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Indonesia's Exchange Rate: Fundamental Value & Path

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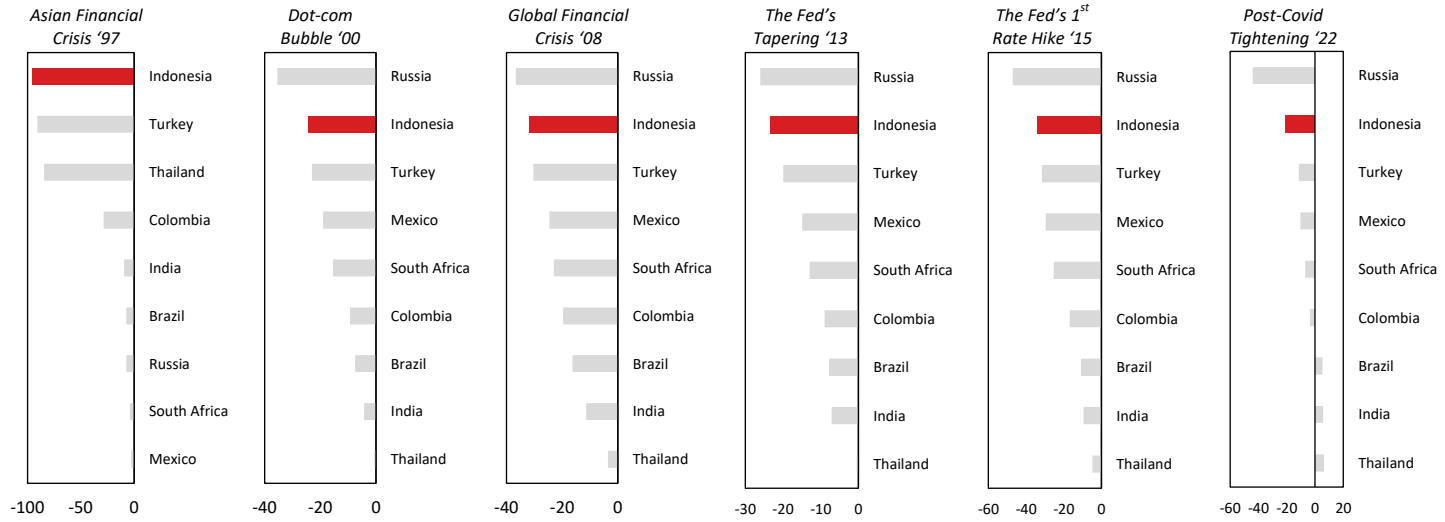
- Indonesia's small-open economy is highly susceptible to external shocks, affecting Rupiah (IDR), considerably. Episodes like the Asian Financial Crisis and recent monetary tightening post-COVID-19 have exposed the vulnerability of rupiah, often making it one of the most adversely affected emerging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

Exhibit 1. Exchange Rate Movements by Selected Phenomenon/Crises Showed Rupiah is One of "The Biggest Loser" Among Emerging Economies…

In % Change (year-on-year, December)



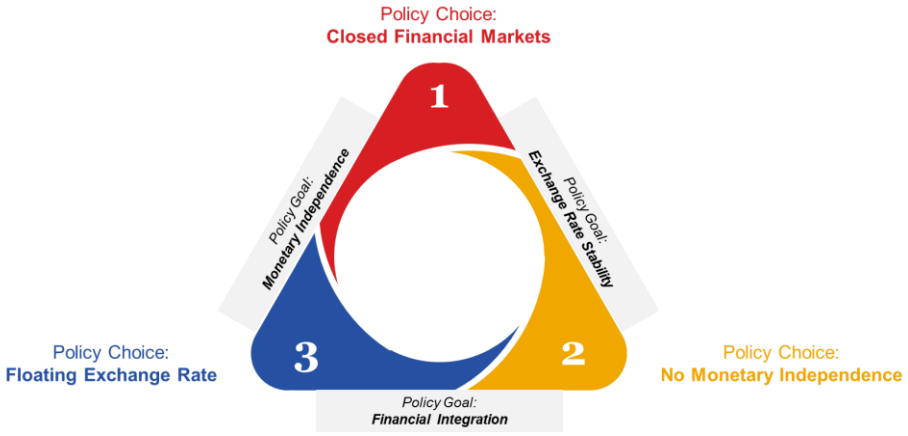
Source: Various, IFGP Research. Note: The data are exchange rates vis-à-vis US dollar (year-on-year percent change in December)

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.

