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IMF Working Paper

Monetary Capital Markets Department

Intervention Under Inflation Targeting—When Could it Make Sense?

Prepared by David Hofman, Marcos Chamon, Pragyan Deb, Thomas Harjes,
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January 2020

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Abstract

We investigate the motives inflation-targeting central banks in emerging markets may have for intervening in foreign exchange markets and evaluate the case for such interventions based on the existing literature. Our findings suggest that the rationale for interventions depends on initial conditions and country-specific circumstances. The case is strongest in the presence of large currency mismatches or underdeveloped markets. While interventions can have benefits in the short-term, sustained over time they could entrench unfavorable initial conditions, though more work is needed to establish this empirically. A first effort to measure the cost of interventions to the credibility of policy frameworks suggests that the negative impact may be smaller than often assumed—at least for the set of more sophisticated inflation-targeting emerging-market central banks considered here.

JEL Classification Numbers: F21, F32

Keywords: emerging markets; monetary and exchange rate policies; inflation targeting; foreign exchange intervention; capital flows

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I. INTRODUCTION ¹

Over the past twenty years, many central banks in emerging market economies (EMEs) have moved away from fixed exchange rate regimes and introduced Inflation Targeting (IT) frameworks with largely floating exchange rates. In many cases this reorientation of monetary policy was successful and has resulted in better inflation outcomes and reduced output volatility.

Despite the move to de jure floating exchange rate regimes, foreign exchange intervention (FXI) has remained a widely-used policy instrument among inflation-targeting EME central banks. This may be somewhat surprising in view of the uncertain effectiveness and costs associated with FXI, and given the arguable tension with the now prevailing IT frameworks. The latter are based on the primacy of an inflation objective and—at least in more orthodox versions—would be expected to rely on the interest rate as the policy instrument.

There are several potential explanations for the continued widespread use of FXI among EME inflation targeters. For instance, EMEs may have less developed financial markets and a greater exposure to external shocks than advanced economies (AEs), which makes macro stabilization more difficult. Also, in circumstances where the financial transmission channel dominates the competitiveness channel, the exchange rate may possibly act as a shock *amplifier* rather than a shock absorber (see e.g., Serena and Sousa 2017).

Along these lines, a 2013 Bank for International Settlements (BIS) meeting of EME central bank deputy governors concluded that while exchange rate flexibility plays a crucial role in smoothing output volatility in their economies, an overly volatile exchange rate could *increase* output volatility and itself become a source of vulnerability. Therefore, many of these EME central bankers indicated they continued to use FXI to limit excessive volatility—even if they were not targeting any specific level of the exchange rate.

EME central banks also seem convinced that interventions are effective in their markets, although the impact of FXI on the exchange rate is notoriously difficult to measure with econometric techniques. A BIS survey among central banks suggests that they believe that FXI works mainly through the signaling channel and can help break the momentum of speculative or cyclical capital flows (Mohanty 2013).

The theoretical and empirical literature on inflation targeting and the role of the exchange rate has been evolving. The conventional view, which goes back to Milton Friedman, argues that countries with a flexible exchange rate are better able to buffer real shocks stemming from

¹ The paper benefitted from comments by Jonathan D. Ostry, Ratna Sahay, Gaston Gelos, Faisal Ahmed, Carlos de Barros Serrao, Kimberly Beaton, Craig Beaumont, Kelly Eckhold, Andrew Filardo, Enrique Flores Curiel, Manuk Ghazanchyan, Metodij Hadzi-Vaksok, Niels-Jakob Hansen, Olamide Harrison, Ken Kashiwase, Tidiane Kinda, Darryl King, Istvan Mak, Tommaso Mancini Griffoli, Svitlana Maslova, Stephen Mulema, Asad Qureshi, Tahsin Saadi, Christian Saborowski, Damiano Sandri, Frederik Toscani, Guido della Valle, Romain Veyrune, and Svetlana Vtyurina.

abroad. There continues to be evidence of this shock absorber role (e.g., IMF 2018). However, the view is being challenged by some recent studies that suggest that the benefits of flexibility may be overstated in the presence of both financial (currency mismatches and endogenous financial risks) and real (dollar invoicing of trade) frictions, potentially providing some support for EME central bank intervention practices.

The key arguments are as follows. The classic ‘divine coincidence’ assumption that domestic price stabilization simultaneously closes the output gap—which holds in a baseline closed-economy new Keynesian model (Blanchards and Gali 2007)—may break down in an open economy (Monacelli 2013), thereby providing a possible rationale for using additional instruments to help achieve both price and output stability.

In addition, in their recent work, Boz et al. (2017) challenge a core piece of the argument for exchange rate flexibility, the strong co-movement of the nominal exchange rate and the terms of trade, which they do not find in the data. Gopinath (2015, 2017) and Casas et al. (2018) argue that the latter result can be explained by the widespread use of the dollar in trade invoicing of emerging markets.² The dollar-invoicing argument lends further support to the lack of ‘divine coincidence’ in the conduct of monetary policy in small open economies. This may provide another reason for rethinking the role of the exchange rate in IT regimes.

Motivated by these developments and by the continued prominence of interventions as a policy instrument in EMEs in practice, this paper aims to provide a policy-oriented analytical overview of both theory and empirical evidence in the existing academic literature to help determine under what circumstances it may make sense for inflation-targeting central banks to undertake (sterilized) FXI. It also assesses and weighs the various arguments and pieces of evidence, to derive some tentative directions for policy advice.

The analysis is organized along the lines of the main objectives that central banks may have to intervene, whether in response to sudden capital in- or outflows or under other circumstances. Each of these objectives (or motives) are discussed—and illustrated with case studies—with a view to distilling some key tentative considerations that could guide policy. To the extent available (e.g., from BIS surveys), the perspectives of EME central bankers are also included.

In the context of our focus on countries with IT frameworks and floating exchange rate regimes, throughout this paper FX market interventions are assumed to be sterilized (so as not to impact domestic liquidity conditions) and aimed at smoothing out short- or medium-term exchange rate volatility, rather than targeting any specific level of the exchange rate.

