

IFG Progress Digest

The Impact of Various Shocks to Indonesia's Bond Yield: Lag-Augmented Local-Projection (LP)

March 14th, 2024 - Issue 17

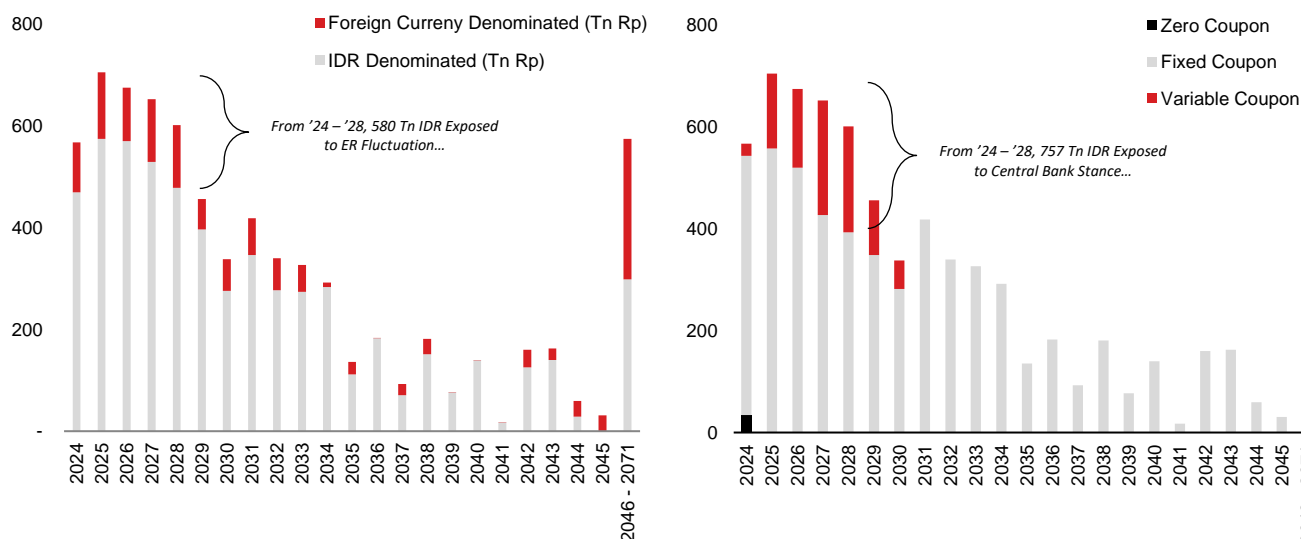
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- This IFG Progress Digest is the follow-up of *Economic Bulletin (EB) – Issue 44 Indonesia's Yield Curve In 2024: Machine Learning & Dynamic Nelson Siegel (DNS) Model* where we explore as to how macroeconomic shocks influence government bond yield;
- We found that our four estimation scenarios for 10-year government bond yield do indeed align with our previous baseline scenarios with the worst number revolve around 7.2%. Regular updates of our predictions will be available at ifgprogress.id.

Based on two of our best-performing models from the previous publication, *Economic Bulletin (EB) – Issue 44 Indonesia's Yield Curve In 2024: Machine Learning & Dynamic Nelson Siegel (DNS) Model*, we estimate that bond for **2-year maturity will hover around 5.7% to 6.4%, 5-year maturity at ±6.5%, and 10-year maturity at 6.6% - 6.9%**. However, with the current volatility and the challenges that we will or are currently facing, are those estimations still valid and relevant? Moreover, what are the magnitude of those challenges in influencing government bonds? This IFG Progress Digest Issue 17 will try to explore those fundamental questions and complete our estimation for 2024 and lessons for beyond.

Exhibit 1. Debt Maturity by The Type of Currency (left) and Coupon (right)



Source: Ministry of Finance, IFGP Research. Note: Debt profile as of 28th of December 2023

In pursuit of answering those two questions, we will start by looking at the structure of Indonesia's government debt maturity profile, both by the type of currency and coupon in Exhibit 1. By its currency, there are as much as 580 Tn IDR in foreign currency denominated exposures and 757 Tn IDR in

variable coupon exposures. These two conditions can develop to even more significant numbers if we face 1) higher level of inflation from El-Nino, 2) hawkish central bank policy stance responding to external and internal shocks, 3) high fluctuation in exchange rate, and lastly 4) bigger and more expansive fiscal stance for the next administration.