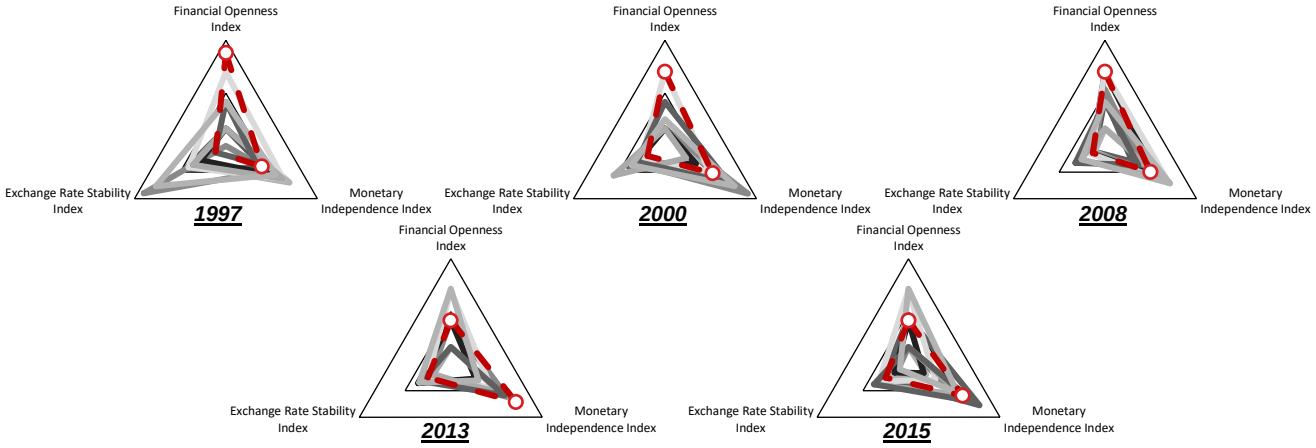
Exhibit 2. Policy "Trilemma" or "Impossible Trinity" Framework



Source: Various, IFGP Research.

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).

Exhibit 3. The "Trilemma" Indexes Showed a Shift in Magnitude, But the Choices Have Always Been Consistent…



Source: Various, IFGP Research. Note: The discussions on the concept of Mundell-Fleming Trilemma, Rey's Dualemma (Rey, 2015), and Aizenman's quadrilemma (Aizenman et al., 2008) are beyond the scope of this paper. Nevertheless, the basic concept of this study relies heavily on those three studies. Graph colored other than red are selected countries from Emerging Market Economies (EME) such as Turkey, South Africa, Brazil, Colombia, Mexico, India, Thailand, & Russia.

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 mechanism[1]. 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[2]. 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)[3]**:**