The working paper takes the perspective of the intervening country and does not consider possible spillovers from domestic policies onto other countries. We also do not directly assess

² When imports and exports are all priced, and sticky in the short run, in US dollars, the terms of trade will be less sensitive to the exchange rate.

the effectiveness of FXI in moving the exchange rate itself. As a working assumption, the analysis presupposes that FXI is, at least at the margin, effective in influencing exchange rates. The paper presents empirical evidence with respect to the possible impact of FXI on the anchoring of inflation expectations. It also includes a brief discussion of the optimal modalities for interventions in an IT context.

II. FXI TO HELP PROMOTE OUTPUT/PRICE STABILITY

In many cases EME central banks have indicated that they use FXI to advance key macroeconomic objectives. In this section we discuss interventions that aim to (i) help control inflation or (ii) promote growth/output objectives.

A. Control Inflation

In EMEs, passthrough effects from exchange rate movements play a significant role in the level and volatility of inflation (Stone 2009, Brandao-Marques et al. 2020). Also, weak policy transmission from interest rates, for example due to high dollarization, may impact central banks' ability to solely rely on the policy rate to manage inflation. Under these circumstances it is not clear a priori that leaving the exchange rate to float freely is optimal, even for the achievement of the inflation target.

While inflation targeting in advanced economies has traditionally gone hand-in-hand with free floating exchange rates—to avoid competing objectives—several studies done in the context of EMEs suggest that some degree of exchange rate management with FXI may improve inflation outcomes there (Berganza and Broto 2012, Buffie et al. 2018). It has also been argued that, especially in the face of large capital inflows, having the option of using FXI as an additional instrument reduces the incentives for the central bank to (temporarily) switch away from IT to more discretionary policies (Ostry, Ghosh and Chamon 2012). This suggests that having FXI in the standard toolbox could strengthen the IT regime and increase the credibility of the central bank's inflation target. Colombia provides an example of an IT-country where conventional interest rate policy has been complemented by FXI to achieve the inflation target (Box 1).

As a special case, Svensson (2000) and McCallum (2000), among others, have suggested that FXI should also be used as an additional instrument when conventional monetary policy instruments are no longer effective (for example, at the effective-lower bound)—advice that was put to practice in the Czech Republic with some success (Badescu 2016, Lizal and Schwarz 2013 and Caselli 2017), as well as in Switzerland.

More broadly, as discussed in the introduction, achieving domestic price stability may not be sufficient to achieve output stabilization, which may also argue for the use of additional instruments, including potentially FXI. Using intervention as an additional policy instrument under inflation targeting, however, may pose difficult communication challenges, especially in countries that have a history of using the exchange rate as the nominal anchor.

Key Considerations

If inflation and exchange rate objectives are mutually consistent, the policy rate should in principle be sufficient to set the central bank's policy. Nonetheless, in some emerging markets, weak transmission from the policy rate may argue for FXI as a temporary additional instrument if it is more effective in affecting the exchange rate than interest rates. It may also be easier to fine-tune FXI to short-term developments (with interest rate policy requiring a “steady hand”). Complementary policies will be needed to improve transmission over time.

Box 1. Controlling Inflation: Colombia

The Colombian central bank, Banco de la Republica (BR), has been an inflation targeter since 1999, using interest rates to maintain low and stable inflation. While exchange rate flexibility is seen as fundamental to this goal, BR has intervened actively to (i) build reserves, (ii) provide FX liquidity to the market, and (iii) mitigate fluctuations in the exchange rate that could adversely impact inflation. Here, we focus on the last motive.

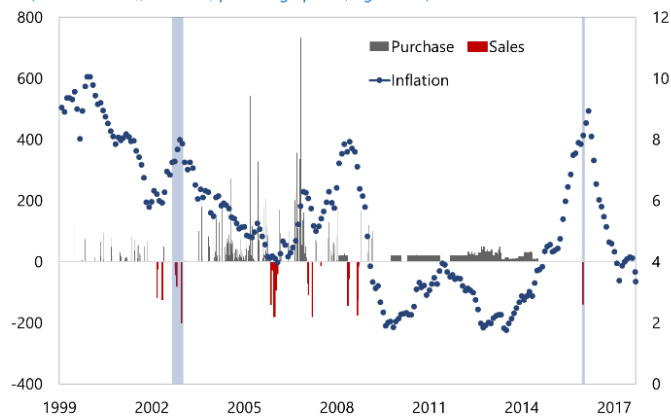
The Colombian peso depreciated significantly from April 2002. By April 2003, the real effective exchange rate had depreciated by about 20 percent (y/y), which due to the high exchange rate pass through had increased inflation to 8 percent, well above target. The BR tightened monetary policy, raising its main refinancing rate by cumulatively 200 basis points to 7.25 percent. However, commercial deposit and lending rates were slow to respond to this tightening and inflation remained high. To contain inflation, the BR complemented interest rate hikes with FX sales (via options*) to stem the depreciation.

The BR also used FX sales (again via options) in May 2016 after the peso had depreciated in response to a sharp drop in the oil price. A key goal was to control depreciation and inflation, as the latter significantly exceeded the target. The amount offered was \$500 million (50 percent of the daily trading volume), of which \$256 million was exercised.

While it is difficult to claim causality from FX interventions to inflation stabilization as several other factors were at play—including possibly lagged effects from monetary policy tightening—in both episodes the inflation trend reversed after the interventions (chart).

Colombia: Central Bank FXI and Inflation

(Millions of US\$, left scale; percentage points, right scale)



Source: Central bank of Colombia, and IMF staff calculations

*The Central Bank wrote call options that gave private agents the right to buy foreign exchange if the daily exchange rate depreciated more than its 20-day moving average (plus 3 percent for the May 2016 options).

