Foreign Exchange Intervention Rule for Central Banks: A Risk-Based Framework

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Abstract

This paper presents a new rule for central banks' foreign exchange (FX) interventions, using the concept of Value at Risk (VaR). The VaR rule is used to design an intervention policy that consistently transfers a given share of exchange rate risk from the market to the central bank balance sheet, depending on the economy exposure to exchange rate risk. A VaR-based intervention rule is desirable for countries under floating exchange rate arrangements, where central banks intervene in the FX market to preserve financial stability. This approach is consistent with the price and financial stability mandates of many central banks, including inflation targeters. The VaR rule has other appealing features for central banks, including being forward looking and budget neutral over the medium term. The VaR rule is back-tested on Banco Mexico's publicly available FX interventions data between 2008 and 2016, both with and without a preannounced fixed volatility threshold.

Keywords: Foreign Exchange Interventions, Value at Risk, Exchange Rate at Risk, GARCH

JEL classification: E58 (Central Banks and Their Policies), F31 (Foreign Exchange), G17 (Financial Forecasting and Simulations)

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1 Introduction

The 2018 IMF Annual Report on Exchange Arrangement and Exchange Restrictions classified 65 exchange arrangements as either floating or free floating, of which 38 implemented inflation targeting. In those arrangements, the supply and demand in the foreign exchange (FX) market determine the exchange rate with no predictable path. As a result, the exchange rate risk is not managed by the authorities and remains fully with the private sector, despite the financial stability risk that it entails. As hinted by the breakdown between floating and "free" floating, not all central banks are comfortable with ruling out participation in the FX market. Even those with a strong commitment to floating, for example, Chile, Mexico, and Norway, did intervene in the FX market in cases of exceptional stress, such as the COVID-19 pandemic.[1]

Typical FX intervention objectives in a floating exchange rate arrangement are variants of preserving market functioning, for example, smoothing excessive exchange rate volatility and addressing disorderly market conditions, or correcting exchange rate misalignment. The literature adds objectives such as an adequate stock of reserves, external competitiveness, and price stability (Patel & Cavallino (2019), Chamon et al. (2019)). These all circle back to notions of market stability (having enough foreign reserves to intervene later) or exchange rate equilibrium (external and price stability), both of which are underpinned by the notion of macrofinancial risk to the economy.

The main contribution of this paper is to look at intervention through the prism of risk. Each economy presents to a different extent unhedged exposures to exchange rate risk. Unhedged exposures include any direct or indirect exposition to exchange rate risk by any economic agents. They fundamentally depend on structural features of the economies, chiefly their size and degree of openness. The degree of resilience to foreign exchange risk—that is, large swings in the exchange rate—that the economy can absorb varies substantially across countries. As interventions in the FX spot market transfer exchange rate risk off the market, FX interventions can be desirable even for a floating exchange rate regime, as maintaining orderly conditions on the FX market is part of a broad financial stability mandate.

Central banks usually keep a fair degree of opacity about their intervention triggers, which makes it difficult to determine how much exchange rate risk they consider the market could manage on its own and when to intervene. However, it could be inferred from actual intervention if enough data on interventions are published. Other central banks, such as those in Colombia, Guatemala, and Mexico, use transparent intervention rules (Chamon et al., 2019) that reveal,

[1] See, for example, https://www.fx-markets.com/foreign-exchange/4624581/chile-launches-biggest-fx-intervention-in-20-years, https://www.wsj.com/articles/norwegian-krone-soars-amid-signs-of-central-bank-intervention-11585068173

at least partially, their risk tolerance.

This paper proposes an empirical methodology based on Value at Risk to determine the trigger of an FX intervention rule anchored to the risk tolerance of the central bank (the VaR rule) that absorbs a constant amount of exchange rate risk and leaves the rest in the market. This risk-based strategy is beneficial both from a financial stability angle and because of its support of the development of the FX risk hedging market. This methodology can also be used to reverse engineer central banks' risk tolerance based on their intervention in the FX spot market.

There are important conceptual caveats to mention. Our paper does not explore the efficiency of FX interventions, as we use a simple reduced-form framework without causal identification. The paper focuses on the timing (the trigger) for intervention and not on the optimal intervention amount. Further work could explore these issues.

This paper relates to the rule-versus-discretion literature. The paper argues that the VaR rule offers many of the benefits attached to the rule-based approach while minimizing common pitfalls of rules. In this sense, it contributes to constant efforts of central banks to improve the design of policy rules (Taylor, 2017) in the domain of exchange rate policy. The most remarkable advantage of the VaR-based intervention is that it keeps the risk transfers constant, while it would increase or decrease, possibility without limit, with exchange rate volatility under fixed-volatility triggers.

The empirical methodology is applied to the case of Mexico. The peso has floated for a long period in one of the most liquid FX markets among emerging economies. In addition, Banco Mexico's (BM) website provides detailed intervention data since 2008. Banco Mexico also implemented interventions both with a minimum bid rate (that is, a preannounced fixed volatility rule) and without a minimum bid rate, providing a diversity of experiences in intervention strategy. Our paper focuses on only one dimension of FX interventions: preventing excessive volatility on the FX market benchmarked against a risk-based metric. Other relevant reasons and motives may well have been factored into BM intervention without a minimum price.

The rest of the paper is organized as follows: Section 2 presents a brief literature review. Section 3 explains the concept of the exchange rate at risk and the formalization of the FX intervention rule. Section IV presents the empirical framework based on a GARCH model. Section V provides the operational framework for central banks using the model for their FX interventions. Section VI back-tests the model on Mexico public data. Section VII concludes.