"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

Exhibit 4. Literature Review on Exchange Rate Fundamental Model

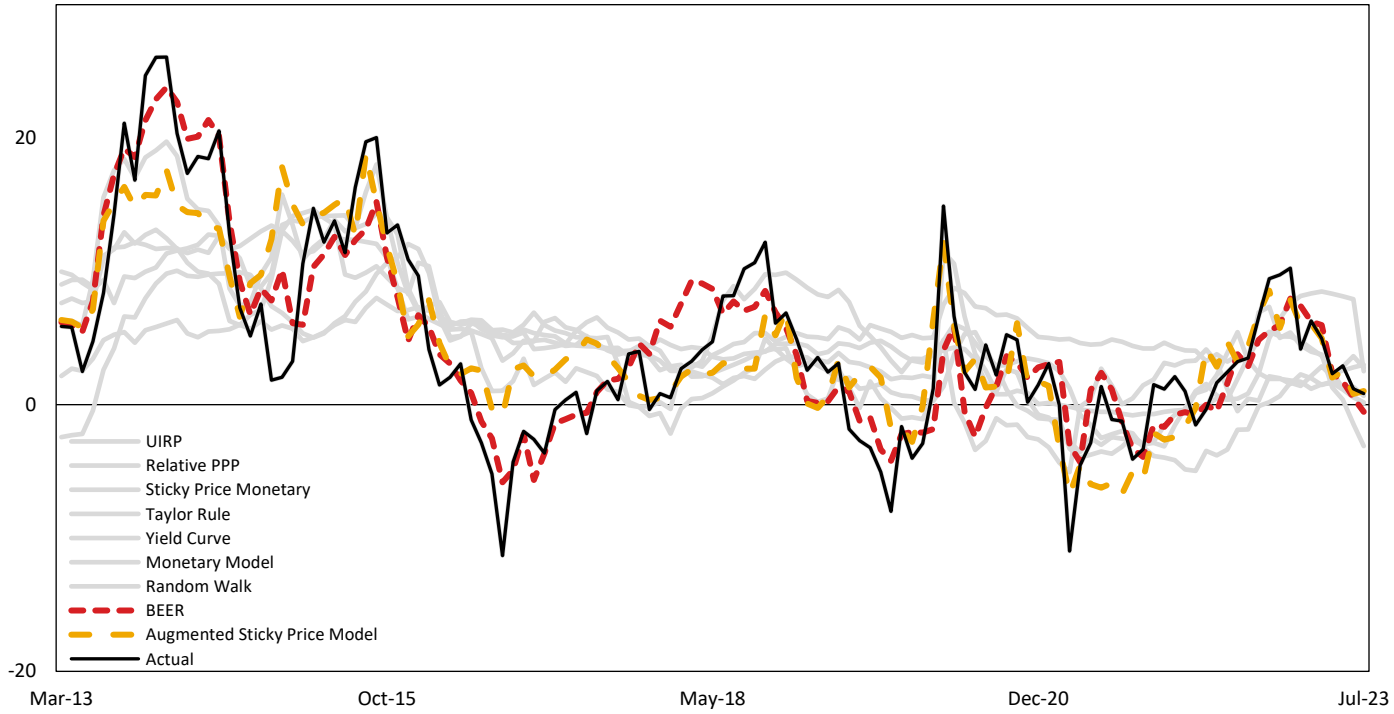
Method	Fundamental Function	Reference
Random Walk	$X_{t+h} - X_t = \varepsilon_{t+h}$	-
UIRP	$X_{t+k} = X_t + \hat{\imath}_{t,k}$	Alquist and Chinn (2008); Rossi (2013); Wu and Wang (2013); MacDonald and Nagayasu (2015); Kouwenberg et al. (2017); Cheung et al. (2019); Zhang and Hamori (2020); Colombo and Pelagatti (2020).
Relative PPP	$X_t = \alpha_0 + \hat{p}_t$	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)
Sticky Price Monetary	$X_t = \alpha_0 + \beta_1\hat{m}_t + \beta_2\hat{y}_t + \beta_3\hat{\imath}_t + \beta_4\hat{\pi}_t + \varepsilon_t$	Wolff (1987), Schinasi and Swamy (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)
BEER	$X_t = \alpha_0 + \beta_1\hat{p}_t + \beta_2\hat{\omega}_t + \beta_3\hat{r}_t + \beta_4\hat{y}_t + \beta_5\hat{\delta}_t + \beta_6\hat{\theta}_t + \varepsilon_t$	Clark and MacDonald (1999), Yilmaz (2003), Schnatz et al., (2004), Cheung et al. (2005), Cheung et al. (2019)
Taylor Rule	$X_{t+k} - X_t = \alpha_0 + \beta_1\hat{\tilde{y}}_t + \beta_2\hat{\pi}_t + \varepsilon_t$	Engel et al. (2008), Molodtsova and Papell (2009), Rossi (2013), Wu and Wang (2013), Byrne et al. (2016), Kouwenberg et al. (2017), Cheung et al. (2019), Engel et al. (2019), Wang, Morley and Stamatogiannis (2019), Krohn and Moore (2019), Zhang and Hamori (2020), Colombo and Pelagatti (2020)
Augmented Sticky Price Monetary	$X_t = \alpha_0 + \beta_1\hat{m}_t + \beta_2\hat{y}_t + \beta_3\hat{\imath}_t + \beta_4\hat{\pi}_t + \beta_5\widehat{VIX}_t + \beta_6\widehat{TED}_t + \varepsilon_t$	Wolff (1987), Schinasi and Swamy (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)
Yield Curve	$X_{t+h} - X_t = \alpha_0 + \beta_1(\hat{\imath}_t) + \beta_2(\widehat{slope}_t) + \varepsilon_{t+h}$	Chen and Tsang (2013) & Cheung et al. (2019)
Monetary Model	$X_t = (m_t - m_t^*) - \gamma(y_t - y_t^*) + \delta(i_t - i_t^*)$	Meese and Rogoff (1983), Meese and Rose (1991), Rapach and Wohar (2002), Faust et al. (2003), Groen (2005), Engel et al. (2008), Della Corte et al. (2009), Costantini et al. (2016), Beckmann & Schussler (2016), Crespo Cuaresma et al. (2018), Zhang and Hamori (2020), Colombo and Pelagatti (2020),

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

[2] https://www.bi.go.id/en/fungsi-utama/moneter/Default.aspx. What's meant by Rupiah's stability is in terms of low and stable inflation as well as exchange rate stability. Accessed by 29th of August 2023.
[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)[4]. 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.

Exhibit 5. Standard Model Performance Compared to The Actual Movement of Exchange Rate



Source: Various, IFGP Research. Note: We use percentage data in our model and convert the result into the nominal term for the result