B. Prevent Dutch Disease and Promote Competitiveness

Many EMEs use FXI in the face of sustained appreciation pressures, e.g., Israel's experience in the aftermath of the global financial crisis provides a case in point (Box 2). FXI to stem excessive appreciation can be an optimal response in a model where exporting firms are financially constrained (Caballero and Lorenzoni 2014) or when there is learning by doing (Faltermeier et al. 2017). Sometimes, a political economy argument is also made: if there is a

perception that the government needs to “do something” about the erosion in competitiveness, FXI is likely preferable to more distortionary policies such as protectionism or targeted subsidies. Chamon et al. (2019), however, caution against potential risks of using FXI in response to Dutch disease. First, it is hard to discern in real time whether the central bank is resisting an overshooting rather than an adjustment of the exchange rate to a new equilibrium.

Box 2. Leaning Against Competitiveness Pressures: Israel

From the 1990s, the Bank of Israel (BOI) has used the interest rate as the main monetary policy instrument for attaining its inflation targets. The BOI initially continued to intervene in FX market to keep the exchange rate within a trading band, which was gradually widened and eventually abolished in 2005. For a decade, until 2008, the BOI refrained from intervention, though it retained the option to intervene if needed.

During the global financial crisis and the subsequent weak global recovery, Israel faced large capital inflows which lead to a sharp real exchange rate appreciation. Unconventional monetary policies pursued by the major economies were a contributing factor. Israel also discovered large gas fields in 2009 and 2010.

The BOI started conducting FX interventions again in 2008. These interventions had multiple objectives. An initial key motivation was to build FX reserves (which were at a relatively low level), but the timing of the FX purchases was chosen following a period of rapid appreciation deemed inconsistent with economic fundamentals and weighing on the flagging economy. This way, the interventions helped address concerns about exchange rate misalignment stemming from the capital inflows and Dutch disease—thereby supporting competitiveness and the economic recovery.

FX purchases started with a fixed daily amount of \$25 million and were increased to a daily amount of \$100 million. In August 2009, fixed daily purchases were discontinued, and the BOI purchased foreign exchange on an ad hoc basis thereafter. Interventions were continued during the recession to reduce the appreciation of the shekel, which had contributed to a sharp drop in demand for exports. BOI officials argue that the interventions moderated the over-appreciation of the shekel, and thus helped mitigate the negative effects of the global crisis on the exports and growth (Flug and Shpitzer, 2013).

In the aftermath of the crisis, the authorities considered FX intervention a necessary tool to maintain a simulative monetary stance when policy rates were already very low—and to lean against excessive appreciation. At the same time, the interventions may have inadvertently attracted further capital inflows. By end 2018, Israel stopped FX purchases for the purpose of offsetting the effect of the natural gas production on the exchange rate because, in line with Fund advice, it established a sovereign wealth fund that was expected to become operational soon.

Second, if the shock is caused by persistent inflows, the central bank may end up encouraging more inflows as investors expect the exchange rate to continue to appreciate, increasing their expected gains. Finally, to the extent that intervention is perceived to be costly, its use becomes less appealing in the face of persistent shocks vis-à-vis other alternatives. For example, in the model presented in Ostry, Ghosh and Chamon (2012) intervention is more suitable for addressing less persistent shocks, with changes in the policy rate playing a stronger role in the response to more persistent shocks. Indeed, arguably owing to methodological challenges, the literature offers little evidence that FXI can affect the exchange rate over extended periods.

Key Considerations

Uncertainties with respect to the equilibrium level of the exchange rate argue for caution in using FXI to promote growth. Yet, in the face of abrupt exchange rate changes, there may be a case for smoothing the path of the exchange rate to buy time for the economy to adjust, and as an insurance against short-term overshooting. Communication challenges are considerable. Also, there may be more suitable instruments to deal with persistent shocks (for instance, the monetary-fiscal policy mix, or structural reforms).

III. FXI TO ENSURE FINANCIAL STABILITY

EME central bank interventions in FX markets are also often motivated by financial stability objectives. These objectives can take various forms. In this section we consider interventions that aim to (i) build reserves, or (ii) avoid negative balance sheet impacts from sharp exchange rate movements, (iii) affect credit growth and risk taking; and (iv) provide liquidity to temporarily or structurally illiquid markets.

A. Build Reserves

Official reserves—up to a certain level—provide useful precautionary buffers that EMEs can fall back on in times of liquidity pressures. Building reserves requires the purchase of foreign exchange in the market, and this is another common motivation for EME central banks to intervene. Since influencing the exchange rate is not the objective per se of such purchases, intervention strategies may be deployed that minimize the impact on the exchange rate level. These include a spreading out purchases over time (sometimes on a preannounced schedule) or basing them on a transparent intervention rule (e.g., using options as was done in Mexico and Colombia). Of course, in practice, the reserve building objective can coincide with other objectives of the central bank that do include the exchange rate level.

Key Considerations

The case for FXI for reserve building depends on countries having insufficient existing buffers and it weakens after reserves reach an adequate level. FXI for reserves building is best done in ways that seek to minimize the impact on the exchange rate level.

B. Manage Balance Sheet Mismatches

The financial structure of many emerging markets economies has been an important source of vulnerability (Allen et al. 2002). Foreign currency exposure of unhedged balance sheets of banks, corporates and/or households (liability dollarization) implies that sharp exchange rate movements can be highly disruptive, possibly leading to widespread bankruptcies and recession. Indeed, balance sheet effects have been viewed as a crucial factor in explaining the dynamics of many emerging market crises (Frankel 2005, Burnside et al. 2008). While the first-best solution may be to prevent sizable balance sheet mismatches from the outset (e.g., with macroprudential

policies), once they are present, large exchange rate swings amplify effects on the economy and may jeopardize financial stability. It is therefore not surprising that balance sheet mismatches have been among the most prominent motivators for many EMEs to continue to manage their exchange rate (Reinhart 2000, Calvo and Reinhart 2000, and Frankel 2011). The interventions in some highly-dollarized Latin American inflation targeters illustrate this motive (see e.g., Cubero, Lankester and Munoz 2019 for Costa Rica; Armas and Vega 2019 for Peru; and Bucacos et al. 2019 for Uruguay).

