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Macroeconomic Drivers of Brazil's Yield Curve

Gustavo Silva Araujo, José Valentim Machado Vicente, Wagner Piazza
Gaglianone

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Citizen Service Division

Banco Central do Brasil

Deati/Diate

SBS – Quadra 3 – Bloco B – Edifício-Sede – 2º subsolo

70074-900 Brasília – DF – Brazil

Toll Free: 0800 9792345

Fax: +55 (61) 3414-2553

Internet: <http://www.bcb.gov.br/?CONTACTUS>

Non-technical Summary

This paper examines how the Brazilian yield curve reacts to key macroeconomic fundamentals. Understanding these movements is important, as they influence government financing costs, private investment decisions, and the overall stability of the economy.

Using data from 2003 to 2025, the study analyzes the impact of inflation, fiscal policy, economic activity, and U.S. interest rates on domestic yields. The results show that inflation, economic activity, and global financial conditions consistently shape both short- and long-term rates. For instance, U.S. interest rates play a significant role in driving Brazil's long-term borrowing costs, reflecting the country's sensitivity to global markets.

A key finding is that fiscal policy matters, but in a specific way. Indicators of current fiscal flows, such as the primary surplus, affect the slope of the yield curve – the difference between long and short rates – more than stock variables like the debt-to-GDP ratio. This suggests that markets might pay closer attention to the government's short-term fiscal discipline than to its accumulated debt levels.

The study also considers financial conditions and credit dynamics. It finds that short-term rates are especially sensitive to changes in domestic financial signals and to shifts in monetary policy regimes. By contrast, long-term rates respond more strongly to external conditions, credit growth, and persistent monetary stances. These results hold when the analysis is extended to real interest rates, further underscoring the importance of fiscal flows and credit dynamics.

Overall, the findings highlight the importance of maintaining credible fiscal and monetary frameworks. For policymakers, ensuring consistent primary surpluses can help anchor expectations, reduce refinancing risks, and support economic stability in a challenging global environment.

Sumário Não Técnico

Este estudo examina como a curva de juros brasileira reage a fundamentos macroeconômicos. Entender tais movimentos é importante pois eles influenciam os custos de financiamento do governo, as decisões de investimento privado e a estabilidade geral da economia.

Usando dados de 2003 a 2025, o estudo analisa como a inflação, a política fiscal, a atividade econômica e as taxas de juros dos Estados Unidos afetam os rendimentos domésticos. Os resultados mostram que a inflação, a atividade econômica e as condições financeiras globais moldam de forma consistente tanto as taxas de curto quanto as de longo prazo. Por exemplo, as taxas de juros dos EUA ajudam a determinar o custo de financiamento de longo prazo do Brasil, refletindo a sensibilidade do país aos mercados globais.

Um resultado central sugere que a política fiscal importa, mas de maneira específica. Indicadores de fluxos fiscais correntes, como o superávit primário, afetam a inclinação da curva de juros – a diferença entre taxas longas e curtas – mais do que variáveis de estoque, como a razão dívida/PIB. Isso sugere que os mercados tendem a prestar mais atenção à disciplina fiscal de curto prazo do governo do que ao nível acumulado da dívida pública.

O estudo também considera as condições financeiras e a dinâmica do crédito. Constata-se que as taxas de curto prazo são especialmente sensíveis a mudanças nos sinais financeiros domésticos e a alterações nos regimes de política monetária. Já as taxas de longo prazo respondem mais fortemente a condições externas, expansão do crédito e posturas monetárias persistentes. Esses resultados se mantêm quando a análise é estendida para taxas de juros reais, reforçando ainda mais a importância dos fluxos fiscais e da dinâmica do crédito.

De forma geral, os resultados destacam a importância de políticas fiscais e monetárias críveis. Para os formuladores de políticas, garantir superávits primários consistentes pode ajudar a ancorar expectativas, reduzir riscos de refinanciamento e sustentar a estabilidade econômica em um ambiente global desafiador.

Macroeconomic Drivers of Brazil's Yield Curve*

Gustavo Silva Araujo[†]

José Valentim Machado Vicente[‡]

Wagner Piazza Gaglianone[§]

Abstract

This paper investigates how the Brazilian yield curve has responded to macroeconomic fundamentals over the past two decades. Using a set of OLS regressions applied to short- and long-term interest rates, as well as the yield curve slope, we examine the roles of domestic inflation, fiscal stance, economic activity, and external interest rates. Our findings show that domestic inflation and economic activity, together with U.S. yields, exhibit consistent significance across maturities. Fiscal indicators based on primary surplus, rather than public debt, exert a clear effect on short-term rates and the slope, underscoring the relevance of fiscal flows over fiscal levels. Robustness exercises incorporating financial conditions, credit indicators, and the monetary policy stance confirm that short-term rates are especially responsive to financial signals and regime changes, whereas long-term rates are more strongly influenced by external conditions, credit dynamics, and a persistent monetary stance. The analysis is further extended to real interest rates, confirming the robustness of the main results and highlighting the enduring influence of fiscal flows and credit dynamics on the slope and long-term rates. These findings show the importance of credible fiscal and monetary frameworks and provide new evidence on how emerging market yield curves reflect domestic and external fundamentals.

Keywords: Yield Curve; Fiscal Policy; Monetary Stance; Financial Conditions; Credit.

JEL Classification: C22, E43, E52, E62, H63.

*The views expressed in the paper are those of the authors and do not necessarily reflect those of the Banco Central do Brasil.

[†]Research Department, Banco Central do Brasil, and FGV-EPGE. E-mail: gustavo.araujo@bcb.gov.br

[‡]Research Department, Banco Central do Brasil. E-mail: jose.valentim@bcb.gov.br

[§]Research Department, Banco Central do Brasil, and FGV Crescimento & Desenvolvimento. E-mail: wagner.gaglianone@bcb.gov.br

1 Introduction

Understanding the behavior of interest rate term structures is fundamental for both macroeconomic policymaking and the pricing of financial assets, particularly in environments with high uncertainty and risk premia. For emerging economies such as Brazil, the yield curve is especially sensitive to both domestic vulnerabilities and global shocks (Montes and Fonseca, 2022). In this context, policymakers and investors need to evaluate how inflation, fiscal sustainability, and international interest rates influence domestic yield curve dynamics.

This study is motivated by the need to better understand how yield curves behave in emerging markets, where monetary, fiscal, and financial conditions interact in more complex and less predictable ways (Fonseca, 2024; Dai and Philippon, 2006). While much of the literature focuses on interest rate modeling in developed economies (Diebold and Li, 2006; Adrian et al., 2013), there is comparatively limited empirical evidence on how yield curve sensitivities evolve in economies characterized by higher risk premia and fiscal constraints.