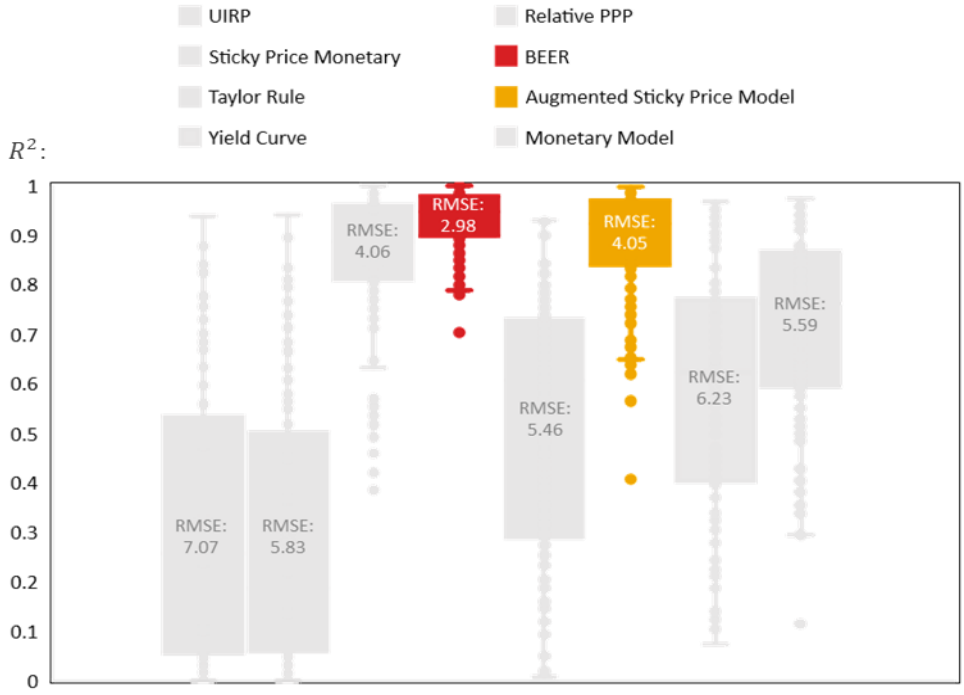
Out of all eight fundamental models that we use, there are several lessons that we can learn from (Exhibit 5 & Exhibit 6):

- 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;

[4] See Bilson (1978, 1979), Frenkel (1976), Dornbusch (1976), Frankel (1979, 1981), Hooper and Morton (1982), Taylor (1993), Mark (1995), Williamson (1994), MacDonald (1998), Macdonald and Clark (1998), Driver and Westaway (2004), Isard (2007), Bussière et al. (2010), and Couharde et al. (2018)

- 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:**

$$X_t = \alpha_0 + \beta_1 \hat{p}_t + \beta_2 \hat{\omega}_t + \beta_3 \hat{r}_t + \beta_4 \hat{y}_t + \beta_5 \hat{\delta}_t + \beta_6 \hat{\theta}_t + \beta_7 \widehat{FCI}_t + \varepsilon_t$$

- **Augmented Sticky Price Model:**

$$X_t = \alpha_0 + \beta_1 \hat{m}_t + \beta_2 \hat{y}_t + \beta_3 \hat{\imath}_t + \beta_4 \hat{\pi}_t + \beta_5 \widehat{VIX}_t + \beta_6 \widehat{TED}_t + \beta_7 \widehat{FCI}_t + \varepsilon_t$$

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.

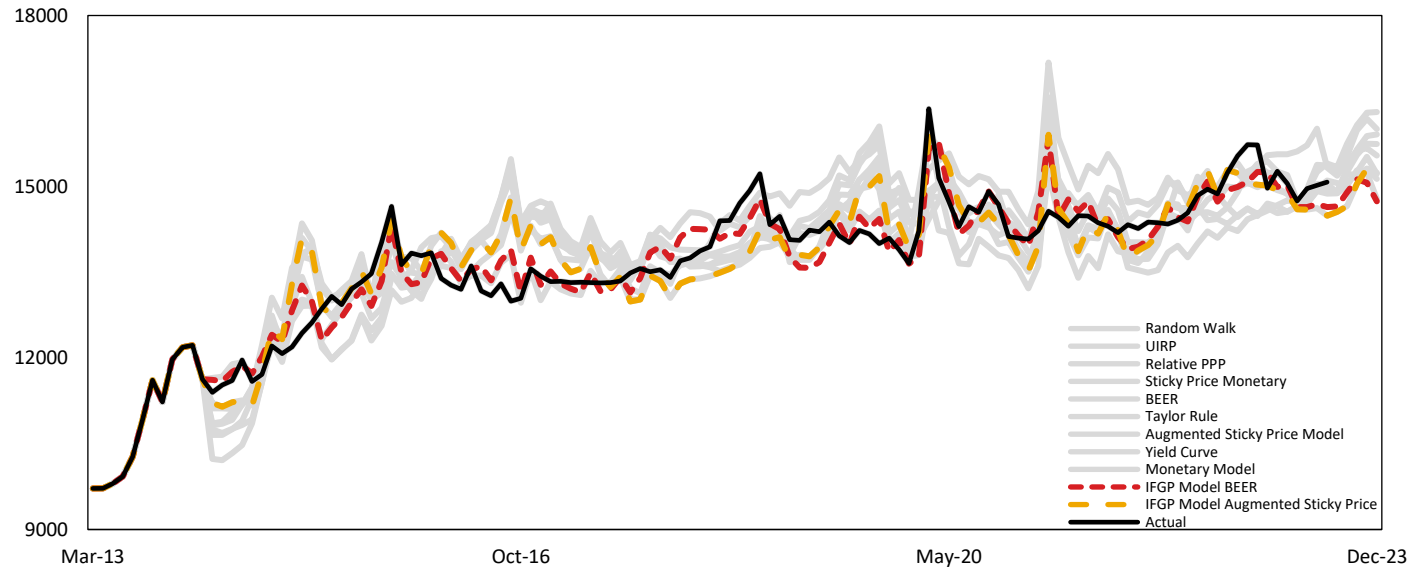
[5] See more our FCI: https://ifgprogress.id/wp-content/uploads/2022/02/IFG-Progress-Weekly-Digest-No.-7-February-10-2022-FINAL-1.pdf

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

In Rupiah



Source: IFGP Research.