The literature generally offers support for the use of FXI to protect balance sheets. For instance, Benes et al. (2013) show that FXI can help insulate the economy from shocks, especially those to international financial conditions, and Ostry, Ghosh, and Chamon (2012) argue that a regime of (two-way) sterilized intervention-cum-inflation targeting can improve outcomes and safeguard financial stability in the presence of balance sheet mismatches.

However, FXI to protect balance sheets comes with at least two drawbacks. First, FXI may prevent necessary adjustment of the exchange rate to a new equilibrium (Benes et al. 2013). Second, FXI-induced exchange rate stability may encourage further unhedged foreign currency exposures. For instance, Mohanty (2013) finds (indirect) evidence that increased exchange rate flexibility is associated with a reduction in vulnerabilities such as currency mismatches. Ghosh, Ostry, and Tsangarides (2010) and Ghosh, Ostry and Qureshi (2014) find that macroeconomic and financial vulnerabilities are significantly greater under less flexible intermediate regimes, and that floating rate regimes are associated with lower risk of financial crises and smoother external adjustment than pegged or intermediate regimes. The experiences of Chile (Box 3) and Peru (Box 4) may illustrate some of the above mechanisms.

Box 3. Reducing Currency Mismatches: Chile

Even though many of the ingredients that led to dollarization in other Latin American countries were present, Chile has traditionally not been a highly dollarized economy overall, mostly because many loans and deposits were indexed to inflation (see, Jadresic 2005). Nevertheless, Herrera and Valdes (2004) argue that Chile's tightly managed exchange rate regime during the 1990s helped hide currency risk, created incentives for currency mismatches and dollarization, and slowed the development of hedging markets.

Since the adoption of a full-fledged flexible IT regime with a permanent inflation target in the late 1990s, and the abandonment of a target zone for the exchange rate, the Central Bank of Chile has been one of the most committed central banks in preserving/promoting exchange rate flexibility, allowing the currency to adjust freely to shocks (see, Claro and Soto 2013).

Cowan et al. (2006) find significant changes in the level of currency exposure of Chilean corporates after the implementation of the floating exchange rate regime in 1999. They analyze firm-level data that includes foreign currency debt, foreign currency assets, and foreign currency derivative positions, correcting for the omitted variables present in many previous studies of balance sheet effects. They find that the previous policy of reducing the volatility of the exchange rate by targeting a zone for the exchange rate (an implicit exchange-rate insurance) had led to higher FX exposure of the corporate sector.

At the 2013 BIS meeting referenced above, EME central bank deputy governors generally agreed that exchange rate flexibility helps to reduce currency mismatches and tends to lower foreign currency borrowing. They also noted that FXI-induced lower FX volatility would encourage investors to exploit any existing interest rate differential more aggressively through carry trades.

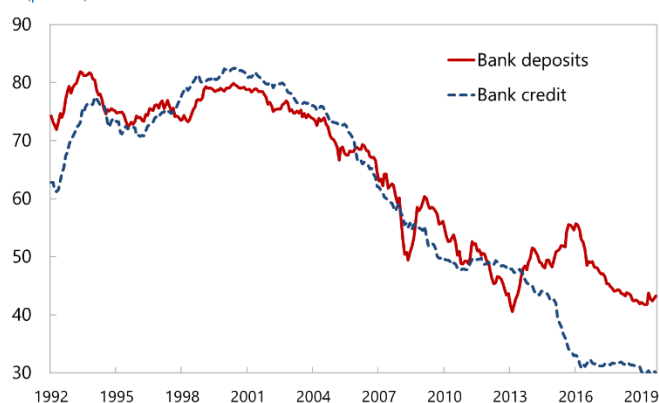
Box 4. Protecting Unhedged Balance Sheet Mismatches: Peru

Peru has a high degree of financial dollarization, although it has been on a decreasing path over the past two decades with noticeable gains made in reducing credit dollarization following the introduction of de-dollarization measures—including differentiated reserve requirements—in 2013 (Castillo et al. 2016). At the beginning of the 2000s, dollarization was around 80 percent for both deposits and loans. It has since declined, but as of 2017 dollarization levels remained around 45 and 30 percent, respectively (text figure).

While adhering to an inflation targeting regime since 2002, the Peruvian authorities have continued to intervene very frequently with the objective of smoothing volatility in the FX market. The authorities consider that by reducing exchange rate volatility, foreign exchange intervention minimizes the risk of triggering perverse balance sheet effects, which would otherwise unleash excessive output volatility.

Although establishing causality is difficult, Peru has enjoyed impressive policy outcomes over the past 15 years, with robust growth (5½ percent on average during 2002–17) and low inflation (2¾ percent on average), and has avoided significant private sector balance sheet problems—in line with the authorities’ policy objectives. However, the frequent interventions may have also contributed to relatively slow financial market development, including of hedging instruments. This raises the question if dollarization may have been more persistent than it could have been if the inflation gains from the IT regime had been paired with a more flexible exchange rate.

Peru: Dollarization of the Banking System
(percent)



Source: Central Reserve Bank of Peru

Key Considerations

In case of large balance sheet currency mismatches, there is a case for using FXI initially to smooth sharp exchange rate adjustments and contain immediate financial stability risks. Over time, however, exchange rate flexibility should be gradually increased to reduce perceptions of exchange rate guarantees, and to incentivize hedging and strengthening of balance sheets. Complementary tools, e.g., macroprudential policy, should also be used to mitigate vulnerabilities and reduce reliance on FXI.