The Models

To test and model those four possibilities, we use and build Local-Projection (LP) model to obtain the Impulse-Response Function (IRF) following Jordà (2005)¹. We chose to pick the IRF from LP rather than the traditional Vector Autoregressions (VAR) to get more robust estimation, can accommodate non-linear characteristics, and flexible specifications. The primary difference between the LP and the traditional VAR is that the LP will estimate local projections at each period that we specify. Meanwhile, the VAR will conduct extrapolations in which accuracy and precision are very dependent on the length of the horizon being used. The LP that we use follows Jordà (2005) specifications:

$$y_{t+s} = \alpha^s + B_1^{s+1}y_{t-1} + B_2^{s+1}y_{t-2} + \dots + B_p^{s+1}y_{t-p} + u_{t+s}^s$$

Where α^s is constants and B_i^{s+1} are coefficients for each lag at each horizon. We also estimate the IRF using:

$$\widehat{IR}(t, s, d_i) = \widehat{B}_1^s d_i$$

Where d_i is the shock and \widehat{B}_1^s is the coefficient.

We use several series of maturities as the dependent variables; they are 1) 1-year, 2) 2-year, 3) 3-year, 4) 5-year, 5) 10-year, 6) 20-year, and 7) 30-year. Furthermore, we set four variables as the exogenous variables; they are 1) Inflation rate, 2) Exchange rate, 3) Bank Indonesia rate and 4) Supply for Government Bond (Outstanding). Lastly, to use the correct adjustment for the model, we also follow the inferential approach of LP's model from Montiel Olea & Plagborg-Møller (2021)². They suggested Lag-Augmented Local Projection, where the main purpose of this approach is to make the variables of interest stationary even when the dependent variables have a unit root. This Lag-Augmented Local Projection has two consequences, 1) additional 1 lag if the true model is believed to be a VAR of order p (p+1) and 2) White-corrected standard errors should be reported (we use Newey-West standard errors). Hence, before conducting the LP, we tested the order of the VAR and used white-corrected standard errors to get a robust result.

The Results

In Exhibit 2, we clustered the IRF by their shocks (1) Inflation rate, 2) Exchange rate, 3) Bank Indonesia rate, and 4) Supply for Government Bond (Outstanding)). We generate the IRF step by as many as 12 or equal to 12 months (1 whole year). Since all the variables have been converted and transformed into percentages, we can interpret the 1-unit shock and its response in percentage points.

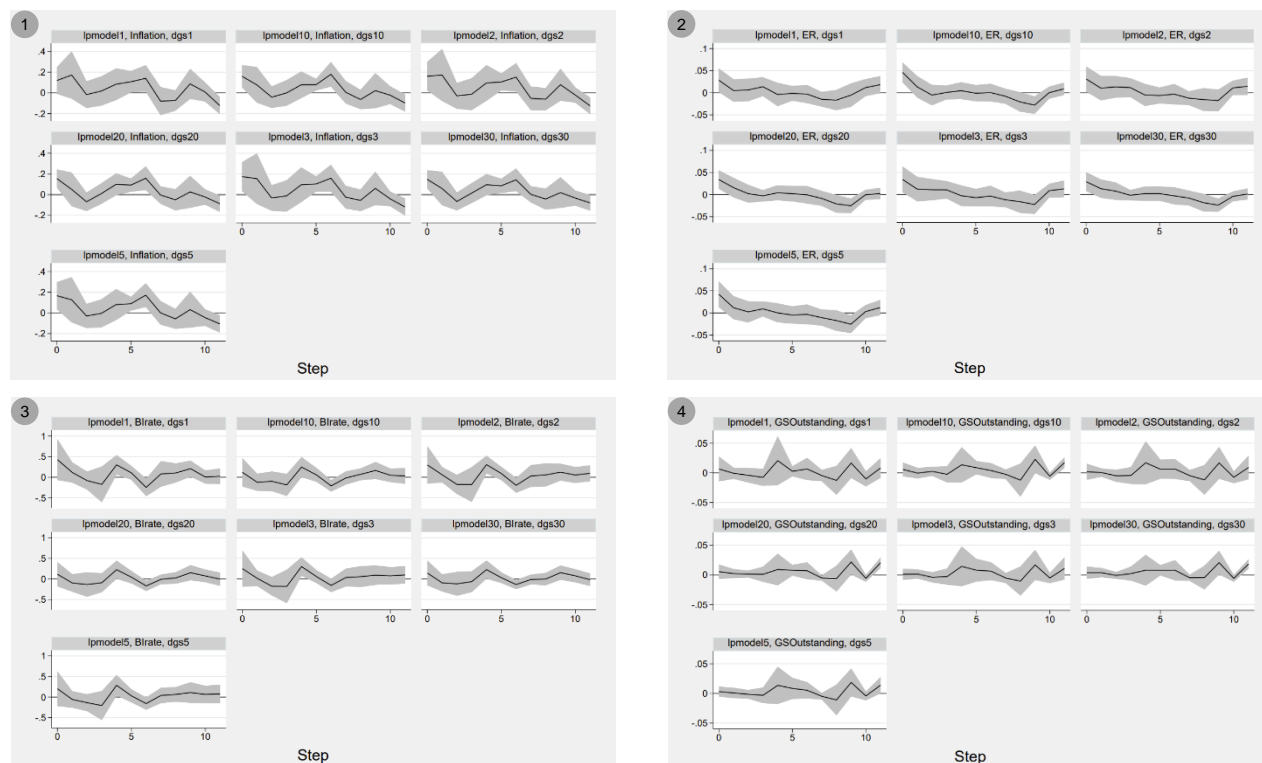
All the responses from those four shocks (impulses)

