

Monetary Transmission and Financial Market Stability in Indonesia: Evidence from Yield Curve Dynamics and Implications for Islamic Finance

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Abstract

This study aims to apply the Christensen, Diebold, and Rudebusch (CDR) model to analyze monetary transmission through the government bond yield curve in Indonesia from 2010 to 2024. It specifically seeks to extract the latent factors (level, slope, curvature) of the yield curve and assess their interaction with key macroeconomic variables, namely inflation and GDP. The research employs a two-stage methodology: first, estimating the latent factors using the Arbitrage-Free Nelson-Siegel (AFNS) model within a state-space framework; and second, analyzing the dynamic relationships using a Vector Autoregression (VAR) approach complemented by Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD). The results confirm the applicability of the CDR model, revealing a dominant level factor linked to inflation expectations, a consistently negative but flattening slope factor indicating moderate growth expectations, and a highly volatile curvature factor. The conclusion is that monetary policy transmission is effective in the short term but weaker over the long term. The study recommends future research to incorporate machine learning techniques and high-frequency data to better capture non-linearities and structural breaks in the post-pandemic economic environment.

Keywords: CDR Model; Latent Factors; Macro-Finance; Monetary Transmission; Yield Curve.

Abstrak

Studi ini bertujuan untuk menerapkan model Christensen, Diebold, dan Rudebusch (CDR) untuk menganalisis transmisi moneter melalui kurva imbal hasil obligasi pemerintah Indonesia dari tahun 2010 hingga 2024. Secara spesifik, penelitian ini berupaya mengekstrak faktor-faktor laten (level, slope, curvature) dari kurva imbal hasil dan menilai interaksinya dengan variabel-variabel makroekonomi kunci, yaitu inflasi dan PDB. Penelitian ini menggunakan metodologi dua tahap: pertama, mengestimasi faktor-faktor laten menggunakan model Arbitrage-Free Nelson-Siegel (AFNS) dalam kerangka state-space; dan kedua, menganalisis hubungan dinamis menggunakan pendekatan Vector Autoregression (VAR) yang dilengkapi dengan Impulse Response Functions (IRF) dan Forecast Error Variance Decomposition (FEVD). Hasil penelitian mengonfirmasi penerapan model CDR, yang mengungkapkan adanya faktor level yang dominan terkait dengan ekspektasi inflasi, faktor slope yang secara konsisten negatif namun semakin mendatar yang mengindikasikan ekspektasi pertumbuhan yang moderat, serta faktor curvature yang sangat volatil. Kesimpulannya adalah transmisi kebijakan moneter efektif dalam jangka pendek tetapi lebih lemah dalam jangka panjang. Studi ini merekomendasikan penelitian selanjutnya untuk mengintegrasikan teknik machine learning dan data frekuensi tinggi guna menangkap non-linearitas serta perubahan struktural dalam lingkungan ekonomi pasca-pandemi dengan lebih baik.

Kata Kunci: Model CDR; Faktor Laten; Makro-Keuangan; Transmisi Moneter; Kurva Imbal Hasil.

A. Introduction

Indonesia has been implementing the Inflation Targeting Framework (ITF) since 2000, with the policy interest rate (BI Rate) as the main instrument in monetary policy. Monetary policy aims to stabilize, maintain and maintain the stability of the rupiah, one of which is reflected in a low and stable inflation rate¹. The determination of the BI Rate as the main policy instrument to influence economic activity with the ultimate goal of achieving inflation. However, the path or transmission from the BI rate decision to the achievement of the inflation target is very complex and requires time (time lag)².

Monetary policy affects real economic activity through a variety of channels, including interest rates, monetary aggregates, credit, exchange rates, asset prices, and expectations. Therefore, the identification of monetary policy transmission is important for monetary policy makers in influencing economic growth (GDP)³. The effectiveness of monetary transmission especially from policy interest rates to long-term interest rates is often questioned given the still developing financial market conditions and unstable inflation rates, in addition to monetary instruments and bond yields, monetary policy transmission of interest rate channels is also influenced by broader macroeconomic conditions, such as actual inflation, inflation target, economic growth (GDP)⁴. Fluctuations in these variables can affect market expectations and, ultimately, affect government securities. Regardless of the monetary policy signals given by BI (Mwase, 2021).