C. Affect Credit Growth, Financial Conditions, and Risk Taking

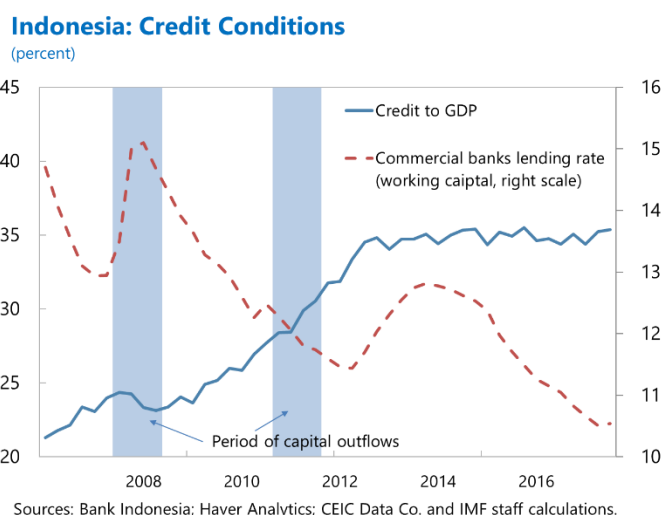
While not prominently cited as a motivation in past surveys, central banks may use FXI as a tool to contain or promote credit growth or to affect financial conditions more broadly. For instance, capital inflows can expand banking-system credit to the economy, but by undertaking sterilized

intervention the central bank can absorb the inflow (in FX reserves) and mute its impact on the real economy. Ghosh, Ostry, and Qureshi (2017) find some evidence for the effectiveness for such interventions. In a recent theoretical paper, Chang (2018) illustrates how sterilized foreign exchange sales cause a reduction of central bank debt to the banking system, leading to an increase in the supply of bank credit to domestic agents. While an inflation-targeting central bank, as a first resort, would use the interest rate channel to affect changes in domestic credit, the effects of sterilized FXI on credit supply may provide a desirable policy option in cases where changes in (policy) interest rates risk “fanning the flames” of capital flows. Box 5 discusses Indonesia as a case where FXI helped smooth the credit cycle.

Box 5. Smoothing the Credit Cycle and Promoting Financial Stability: Indonesia

The Indonesian economy continued to grow at a robust pace after the global financial crisis, attracting investment from foreign short-term investors. Indonesia’s gross international reserves grew rapidly from 2009 to 2011 on frequent central bank intervention. In August 2011, however, due to a worsening global environment (downgrade of the US sovereign rating and the deepening of the crisis in Greece), Indonesia experienced sharp capital outflows. The outflows coincided with domestic policy developments: Bank Indonesia (BI) lowered its policy rate, allowed market interest rates to fall, and stepped up government purchases of government debt.

BI officials believed that volatile capital flows caused undue exchange rate volatility and that movements did not reflect fundamentals. This motivated them to intervene. From September 2011, BI supplemented FX sales with the purchase of government securities in the secondary market. This “dual intervention” was conducted to stabilize the exchange rate, counter the sales of government securities by foreign investors, recycle liquidity into domestic market, and to support financial stability. The 2011 intervention contributed to stabilizing foreign exchange and government securities markets. This contrasted with the experience during the global financial crisis, when heavy FX intervention without the government bond purchases caused a shortage of domestic liquidity, putting pressures on domestic financial conditions (Warjiyo 2013).



BI’s presence in the foreign exchange market and the accumulation of foreign reserves during capital inflows after the global crisis, provided room for the “dual intervention” during the 2011 outflows. However, the interventions, through a more stable rupiah and suppressed appreciation potential, may have attracted more short-term foreign investors to invest in government securities and SBIs. Then, in 2011, while intervention contributed to stabilizing the foreign exchange and government bond markets during the capital outflow episode, excess liquidity built up in the money market partly due to the sharp increase in BI’s purchases of government securities. The surplus liquidity and strong credit growth added to price and exchange market pressures, as well as leading to asset quality deterioration (IMF 2012). The experience illustrates the difficulty in fine tuning policy and assessing ex-ante the demand for liquidity or deviations of the exchange rate from its equilibrium level.

Key Considerations

In the face of large and volatile capital flows, the availability of FXI as an additional policy instrument may strengthen the central bank's ability to manage domestic credit. This could help achieve inflation objectives and contain the build-up of financial stability risks. Such benefits need to be weighed against the communication challenges around interventions and loss of clarity of the monetary policy framework (with potentially adverse effects on credibility). Macroprudential measures could provide a preferable alternative to FXI.

D. Ensure Liquidity (in Shallow Markets)

Providing liquidity to shallow and underdeveloped foreign exchange markets is a common motivation for intervention by central banks in low income countries (LICs) and EMEs (BIS, 2005). Shallow markets can amplify exchange rate shocks, causing undue short-term exchange rate volatility, with potential for disorderly market conditions (Stone et al. 2009). If such market conditions are structural, they can provide a rationale for regular central bank interventions, even under an inflation targeting framework. But also, in more developed markets, central banks at times intervene to provide FX liquidity (and currency hedging instruments) when faced with large liquidity shocks. For example, Brazil intervened for these purposes during the global financial crisis and the taper tantrum (Barroso 2019). Central banks may intervene to keep the short-term costs of liquidity insurance in check, preserve market functioning, and to help investors needing to close positions in an EME currency do so in a timely and cost-effective manner (Domanski et al. 2016).

The IT literature has often recognized the need to intervene for liquidity purposes (e.g., Carare et al. 2002, Mishkin and Schmidt-Hebbel 2001). While foreign exchange liquidity support from LIC and EME central banks may be necessary, it is not without drawbacks. A key problem is that extended interventions in the foreign exchange market may dull incentives for market development and for the private sector to develop currency risk management tools. Indeed, in several countries higher exchange rate volatility has been associated with more developed financial markets and greater use of hedging instruments (Mohanty 2013, Gadanecz and Mehrotra 2013). A second problem is that intervention can also be costly since it can result in reserve losses for the central bank. Moreover, if they are not well understood by the markets, interventions may send mixed signals about the objectives of the central bank, undermining the credibility of the monetary policy framework.

Key Considerations

FXI may be needed in underdeveloped and structurally illiquid markets to ensure proper market functioning and to avoid excessive volatility of the exchange rate. However, interventions should be a transitional tool, alongside initiatives to promote market deepening. Interventions should also be properly sterilized.

IV. FXI AND MONETARY POLICY CREDIBILITY IN EMERGING MARKETS³

FXI is not without costs. In particular, there are operational costs associated with the sterilization of interventions and holding reserves. Another relatively well-documented “cost” of interventions (selling foreign exchange) is that a significant depletion of reserves increases the vulnerability to crises (Frenkel and Saravelos 2012; IMF 2015).

