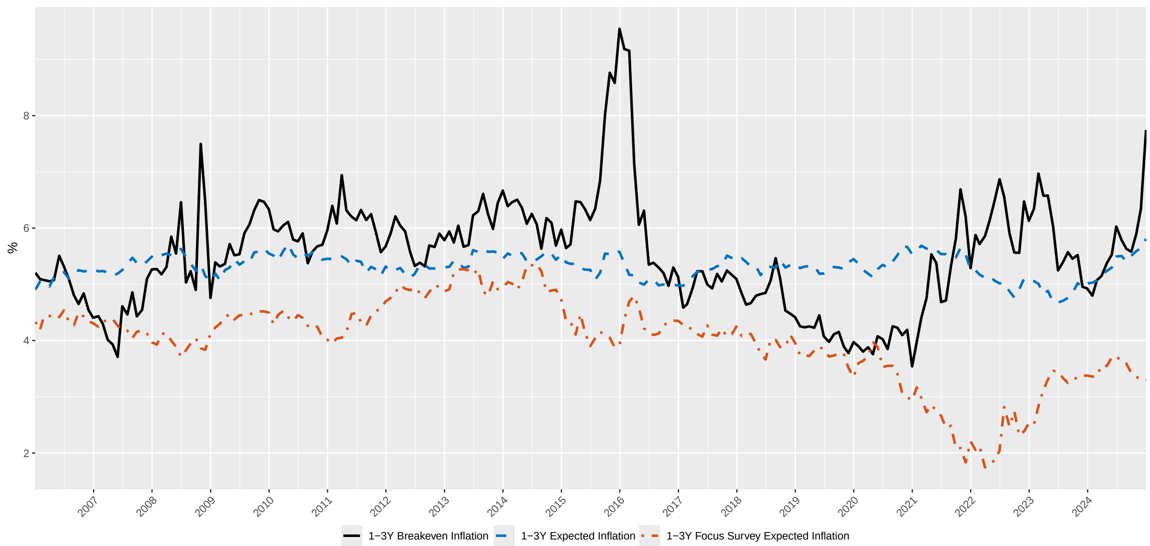


This result may shed light on the potential combinations of model-implied inflation expectations and market surveys regarding the anchoring of expectations. The Figure 7 provides plots of 1-3Y Breakeven Inflation, 1-3Y Model-Implied Expected Inflation, and 1-3Y Focus Survey Expected Inflation. The series illustrates key differences in how inflation expectations are formed and measured. The breakeven inflation captures the immediate reactions of markets to economic shocks, while the expected inflation provides a more stable and model-driven perspective. Meanwhile, the Focus survey bridges market sentiment and long-term forecasting assumptions, highlighting changes in perceptions of inflation anchoring over time.

Based on the results of the out-of-sample forecasts, it can be inferred that monetary policy has the potential to effectively anchor expectations within the bounds delineated by the dashed blue and dotted orange lines—an aspect that could be systematically monitored by the monetary authority to assess the degree of anchoring of inflation expectations, particularly for longer horizons, which also fall within the relevant horizon for monetary policy.

Figure 7: **1-3Y Forward Breakeven Inflation**

Note: The figure provides a comparative analysis of inflation expectations from different approaches.



4 Concluding remarks

This study underscores the critical role of decomposing the breakeven inflation rate (BEIR) into its two primary components: inflation expectations (IE) and the inflation risk premium (IRP), for better fiscal and monetary policy insights in Brazil. By leveraging an arbitrage-free Gaussian term structure model of Abrahams *et al.* (2016), we modeled nominal and real yield curves jointly, enabling the isolation of IRP and IE. The results reveal that term premiums are time-varying, generally increasing with maturity. Such decomposition provides a detailed understanding of long-term inflation risks and expectations.

Our analysis demonstrates a moderate positive correlation between the IRP and Credit Default Swap (CDS) premia on Brazilian sovereign debt, identifying IRP as a potential proxy for fiscal stability. The interaction between these variables indicates that periods of heightened fiscal risk—such as during economic or political instability—are often accompanied by significant increases in the IRP. For example, political events, including Lula's and Bolsonaro's elections, and major fiscal measures like the Income Tax Exemption Announcement in 2024, are reflected in both the CDS and IRP movements. These findings emphasize the alignment between credit risk and inflation risk in uncertain economic environments.

Furthermore, the integration of BEIR-derived IE with survey-based inflation expectations improves the precision of inflation forecasts. IE offers a real-time, market-driven perspective that complements survey forecasts, which may be subject to biases. Among the models analyzed, the EI+Focus model consistently provided superior forecasting accuracy, with relative MAE values falling below 1 across longer horizons. This improvement may be attributed to the removal of IRP, which is typically positive and increases with maturity, thus refining the accuracy of inflation forecasts. Overall, this study highlights the dual importance of understanding inflation expectations and the inflation risk premium in Brazil's fiscal and monetary policy contexts. Policymakers can utilize these insights to monitor fiscal stability, assess sovereign risk, and fine-tune monetary policy strategies.

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