Indonesia's monetary policy through the interest rate channel is transmitted quite well, especially on deposit rates, lending rates, output, and inflation. The government issued government securities which we call bonds to finance Indonesia's Economic Work program where the relationship of the yield curve on three factors level, slope and curvature is vital with three macroeconomic variables namely real activity or output, inflation, and policy interest rates⁵. One of the government securities, namely bonds, depends on the structure of the domestic financial market where the period 2010-2024 showed dynamics in bond yields with various

¹ Dewi Mahrani Rangkuty and Mohammad Yusuf, *EKONOMI MONETER* (Medan: CV. Manhaji, 2020).

² Rini Dwi Astuti and Sri Rahayu Budi Hastuti, "Transmisi Kebijakan Moneter Di Indonesia," *Jurnal Ekonomi-Qu* 10, no. 1 (2020): 1–22, <https://doi.org/10.35448/jequ.v10i1.8576>.

³ Phany Ineke Putri, "THE IMPACT OF MONETARY POLICY SHOCKS IN INDONESIA," *Jurnal Ilmiah Manajemen, Ekonomi, & Akuntansi (MEA)* 6, no. 3 (October 28, 2022): 983–94, <https://doi.org/10.31955/mea.v6i3.2507>.

⁴ Olajide O Oyadeyi, "Financial Development, Financial Inclusion and the Effectiveness of Monetary Policy Transmission Mechanism in Africa," *Borsa Istanbul Review*, October 2025, 1–15, <https://doi.org/10.1016/j.bir.2025.10.016>.

⁵ Firman Mochtar, Sahminan Sahminan, and Aida s Budiman, *Transmisi Kebijakan Moneter Di Indonesia Menuju Era Ekonomi Digital* (Jakarta: DEPARTEMEN KEBIJAKAN EKONOMI DAN MONETER BANK INDONESIA, 2020).

tenors of 1-year, 5-year, 10-year, and 15-year including the period of the global crisis and the COVID-19 pandemic where the yield curve had inversion.

Table 1. *Descriptive Statistics (2010-2024)*

Variable	Mean	Max	Min	Std. Dev.
Inflasi	4,06	8,38	1,57	2,25
interbank	5,53	7,75	2,79	1,52
GDP	5,06	6,50	2,07	1,07
1-Year	5,93	8,11	3,68	1,33
5-Year	6,60	8,90	4,89	1,20
10-Year	7,06	8,87	5,17	1,04
15-Year	7,43	8,96	5,91	1,05

Source: Processed by the researcher, 2025

The monetary transmission mechanism explains how central bank policies affect the real economy. The effect of monetary policy on interest rates has a significant effect on the stock and bond markets. Bonds become more attractive when interest rates rise, as their yields increase ⁶. When a central bank changes short-term policy interest rates through open market operations that affect interbank money market rates, the change is transmitted across the spectrum of real interest rates in the economy. An increase in short-term interest rates will affect market expectations and the risk premium, leading to an increase in yields on long-term instruments, such as government bonds of various tenors. This increase in real interest rates then increases borrowing costs for companies and households, ultimately depressing business investment spending and durable consumption. This decrease in aggregate expenditure leads to a decrease in output (Gross Domestic Product) and downward pressure on the price level (inflation) ⁷.

However, the effectiveness of this transmission depends heavily on the structure of a country's financial markets which may work differently in developing countries than in developed countries. ⁸in a comparative study, they found that monetary transmission in developed countries between short-term interbank interest rate policy and long-term bond yields has a better-behaved yield curve than in developing and low-income countries.

⁶ Sigit Hartoko and La Ode Hasiara, *EKONOMI MONETER* (Medan: PT Media Penerbit Indonesia, 2024).

⁷ Frederic S Mishkin and Stanley G Eakins, *FINANCIAL MARKETS AND INSTITUTIONS*, *Financial Markets And Institutions*, 9th ed. (United Kingdom: Pearson Education, 2018), www.myfinancelab.com.

⁸ Aleš Bulíř and Jan Vlček, "Monetary Transmission: Are Emerging Market and Low-Income Countries Different?," *Journal of Policy Modeling* 43, no. 1 (2021): 95–108, <https://doi.org/10.1016/j.jpolmod.2020.06.006>.

The government securities yield curve is a vital indicator of market expectations ⁹. The yield on bonds of different tenors (1 year, 5 years, 10 years and 15 years) reflects the cost of short, medium and long-term loans. Modern studies of monetary transmission must take into account the dynamics of the entire yield curve, not just a single interest rate.