The relationship between the term structure of interest rates and macroeconomic variables has been widely investigated in the literature. The seminal contribution by Estrella and Hardouvelis (1991) showed that the yield curve embeds valuable information for forecasting future real economic activity. More recent studies have advanced this connection using structural and arbitrage-free models. Ang and Piazzesi (2003), for example, developed a dynamic term structure model with macroeconomic factors and found that such factors explain up to 85% of the variation in U.S. bond yields. Building on equilibrium foundations, Piazzesi and Schneider (2007) explored the role of inflation in shaping yield curve dynamics, highlighting that agents' perceptions about the impact of inflation on the economy are key to understanding interest rate behavior.

The fiscal dimension of the yield curve has also received increasing attention. Dai and Philippon (2006) used an arbitrage-free term structure model to analyze the response of U.S. yields to fiscal shocks, showing that increases in the debt-to-GDP ratio lead to higher long-term interest rates. Kucera et al. (2023) found similar results for the Czech Republic, where government expenditure shocks were transmitted to the yield curve.

In the Brazilian context, Matsumura, Moreira and Vicente (2011) apply linear factor models to forecast the yield curve, showing that parsimonious approaches can efficiently capture the main dynamics of interest rates. In turn, Montes and Fonseca (2022) constructed a fiscal sentiment index based on official communications from the Finance Ministry and the Central Bank of Brazil, and showed that this index is correlated with domestic interest rates. Using a similar approach, Avila (2023) created a fiscal risk index based on natural language processing and found that increases in

fiscal risk are associated with higher long-term rates and a steeper curve. More recently, Fonseca (2024) estimated a macro-augmented Nelson-Siegel model for Brazil and found that larger primary deficits and higher gross public debt levels are associated with increases in the slope of the yield curve.

This issue has gained renewed urgency as public debt levels are now higher and rising faster in 80% of the global economy, according to the International Monetary Fund (2025), highlighting the increasing pressure on interest rate dynamics and fiscal sustainability in both advanced and emerging markets.

In addition to fiscal and external factors, financial conditions and credit dynamics have emerged as important determinants of the yield curve, particularly in emerging markets. Recent empirical work underscores the role of credit expansions and monetary policy regimes in shaping market expectations along different segments of the curve (Hatzius et al., 2010; Drehmann et al., 2011). This study contributes to this literature by incorporating such variables in a robustness framework to better capture the short- and long-term sensitivities of Brazilian interest rates.

As an extension, the paper also examines the same empirical models using real interest rates derived from inflation-indexed government bonds, allowing for a more robust assessment of the role of macroeconomic fundamentals net of inflation expectations.

The remainder of this paper is structured as follows. Section 2 presents the econometric framework. Section 3 discusses the empirical results, and Section 4 concludes.

2 Methodology

We estimate a set of Ordinary Least Squares (OLS) regressions applied to different segments of the interest rate term structure, namely, the 1-year rate, the 5-year rate, and the slope of the yield curve, using monthly data from January 2003 to February 2025.¹

Several model specifications are tested to identify statistically significant regressors with theoretically consistent signs. Heteroskedasticity and autocorrelation-consistent (HAC) standard errors are computed using Newey-West correction.

¹We focus on the slope, short-term (1-year), and long-term (5-year) interest rates, as these segments of the yield curve broadly capture its main dynamics. This choice is supported by principal component analyses (PCAs) of Brazilian interest rate curves, which show that the first two components, typically interpreted as level and slope, explain the vast majority of yield curve variation. For instance, for daily data in levels since 2006, the first two PCAs yield 96.87% and 2.82% of explained variance, respectively; for monthly data in first differences, these values are 76.13% and 20.14%.

The baseline reduced-form model for the yield curve slope is specified as:

$$\left(i_t^{long} - i_t^{short}\right) = \gamma + \delta_1 \left(i_{t-1}^{*long} - i_{t-1}^{*short}\right) + \delta_2 \pi_{t-1} + \delta_3 h_{t-1} + \delta_4 f_{t-1} + \epsilon_t, \quad (1)$$

and the corresponding model in first differences for both short- and long-term interest rates is given by:

$$\Delta i_t = \alpha + \beta_1 \Delta i_{t-1}^* + \beta_2 \pi_{t-1} + \beta_3 h_{t-1} + \beta_4 f_{t-1} + \varepsilon_t, \quad (2)$$

where Δ denotes the first-difference operator, i_t represents the domestic interest rate (short- or long-term), i_t^* is the U.S. interest rate (short- or long-term), π_t is domestic inflation rate, h_t is the output gap, and f_t is a proxy for fiscal policy. All regressors are lagged by one period to mitigate endogeneity concerns.

This parsimonious specification captures key macroeconomic drivers affecting interest rate movements in an emerging economy like Brazil. The selection of inflation, output gap, fiscal policy, and external interest rates as explanatory variables in the baseline models reflects both theoretical foundations and empirical evidence on interest rate formation in emerging markets.²

Inflation and the output gap are core components of Taylor-type monetary policy rules, directly influencing short-term rates and market expectations (Bernanke and Mihov, 1998).

External interest rates (particularly U.S. Treasury yields) are known to transmit global financial conditions into domestic term structures, especially in countries with integrated capital markets and currency risk premia (Adrian et al., 2013). Finally, fiscal indicators capture concerns about debt sustainability and credibility, which are often priced into longer maturities, especially in economies with a history of fiscal volatility. In the Brazilian context, Favero and Giavazzi (2004) provide early evidence that fiscal policy credibility significantly affects risk premia and the slope of the yield curve.

In a subsequent step, we expand the baseline specification by introducing additional control variables (such as financial conditions, credit indicators, and monetary regime indicators) to further assess the robustness of the results and better capture short- and long-term interest rate dynamics.

As an additional robustness check, we replicate previous specifications using real interest rates (r_t), rather than nominal rates (i_t), as the dependent variable. This exercise allows us to assess whether the macroeconomic factors identified in previous specifications better fit the dynamics of

² Alternative approaches frequently employed in the literature include VAR/VECM frameworks, dynamic Nelson-Siegel models, Bayesian/MCMC methods, state-space factor models, and regime-switching approaches. While these techniques provide valuable tools to capture dynamic interactions and potential nonlinearities, our study has opted for a more parsimonious and transparent econometric framework, ensuring comparability with the empirical literature on emerging markets. Exploring such alternative methodologies remains an important avenue for future research.

real interest rates, or whether their effects are largely captured via inflation expectations embedded in nominal yields.