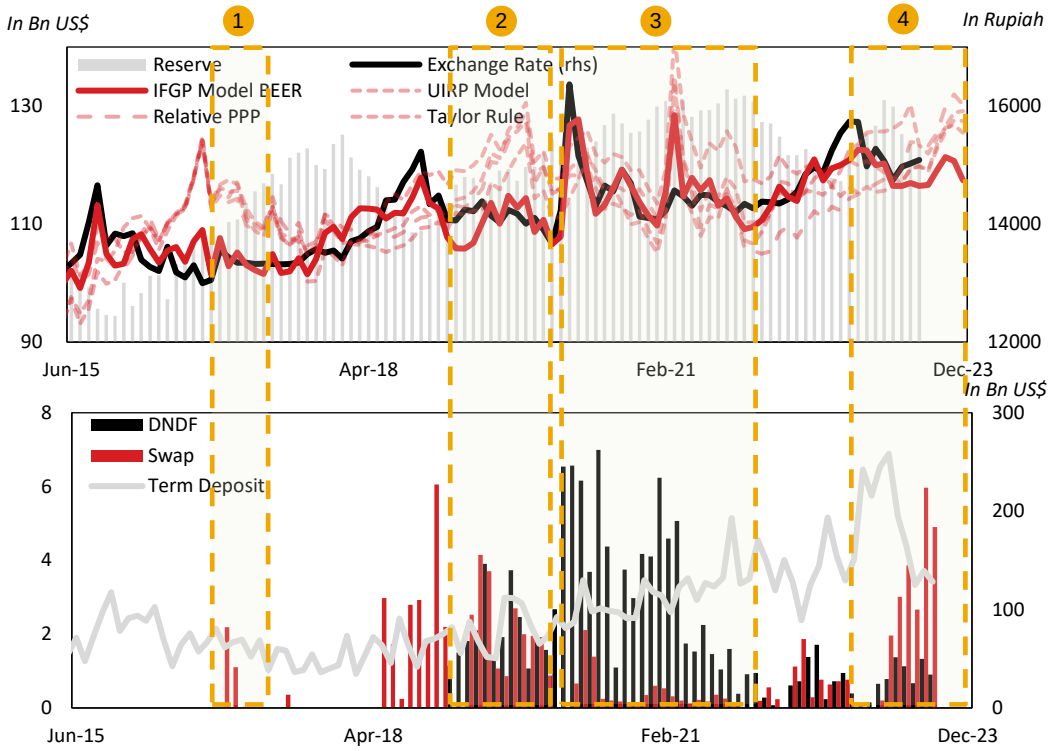
BI FX Intervention: Stabilizing Rupiah Along Its Fundamental Value

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

[6] See more on the effectiveness of Bank Indonesia FX Intervention: Juhro & Azwar (2021)

Exhibit 8. BI Policy & FX Intervention Will Play A Key Role…. At Least In The Short Term….



Source: Bank Indonesia, IFGP Research. Note: We may never know what's the actual number or the total value of FX Intervention by BI as it didn't publish the total accumulated number, at least that we know of. We use these numbers only as a signal. We acquire these numbers from BI official website. TD value only include overnight 1days – 3 days, non-overnight 1week – 3months, and Sharia 1week – 3months.

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.