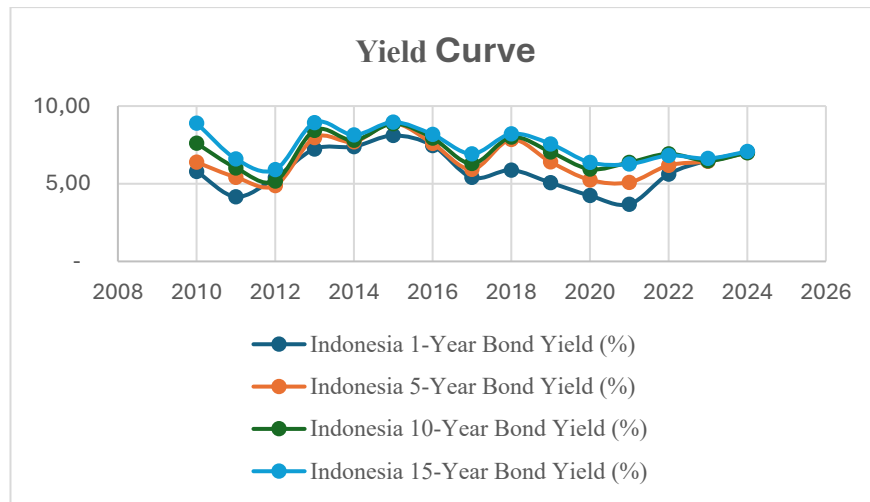


Figure1 : Yield Curve

Research into monetary transmission in emerging markets often uses parametric models, such as the Nelson-Siegel dynamic model or its variants (such as the Christensen, Diebold, and Rudebusch/CDR models), to extract information contained in government bond yields. This Model allows yield data to be decomposed into latent level, slope, and curvature factors which can then be integrated into macroeconomic models to analyze the impact of monetary policy on various interest rate tenors and real economic conditions ¹⁰.

The effectiveness of monetary transmission cannot be separated from broader macroeconomic conditions. The government bond yield curve is significantly influenced by various macroeconomic and monetary indicators, making it a vital indicator that reflects market expectations on domestic economic conditions, including GDP growth and the expected inflation rate ¹¹.

⁹ Perdana Wahyu Santosa, "Macroeconomic Indicators and Yield Curve of Indonesian Government Bond," *Business, Management and Economics Engineering* 19, no. 1 (2021): 34–48, <https://doi.org/10.3846/bmee.2021.13167>.

¹⁰ Luis Brandao-Marques et al., "Monetary Policy Transmission in Emerging Markets and Developing Economies," *IMF Working Papers* 20, no. 35 (2020), <https://doi.org/10.5089/9781513529738.001>.

¹¹ Santosa, "Macroeconomic Indicators and Yield Curve of Indonesian Government Bond."

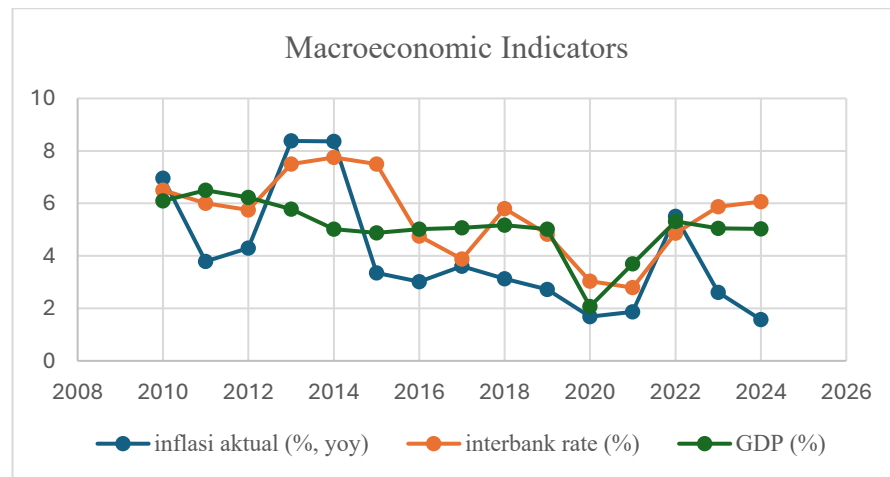


Figure2: Macroeconomic Indicators

The secular (long-term) movement of inflation causes the entire set of nominal interest rates (on all bond tenors) to exhibit unit root characteristics or trends that cannot be undone separately per tenor. It is emphasized that the fundamental trend on all tenors must be uniform, which empirically increases the contribution of the level factor (level) in explaining the overall variability of the yield curve. As a methodological and intuitive consequence, the shortest-term monetary policy rate or interbank interest rate is chosen as the anchor for this shared trend, since it is this instrument that is the most responsive and most likely to reflect the development of underlying inflation¹².