We construct both nominal and real interest rates using the Svensson (1995) methodology, applied to Brazilian federal government bonds.^{3 4} This approach is widely recognized in financial markets and is currently employed by central banks in various countries.⁵ The Svensson model is designed to flexibly and smoothly estimate yield curves by fitting a discount function to bond prices at a given point in time. The spot interest rate is modeled using the following parametric equation:

$$s_m = \beta_0 + \beta_1 \left[\frac{1 - \exp(-\lambda_1 m)}{\lambda_1 m} \right] + \beta_2 \left[\frac{1 - \exp(-\lambda_1 m)}{\lambda_1 m} - \exp(-\lambda_1 m) \right] + \beta_3 \left[\frac{1 - \exp(-\lambda_2 m)}{\lambda_2 m} - \exp(-\lambda_2 m) \right]. \quad (3)$$

Here, s_m denotes the spot rate for maturity m , and the parameters β_0 , β_1 , β_2 , β_3 , λ_1 and λ_2 are estimated through constrained nonlinear optimization, with the constraints $\lambda_1 > 0$ and $\lambda_2 > 0$.

To estimate these parameters, we minimize an error function that measures the squared differences between observed and model-implied bond prices, weighted by the inverse of each bond's duration, as follows:

$$\min error = \sum_{i=1}^I \left[\frac{1}{d_i} \left(PU_{i,t} - \widehat{PU}_{i,t} \right) \right]^2, \quad (4)$$

where d_i is the duration of bond i , $PU_{i,t}$ is the price of bond i , and $\widehat{PU}_{i,t}$ is the estimated price of bond i , both on date t .

³Nominal rates are constructed using yields of LTNs (Letras do Tesouro Nacional), which are zero-coupon bonds with maturities typically up to 1 or 2 years. Long-term nominal rates are derived from NTN-Fs (Notas do Tesouro Nacional – Série F), which are fixed-coupon bonds with semiannual interest payments and longer maturities, typically ranging from 3 to 10 years. Real interest rates are built using inflation-linked government bonds (Notas do Tesouro Nacional – Série B, or NTN-Bs).

⁴Recently, Benetti et al. (2025) also applied the Svensson method to analyze the macroeconomic determinants of the yield curve, highlighting its usefulness in empirical studies on the relationship between macro fundamentals and different segments of the curve.

⁵To address potential concerns about the Svensson (1995) methodology for constructing the yield curve, we conduct robustness exercises (not reported here to save space) using an alternative approach based on cubic splines (McCulloch, 1971, 1975; Varga, 2009). The empirical findings remain qualitatively unchanged when interest rates derived from the cubic spline method are employed instead of Svensson-based rates. This result is supported by the high correlation between the two procedures: for nominal yields, the correlation between 1-year rates computed by the Svensson and cubic spline methods reaches 0.994 (0.987 for 5-year rates). When considering first-differences, the correlations are 0.995 and 0.988, respectively.

3 Empirical Exercise

3.1 Data

The monthly dataset spans from January 2003 to February 2025 and includes the following variables: domestic interest rates (1-year and 5-year nominal market rates), inflation (IPCA, monthly change and 12-month accumulated), economic activity (IBC-Br output gap, seasonally adjusted, HP-filtered), fiscal indicators (primary result and public sector net debt as % of GDP, both actual and Focus expectations⁶), external interest rates (U.S. Treasury rates, 3-month and 10-year).⁷

In addition to these variables, we include extra control variables in a robustness exercise, namely: $[FCI_{t-1}; credit/GDP_{t-1}; cycle_{t-1}^{credit/GDP}; cycle_{t-1}^{monet. policy}]'$, along with their respective first-differences. FCI_{t-1} is the Financial Conditions Indicator constructed by the Banco Central do Brasil (BCB).⁸ $credit/GDP_{t-1}$ is the credit-to-GDP ratio, which serves as a proxy for credit market conditions and private sector leverage. $cycle_{t-1}^{credit/GDP}$ is the HP-filtered series of the credit-to-GDP ratio, capturing medium- to long-term fluctuations in credit availability, typically associated with credit booms or retrenchments. The variable $cycle_{t-1}^{monet. policy}$ is a categorical indicator of the monetary policy stance.⁹ It is constructed as a dummy variable based on changes in the SELIC rate: taking values of +1, 0, or -1 for interest rate increases, stability, or decreases, respectively.

3.2 Results

3.2.1 Yield curve slope

All model specifications in Table 1 show significant responses to U.S. term spreads, domestic inflation,¹⁰ and the economic activity gap (excepting model 1.2). Fiscal variables, especially the primary surplus to GDP, show a consistent and negative effect,¹¹ suggesting a steepening of the yield curve with fiscal deterioration (see models 1.1 and 1.2). In turn, debt-to-GDP ratio (actual or expected, models 1.3 and 1.4) used as a proxy for fiscal indicators are not statistically significant

⁶Median expectations for the end of calendar years, from the Focus survey conducted by Banco Central do Brasil, are linearly interpolated to construct fixed-horizon expectations 12 months ahead.

⁷Time series graphics are presented in Appendix A, while data sources are detailed in Table A.1.

⁸This FCI incorporates daily information from 26 domestic and external variables, which are separated into 7 groups (domestic interest rates, foreign interest rates, risk, currencies, oil prices, commodities, and capital markets). It is used to monitor developments of financial conditions in a timely manner and can be viewed as a leading indicator of Brazilian economic activity. For more details, see BCB (2020, 2022).

⁹We use a categorical indicator of the monetary policy stance instead of the Selic rate to capture regime shifts and directional changes in policy that may not be fully reflected in the nominal policy rate.

¹⁰The negative sign on inflation reflects the fact that short-term interest rates tend to rise more than long-term rates in response to inflation shocks, resulting in a flatter yield curve.

¹¹Market participants demand higher long-term premia when fiscal risk rises.

throughout our sample period.

The estimates of the fiscal variables can be interpreted through the lens of the distinction between flow and stock indicators. The primary surplus, a *flow* variable, reflects the government's current fiscal stance and its immediate commitment to fiscal discipline. Markets tend to respond more quickly to these signals, as they directly affect the expected path of future interest rates, particularly long-term rates.

In contrast, the debt-to-GDP ratio is a *stock* variable that represents the cumulative result of past fiscal behavior. While important for assessing long-term sustainability, it may not significantly influence the yield curve if the current fiscal flow suggests a credible path toward adjustment, especially in contexts where credibility hinges on short-term signals rather than accumulated liabilities (Favero and Giavazzi, 2007).

This interpretation implies that financial markets are more forward-looking and prioritize signals about where fiscal policy is heading rather than the current level of indebtedness, a finding also consistent with Goyal (2004), who highlights that flow-based fiscal indicators exhibit greater predictive power over interest rate movements in emerging economies.

