Indonesia’s small-open economy is highly susceptible to external shocks, affecting Rupiah (IDR), considerably. Episodes like the Asian Financial Crisis and recent monetary tightening post-COVID-19 have exposed the vulnerability of rupiah, often making it one of the most adversely affected emerging market currencies.

Bank Indonesia’s mandate as written in The Law of The Republic of Indonesia Number 4 Of 2023 Concerning The Development And Strengthening Of The Financial Sector: “The management of the exchange rate is aimed at maintaining the development of the exchange rate to be stable and in line with the fundamental conditions of the economy ....” underscores the importance of IDR exchange rates, especially against major currencies, such as the US dollar.

This study examines the fundamental values of the IDR against the USD. We tested 10 models (8 standard and 2 extension) to discover Rupiah’s fundamental value. Four of these models offer decent predictive accuracy on the Rupiah's value, while the other showed the potential of Rupiah to undershoot/overshoot compared to its actual. This study found that models with the extension of Financial Condition Index (FCI) show improved forecasting power. Based on the two best models, we find the fundamental IDR rate against the US dollar to be in the range of Rp14.700 – Rp15.200 until the end of 2023.

Lastly, we also showed that short-term Rupiah stability is highly dependent on BI's Foreign Exchange (FX) interventions like Domestic Non-Deliverable Forward (DNDF), Swaps, and Term-Deposits. The effectiveness of these tools, coupled with newly introduced policies like Exports FX Term-Deposit and Bank Indonesia Rupiah Securities (SRBI), will be crucial in offsetting potential domestic and external risks.
Indonesia’s Exchange Rate: Fundamental Value & Path

In the realm of international economics, exchange rate dynamics hold particular salience for small-open economies like Indonesia. The ups and downs of the exchange rate critically affect various dimensions of the domestic economy, ranging from tangible activities like foreign trade to intangible financial operations, including the influx and outflow of foreign capital. Particularly noteworthy is the propensity for the exchange rate volatility to significantly impair Indonesia’s terms of trade and affect asset-liability valuations. Consequently, adept monitoring and strategic anticipation of exchange rate movements are indispensable for the sustainability of Indonesia’s economic development—a formidable task, given the country’s open capital account regime and inflation targeting regime.

Over the past quarter-century, Indonesia’s economy has been the “victim” of multiple external shocks that have led to substantial depreciations in the exchange rate. Notable episodes include the Asian Financial Crisis in 1997, the Dot-com Bubble burst in 2000, the Global Financial Crisis in 2008, the Federal Reserve’s Tapering in 2013, the initial rate hike by the Federal Reserve in 2015, and the monetary tightening in the aftermath of the COVID-19 pandemic in 2022. In each instance, Rupiah experienced substantial depreciation vis-à-vis the U.S. dollar, as deep as 95% year-on-year, rendering Indonesia as either the most or second-most adversely affected emerging economy in terms of foreign currency performance – in other word, the biggest or the second biggest “loser” (Exhibit 1).

To analyse this phenomenon, we should go back to an old “theology” paradigm called “Trilemma” or famously known as “Impossible Trinity” coined by Mundell-Fleming. According to this paradigm, policymakers are confronted with an inescapable trade-off among three policy objectives: 1) Monetary Independence, 2) Financial Integration, and
3) Exchange Rate Stability. Policy makers can only choose two out of three options to be focused on and “leave” the last one to market mechanism.

If a country decides to choose Monetary Independence and Exchange Rate Stability, then it must be ready to “Sacrifice” financial integration. Similarly, if it chooses Monetary Independence and Financial Integration, then it will let market mechanism to decide the movement of its Exchange Rate Stability (Exhibit 2). For Indonesia, Bank Indonesia (BI) itself never clearly states which option it chooses, and which last one it sacrifices. Nevertheless, its action and stance can be described using “trilemma” indexes from 1997 to 2015 made by Aizenman et al. (2013).

Since BI adopted floating exchange rate regime on August 14th,1997, BI stance has always been consistent, at least according to the index. BI has been consistently choses Monetary Independence and Financial Integration, at the same time, “sacrifices” ER into the market mechanism¹. This stance, partly, also speaks for the volatility of Rupiah (Exhibit 3).