Research on monetary transmission mechanisms in Indonesia has been widely conducted, focusing on various transmission lines such as interest rates, money supply, asset prices and investments^{13 14}. Previous studies have often used Vector Autoregression (VAR) or Error Correction Model (ECM) models to analyze macroeconomic relationships in general^{15 16}. Findings from previous studies have shown mixed results regarding the effectiveness of each

¹² Bulíř and Vlček, “Monetary Transmission: Are Emerging Market and Low-Income Countries Different?”

¹³ I Made Oka Aditya, Taufiq Chaidir, and Gusti Ayu Arini, “Analisis Pengaruh Transmisi Kebijakan Moneter Melalui Jalur Suku Bunga Dan Harga Aset Terhadap Inflasi Di Indonesia Tahun 2017-2023,” *Jurnal Sosial Ekonomi Dan Humaniora* 10, no. 3 (2024): 402–16, <https://doi.org/10.29303/jseh.v10i3.611>.

¹⁴ Moh. Faizin, “Penerapan Vector Error Correction Model Pada Variabel Makro Ekonomi Di Indonesia,” *Jurnal Ekonomi* 25, no. 2 (2020): 287–303, <https://doi.org/10.24912/je.v25i2.671>.

¹⁵ Deswita Herlina, Stannia Cahaya Suci, and Muhammad Rafi Rahman, “The Impact of the Monetary Policy Transmission Mechanism-the Money Supply Channel on the Economy,” *Journal of Business and Information System* 5, no. 1 (2023): 63–78, <https://doi.org/10.36067/jbis.v5i1.172>.

¹⁶ Kezia Angel Pinaria, Harya Kuncara Wiralaga, and Ari Saptono, “Efektivitas Mekanisme Transmisi Kebijakan Moneter Jalur Harga Aset Di Indonesia Tahun 2016 - 2022,” *Jurnal Ilmiah Manajemen Dan Akuntansi* 1, no. 4 (2024): 157–68, <https://doi.org/10.69714/0cmp1k58>.

transmission pathway, with some studies indicating a more dominant exchange rate pathway ¹⁷ while others highlight the importance of the long-term interest rate path ¹⁸.

However, studies that specifically integrate macroeconomic data (inflation and GDP) with the dynamics of the yield curve using a no-arbitrage model that is consistent macro-financially are still rare in the Indonesian context. The Christensen, Diebold, and Rudebusch models (hereinafter referred to as CDR models) offer a sophisticated approach by adopting the dynamic arbitrage-free Nelson-Siegel model, which effectively decomposes the yield curve into three latent factors: level, slope, and curvature ¹⁹. These factors can be simultaneously attributed to macroeconomic variables within an integrated macro-finance framework ²⁰.

This research contributed to the literature in several ways. First, the study applies the CDR model, which ensures temporal consistency and prevents arbitrage opportunities, to Indonesia's bond data from 2010 to 2024, covering the period from post-global financial crisis to post-pandemic dynamics. Second, we explored specifically how changes in yield curve factors (level, slope, curvature) extracted from the CDR model represent and test the function of interest rate transmission mechanisms along the maturity spectrum of government bonds. Third, the study uses data updated to 2024, providing contemporary insights into the effectiveness of Bank Indonesia's monetary policy in responding to current economic conditions.

Theoretically, the CDR model allows testing the hypothesis that short-term interest rate movements controlled by the central bank will affect long-term interest rates through market expectations and risk premiums, which are reflected in the movement of those yield curve factors. This research gap lies in a deep empirical analysis of how these three yield curve factors interact with inflation and GDP growth in Indonesia, as well as measuring the degree of pass-through of benchmark interest rate policies to various bond yield tenors.