Beyond these more traditional drawbacks, one additional potential cost that has been identified specifically in the context of inflation targeters is that using a second policy instrument (FXI) may muddle the clarity of the IT framework. This could have negative impacts in particular if FXI is used to promote objectives other than price stability in a narrow sense. In these cases, FXI may potentially create confusion about the “true” objectives of the central bank. Such confusion could de-anchor the public’s inflation expectations, with negative repercussions for the central bank’s ability to meet its price stability objective. This issue has been highlighted in inflation targeting literature, which has sometimes taken the view that IT requires a fully floating exchange rate (e.g., Masson, Savastano, and Sharma 1997). This section investigates the extent to which this possible tension is born out in the experience of EME inflation targeters.

From a theoretical perspective, the gains from FXI are maximized for central banks with high perceived commitment to their inflation target. For central banks with low perceived commitment, the use of FXI may exacerbate the inflation bias problem:

- FXI may help a central bank to more easily *manipulate* the short-term inflation-output trade-off, with negative long-term consequences for inflation. For example, the central bank may find that lowering the policy rate eventually generates diminishing gains in terms of short-term output expansion but being able to use FXI as well to keep the exchange rate depreciated yields further output gains.
- FXI may have a negative *signaling* effect if foreign investors expect only non-credible central banks to use FXI and expect credible ones to refrain from using it.
- Once a central bank adopts FXI alongside the policy rate as a second instrument to tackle the two objectives of inflation and the exchange rate, the government may pressure it to add *further objectives*, e.g., export promotion and shoring up unhedged SOEs.

If the central bank has only had a short experience with inflation targeting, then FXI may potentially have an additional negative effect:

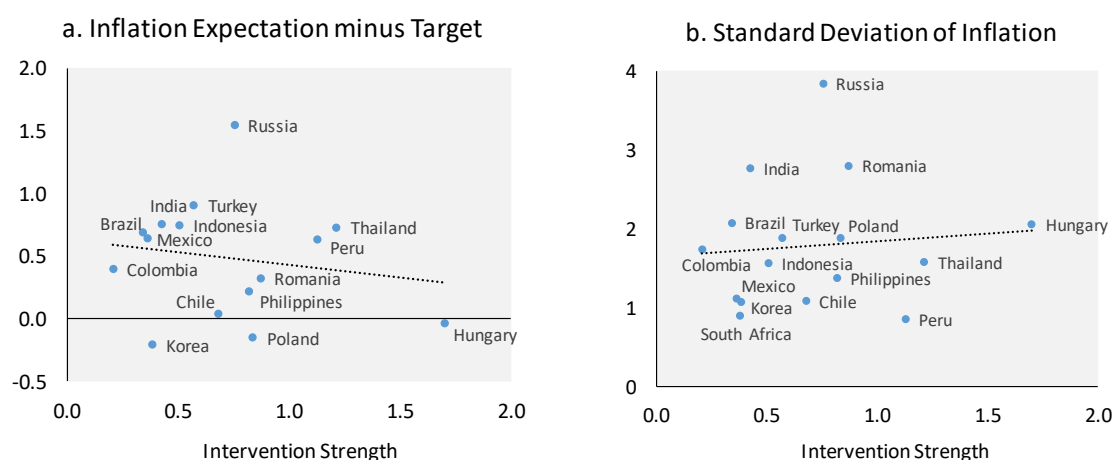
- FXI may make it harder for foreign investors to *learn* the central bank’s monetary policy rule, since these investors are conditioned to learning policy rules in advanced economies where FXI is less common.

³ Jonathan D. Ostry, Suman Basu, and Ursula Wiriadinata contributed to this section.

Resolving the economic relevance of these economic mechanisms is ultimately an empirical question. Crucially, the set of EMEs is a heterogeneous set of countries with different initial conditions: not only IT credibility and the length of experience with IT, but also domestic financial market depth, foreign participation in the FX market, capital account openness, and political pressures. The credibility costs of FX intervention may differ for different sets of countries according to such characteristics.

In the analysis here, we focus on inflation outcomes for a set of relatively mature EMEs that have implemented broadly credible IT regimes. To examine whether there is a relationship between inflation outcomes and FXI, in Figure 1, we plot the deviation of inflation expectations from the target, and the volatility of inflation, against the strength of intervention. We show that for the set of credible inflation-targeting EMEs considered, there is no statistically significant relation between inflation outcomes and the strength of intervention. This result is generally robust for subsamples over different time periods.

Figure 1. Inflation Performance Against Intervention Strength⁴



Sources: Authors' calculations; the FFA, WEO, and Consensus Forecasts databases; and central bank websites.

Country-specific time series plots back up this finding: for these EMEs, there is no general de-anchoring of inflation expectations from the target after episodes of intervention, and no re-anchoring after episodes of lower intervention. The plots reveal instead that inflation responded

⁴ Intervention strength is measured by the standard deviation of changes in the reserves to GDP ratio, where the latter is calculated from the FFA database. This intervention measure does not capture intervention with derivatives, which are important in a few countries. The measure also does not distinguish between different motives for intervention (e.g., reserves building or actively trying to affect the exchange rate). The inflation expectation is the average one-year-ahead inflation forecast recorded in the Consensus Forecasts database. Inflation is calculated from the WEO database. The sample covers quarterly data over 2010–18, and the sample EMEs are Brazil, Chile, Colombia, Peru, Mexico, Indonesia, India, Korea, Philippines, Thailand, South Africa, Czech Republic, Hungary, Poland, Romania, Russia, and Turkey. We exclude the Czech Republic from the graphs because it is a large outlier; but including it does not change the cross-sectional relation between inflation outcomes and intervention strength.

to large shocks to the exchange rate (e.g., due to the post-crisis surge in capital flows to EMEs, and changes in commodity prices), and intervention policy also responded to those same external shocks. Inflation expectations, meanwhile, are broadly stable in many countries. Interventions appear to play a secondary role. Indeed, to the extent that intervention can stabilize the exchange rate, it may help reduce inflation volatility.