[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

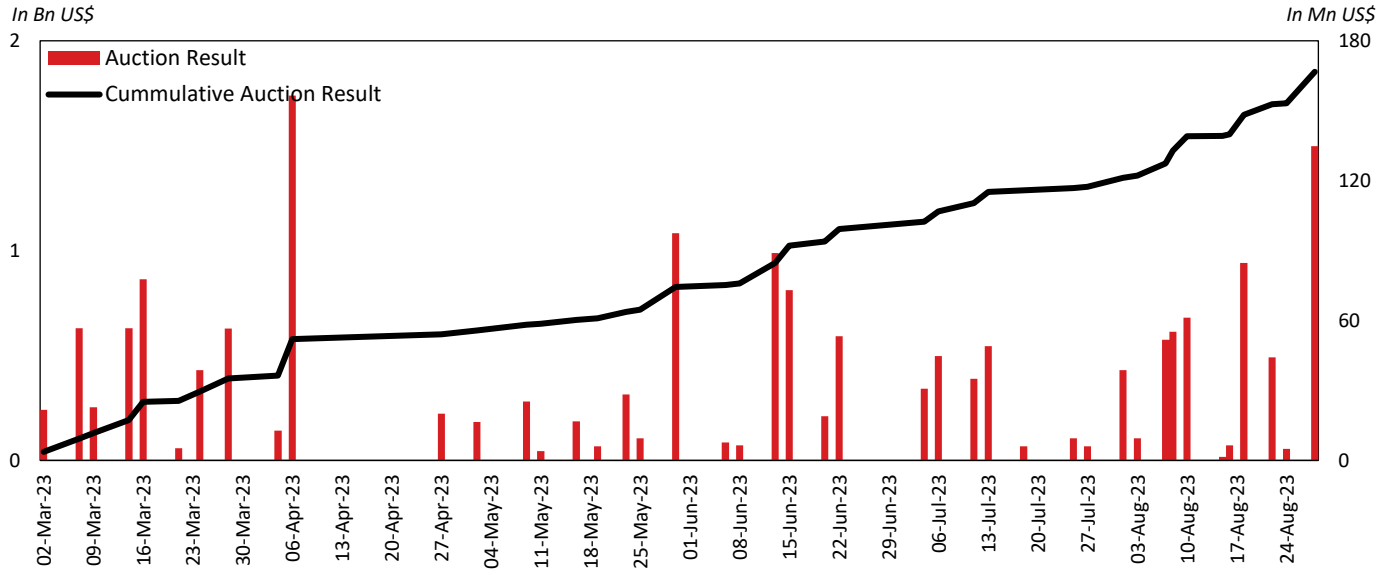
APPENDIX

Appendix 1. The Notation

Symbol	Description
X_t	Foreign Exchange Rate at time t
X_{t+h}	Foreign Exchange Rate at time t+h
$\hat{\imath}_{t,k}$	Intercountry difference of Interest rate at maturity k
$\hat{p}_t$	Intercountry difference of price level
$\hat{m}_t$	Money supply
$\hat{y}_t$	Real GDP
$\hat{\imath}_t$	Interest rate
$\hat{\pi}_t$	Inflation rate
$\hat{\omega}_t$	Relative price of non-tradables
$\hat{r}_t$	Real interest rate
$\hat{\gamma}_t$	Government debt
$\hat{\delta}_t$	Terms of trade
$\hat{\theta}_t$	Net foreign asset
$\hat{\tilde{y}}_t$	Output gap
$\widehat{VIX}_t$	Volatility index
$\widehat{TED}_t$	3-Monh bank rate
$\widehat{slope}_t$	10-Year government bond yield minus 3-Month bank rate
m_t^*	Foreign money supply
y_t^*	Foreign output
i_t^*	Foreign interest rate
$\widehat{FCI}_t$	Financial Condition Index

Source: IFGP Research.

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



Source: Bank Indonesia, IFGP Research.

Appendix 3. *References*

Aizenman, J., Chinn, M. and Ito, H. (2008) Assessing the emerging global financial architecture: Measuring the Trilemma's configurations over time [Preprint]. doi:10.3386/w14533.

Aizenman, J., Chinn, M.D. and Ito, H. (2013) 'The "impossible trinity" hypothesis in an ERA of global imbalances: Measurement and testing', Review of International Economics, 21(3), pp. 447–458. doi:10.1111/roie.12047.

Alquist, R. and Chinn, M.D. (2008) 'Conventional and unconventional approaches to exchange rate modelling and assessment', International Journal of Finance & Economics, 13(1), pp. 2–13. doi:10.1002/ijfe.354.

Beckmann, J. and Schhssler, R.A. (2014) 'Forecasting exchange rates under parameter and model uncertainty', SSRN Electronic Journal [Preprint]. doi:10.2139/ssrn.2502382.

Bilson, John F.O. (1978) 'Rational Expectations and The Exchange Rate', in: J. Frenkel and H. Johnson, eds., The Economics of Exchange Rates (Addison-Wesley Press, Reading).

Bilson, John F.O. (1979) 'The Deutsche Mark/Dollar Rate', Carnegie-Rochester Conference Series on Public Policy, 11, pp. 59–101. doi:10.1016/0167-2231(79)90035-6.

Branson, W.H. (1981) '"The Collapse of Purchasing Power Parities During The 1970's" by Frenkel', European Economic Review, 16(1), pp. 167–171. doi:10.1016/0014-2921(81)90056-8.

Bussière, M., Ca' Zorzi, M., Chudik, A., Dieppe, A. (2010) 'Methodological Advances in The Assessment of Equilibrium Exchange Rates', Working Paper Series 1151, European Central Bank.

Byrne, J.P., Korobilis, D. and Ribeiro, P.J. (2014) 'Exchange rate predictability in a Changing World', SSRN Electronic Journal [Preprint]. doi:10.2139/ssrn.2396138.

Ca' Zorzi, M., Kocięcki, A. and Rubaszek, M. (2015) 'Bayesian forecasting of real exchange rates with a Dornbusch prior', Economic Modelling, 46, pp. 53–60. doi: 10.1016/j.econmod.2014.10.060.

Ca' Zorzi, M., Muck, J. and Rubaszek, M. (2015) 'Real Exchange Rate Forecasting and PPP: This time the random walk loses', Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Papers, 2015(229). doi:10.24149/gwp229.