This study aims to apply the CDR model in extracting latent factors (level, slope, and curvature) of the bond yield curve for the period 2010-2024. Furthermore, this study will analyze and measure the effectiveness of Bank Indonesia's interest rate policy transmission mechanism along the bond yield curve based on the dynamics of these CDR factors, as well as

¹⁷ Elisa Elisa, Muhammad Subardin, and Sri Andaiyani, "The Monetary Policy Transmission Mechanism In Indonesia: A Comparative Analysis," *Jurnal Ekonomi Dan Studi Pembangunan* 15, no. 2 (October 26, 2023): 64–77, <https://doi.org/10.17977/um002v15i22023p064>.

¹⁸ Muhammad Yusuf, "Efektivitas Jalur-Jalur Transmisi Kebijakan Moneter Di Indonesia Dengan Sasaran Tunggal Inflasi," *Indonesian Treasury Review Jurnal Perbendaharaan Keuangan Negara Dan Kebijakan Publik* 1, no. 1 (2016): 1–10, <https://doi.org/10.33105/itrev.v1i1.58>.

¹⁹ Bulíř and Vlček, "Monetary Transmission: Are Emerging Market and Low-Income Countries Different?"

²⁰ Salih Fendoglu, "JGB Yield Curve and Macro-Financial Stability," *Selected Issues Papers* 2023, no. 032 (May 2023): 1–13, <https://doi.org/10.5089/9798400244032.018>.

identify and compare the response of inflation and GDP macroeconomic variables to monetary policy shocks transmitted through changes in The Shape of the yield curve in Indonesia.

B. Research Method

This study uses the Arbitrage-Free Nelson-Siegel (AFNS) approach from Christensen, Diebold, and Rudebusch (CDR) to analyze monetary transmission in Indonesia during the period 2010 to 2024. This research data in the form of secondary data with data collection techniques using data reports from Bank Indonesia, BPS, and Investing. The variables used in this study consist of macroeconomic variables and bond Finance variables related to the yield curve. The research methodology involves two main stages: first, estimating the latent factors of the yield curve using the Arbitrage-Free Nelson-Siegel (AFNS) model from Christensen, Diebold, and Rudebusch (CDR); and second, analyzing the dynamic relationship between variables using the Vector Autoregression (VAR) or Vector Error Correction Model (VECM), followed by Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analysis to test the effectiveness of monetary transmission.

In the first stage, we break down the Indonesian bond yield curve into three latent factors that represent the overall movement of the curve: (1) Level (β_{1t}): represents the overall height of the yield curve (parallel movement). (2) Slope (β_{2t}): represents the slope of the curve (the difference between long and short term interest rates). (3) Curvature (β_{3t}): represents the curvature or hump shape of a curve (humped-shape)²¹. The equation of yield curve model on tenor τ at time t is as follows:

$$y_t(\tau) = \beta_{1t}L(\tau) + \beta_{2t}S(\tau) + \beta_{3t}C(\tau)$$

where $L(\tau)$, $S(\tau)$, $C(\tau)$ are the base functions for the predetermined level, slope, and curvature. These latent factors are assumed to follow a stochastic process within the framework of a State-Space Model estimated using a Kalman Filter.

The second stage involves testing the functioning of the interest rate transmission mechanism by integrating the extracted CDR factors into the macroeconomic system. We analyze the macroeconomic variables of inflation and GDP on the yield curve (Level, Slope, Curvature) that analyze the response of economic variables to changes in interest rates: (1) econometric Model: this study will use a Vector Autoregression (VAR) or Structural Vector Autoregression (SVAR) approach to analyze the dynamic relationship between variables. (2) impulse response function (FIR) Analysis: This analysis will be used to track how unexpected (shock) changes in policy interest rates affect yield curve factors (level, slope, curvature) across different SBP tenors over time, as well as how changes in the yield curve affect macroeconomic

²¹ Bulíř and Vlček, "Monetary Transmission: Are Emerging Market and Low-Income Countries Different?"

variables (inflation, GDP). (3) decomposition of variance (FEVD): this method will be used to determine the relative contribution of each shock (including monetary policy shock) to variations in other variables in the system ²².