¹ Jordà, Ò. (2005) 'Estimation and inference of impulse responses by local projections', American Economic Review, 95(1), pp. 161–182. doi:10.1257/0002828053828518.

² Montiel Olea, J.L. and Plagborg-Møller, M. (2021) 'Local projection inference is simpler and more robust than you think', Econometrica, 89(4), pp. 1789–1823. doi:10.3982/ecta18756.

generated various responses across maturities. From the first impulse variable, which is inflation, one unit shock in inflation would cause government yield to increase significantly. While the type of the shock is different (an increase in the short to medium horizon and normalized in the long horizon), the impact of inflation showed a lasting response for government yield. Next, on the second impulse variable, which is the exchange rate, the impulse seemed to be short-lived as the government bond yield only responded with an increase in the short horizon and normalized in the long horizon.

Exhibit 2. Impulse-Response Function (IRF) From Local Projection Model with Lag-Augmented Approach



Source: IFGP Research. Note: The response of 1 unit shock. Dgs is a differentiated government securities with the following number (dgs*10') as its maturity year. The middle word is the impulse variable

Different from the previous two impulses, the third impulse, which is Bank Indonesia Policy Rate, one unit shock in the rate would cause government yield to increase significantly only in the medium horizon or in the 3rd/4th month after the impulse. Lastly, for the fourth shock, which is the government outstanding, one unit shock would cause an increase in government yield with the peak in 4th and 9th horizon. Although the movement (responses) from all the shocks (impulses) are pretty similar across maturities, however, we can see that there are some different reactions between them, especially in terms of magnitude of the response.

The Scenarios

To make things more relevant, we scale up the impact (response) of our Local-Projection (LP) model to follow our macroeconomic assumptions in a real-world condition as indicated in Exhibit 3. Before incorporating our macroeconomic assumptions, we first showed that our assumptions were indeed valid and robust with minimum gap compared to the Ministry of Finance's assumptions and its actual numbers. Our numbers are in range, and we use the

median of the range for our scenario. For the government outstanding, we follow the MoF's budget plan guidance for 2024 at 666.4 Tn IDR (nett). The adjusted estimation can be found in Exhibit 4.

Exhibit 3. IFG Progress Macroeconomic Assumptions

2022					
Historical Tracking	APBN	Projection	Actual	Gap Compared to Actual (%)	
				APBN	Projection
GDP Growth (%yoy)	5.2	5.1 - 5.3	5.31	-0.11	-0.01 - -0.21
Inflation (EoY, %)*	3.0	4.2 - 4.4	4.21	-2.41	-0.01 - 0.19
Exchange rate (EoY, Rp)	14,350	15,800 - 16,000	15.645	-8.28	0.99 - 2.27
10 Year Government Bond (EoY, %)	6.8	7.4 - 7.6	6.93	-0.13	0.47 - 0.67
Current Account Balance (% of GDP)					
2023					
Historical Tracking	APBN	Projection	Actual	Gap Compared to Actual (%)	
				APBN	Projection
GDP Growth (%yoy)	5.3	4.9 - 5.0	5.04	-2.96	-0.14 - 0.04
Inflation (EoY, %)*	3.6	2.8 - 3.2	2.62	-0.98	-0.58 - 0.18
Exchange rate (EoY, Rp)	14,800	15.600 - 15.900	15.606	-5.16	-0.03 - 1.89
10 Year Government Bond (EoY, %)	7.9	6.80 - 7.30	6.66	-1.24	-0.14 - 0.64
Current Account Balance (% of GDP)					
2024					
Historical Tracking	APBN	Projection**			
GDP Growth (%yoy)	5.2	4.8 - 5.1			
Inflation (EoY, %)*	2.8	3.0 - 3.4			
Exchange rate (EoY, Rp)	15,000	15.000 - 15.400			
10 Year Government Bond (EoY, %)	6.7	6.60 - 6.90			
Current Account Balance (% of GDP)	-	-0.4 - -1.0			