Moreover, the lack of significance for debt may suggest that markets respond more directly to fiscal flows than to stock variables, such as the debt-to-GDP ratio. This aligns with evidence from Lima et al. (2008), who find that the fiscal sustainability in Brazil is state-dependent, with debt having greater relevance under adverse conditions, supporting the idea that its impact may not be linear or uniformly perceived across time.

Furthermore, evidence from Vicente and Graminho (2015) suggests that inflation risk premia in Brazil are time-varying, particularly at longer horizons, and are influenced by factors such as consumption and equity market volatility. Their findings imply that, beyond expected inflation, long-term interest rates may also embed risk compensation components that fluctuate with macro-financial conditions, further shaping the slope of the yield curve.

Table 1 - Yield curve, dependent variable: Slope = $i_t^{5y} - i_t^{1y}$

regressors	model (1.1)		model (1.2)		model (1.3)		model (1.4)	
$(i_{t-1}^{*10y} - i_{t-1}^{*3m})$	0.498	***	0.546	***	0.519	***	0.441	**
π_{t-1}^{12m}	-0.450	***	-0.456	***	-0.500	***	-0.495	***
h_{t-1}	-0.081	**	-0.060		-0.117	***	-0.110	***
$f_{t-1}^{primary}$	-0.245	***						
$f_{t-1}^{primary, Focus}$			-0.279	***				
f_{t-1}^{debt}					0.033			
$f_{t-1}^{debt, Focus}$							0.018	
constant	2.837	***	2.935	***	1.860	**	2.129	*
R^2 -adj.	0.684		0.687		0.553		0.542	

Notes: Sample: Jan-2003 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

$(i_{t-1}^{*10y} - i_{t-1}^{*3m})$ is the slope of U.S. interest rates, π_{t-1}^{12m} is the 12-month accumulated IPCA inflation.

3.2.2 One-year interest rate

Table 2 shows that short-term interest rates respond significantly to lagged U.S. 10-year rates, domestic inflation, and the output gap, suggesting that these variables are key drivers of short-term rate dynamics in Brazil.¹² The fiscal variables (whether actual or expected) appear only weakly significant in this context.

These results are consistent with Taylor-type policy rules, where short-term interest rate adjustments are primarily driven by deviations of inflation and output from their respective targets.

In this context, short-term expectations derived from market prices can also shed light on the informational content of interest rates. Araujo and Vicente (2017) estimate short-term inflation expectations embedded in fixed income instruments and show that such measures respond quickly to monetary policy surprises and risk aversion shocks. This reinforces the notion that short-term rates are strongly shaped by forward-looking inflation expectations and macro-financial risks.

¹²For instance, indicating that monetary authorities may adjust short-term rates more actively in response to cyclical fluctuations and price dynamics.

Table 2 - Yield curve, dependent variable: First difference of the 1-year rate (Δi_t^{1y})

regressors	model (2.1)		model (2.2)		model (2.3)		model (2.4)	
Δi_{t-1}^{*10y}	0.325	**	0.323	**	0.322	**	0.334	**
π_{t-1}^{1m}	0.259	**	0.277	**	0.278	**	0.270	**
h_{t-1}	0.051	***	0.053	***	0.046	**	0.048	***
$f_{t-1}^{primary}$	-0.032	**						
$f_{t-1}^{primary,Focus}$			-0.032	*				
f_{t-1}^{debt}					0.005			
$f_{t-1}^{debt,Focus}$							0.003	
constant	-0.141	**	-0.137	**	-0.322	*	-0.299	
R^2 -adj.	0.184		0.178		0.154		0.148	

Notes: Sample: Jan-2003 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Δi_{t-1}^{*10y} is the first-difference of U.S. 10-year rate, π_{t-1}^{1m} is the monthly IPCA inflation.

3.2.3 Five-year interest rate

Table 3 indicates that the 5-year interest rate responds strongly and consistently to lagged changes in U.S. long-term yields, highlighting the importance of global financial conditions in shaping Brazil's long-term borrowing costs. Domestic inflation is not statistically significant, whereas the impact of the output gap remains significant across models, suggesting that market participants incorporate expectations about medium-term economic activity when pricing long-term rates.

Regarding fiscal policy, the estimated effects are weak and limited. Only in model 3.1 does the primary surplus variable reach marginal significance (at the 10% level), while all other fiscal indicators, including debt-to-GDP ratios, remain statistically insignificant across specifications. This suggests that fiscal fundamentals are not systematically priced into long-term interest rates over the sample period, at least not in a linear or immediate manner. Instead, markets may condition their response to fiscal information on broader macro-financial contexts, reinforcing the notion that fiscal credibility tends to affect the yield curve primarily through its slope, rather than by altering the level (or first-difference) of long-term rates directly. See Goyal (2004) and Laubach (2009).

Table 3 - Yield curve, dependent variable: First difference of the 5-year rate (Δi_t^{5y})

regressors	model (3.1)		model (3.2)		model (3.3)		model (3.4)	
Δi_{t-1}^{*10y}	0.487	***	0.488	***	0.484	***	0.493	***
π_{t-1}^{1m}	0.101		0.110		0.112		0.106	
h_{t-1}	0.038	**	0.038	**	0.035	**	0.036	**
$f_{t-1}^{primary}$	-0.018	*						
$f_{t-1}^{primary, Focus}$			-0.015					
f_{t-1}^{debt}					0.003			
$f_{t-1}^{debt, Focus}$							0.001	
constant	-0.058		-0.058		-0.162		-0.129	
R^2 -adj.	0.074		0.070		0.067		0.065	

Notes: Sample: Jan-2003 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Δi_{t-1}^{*10y} is the first-difference of U.S. 10-year rate, π_{t-1}^{1m} is the monthly IPCA inflation.

3.2.4 Robustness exercise

Yield curve slope: The results, summarized in Table B.1 (Appendix), indicate that among the control variables, only ΔFCI_{t-1} and $\Delta credit/GDP_{t-1}$ are statistically significant. The coefficient on ΔFCI_{t-1} is positive and significant at the 1% level, suggesting that tighter financial conditions (often interpreted as headwinds to growth) are associated with a steeper yield curve slope. This result is consistent with the idea that long-term rates incorporate future expectations of monetary easing in response to deteriorating financial conditions, as pointed out by Hatzius et al. (2010) and supported in the Brazilian context by Gaglianone and Areosa (2017).

The coefficient on $\Delta credit/GDP_{t-1}$ is also positive and significant at the 5% level, implying that increases in credit penetration (interpreted as either improving access to finance or an increase in economic leverage) are associated with a steeper yield curve. This may reflect higher long-term inflation or risk premia expectations associated with credit-fueled expansions, in line with findings by Drehmann et al. (2011), who emphasize the role of credit-to-GDP gaps as early warning indicators of macro-financial imbalances.