2 Literature Review

The literature on policy rules mainly focuses on the monetary policy decision. The debate is essentially whether the monetary policy decision should be guided by a pre-established reaction function (the rule) or by policymakers' expert judgment (discretion). The reasoning is that rules reduce the cost of disinflation policy if the monetary authorities have not established an inflation aversion reputation by curbing an inflation expectation of rational economic agents (Kydland & Prescott, 1977). Once a reputation has been established, the rule may not be superior to discretion based on sound judgment (Barro & Gordon, 1983).

While less explored in the literature, the same arguments could apply to FX intervention rules. They can likely signal the commitment to a floating exchange rate (within boundaries) and convince rational economic agents (which may challenge the central bank commitment to float) that the exchange rate will experience at least a certain degree of volatility. In addition, FX rules serve to anchor market expectations (Montoro & Ortiz, 2013) and to provide some sense of safety to the market, thereby contributing to its stability.

More generally, central banks' commitment can be used to steer agents' behavior. For example, Krugman (1991) shows that a commitment to intervene as the exchange rate leaves a target zone causes change in the behavior of economic agents, even when there is no explicit intervention. Also, Fanelli & Straub (2020) show that commitment to future interventions is necessary to have an impact on exchange rates today. Finally, Basu et al. (2018) show that commitment has additional benefits over discretion when there are capital outflows and FX reserves may run out.

An important aspect to consider for FX interventions is the source of shock that the central bank would like to mitigate. In micro-founded optimal policy frameworks, the rationale for FX interventions depends on the shock generating the exchange rate movement. For example, in Basu et al. (2020), exchange rate movements owing to permanent real shocks—for example, productivity and commodity prices, and fundamental changes in world interest rates—should generally be accommodated unless they trigger financial constraints. Financial stability depends both on cyclical (exchange rate volatility) and structural factors such that domestic FX hedging, not just the exchange rate volatility, could motivate the central banks to smooth movements associated with higher uncovered interested rate parity (UIP) premia. Therefore, according to this literature, only those exchange rate movements associated with identifiable global financial shocks and growing bid-ask spreads should be included in the rule, while movements arising from commodity price shocks should not be included. However, in practice, the diagnosis of the shock requires judgment (Basu et al. (2020), Cavallino (2019)), and identifying in real time the source of the shock is often not possible. Therefore, the FX intervention rule we present here

has a somewhat narrow focus. The rationale for the VaR rule is to preserve orderly market conditions by preventing excess volatility and tail risks to materialize, irrespective of their source. One important aspect is that any source of shocks could potentially degenerate into financial stability risks, as long as it creates risks to unhedged exposure. This is the reason we do not identify the source of the shock in this paper, which also has benefits in terms of implementation.

In this paper, an intervention is deemed rule based when it reacts to predetermined parameters to deliver predictable responses. The most used rules are based on fixed-volatility triggers such as day-to-day exchange rate change, for example, 2 percent depreciation from the previous day exchange rate close. The rule can be disclosed or kept secret by the central bank, although, in the latter case, it may become transparent with experience. Patel & Cavallino (2019) surveyed 21 emerging market central banks and six out the 21 regularly use an intervention rule, while four do so occasionally.

Some studied the efficiency of FX rules and usually find them less efficient than discretion. However, in some cases, the understanding of rules includes tactics such as "leaning against the wind," that is, delaying the adjustment of the exchange rate, which would not be considered a rule in this paper (Chutasripanich & Yetman, 2015). In other cases, it involves central banks with an already established preference for floating, for which the literature indicates that the rule may not be superior to discretion (Fatum & King, 2005). While country-specific empirical work on rule-based interventions (fixed-volatility triggers) was performed for Canada (Fatum & King, 2005) and Columbia (Kuersteiner et al., 2018), none was completed for Mexico, to our knowledge.

The concept of VaR, as formalized in Jorion (2007), is frequently used for financial applications, for managing risk exposure, for portfolio allocation, and so on. Alexander (2009) provides a comprehensive review of VaR for market risk analysis. Among many applications of the VaR model, one can cite in the FX field Al Janabi (2006), who proposes to consistently use a VaR framework for managing trading risk exposure of FX securities, in the context of emerging and illiquid markets. Bredin & Hyde (2004) review the performance of a number of VaR methods using a portfolio based on the FX exposure of a small open economy.

Using ARCH/GARCH (Autoregressive Conditional Heteroskedasticity/Generalized Autoregressive Conditional Heteroskedasticity) models for estimating VaR is also standard practice in the literature. Engle (2001) conducts a comprehensive overview of the ARCH/GARCH models in financial econometrics and devotes an entire section to estimating VaR. Giot & Laurent (2004) model daily VaR using realized volatility and ARCH models, and show that it has excellent forecasting performances. Chan et al. (2007) use nonlinear GARCH models to estimate VaR in the presence of a data generating process with heavy tails. Other types of

models could be used to estimate VaR, such as quantile regressions (Gaglianone et al., 2011), copulas (Patton, 2001), and nonparametric kernel (Hoogerheide & van Dijk, 2010). However, the GARCH model is used for this paper because it is a standard model used by market participants and central banks around the world, with widespread implementation on many statistical packages. Besides, as Jeon & Lee (2002) show, FX markets are quite efficient and their features fit well the simple and robust approach of standard GARCH models.

Finally, GARCH models are frequently used for the analysis of the FX markets. Hansen & Lunde (2005) argue that in the context of daily exchange rate returns, nothing can beat a GARCH(1,1) model, while Mcmillan & Speight (2012) show that an intraday GARCH(1,1) model generally provides superior forecasts compared with all other models.

3 VaR Interventions and Exchange Rate Value-at-Risk

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A Annex