C. Discussion

1. CDR Estimates of the Latent Factors

The Level factor showed significant variation over the period 2010-2024, with a high of 17.38 in 2010 and a low of 3.09 in 2021. The average factor level was 9.12 with a consistent downward trend from the beginning to the end of the study. This finding is consistent with research ²³ which states that level factors represent long-term inflation expectations and risk premiums. The decrease in the factor level from 17.38 to 7.66 reflects an increase in the credibility of Indonesia's monetary policy, in line with a decrease in inflation from 6.96% to 1.57%. However, factor levels that are still relatively high (7-8) in the 2022-2024 period indicate a significant residual risk premium. High factor levels in the early period reflect the challenge of monetary policy credibility after the 2008 global crisis, while a gradual decline indicates consolidation of the inflation targeting framework²⁴.

Table 2: CDR Latent Factors Estimation

<i>CDR LATENT FACTORS ESTIMATION:</i>				
	<i>year</i>	<i>level</i>	<i>slope</i>	<i>curvature</i>
1	2010	17.388873	-11.63224025	-11.60503084
2	2011	7.590116	-3.83013073	-0.02185131
3	2012	13.943150	-8.25048421	-14.08013665
4	2013	10.463995	-3.40950242	-0.01720306
5	2014	9.483500	-2.12088872	-1.30612243
6	2015	8.945656	-2.09943600	1.84576073
7	2016	8.776944	-1.21012529	-2.09790133
8	2017	10.009265	-4.67099680	-3.18263075
9	2018	8.306768	-4.92772097	2.58710263
10	2019	8.427322	-3.83943738	0.03217090
11	2020	7.481807	-3.58266186	0.09193052
12	2021	3.089524	-0.07937974	11.06256984
13	2022	7.318968	-0.56088141	-5.09870567
14	2023	7.942819	-1.39870664	-2.25634198
15	2024	7.660389	-0.60275943	-1.05461423

Source: Processed by the researcher, 2025

Slope factor was consistently negative during the study period with an average of -3.48. The negative value occurred in 2010 (-11.63) and was close to zero in 2021 (-0.079).

²² Bulíř and Vlček.

²³ Bulíř and Vlček.

²⁴ Frederic S. Mishkin and Michael T. Kiley, "The Evolution of Inflation Targeting from the 1990s to the 2020s: Developments and Challenges," *SSRN Electronic Journal* 2854 (2025): 1–52, <https://doi.org/10.2139/ssrn.5190773>.

In the Nelson-Siegel model, a negative slope factor indicates an upward sloping (normal) yield curve. These findings are consistent with studies ²⁵ which states that the slope factor represents the slope of the curve. However, a slope close to zero in recent years indicates a flattening yield curve, which is consistent with the findings ²⁶ on the relationship between a flattening yield curve and the moderation of economic growth. Slope factor is getting closer to zero reflects the expectations of moderate economic growth and potential output is not optimal ²⁷.



Figure 3: CDR Latent Factors

The Curvature factor shows high volatility with an average of -1.67 and a standard deviation of 5.81. Values range from -14.08 in 2012 to 11.06 in 2021. The high volatility of the curvature factor reflects the instability of liquidity premiums and changes in investor preferences. These findings are in line with research ²⁸ on the liquidity premium in the interest rate structure. The high positive Curvature in 2021 may be related to the COVID-19 pandemic conditions where investors are looking for safe havens in medium tenors. The high volatility of curvature factor in emerging markets such as Indonesia reflects financial market immaturity and sensitivity to external shocks ²⁹.

²⁵ Jens H.E. Christensen, Francis X. Diebold, and Glenn D. Rudebusch, "The Affine Arbitrage-Free Class of Nelson-Siegel Term Structure Models," *Journal of Econometrics* 164, no. 1 (2011): 4–20, <https://doi.org/10.1016/j.jeconom.2011.02.011>.

²⁶ Keyra Primus, "The Effectiveness of Monetary Policy in Small Open Economies," *Journal of Policy Modeling* 40, no. 5 (September 2018): 903–33, <https://doi.org/10.1016/j.jpolmod.2018.03.001>.

²⁷ Christian Conrad, Zeno Enders, and Gernot J. Müller, "Inflation Forecast Targeting Revisited," *SSRN Electronic Journal*, 2025, <https://doi.org/10.2139/ssrn.5363601>.

²⁸ Tobias Adrian, Richard K. Crump, and Emanuel Moench, "Pricing the Term Structure with Linear Regressions," *Journal of Financial Economics* 110, no. 1 (2013): 110–38, <https://doi.org/10.1016/j.jfineco.2013.04.009>.