Cheung, Y.-W. and Chinn, M.D. (1998) 'Integration, cointegration and the forecast consistency of structural exchange rate models', Journal of International Money and Finance, 17(5), pp. 813–830. doi:10.1016/s0261-5606(98)00009-6.

Cheung, Y.-W. et al. (2019) 'Exchange rate prediction redux: new models, new data, new currencies', Journal of International Money and Finance, 95, pp. 332–362. doi: 10.1016/j.jimonfin.2018.03.010.

Chen, Y. and Tsang*, K.P. (2013) 'What does the yield curve tell us about exchange rate predictability?', Review of Economics and Statistics, 95(1), pp. 185–205. doi:10.1162/rest_a_00231.

Chinn, M.D., Cheung, Y.-W. and Garcia Pascual, A.I. (2005) 'Empirical exchange rate models of the nineties: Are any fit to survive?', SSRN Electronic Journal [Preprint]. doi:10.2139/ssrn.318971.

Clark, P.B. and MacDonald, R. (1999) 'Exchange rates and economic fundamentals: A methodological comparison of beers and feers', Equilibrium Exchange Rates, pp. 285–322. doi:10.1007/978-94-011-4411-7_10.

Clark, P.B. and MacDonald, R. (2000) 'Filtering the beer: A permanent and transitory decomposition', IMF Working Papers, 00(144), p. 1. doi:10.5089/9781451856439.001.

Colombo, E. and Pelagatti, M. (2020) 'Statistical learning and exchange rate forecasting', International Journal of Forecasting, 36(4), pp. 1260–1289. doi: 10.1016/j.ijforecast.2019.12.007.

Costantini, M., Cuaresma, J.C. and Hlouskova, J. (2016) 'Forecasting errors, directional accuracy and profitability of currency trading: The case of EUR/USD exchange rate', Journal of Forecasting, 35(7), pp. 652–668. doi:10.1002/for.2398.

Couharde, C., Delatte, A.-L., Grekou, C., Mignon, V., Morvillier, F. (2018) 'EQCHANGE: A World Database on Actual and Equilibrium Effective Exchange Rates', International Economics 156, 206 – 230.

Della Corte, P., Sarno, L. and Tsiakas, I. (2008) 'An economic evaluation of empirical exchange rate models', Review of Financial Studies, 22(9), pp. 3491–3530. doi:10.1093/rfs/hhn058.

Dornbusch, R. (1976) 'Expectations and exchange rate dynamics', Journal of Political Economy, 84(6), pp. 1161–1176. doi:10.1086/260506.

Driver, R. L., Westaway, P. F. (2004) 'Concepts of equilibrium exchange rate.', Working Paper Series 248, Bank of England

Engel, C. et al. (2007) 'Exchange rate models are not as bad as you think [with comments and discussion]', NBER Macroeconomics Annual, 22, pp. 381–473. doi:10.1086/ma.22.25554969.

Engel, C. et al. (2019) 'The uncovered interest parity puzzle, exchange rate forecasting, and Taylor rules', Journal of International Money and Finance, 95, pp. 317–331. doi: 10.1016/j.jimonfin.2018.03.008.

Faust, J., Rogers, J.H. and Wright, J.H. (2001) 'Exchange rate forecasting: The errors we've really made', International Finance Discussion Paper, 2001(714), pp. 1–35. doi:10.17016/ifdp.2001.714.

Frenkel, J.A. (1976) 'A Monetary Approach to The Exchange Rate: Doctrinal Aspects and Empirical Evidence', Flexible Exchange Rates and Stabilization Policy, pp. 68–92. doi:10.1007/978-1-349-03359-1_7.

Frankel, Jeffrey A. (1979) 'On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differentials', American Economic Review 69, 610-622.

Frankel, Jeffrey A. (1981) 'On The Mark: Reply', American Economic Review 71, 1075-1082.

Frömmel, M., MacDonald, R. and Menkhoff, L. (2005) 'Markov switching regimes in a monetary exchange rate model', Economic Modelling, 22(3), pp. 485–502. doi:10.1016/j.econmod.2004.07.001.

Hooper, P. and Morton, J. (1982) 'Fluctuations In The Dollar: A Model Of Nominal And Real Exchange Rate Determination', Journal of International Money and Finance, 1, pp. 39–56. doi:10.1016/0261-5606(82)90004-3.

Isard, P. (2007) 'Equilibrium Exchange Rates: Assessment Methodologies', Working Paper 296, International Monetary Fund.

Jordà, Ò. and Taylor, A.M. (2012) 'The carry trade and fundamentals: Nothing to fear but Feer itself', Journal of International Economics, 88(1), pp. 74–90. doi:10.1016/j.jinteco.2012.03.001.

Juhro, S.M. and Azwar, P. (2021) 'Fx Intervention Strategy And Exchange Rate Stability In Indonesia', Working Paper, WP/03/2021. Available at: https://publication-bi.org/repec/idn/wpaper/WP032021.pdf (Accessed: 2023).