Source: Ministry of Finance (MoF), IFGP Research. Note: Gap is the gap between IFG Progress projection and actual. *Projection and actual for Inflation in 2022 are in Average. End of Year (EoY) is at 5.41%. **January 2024 Projection.

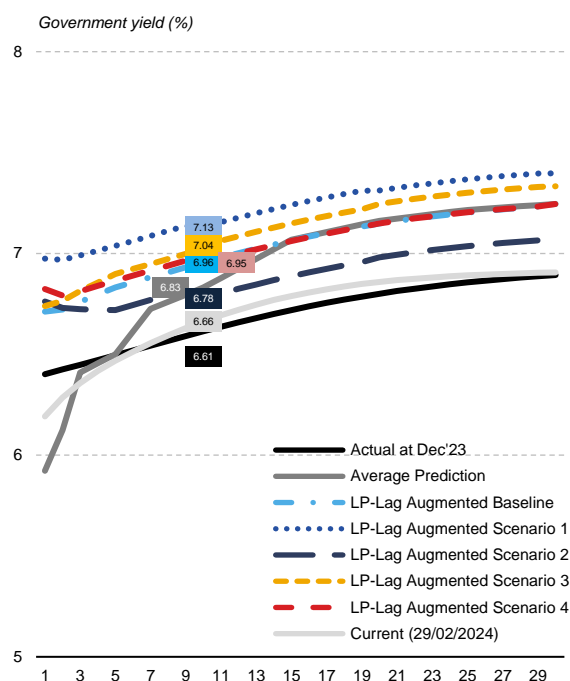
On top of the baseline model, we also extend the model to accommodate our scenarios. We create four scenarios, 1) Spike in Inflation at 4%, 2) Rupiah at Rp16000, 3) Government outstanding shot-up 20% from MoF's budget plan and 4) Bank Indonesia (BI) cuts rate 50bps by 2024. In Exhibit 4, we also included our average prediction from two of our best models taken from Economic Bulletin – Issue 44 to decide whether our baseline predictions are still relevant or not. For the 10-year government bond yield, our 2024 forecast range is at 6.6% - 6.9% (or 6.83%).

In 10-year yield predictions, most predictions revolve around our range, except for scenario 1 and scenario 3. LP-Lag Augmented baseline is at 6.96%, LP-Lag Augmented

scenario 1 is at 7.13%, LP-Lag Augmented scenario 2 is at 6.78%, LP-Lag Augmented scenario 3 is at 7.04% and LP-Lag Augmented scenario 4 is at 6.95%. Currently (29th of February 2024), 10-year yield is at 6.66%. We maintain our view and still see that the range of 10-year yield for 2024 would still revolve around 6.6% - 6.9% with a low probability scenario at 7.2%. (For now, these models still do not account for Bank Indonesia's intervention policy such as Operation Twist).

We will update these numbers on a regular basis at <https://ifgprogress.id/>

Exhibit 4. Our Baseline & Impact-Adjusted Numbers



Source: IBPA, IFGP Research. Note: Actual is the yield from the end of the year (2023). Average prediction is the average from two of our best models taken from [Economic Bulletin – Issue 44](#). Baseline is derived from the baseline assumption on Exhibit 3. Scenario 1 is derived from spike in inflation at 4%, Scenario 2 from Rupiah at Rp16000, Scenario 3 from Government Outstanding shot-up 20% from Mof's Budget Plan, and Scenario 4 from BI cuts rate 50bps by 2024. Since we only use seven maturities, the others are linearly interpolated for the sake of the graph. The scenarios are in partial impact approach, meaning we shock one assumption and holding the others constant (*ceteris paribus*).

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