The results are also confirmed by panel regressions exploiting both the cross-country and within-country variation in the intensity of past intervention (Ostry et al. 2019). There is no evidence that intervention affects the dispersion of market forecasts in the short-term rate (a measure of uncertainty over upcoming monetary policy changes). Accordingly, the analysis suggests that perhaps for this specific set of EMEs, the use of FXI could deliver gains of policy flexibility without clear negative side-effects on the credibility of the inflation target.

V. MODALITIES OF FXI

Once an inflation-targeting central bank has chosen to intervene, the specific modalities of such interventions may have a bearing on the extent to which markets and the general public perceive these actions as consistent, or as potentially at odds, with the central bank's primary goal of price stability. Thus, modalities may matter.

FXI can take many forms. For example, it can be carried out openly or secretly, following pre-announced rules or under discretion, and take place in spot or in derivative markets.⁵ The specific modality of intervention can have implications for its impact on the exchange rate. This section focuses on the specific question of how different modalities of FXI can hamper or promote the effective operation of the IT framework.

Since in IT regimes there may be concerns that FXI could undermine the primacy of the inflation target, transparency and communication strategies may help manage this potential tension. This is the finding of Chamon et al. (2019) based on a review of the Latin American experience. As highlighted in the previous section, the ex-ante credibility of the IT regime may matter. If a central bank does not face inflation credibility concerns, or intervention is not perceived by the market to create a conflict with IT, then modalities of FXI may not matter for the credibility of the monetary policy framework. But in countries where credibility is not well established, transparency and clear communications about FXI can help reassure markets. This can involve combinations of transparency both ex ante (e.g., disclosing the criteria that guide intervention decisions) and ex post (e.g., the publication of intervention data).

Latin American countries have struggled with controlling inflation in the past, which may have been a factor in current preference for openness and transparency about FXI. In contrast, Asian EMEs tend to be less transparent. One drawback of secret interventions is that they do not (optimally) make use of the signaling channel for affecting the exchange rate. But there are other

⁵ See Chapter 3 in Chamon et al. (2019) for an extensive discussion in the context of Latin America.

features that may make secret interventions desirable. These typically include fears that market knowledge of the scope of intervention may invite speculative behavior. Secret interventions can also allow the central bank to make more use of the order flow channel. These and other tactical considerations are discussed in Archer (2005).

Central banks may take the choice for transparency one step further by pre-announcing rules for their FXI. This is particularly helpful when the objective is to build reserves—when ideally the impact on the exchange rate should be minimal—but can also provide clarity and rigor to efforts to contain excessive volatility. For example, countries may pre-announce how much they will intervene daily (e.g., Brazil, Mexico), or announce rules with a trigger and the amount of intervention (e.g., Colombia and Mexico). Such approaches can attenuate the confusion FXI may otherwise create, by making it predictable. This said, in practice, intervention rules often tend to be short-lived as countries that adopted rules-based interventions often have had to fine-tune, or ultimately abandon, their rules when external and market conditions changed.

Other dimensions of FXI modalities do not seem to have as clear implications for the IT framework. For example, the decision of whether to intervene through spot or derivatives is typically a response to where the pressures are arising (e.g., whether there is a need for spot FX or whether there is rather an excess demand for hedging). Although the experience of Brazil illustrates that intervention in the deeper forward market obviates the immediate need of using central bank reserves to stabilize the currency.

On balance, it seems transparency could help when it comes to effectively communicating the role of FXI and consistency with the IT regime. Yet, countries with a high degree of credibility may get away with intervening in less transparent ways. If managing the potential tension of FXI and IT is a significant concern, adopting a rules-based approach could possibly help address the problem. The benefit will be stronger to the extent rules are designed in a way that is robust and can accommodate a wide range of developments and market pressures.

VI. CONCLUDING REMARKS

There can be legitimate motivations for (occasional) intervention in the foreign exchange market by inflation-targeting central banks in emerging markets. The findings in this paper suggest that the rationale for intervention often depends on the presence of specific adverse initial conditions. The case seems strongest in the presence of large unhedged currency mismatches or underdeveloped markets—where in the short term few alternative instruments may be available to manage risks. Low reserve levels provide another clear rationale for interventions (to buy foreign exchange). Intervention sometimes also seems a useful instrument to buffer capital in- or outflows and help manage the credit cycle. This provides a somewhat special case that may serve both macroeconomic and financial stability objectives, and where use of the standard interest rate instrument may be counterproductive.

However, intervention to shield vulnerable balance sheets, provide liquidity to structurally shallow markets, or build reserves, should often be seen as a transitional policy instrument, the

value of which will diminish over time as the adverse initial conditions that prompt its use are gradually remedied.

In any event, the benefits of intervention need to be weighed against the costs. Beyond the operational costs associated with reserves holdings and sterilization efforts, and the risk of running out of reserves, we distinguish two main potential costs of FXI.

First, FXI may help entrench structural weaknesses by reducing incentives for markets and economic agents to cope on their own. For instance, the more predictable exchange rate path achieved by systematic FXI may provide incentives for further foreign currency borrowing by the private sector. It may also weaken the need for private sector hedging markets to develop. Similarly, a central bank that reliably acts as a buyer or seller of last resort in a shallow domestic FX market will dull the incentives for market participants to start generating adequate liquidity themselves. These mechanisms do not seem to be subject of much controversy among central bank practitioners and there is a significant body of empirical literature that documents the links between balance sheet weaknesses and less flexible exchange rate regimes. However, more evidence on the specific channels and direction of causality would be desirable, in particular for the link with market development. By and large, the feedback mechanisms suggest that the use of FXI as a transitional instrument should go hand-in-hand with active policies to promote de-dollarization and market development. That is, there should be an exit strategy for interventions.

A second key potential cost usually associated with FXI in the context of inflation-targeting is that it may create confusion about the objectives of the central bank and the primacy of its inflation target. The use of FXI, alongside the policy rate and for other purposes than narrow inflation control, could therefore undermine the credibility of the monetary policy framework. Somewhat surprisingly, few efforts have been made in the academic literature to date to estimate the extent of this cost. Some early evidence provided in this paper, however, suggests that the intervention practices of relatively established inflation-targeting EME central banks have little impact on the degree to which inflation expectations are anchored around the target in their countries. Thus, it appears that, at least for credible EME central banks, the tensions that FXI creates with the IT framework may be quite manageable.