²⁹ Hamid Reza Davoodi, S. V. S. Dixit, and Gabor Pinter, "Monetary Transmission Mechanism in the East African Community: An Empirical Investigation," *IMF Working Papers* 13, no. 39 (2013): 1–58, <https://doi.org/10.5089/9781475530575.001>.

2. Robustness Checks

PCA analysis revealed extreme dominance of PC1 (88.17%) in explaining Indonesia's yield curve variation, with cumulative proportion of PC1 and PC2 reaching 97.29%. PC3 and PC4 made minimal contributions (2.71% combined). Research ³⁰ found a high coherence between global market assets and the yield to maturity of emerging market bonds. Increased global investor risk aversion positively affects yields in African bond markets, bolstering the argument that global uncertainty increases market sensitivity to the underlying risk factor level factor. Research ³¹ explicitly arguing the existence of such integration efforts in the banking and monetary sectors, ASEAN countries show substantial heterogeneity in their financial markets and support the idea that Indonesia has distinct market characteristics that affect the way monetary risk and signals are transmitted. The dominance of extreme factor levels in emerging markets reflects the concentration of policy risk and over-reliance on domestic monetary signals in a volatile global environmente ³².

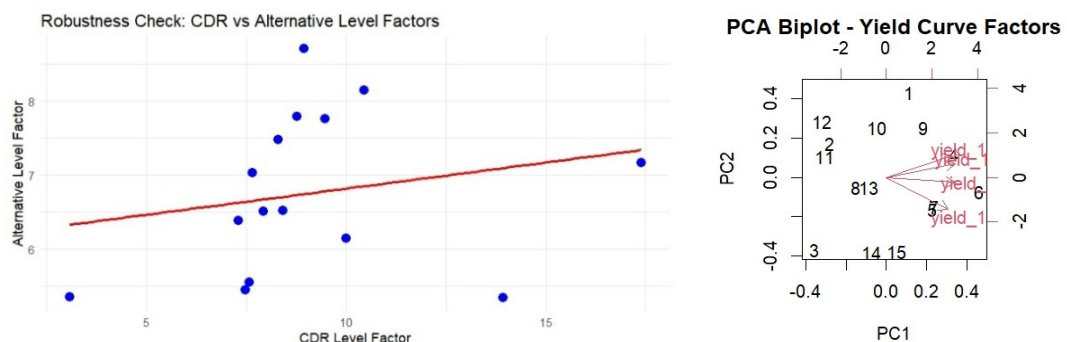


Figure 4: PCA and Robustness Checks

The correlation of CDR vs alternative factor level is only 0.2093, showing significant inconsistency. This low correlation supports the findings ³³ on the impact of structural pandemic breaks on yield curve model estimates in emerging markets. More complex CDR methods may be more sensitive to structural changes in the post-2020 market microstructure. Regime change shows different performance and disrupts the

³⁰ Godfred Amewu, Nana Kwame Akosah, and Mohammed Armah, "African Sovereign Risk Premia and International Market Assets: A Relook under the COVID-19 Outbreak," *Heliyon* 10, no. 21 (2024): 1–25, <https://doi.org/10.1016/j.heliyon.2024.e40194>.

³¹ Icuik Rangga Bawono, Rangga Handika, and Emir Surya Rahmajati, "How Do Firms' Characteristics Affect Risks? ASEAN Firms Panel Data Analysis," *Cogent Business and Management* 12, no. 1 (2025), <https://doi.org/10.1080/23311975.2024.2436646>.

³² Povilas Lastauskas and Anh Dinh Minh Nguyen, "Spillover Effects of US Monetary Policy on Emerging Markets amidst Uncertainty," *Journal of International Financial Markets, Institutions and Money* 92 (2024): 1–31, <https://doi.org/10.1016/j.intfin.2024.101956>.

³³ Ariadne Checo, Francesco Grigoli, and Damiano Sandri, "Monetary Policy Transmission in Emerging Markets: Proverbial Concerns, Novel Evidence," *IMF Working Paper* 24, no. 93 (2024): 1–45, <https://doi.org/10.5089/9798400268564.001>.

consistency of traditional parametric estimation, requiring adaptive estimation techniques for rapidly changing market conditions ³⁴.