Kouwenberg, R. et al. (2017) 'Model uncertainty and exchange rate forecasting', Journal of Financial and Quantitative Analysis, 52(1), pp. 341–363. doi:10.1017/s0022109017000011.

Krohn, I. and Moore, M.J. (2019) 'Dealer activity and Macro Fundamentals – new evidence from hybrid exchange rate models', Journal of International Money and Finance, 95, pp. 363–378. doi:10.1016/j.jimonfin.2018.03.007.
MacDonald, R. and Taylor, M.P. (1994) 'The Monetary Model Of The Exchange Rate: Long-Run Relationships, Short-Run Dynamics And How To Beat A Random Walk', Journal of International Money and Finance, 13(3), pp. 276–290. doi:10.1016/0261-5606(94)90029-9.
Mark, N.C. (1995) 'Exchange Rates and Fundamentals: Evidence on Long-Horizon Prediction'. American Economic Review 85, 201–218
MacDonald, R. (1998) 'What Determines Real Exchange Rates?: The Long And The Short of It.' Journal of International Financial Markets, Institutions and Money 8 (2), 117 – 153.
MacDonald, R., Clark, P. B. (1998) 'Exchange Rates and Economic Fundamentals: A Methodological Comparison of Beers and Feers'. IMF Working Papers 98/67
MacDonald, R. and Nagayasu, J. (2015) 'Currency forecast errors and carry trades at times of low interest rates: Evidence from survey data on the yen/Dollar exchange rate', Journal of International Money and Finance, 53, pp. 1–19. doi:10.1016/j.jimonfin.2014.12.011.
Meese, R.A. and Rogoff, K. (1983) 'Empirical exchange rate models of the Seventies', Journal of International Economics, 14(1–2), pp. 3–24. doi:10.1016/0022-1996(83)90017-x.
Meese, R.A. and Rose, A.K. (1991) 'An empirical assessment of non-linearities in models of exchange rate determination', The Review of Economic Studies, 58(3), p. 603. doi:10.2307/2298014.
Molodtsova, T. and Papell, D.H. (2009) 'Out-of-sample exchange rate predictability with Taylor Rule Fundamentals', Journal of International Economics, 77(2), pp. 167–180. doi:10.1016/j.jinteco.2008.11.001.
Ng, P. and Heidari, A. (1992) 'Forecast comparison of exchange rate models with the Kalman filter', Technological Forecasting and Social Change, 41(4), pp. 435–443. doi:10.1016/0040-1625(92)90048-x.
Rapach, D.E. and Wohar, M.E. (2002) 'Testing the monetary model of exchange rate determination: New evidence from a century of data', Journal of International Economics, 58(2), pp. 359–385. doi:10.1016/s0022-1996(01)00170-2.
Rey, H. (2015) Dilemma not trilemma: The global financial cycle and monetary policy independence [Preprint]. doi:10.3386/w21162.
Rossi, B. (2013) 'Exchange rate predictability', SSRN Electronic Journal [Preprint]. doi:10.2139/ssrn.2316312.
Schinasi, G.J. and Swamy, P.A. (1987) 'The out-of-sample forecasting performance of exchange rate models when coefficients are allowed to change', International Finance Discussion Paper, 1987(301), pp. 1–35. doi:10.17016/ifdp.1987.301.
Taylor, J.B. (1993) 'Discretion Versus Policy Rules In Practice', Carnegie-Rochester Conference Series on Public Policy, 39, pp. 195–214. doi:10.1016/0167-2231(93)90009-l.
Wang, R., Morley, B. and Stamatogiannis, M.P. (2018) 'Forecasting the exchange rate using non-linear Taylor rule-based models', SSRN Electronic Journal [Preprint]. doi:10.2139/ssrn.3354751.
Williamson, J.B. (1994) 'Estimating Equilibrium Exchange rates', Journal of Macroeconomics, 17(3), p. 544. doi:10.1016/0164-0704(95)80071-9.
Wolff, C.C. (1987) 'Time-varying parameters and the out-of-sample forecasting performance of structural exchange rate models', Journal of Business & Economic Statistics, 5(1), pp. 87–97. doi:10.1080/07350015.1987.10509563.
Wu, J.-L. and Wang, Y.-C. (2013) 'Fundamentals, forecast combinations and nominal exchange-rate predictability', International Review of Economics & Finance, 25, pp. 129–145. doi:10.1016/j.iref.2012.07.002.
Yilmaz, K. (2003) 'Martingale property of exchange rates and central bank interventions', Journal of Business & Economic Statistics, 21(3), pp. 383–395. doi:10.1198/073500103288619034.
Zhang, Y. and Hamori, S. (2020) 'The predictability of the exchange rate when combining machine learning and fundamental models', Journal of Risk and Financial Management, 13(3), p. 48. doi:10.3390/jrfm13030048.
Zorzi, M.C. and Rubaszek, M. (2020) 'Exchange rate forecasting on a napkin', Journal of International Money and Finance, 104, p. 102168. doi:10.1016/j.jimonfin.2020.102168.

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