By contrast, the levels and cyclical components of $credit/GDP$ and monetary regime indicators do not show statistically significant effects. These findings suggest that short-run financial dynamics, particularly those captured by FCI and the flow of new credit, are more informative for shifts in the yield curve than long-term trends or categorical regimes.

In general, the inclusion of these controls does not qualitatively alter the main findings of the baseline regressions but reinforces the view that the yield curve is sensitive to financial and credit conditions, in addition to inflation, fiscal stance, and global rates.

One-year interest rate: The results in Table B.2, based on the 1-year rate, confirm the relevance of short-term financial and credit conditions in explaining movements in short-term interest rates. Among the control variables, ΔFCI_{t-1} is positive and significant at the 5% level, suggesting that tighter financial conditions, such as reduced liquidity or elevated risk aversion, are associated with increases in the 1-year rate.

The first-difference of the credit-to-GDP ratio ($\Delta credit/GDP_{t-1}$) is also positive and highly significant (1% level), indicating that rapid credit growth is positively associated with short-term interest rates. This may reflect anticipations of monetary tightening or increased inflation risk stemming from credit-fueled expansions. In addition, the first-difference of the cyclical component of credit ($\Delta cycle_{t-1}^{credit/GDP}$) is weakly significant (10%), reinforcing the idea that short-term rates are responsive to both the structural and cyclical dynamics of credit in the economy.

Most notably, the level of the monetary policy regime indicator ($cycle_{t-1}^{monet. policy}$) is positive and highly significant (1%), implying that when the policy stance is classified as contractionary, short-term rates tend to be significantly higher. This suggests that the 1-year rate effectively incorporates the prevailing monetary regime and reacts not only to macroeconomic fundamentals like inflation and output but also to qualitative shifts in the policy cycle. This result is consistent with the view that monetary stance has direct signaling effects on the short end of the yield curve. The first-difference of the policy stance ($\Delta cycle_{t-1}^{monet. policy}$) is also positive and significant at the 5% level, indicating that changes in the monetary regime (e.g., shifts from neutral to tightening) influence short-term rate adjustments beyond what is captured by fundamentals alone.

Altogether, these findings underscore the forward-looking nature of short-term interest rate formation in Brazil and highlight the importance of incorporating real-time financial signals and policy stance indicators (Bernanke and Mihov, 1998). They also support the inclusion of monetary regime information in models aiming to capture yield curve dynamics in emerging market economies.

Five-year interest rate: The results in Table B.3 offer additional insights into the determinants of long-term interest rates. As in the baseline model, the 5-year rate responds strongly to changes in U.S. long-term yields, with Δi_{t-1}^{*10y} remaining positive and highly significant across all specifications. This reinforces the central role of global financial conditions in shaping long-term domestic rates.

Among the control variables, several effects stand out. First, ΔFCI_{t-1} is positive and highly significant (1%), indicating that tightening financial conditions are associated with increases in the 5-year rate. This suggests that in the face of deteriorating liquidity or financial stress, market participants demand higher compensation for holding longer-term assets, consistent with risk premium adjustments at longer maturities.

Second, the first-difference of the credit-to-GDP ratio ($\Delta credit/GDP_{t-1}$) and its cyclical component ($\Delta cycle_{t-1}^{credit/GDP}$) are both positive and significant at the 1% level. These results imply that recent expansions in credit availability, particularly when exceeding trend, are interpreted by markets as signs of rising leverage or future inflationary pressures, leading to upward adjustments in long-term interest rates.

Interestingly, the level of the monetary policy regime indicator ($cycle_{t-1}^{monet. policy}$) also appears statistically significant (5%), with a positive coefficient. This suggests that when the prevailing regime is contractionary, it may exert upward pressure on long-term rates, perhaps due to expectations of persistent inflation risks or tighter funding costs. However, the first-difference of the same variable is not significant, indicating that regime shifts alone may not trigger immediate changes in long-term yields.

The primary fiscal balance is not statistically significant,¹³ consistent with earlier findings that fiscal information is more consistently priced through the slope of the curve rather than the level of long-term rates. The output gap is statistically significant in several models, while inflation remains insignificant.

Overall, these robustness results reinforce the conclusion that long-term rates in Brazil are jointly determined by global financial drivers and domestic macro-financial signals, particularly output gap, credit dynamics and prevailing monetary and financial conditions (Iania, Lyrio, and Moura, 2021).

While fiscal variables continue to play a secondary role at this horizon, the incorporation of financial indicators improves the explanatory power of the model and aligns with recent literature emphasizing the role of credit and risk perceptions in shaping long-term yields (Laubach, 2009; Hatzius et al., 2010; Drehmann et al., 2011).

¹³With the exception of model (7), in which the primary surplus coefficient is statistically significant at the 10% level.

3.2.5 Robustness using real interest rates

We now extend the analysis by re-estimating the baseline and augmented specifications using real interest rates, rather than nominal ones, as the dependent variable. To preserve comparability with the previous results, we maintain the same set of explanatory variables employed in Appendix B across all model specifications. Since real rates are computed by deflating nominal yields with breakeven inflation, most of which is composed of inflation expectations, the inclusion of observed inflation as a regressor may introduce potential redundancy or multicollinearity. To address this, we estimate models both with and without the inflation term, allowing for a robust assessment of the role played by macroeconomic and financial variables in driving real yield dynamics. The results including observed inflation are reported in Appendix C. Overall, they confirm many of the patterns observed in the nominal rate models while also revealing important differences in how macro-financial variables are priced along the real yield curve.

For the **real slope of the yield curve (Table C.1)**, the results show a consistent and significant effect of the U.S. term spread, domestic inflation, and the primary surplus. Notably, the coefficient on the primary surplus remains negative and statistically significant across all specifications, reinforcing the idea that markets respond to fiscal flows even when controlling for inflation expectations embedded in nominal rates. Inflation continues to exhibit a statistically significant negative effect, possibly capturing residual inflation risk premia or discrepancies between expected and realized inflation. The output gap becomes weakly or marginally significant, while financial controls, particularly changes in the FCI and the change in credit-to-GDP ratio, exhibit strong effects, consistent with prior results using nominal data.

Regarding the **short-term real rate (Table C.2)**, inflation is a relevant variable, with a positive and highly significant coefficient in all models. This suggests that despite controlling for expected inflation, observed inflation continues to influence the perceived real cost of borrowing, suggesting that real yields may still internalize short-term inflation dynamics or reflect imperfectly anchored expectations. The output gap also remains significant and positively signed, in line with Taylor-rule interpretations. However, fiscal variables lose statistical significance, reinforcing the notion that short-term real rates are driven primarily by cyclical and monetary dynamics. Among control variables, the level of the monetary policy stance dummy is positive and significant, suggesting that the qualitative regime influences short-term real rates, while other control variables become mostly insignificant.