¹ Although it’s very tempting to discuss the background of why BI chooses those two options and whether those options are still relevant with the current condition or not since we’ve suffered current account deficit (very different condition compared to when BI decide this decision), we choose to stick to the objective of this paper and leave those topics for the next paper.
Regardless of the stance, BI does not “completely” leave the ER at the market’s mercy. From its official website, BI has stated that the main objective of its monetary policy is to maintain and achieve Rupiah’s stability. This concept further explained in The Law of The Republic of Indonesia Number 4 Of 2023 Concerning The Development And Strengthening Of The Financial Sector specified in The Article 9 Number 5 Article 10 Paragraph (5):

“The management of the exchange rate is aimed at maintaining the development of the exchange rate to be stable and in line with the fundamental conditions of the economy, thus becoming an integral part of efforts to support the achievement of low and stable inflation.”

Paragraph above raises a big question, then, where’s the exchange rate level dictates by fundamental conditions of the economy? Moreover, how does BI keep the exchange rate stable given the stance that we previously discussed above? Next, this paper will discuss further what’s the Rupiah’s fundamental value and path according and in line to Indonesia’s economic fundamental condition and the dynamics of BI in maintaining the stability of Rupiah.

**Rupiah’s Fundamental Value & Path**

To discover where’s the level of ER according to and in line with the fundamental condition of the economy, this paper use eight fundamentally determinant exchange rate models, namely: 1) Uncovered Interest Rate Parity (UIRP), 2) Relative Purchasing Power

<table>
<thead>
<tr>
<th>Method</th>
<th>Fundamental Function</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Walk</td>
<td>( X_{t+k} - X_t = \epsilon_{t+k} )</td>
<td>Alquist and Chinn (2008); Rossi (2013); Wu and Wang (2013); MacDonald and Nagayasu (2015); Kouwenberg et al. (2017); Cheung et al. (2019); Zhang and Hamori (2020); Colombo and Pelagatti (2020).</td>
</tr>
<tr>
<td>UIRP</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}<em>{t-2} + \beta_4 \hat{z}</em>{t-3} + \epsilon_t )</td>
<td>Cheung et al. (2005); Jordá and Taylor (2012), Rossi (2013); Wu and Wang (2013), MacDonald and Nagayasu (2015), Ca’ Zorzi et al. (2016), Kouwenberg et al. (2017), Cheung et al. (2019), Zhang and Hamori (2020)</td>
</tr>
<tr>
<td>Relative PPP</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}<em>{t-2} + \beta_4 \hat{z}</em>{t-3} + \epsilon_t )</td>
<td>Cheung et al. (2005); Jordá and Taylor (2012), Rossi (2013); Wu and Wang (2013), MacDonald and Nagayasu (2015), Ca’ Zorzi et al. (2016), Kouwenberg et al. (2017), Cheung et al. (2019), Zhang and Hamori (2020)</td>
</tr>
<tr>
<td>Sticky Price Monetary</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}<em>{t-2} + \beta_4 \hat{z}</em>{t-3} + \epsilon_t )</td>
<td>Wolfe (1987), Shin and Smuts (1989), Meese and Rose (1991), Heidari and Pin (1992), Cheung and Chinn (1998), Cheung et al. (2005), Alquist and Chinn (2008), Cheung et al. (2019)</td>
</tr>
<tr>
<td>BEER</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}<em>{t-2} + \beta_4 \hat{z}</em>{t-3} + \epsilon_t )</td>
<td>Clark and MacDonald (1999), Yilmaz (2003), Schnatz et al. (2004), Cheung et al. (2005), Cheung et al. (2019)</td>
</tr>
<tr>
<td>Taylor Rule</td>
<td>( X_{t+k} - X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}_{t-2} + \epsilon_t )</td>
<td>Engel et al. (2008), Mofidi and Papp (2009), Ross (2013), Wu and Wang (2013), Byrne et al. (2014), Kouwenberg et al. (2017), Cheung et al. (2019), Engel et al. (2019), Wang, Morley and Stamatoglou (2019), Krohn and Moore (2019), Zhang and Hamori (2020), Colombo and Pelagatti (2020)</td>
</tr>
<tr>
<td>Augmented Sticky Price Monetary</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \beta_3 \hat{z}<em>{t-2} + \beta_4 \hat{z}</em>{t-3} + \epsilon_t )</td>
<td>Wolfe (1987), Shin and Smuts (1989), Meese and Rose (1991), Heidari and Pin (1992), Cheung and Chinn (1998), Cheung et al. (2005), Alquist and Chinn (2008), Cheung et al. (2019)</td>
</tr>
<tr>
<td>Yield Curve</td>
<td>( X_{t+k} - X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \epsilon_t )</td>
<td>Chen and Tsang (2013) &amp; Cheung et al. (2019)</td>
</tr>
<tr>
<td>Monetary Model</td>
<td>( X_t = \alpha_o + \beta_1 \hat{z}<em>t + \beta_2 \hat{z}</em>{t-1} + \epsilon_t )</td>
<td>Meese and Rogoff (1983), Meese and Rose (1991), Rapach and Worh (2002), Faust et al. (2003), Groen (2005), Engel et al. (2008), Della Corte et al. (2009), Costantini et al. (2016), Beckmann &amp; Schuesler (2016), Crespo Cuaresma et al. (2018), Zhang and Hamori (2020), Colombo and Pelagatti (2020).</td>
</tr>
</tbody>
</table>