Table 3: PCA Results

	<i>Importance of components:</i>			
	<i>PC1</i>	<i>PC2</i>	<i>PC3</i>	<i>PC4</i>
<i>Standard deviation</i>	1.8780	0.60394	0.30038	0.13494
<i>Proportion of Variance</i>	0.8817	0.09119	0.02256	0.00455
<i>Cumulative Proportion</i>	0.8817	0.97289	0.99545	1.00000

Source: Processed by the researcher, 2025

Table 4: Robustness Checks

<i>CORRELATION BETWEEN CDR AND ALTERNATIVE FACTORS:</i>			
	<i>level_corr</i>	<i>slope_corr</i>	<i>curvature_corr</i>
<i>1</i>	0.2093	-0.4324	0.7225

Source: Processed by the researcher, 2025

Negative slope factor correlation (-0.4324) between CDR and alternative methods. This finding is in line with ³⁵ in the consistency of slope factor estimates during periods of high policy uncertainty. In Indonesia, inconsistencies may have been exacerbated by BI's shifting monetary policy framework during the pandemic. The transmission of policy uncertainty through slope factor impacts became more pronounced during the pandemic where its effectiveness was reduced.

High correlation curvature factor (0.7225) shows robust consistency. This consistency is about the resilience curvature factor to market stress in emerging markets. Curvature may be influenced more by structural factors such as investor base composition than transient policy shocks. The stability of the curvature factor during volatile periods indicates relative depth in the intermediate tenor, which is less susceptible to policy-induced distortions ³⁶.

3. Policy implications

Monetary policy transmission Bank Indonesia is effective in transmitting policy interest rates to government interest rates, especially for the short term. However, the

³⁴ Renata Tavanielli and Márcio Laurini, "Yield Curve Models with Regime Changes: An Analysis for the Brazilian Interest Rate Market," *Mathematics* 11, no. 11 (2023): 1–28, <https://doi.org/10.3390/math11112549>.

³⁵ Tavanielli and Laurini.

³⁶ Bryan Hardy, Deniz Igan, and Enisse Kharroubi, "Resilience in Emerging Markets: What Makes It, What Could Shake It?," *BIS Bulletin*, no. 88 (2024): 1–6, www.bis.org.

transmission to the long term is weaker. This can be due to various factors such as long-term inflation uncertainty, country risk, or insufficient market depth.

The latent factor of the yield curve is the dominant factor in the Indonesian yield curve, and is related to inflation expectations. A consistently negative Slope factor may reflect low economic growth expectations or long-term risks.

The limitations of linear regression models with macroeconomic variables are not sufficient to explain the movement of CDR factors. This indicates that there are other influencing factors, such as global factors, political risks, or fiscal policy. The study recommends adoption of machine learning techniques and high-frequency data analysis to capture non-linearity and structural breaks in an increasingly complex post-pandemic environment.

D. Conclusion

Based on the analysis that has been done, this study concludes that the Christensen, Diebold, and Rudebusch (CDR) model was successfully applied to extract three latent factors (level, slope, and curvature) of the yield curve of Indonesian government bonds for the period 2010-2024. The results of the latent factor CDR estimation confirm the research hypothesis that the movement of Bank Indonesia's policy rate is transmitted throughout the tenor structure of the yield curve, albeit with different effectiveness. In particular, the transmission of monetary policy proved to be stronger at short-term interest rates, while the transmission to long-term interest rates was weaker, which was characterized by the extreme dominance of level factors as well as a consistently negative and flattening slope. This finding answers the purpose of the study by showing that the dynamics of CDR factors represent a transmission mechanism, where level factors reflect inflation expectations and monetary policy credibility, slope factors indicate economic growth expectations, and highly volatile curvature factors reflect liquidity premiums and sensitivity to shocks.

In addition, the integration of the CDR factor with macroeconomic variables through the VAR/IRF approach reveals that the response of inflation and GDP to monetary shocks varies, with the level factor being the dominant explanation for the variation in the yield curve. However, conventional linear models have limitations in capturing non-linearity and structural breaks, especially after the COVID-19 pandemic. Therefore, this study recommends for further study to adopt more adaptive analysis techniques, such as machine learning and high-frequency data analysis, in order to capture more complex dynamics and include global and fiscal variables in order to enrich the understanding of monetary transmission in Indonesia in an increasingly dynamic and interconnected economic environment.

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