For the **real 5-year rate (Table C.3)**, the primary drivers are the lagged change in the U.S. 10-year rate and the lagged output gap, which are positive and strongly significant. Inflation is not statistically significant at conventional levels, which reinforces the notion that long-term real yields respond more to macro-financial conditions than to transitory price dynamics. Interestingly, both the change in the credit-to-GDP ratio and its cyclical component are positive and significant at the 1% level, indicating that credit expansions (particularly when above trend) raise long-term real rates. The primary surplus is marginally significant in some models, suggesting a weaker fiscal channel compared to the slope regressions displayed in Table C.1. The level of the monetary policy stance remains positively associated with the real 5-year rate, although with reduced statistical precision compared to the short-term model.

In general, these findings indicate that real interest rates, like their nominal counterparts, embed meaningful information about macroeconomic conditions. Credit dynamics and global rates emerge as dominant forces in explaining long-term real rate fluctuations, while fiscal variables tend to influence the slope of the real curve more consistently than its endpoints. These results underscore the importance of integrating financial and macroeconomic signals in policy analysis and market monitoring.

4 Conclusions

Our results emphasize that the Brazilian yield curve is a rich informational source on market perceptions of macroeconomic fundamentals. While inflation and external rates are persistent drivers across horizons, fiscal conditions primarily influence the yield curve slope, which is particularly relevant during periods of deteriorating public finances. This result is consistent with Blanchard (2019), for instance, who argues that in low interest rate environments, the fiscal stance can play an outsized role in shaping the cost of debt and the term structure.

Robustness checks provide further insights about the interaction between financial conditions and the term structure of nominal rates. For the 1-year rate, we find that indicators, such as changes in financial conditions and credit growth, have strong and statistically significant effects. The short-term end of the yield curve also reflects regime shifts in the qualitative monetary policy stance, confirming the view that monetary regimes and investor expectations influence forward-looking interest rates.

In contrast, the 5-year rate is primarily driven by external rates and financial indicators, particularly recent expansions in credit and the prevailing monetary stance. However, changes in the monetary regime per se are not sufficient to affect long-term yields unless perceived as persistent.

These results reinforce the distinction between the role of fundamentals in shaping short-term versus long-term rates, and highlight that the slope of the curve continues to embed fiscal signals more clearly than the individual endpoints.

These patterns are largely preserved when real interest rates are used instead of nominal rates. Inflation and the output gap continue to significantly affect short-term real rates, while long-term real rates remain driven by external factors and credit dynamics. Notably, fiscal variables retain explanatory power for the slope of the real yield curve, reinforcing the idea that fiscal signals are priced in through the curve's shape, even after controlling for inflation expectations.

Our findings resonate with broader global concerns. Recent data show that public debt is accelerating in the vast majority of countries, including emerging economies like Brazil. As noted by the IMF (2025), this widespread debt build-up reinforces the need to understand how fiscal fundamentals affect sovereign yield curves and investor behavior. In this context, Brazil's experience offers valuable insights into how flow-based fiscal signals interact with global financial conditions to shape long-term interest rates.

The empirical findings carry relevant policy implications. First, preserving fiscal credibility, particularly through consistent primary surpluses, can help prevent increases in long-term interest rates, thereby supporting macroeconomic stability by reducing debt refinancing risks and sustaining private investment. Second, the responsiveness of short-term rates to inflation and financial variables reinforces the importance of clear and credible monetary policy communication to anchor expectations and enhance policy transmission. Finally, the differentiated sensitivities across the curve suggest that public debt management strategies should account for the term structure's interaction with both fiscal stance and financial conditions, in order to optimize issuance profiles and reduce rollover and cost risks.

Future research could extend this analysis by incorporating high-frequency data to capture the immediate market response to fiscal announcements, or by applying non-linear models that allow for threshold effects in the relationship between fiscal indicators and interest rates.¹⁴ Additionally, integrating sovereign credit ratings and market volatility measures may help disentangle the interaction between risk perception and the pricing of fiscal fundamentals along the yield curve.

¹⁴Regime-switching methods also represent a promising avenue for further analysis, as illustrated by Tavanielli and Laurini (2023), who apply this type of approach to the Brazilian interest rate market and show that different regimes can significantly affect pricing along the yield curve.

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Appendix A. Database

Figure A.1 - Brazilian market interest rates (% p.y.)

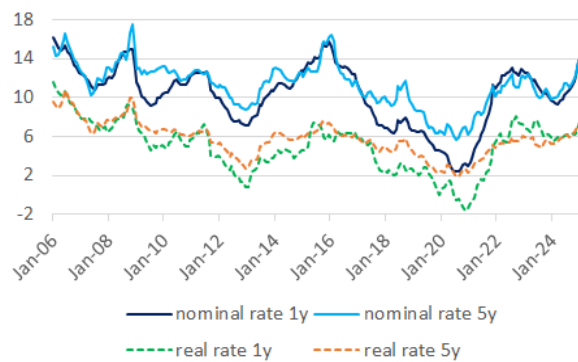


Figure A.2 - U.S. Treasury interest rates (% p.y.)

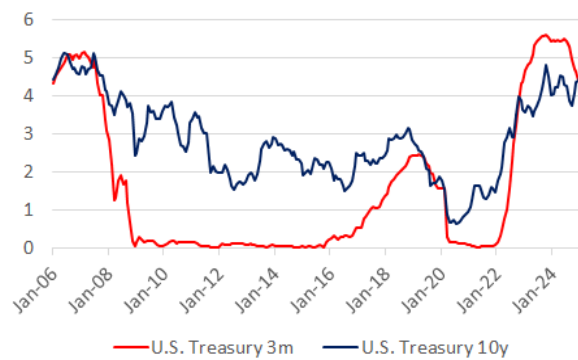


Figure A.3 - Inflation and monetary policy interest rate (Selic)

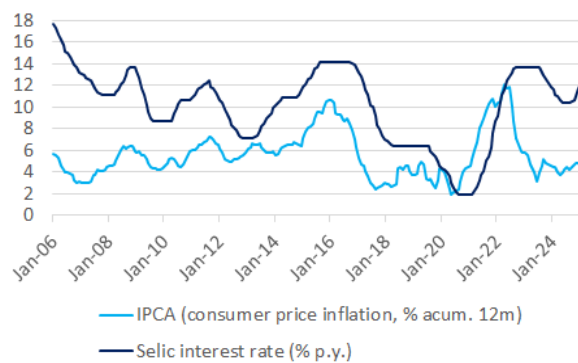


Figure A.4 - Economic activity index (IBC-BR) and credit-to-GDP

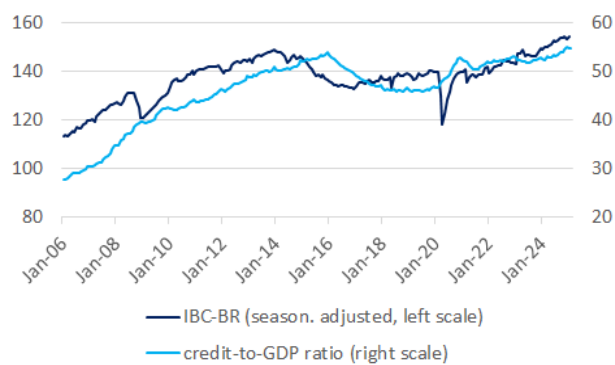


Figure A.5 - Primary result of consolidated public sector (flow accumulated in 12 months, % GDP)