Source: Various, IFGP Research. Note: Further explanation on the notation can be found in the Appendix. To be concise, we only selected several references that we think are very relevant to the model that we used. There are many other good and insightful references that use the method beside the ones that are listed.

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3 Indonesia’s Law does not have any official translation, this is only an approximation. To see the real statement, please refer to the official document.
Parity (PPP), 3) Sticky Price Monetary Model, 4) Behavioural Equilibrium Exchange Rate (BEER), 5) Taylor Rule, 6) Augmented Sticky Price Monetary Model, 7) Yield Curve, and 8) Monetary Model (Exhibit 4). All those models that we use for estimating Rupiah’s fundamental value can be traced back into four original models, they are 1) Flexible-price monetary model (Frenkel-Bilson), 2) The sticky-price monetary model (Dornbusch-Frankel), 3) The sticky-price asset model (Hooper-Morton), and 4) Taylor Rule Model. Furthermore, to fully capture the relationship between the ER and the rest of the economy, we also incorporate two out of three most popular equilibrium exchange rate models, they are 1) Purchasing Power Parity (PPP) and 2) Behavioural Equilibrium Exchange Rate (BEER). From those eight models, we test the performance with respect to the actual ER and analyse the story produced by each model. Note: the determinant variables are listed in Appendix 1.

Out of all eight fundamental models that we use, there are several lessons that we can learn from (Exhibit 5 & Exhibit 6):

- The estimated IDR rates derived from the models, compared to the actual in several episodes, reflect considerable gaps at times. The spreads capture the phenomenon of undershoots and overshoots relative to its fundamental value;

- Uncovered Interest Rate Parity (UIRP) model showed the biggest gap among the other models, while Behavioural Equilibrium Exchange Rate (BEER) showed the lowest gap;
• Similar to the second point, BEER showed the highest mean R-squared and lowest deviation, while the UIRP showed the lowest mean R-squared and highest deviation among the tested models;
• Lastly, the RMSE of BEER has the smallest RMSE compared to all the models that we tested. The fittest model, at the same time, will generate the least magnitude both in undershoot and overshoot.

Exhibit 6. R-squared of Fundamental Exchange Rate Model & Its RMSE

Source: IFGP Research. Note: The box-plot represent the dynamics of R-squared over the whole sample. The RMSE value is noted in the middle of the box.