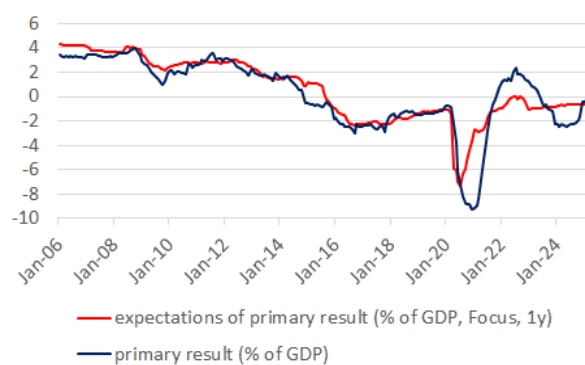


Figure A.6 - Net public debt (% GDP)

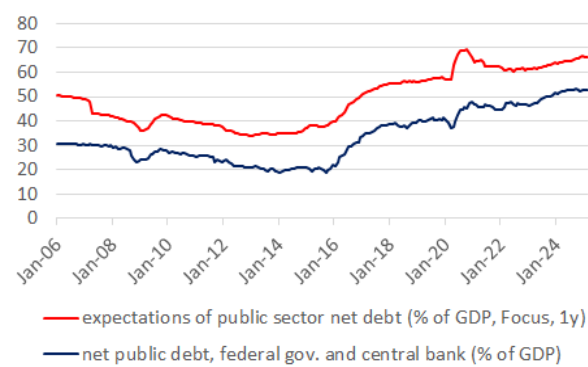


Figure A.7 - Financial Conditions Indicator (FCI)



Table A.1 - Sources of time series data

Time Series	Sources
U.S. Treasury rates, 3-month and 10-year	LSEG Refinitiv Workspace (Thomson Reuters)
Nominal and real market interest rates, 1-year and 5-year	Anbima, authors' calculations
IPCA (consumer price inflation)	BCB, SGS code 433
Selic (monetary policy interest rate)	BCB, SGS code 4189
IBC-Br (economic activity index)	BCB, SGS code 24364
Credit-to-GDP ratio	BCB, SGS code 20622
Primary result of consolidated public sector (flow accum. in 12 months, % GDP)	BCB, SGS code 5793
Net public debt (total, federal government and central bank, % GDP)	BCB, SGS code 4503
Expectations of primary result (% of GDP)	BCB, Focus [*]
Expectations of public sector net debt (% of GDP)	BCB, Focus [*]
FCI (Financial Conditions Index)	BCB, Monetary Policy Report Statistical Annexes ^{**}

Notes: Anbima denotes Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais. BCB means Banco Central do Brasil.

SGS is a time series management system provided by BCB; for more details see: <https://www3.bcb.gov.br/sgspub/>

^{*} <https://www3.bcb.gov.br/expectativas2/#/consultaSeriesEstatisticas>

^{**} <https://www.bcb.gov.br/en/publications/mpr-annexes?ano=2025>

Appendix B. Robustness exercise

Table B.1 - Yield curve, dependent variable: Slope = $i_t^{5y} - i_t^{1y}$

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$(i_{t-1}^{*10y} - i_{t-1}^{*3m})$	0.509 ***	0.465 ***	0.509 ***	0.509 ***	0.541 ***	0.501 ***	0.506 ***	0.509 ***	0.509 ***
π_{t-1}^{12m}	-0.405 ***	-0.384 ***	-0.401 ***	-0.405 ***	-0.366 ***	-0.422 ***	-0.394 ***	-0.403 ***	-0.406 ***
h_{t-1}	-0.073 **	-0.097 ***	-0.073 **	-0.073 **	-0.050 *	-0.082 **	-0.072 **	-0.073 **	-0.073 **
$f_{t-1}^{primary}$	-0.196 ***	-0.151 ***	-0.199 ***	-0.196 ***	-0.201 ***	-0.194 ***	-0.207 ***	-0.196 ***	-0.196 ***
FCI_{t-1}		-0.200							
$credit/GDP_{t-1}$			-0.003						
$cycle_{t-1}^{credit/GDP}$				0.001					
$cycle_{t-1}^{monet. policy}$					-0.210				
$\Delta(FCI_{t-1})$						0.610 ***			
$\Delta(credit/GDP_{t-1})$							0.431 **		
$\Delta(cycle_{t-1}^{credit/GDP})$								0.269	
$\Delta(cycle_{t-1}^{monet. policy})$									-0.033
constant	2.691 ***	2.621 ***	2.791 ***	2.692 ***	2.413 ***	2.805 ***	2.586 ***	2.678 ***	2.694 ***
R^2 -adj.	0.564	0.573	0.562	0.562	0.571	0.578	0.574	0.566	0.562

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Table B.2 - Yield curve, dependent variable: First difference of the 1-year rate (Δi_t^{1y})

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δi_{t-1}^{*10y}	0.449 ***	0.461 ***	0.440 ***	0.445 ***	0.479 ***	0.388 ***	0.505 ***	0.484 ***	0.479 ***
π_{t-1}^{1m}	0.271 **	0.266 **	0.248 *	0.219 *	0.143	0.259 **	0.262 **	0.268 **	0.263 **
h_{t-1}	0.043 ***	0.032 **	0.043 ***	0.047 ***	0.028 *	0.041 *	0.044 ***	0.043 ***	0.042 ***
$f_{t-1}^{primary}$	-0.023 *	-0.005	-0.013	-0.020	-0.026 **	-0.024 **	-0.029 **	-0.023 *	-0.021 *
FCI_{t-1}		-0.093 *							
$credit/GDP_{t-1}$			0.007						
$cycle_{t-1}^{credit/GDP}$				0.055					
$cycle_{t-1}^{monet. policy}$					0.181 ***				
$\Delta (FCI_{t-1})$						0.199 **			
$\Delta (credit/GDP_{t-1})$							0.239 ***		
$\Delta (cycle_{t-1}^{credit/GDP})$								0.178 *	
$\Delta (cycle_{t-1}^{monet. policy})$									0.160 **
constant	-0.130 **	-0.132 **	-0.446 *	-0.107	-0.057	-0.121 *	-0.153 **	-0.129 **	-0.128 **
R^2 -adj.	0.188	0.208	0.191	0.191	0.277	0.200	0.216	0.199	0.209