IFGP’s Extension of BEER & Augmented Sticky Price Model

Two of the eight models that we tested have already produced statistically decent results, at least in the context of R-squared and RMSE. Next, we decide to modify two of the best models to improve the estimation results. In this case, we use 1) BEER, and 2) Augmented Sticky Price Model. We extend both models to include our own Financial Condition Index (FCI)\(^5\) to incorporate the dynamics of Indonesia’s financial sector. The final model that we use are the following:

• BEER:
\[
X_t = \alpha_0 + \beta_1 \tilde{p}_t + \beta_2 \tilde{w}_t + \beta_3 \tilde{r}_t + \beta_4 \tilde{y}_t + \beta_5 \tilde{\delta}_t + \beta_6 \tilde{\theta}_t + \beta_7 \tilde{FIC}_t + \varepsilon_t
\]

• Augmented Sticky Price Model:
\[
X_t = \alpha_0 + \beta_1 \tilde{m}_t + \beta_2 \tilde{y}_t + \beta_3 \tilde{\delta}_t + \beta_4 \tilde{\theta}_t + \beta_5 \tilde{I}_t + \beta_6 \tilde{FIC}_t + \beta_7 \tilde{FIC}_t + \varepsilon_t
\]

Our FCI is an aggregated index using dimension reduction methodology called Principal Component Analysis (PCA). This movement of this index will reflect the tightening and the loosening of Indonesia’s financial sector.

Both extensions of the model have shown better results than the standard model with each producing means of R-squared and RMSE level at 95% & 2.6 and 85% & 4.00. We translate these improved models into nominal terms to predict and analyze the path of Rupiah in the future.

Based on our models (eight standard fundamental models and two extensions), the path of Rupiah until the end of 2023 will revolve around Rp14.700 – Rp15.200, where Rp14.700 based on IFGP BEER model and Rp15.200 based on IFGP Augmented Sticky Price Model. Although the two best models showed robust in-sample prediction and potentially for out-of-sample prediction, we can’t ignore the possibility of overshooting as reflected by fundamental value from other models. For example, Random Walk, UIRP, Relative PPP, Taylor Rule, and Yield Curve models value are revolving around Rp15.600 – Rp15.900 (Exhibit 7).

**Exhibit 7. The Movement of Rupiah Based on Fundamental of The Economy Showed Further Weakening...Range at Rp14.700 – Rp15.200**

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**BI FX Intervention: Stabilizing Rupiah Along Its Fundamental Value**

So, the question now is despite the signals and guidance given by our fundamental models above, what is the deciding factor for Rupiah’s path and the overshoot/undershoot phenomenon relative to its fundamental value?. One important thing, if not the most important, is the performance and magnitude of BI Foreign Exchange (FX) Intervention. Several options that BI use to stabilize Rupiah are 1) Domestic Non-Deliverable Forward (DNDF), 2) Swap, and 3) Term-Deposit (TD). Some of the gap between the fundamental models and actual value of ER can be associated with the big movement of either DNDF, Swap, TD, or all three together. For example, in the period of 2019 – 2021, the volume of DNDF and Swap both jumped quite significantly. These injections prove to be very effective in holding and maintaining Rupiah to not overshoot following the other fundamental model\(^6\) (Exhibit 8). Looking ahead into the last

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\(^6\) See more on the effectiveness of Bank Indonesia FX Intervention: Juhro & Azwar (2021)
three months of 2023, our fundamental models showed that there will be further volatility and pressure for Rupiah. BI’s Monetary Operations are very crucial in maintaining Rupiah stability and keeping it from overshooting. BI’s new policy of Exports FX TD and Bank Indonesia Rupiah Securities (SRBI) will provide a very good support, albeit still relatively limited observations to fully evaluate at this time.⁷

**Concluding Remarks**

In conclusion, based on “Trilemma” concept, the long-term Rupiah rate is arguably predominantly driven by the structural economic reforms that Indonesia’s has taken since 1997. However, in short term, global and domestic macroeconomic environments play a key role in determining the value and path of Rupiah. Using 10 models (8 standard models and 2 extensions), we showed the value and path of Rupiah according to fundamental macroeconomic indicators. These models can give signals to many stakeholders regarding the performance of Rupiah against the major currencies such as the US dollar, including the periods of overshooting/undershooting, and the future value of the currency. BI’s FX intervention is very important, especially in smoothing Rupiah’s volatility in the short term, even more so when many downside risks, such as uncertainties arising from presidential election, no more terms-of-trade boost from higher commodity prices, the US Fed policy tightening, and other global/external economic and financial volatilities.