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B.3 - Yield curve, dependent variable: First difference of the 5-year rate (Δi_t^{5y})

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δi_{t-1}^{*10y}	0.598 ***	0.608 ***	0.592 ***	0.595 ***	0.615 ***	0.473 ***	0.688 ***	0.674 ***	0.614 ***
π_{t-1}^{1m}	0.093	0.088	0.077	0.056	0.020	0.066	0.078	0.086	0.088
h_{t-1}	0.035 **	0.025	0.035 **	0.038 **	0.026 *	0.031 **	0.036 **	0.036 **	0.034 **
$f_{t-1}^{primary}$	-0.015	0.003	-0.008	-0.012	-0.016	-0.016	-0.024 *	-0.014	-0.013
FCI_{t-1}		-0.086							
$credit/GDP_{t-1}$			0.005						
$cycle_{t-1}^{credit/GDP}$				0.040					
$cycle_{t-1}^{monet. policy}$					0.103 **				
$\Delta (FCI_{t-1})$						0.413 ***			
$\Delta (credit/GDP_{t-1})$							0.385 ***		
$\Delta (cycle_{t-1}^{credit/GDP})$								0.385 ***	
$\Delta (cycle_{t-1}^{monet. policy})$									0.087
constant	-0.049	-0.049	-0.264	-0.032	-0.007	-0.029	-0.085	-0.047	-0.047
R^2 -adj.	0.077	0.085	0.075	0.075	0.092	0.122	0.126	0.117	0.078

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix C. Robustness using real interest rates

Table C.1 - Yield curve, dependent variable: Slope (*real interest rate*) = $r_t^{5y} - r_t^{1y}$

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$(i_{t-1}^{*10y} - i_{t-1}^{*3m})$	0.608 ***	0.534 ***	0.608 ***	0.610 ***	0.641 ***	0.599 ***	0.604 ***	0.609 ***	0.608 ***
π_{t-1}^{12m}	-0.254 ***	-0.218 ***	-0.257 ***	-0.252 ***	-0.214 ***	-0.263 ***	-0.241 ***	-0.251 ***	-0.254 ***
h_{t-1}	0.040	-1.43E-05	0.040	0.039	0.064 **	0.034 **	0.042 *	0.041 *	0.040
$f_{t-1}^{primary}$	-0.238 ***	-0.162 ***	-0.235 ***	-0.239 ***	-0.243 ***	-0.234 ***	-0.252 ***	-0.237 ***	-0.238 ***
FCI_{t-1}		-0.341 ***							
$credit/GDP_{t-1}$			0.002						
$cycle_{t-1}^{credit/GDP}$				-0.012					
$cycle_{t-1}^{monet. policy}$					-0.213				
$\Delta(FCI_{t-1})$						0.337 **			
$\Delta(credit/GDP_{t-1})$							0.535 ***		
$\Delta(cycle_{t-1}^{credit/GDP})$								0.437 ***	
$\Delta(cycle_{t-1}^{monet. policy})$									0.001
constant	1.482 ***	1.360 ***	1.403 *	1.471 ***	1.199 ***	1.551 ***	1.352 ***	1.461 ***	1.482 ***
R^2 -adj.	0.530	0.565	0.528	0.528	0.539	0.525	0.550	0.540	0.528

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Table C.2 - Yield curve, dependent variable: First difference of the 1-year real rate (Δr_t^{1y})

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δu_{t-1}^{*10y}	0.208	0.208	0.199	0.209	0.226	0.154	0.186	0.182	0.223
π_{t-1}^{1m}	0.548	*** 0.547	*** 0.524	*** 0.559	*** 0.470	*** 0.539	*** 0.552	*** 0.550	*** 0.544
h_{t-1}	0.030	*** 0.028	** 0.030	*** 0.029	** 0.021	** 0.028	*** 0.030	*** 0.030	*** 0.030
$f_{t-1}^{primary}$	-0.012	-0.008	-0.002	-0.013	-0.014	-0.012	-0.010	-0.013	-0.012
FCI_{t-1}		-0.018							
$credit/GDP_{t-1}$			0.007						
$cycle_{t-1}^{credit/GDP}$				-0.012					
$cycle_{t-1}^{monet. policy}$					0.110	***			
$\Delta (FCI_{t-1})$						0.170			
$\Delta (credit/GDP_{t-1})$							-0.091		
$\Delta (cycle_{t-1}^{credit/GDP})$								-0.129	
$\Delta (cycle_{t-1}^{monet. policy})$									0.078
constant	-0.265	*** -0.263	*** -0.591	** -0.270	*** -0.220	*** -0.256	*** -0.256	*** -0.266	*** -0.264
R^2 -adj.	0.223	0.219	0.227	0.220	0.252	0.233	0.224	0.227	0.225

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.3 - Yield curve, dependent variable: First difference of the 5-year real rate (Δr_t^{5y})

regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δu_{t-1}^{*10y}	0.334 ***	0.338 ***	0.329 ***	0.332 ***	0.344 ***	0.272 ***	0.375 ***	0.369 ***	0.339 ***
π_{t-1}^m	0.082	0.080	0.069	0.054	0.037	0.068	0.075	0.079	0.080
h_{t-1}	0.026 ***	0.022 **	0.026 ***	0.028 ***	0.021 **	0.024 ***	0.027 ***	0.027 ***	0.026 ***
$f_{t-1}^{primary}$	-0.012 *	-0.006	-0.007	-0.010	-0.013 **	-0.013 **	-0.017 **	-0.012 **	-0.012 *
FCI_{t-1}		-0.034							
$credit/GDP_{t-1}$			0.004						
$cycle_{t-1}^{credit/GDP}$				0.029					
$cycle_{t-1}^{monet. policy}$					0.063 **				
$\Delta (FCI_{t-1})$						0.209 ***			
$\Delta (credit/GDP_{t-1})$							0.176 ***		
$\Delta (cycle_{t-1}^{credit/GDP})$								0.181 ***	
$\Delta (cycle_{t-1}^{monet. policy})$									0.030
constant	-0.045	-0.046	-0.215	-0.033	-0.020	-0.036	-0.062 *	-0.044	-0.045
R^2 -adj.	0.104	0.106	0.104	0.104	0.121	0.137	0.133	0.129	0.102

Notes: Sample: Jan-2006 to Feb-2025. HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.