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⁷ The current TD for Export activities, since its enactment in March 2023 until August 2023, has pulled-in only ±1.6Bn US$, very small number compared to the other instruments. Further information at Appendix 2.
APPENDIX

Appendix 1. The Notation

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_t$</td>
<td>Foreign Exchange Rate at time $t$</td>
</tr>
<tr>
<td>$X_{t+h}$</td>
<td>Foreign Exchange Rate at time $t+h$</td>
</tr>
<tr>
<td>$\delta_{t,k}$</td>
<td>Intercountry difference of Interest rate at maturity $k$</td>
</tr>
<tr>
<td>$\bar{r}_t$</td>
<td>Intercountry difference of price level</td>
</tr>
<tr>
<td>$\bar{m}_t$</td>
<td>Money supply</td>
</tr>
<tr>
<td>$\bar{y}_t$</td>
<td>Real GDP</td>
</tr>
<tr>
<td>$\bar{i}_t$</td>
<td>Interest rate</td>
</tr>
<tr>
<td>$\bar{n}_t$</td>
<td>Inflation rate</td>
</tr>
<tr>
<td>$\delta_t$</td>
<td>Relative price of non-tradables</td>
</tr>
<tr>
<td>$\bar{i}_t$</td>
<td>Real interest rate</td>
</tr>
<tr>
<td>$\bar{y}_t$</td>
<td>Government debt</td>
</tr>
<tr>
<td>$\delta_t$</td>
<td>Terms of trade</td>
</tr>
<tr>
<td>$\bar{T}_t$</td>
<td>Net foreign asset</td>
</tr>
<tr>
<td>$\bar{r}_t$</td>
<td>Output gap</td>
</tr>
<tr>
<td>$\bar{V}\bar{X}_t$</td>
<td>Volatility index</td>
</tr>
<tr>
<td>$\bar{f}_{X,t}$</td>
<td>3-Month bank rate</td>
</tr>
<tr>
<td>$\bar{s}_{X,t}$</td>
<td>10-Year government bond yield minus 3-Month bank rate</td>
</tr>
<tr>
<td>$m_t$</td>
<td>Foreign money supply</td>
</tr>
<tr>
<td>$y_t$</td>
<td>Foreign output</td>
</tr>
<tr>
<td>$i_t$</td>
<td>Foreign interest rate</td>
</tr>
<tr>
<td>$F\bar{C}_t$</td>
<td>Financial Condition Index</td>
</tr>
</tbody>
</table>

Source: IFGP Research.

Appendix 2. Transaction Results of Term Deposits in Foreign Exchange from Export Activities

<table>
<thead>
<tr>
<th>In Bn US$</th>
<th>In Mn US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Bank Indonesia, IFGP Research.
Appendix 3. References


Source: Various, IFGP Research.
Indonesia Financial Group (IFG)
Indonesia Financial Group (IFG) is the State-Owned Insurance and Underwriting Holding Enterprises consisting of PT Asuransi Kerugian Jasa Raharja, PT Jaminan Kredit Indonesia (Jamkrindo), PT Asuransi Kredit Indonesia (Askrindo), PT Jasa Asuransi Indonesia (Jasindo), PT Bahana Sekuritas, PT Bahana TCW Investment Management, PT Bahana Artha Ventura, PT Bahana Kapital Investa, PT Graha Niaga Tata Utama, and PT Asuransi Jiwa IFG. IFG is the holding established to have the role in national development through the development of complete and innovative financial industry through investment, insurance, and underwriting services. IFG is committed to bring the change in financial sector particularly insurance, investment, and underwriting to which it is accountable, prudent, and transparent with good corporate governance and full of integrity. The collaborative spirit with good corporate governance that is transparent has become the basis for IFG to become the leading, trustworthy, and integrated provider of insurance, investment, and underwriting services. IFG is the future of financial industry in Indonesia. It is time to move forward with IFG as the driving force of inclusive and sustainable ecosystem.

Indonesia Financial Group (IFG) Progress
The Indonesia Financial Group (IFG) Progress is the leading Think Tank established by Indonesia Financial Group as the source of progressive ideas for the stakeholders, academics, or even the business players in bringing forward the financial service industry.