References

- Abdul Aziz, Norzila. 2013, “Foreign exchange intervention in Malaysia.” *BIS Papers* No. 73: 215–222, Bank for International Settlements. Basel.
- Allen, Mark, Christoph Rosenberg, Christian Keller, Brad Setser, and Nouriel Roubini. 2002, “A Balance Sheet Approach to Financial Crisis.” IMF Working Paper 02/210, International Monetary Fund, Washington, DC.
- Archer, David. 2005, “Foreign Exchange Market Intervention: Methods and Tactics.” In *Foreign Exchange Market Intervention in Emerging Markets: Motives, Techniques, and Implications*, edited by Monetary and Economic Department, Bank for International Settlements. BIS Papers No. 24. Basel: Bank for International Settlements, 40–55.
- Armas, Adrian, and Marco Vega. 2019, Peru: Foreign exchange intervention under financial dollarization. In Marcos Chamon, David Hofman, Nicolas E. Magud, and Alejandro Werner (Eds.), *Foreign exchange interventions in inflation targeters in Latin America* (pp. 227–248).
- Badescu, Bogdan. 2016, “Foreign Exchange Interventions as an Unconventional Monetary Policy Instrument — An Empirical Review.” *Journal of Economics, Business and Management* 4 (1).
- Balogh, Csaba, Áron Gereben, Ferenc Karvalits and György Pulai. 2013, “Foreign currency tenders in Hungary: a tailor-made instrument for a unique challenge.” *BIS Papers* No. 73: 155–168, Bank for International Settlements, Basel.
- Bank for International Settlements (BIS). 2013, “Market volatility and foreign exchange intervention in EMEs: what has changed?” *BIS Papers* No 73, Bank for International Settlements, Basel.
- . 2017, “Foreign exchange liquidity in the Americas.” *BIS Papers* No 90, Bank for International Settlements, Basel.
- Barroso, Joao Barata R.B. 2019, Brazil: Taking stock of the past couple of decades. In Marcos Chamon, David Hofman, Nicolas E. Magud, and Alejandro Werner (Eds.), *Foreign exchange interventions in inflation targeters in Latin America* (pp. 93–114).
- Bank of Thailand. 2013, “Foreign exchange policy and intervention under inflation targeting in Thailand.” *BIS Papers* No. 73: 325–333, Bank for International Settlements, Basel.
- Benes, Jaromir, Andrew Berg, Rafael A. Portillo, and David Vavra. 2013, “Modeling Sterilized Interventions and Balance Sheet Effects of Monetary Policy in a New- Keynesian Framework.” IMF Working Paper 13/11, International Monetary Fund, Washington, DC.
- Berganza, Juan Carlos and Carmen Broto. 2012, “Flexible inflation targets, forex interventions and exchange rate volatility in emerging countries.” *Journal of International Money and Finance* 31: 428–444.
- Blanchard, Olivier, and J. Gali. 2007, “Real wage rigidities and the new Keynesian model.” *Journal of Money, Credit and Banking* 39: 35–65
- Boz, Emine, Gita Gopinath, and Mikkel Plagborg-Møller (2017), Global trade and the dollar. IMF Working Paper 17/293, International Monetary Fund, Washington, DC.
- Bucacos, Elizabeth, Alberta Grana, and Gerardo Licandro. 2019, Uruguay: Interventions and their effects. In Marcos Chamon, David Hofman, Nicolas E. Magud, and Alejandro Werner (Eds.), *Foreign exchange interventions in inflation targeters in Latin America* (pp. 249–284).
- Buffie, Edward F., M. Airaud, and Felipe Zanna. 2018, “Inflation targeting and exchange rate management in less developed countries.” *Journal of International Money and Finance* 81: 159–184.

- Brandao-Marques, Luis, Gaston Gelos, Thomas Harjes, Ratna Sahay, and Yi Xue. 2020, “Monetary Policy Transmission in Emerging Markets and Developing Economies.” IMF Working Paper, International Monetary Fund, Washington, DC.
- Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo. 2008, Currency crisis models. In Steven Durlauf and Lawrence Blume, editors, *The New Palgrave: A Dictionary of Economics*, 2nd Edition. Palgrave Macmillan.
- Caballero, Ricardo J. and Guido Lorenzoni. 2007, “Persistent Appreciations and Overshooting: A Normative Analysis.” Paper presented at the 8th Jacques Polak Annual Research Conference Hosted by the International Monetary Fund, International Monetary Fund, Washington, DC.
- Calvo, Guillermo and Carmen Reinhart. 2002, “Fear of floating.” *Quarterly Journal of Economics* 117 (2): 379–408.
- Cardozo, Pamela. 2019, Learning from experience in Colombia. In Marcos Chamon, David Hofman, Nicolas E. Magud, and Alejandro Werner (Eds.), *Foreign exchange interventions in inflation targeters in Latin America* (pp. 137–154).
- Casas, Camila, Federico J. Diez, Gita Gopinath, and Pierre-Olivier Gourinchas (2017), Dominant currency paradigm: A new model for small open economies. IMF Working Paper 17/264, International Monetary Fund, Washington, DC.
- Caselli, Francesca. 2017, “Did the Exchange Rate Floor Prevent Deflation in the Czech Republic?” IMF Working Paper 17/206, International Monetary Fund, Washington, DC.
- Castillo, Paul, Hugo Vega, Enrique Serrano, and Carlos Burga, 2016, De-dollarization of Credit in Peru: The Role of Conditional Reserve Requirements, in Luis Jacome et al. (eds) *Challenges for Central Banking: Perspectives from Latin America*; IMF: Washington DC
- Chamon, Marcos, David Hofman, Nicolas E. Magud, and Alejandro Werner. 2019, “*Foreign Exchange Interventions in Inflation Targeters in Latin America*” IMF: Washington DC
- Chang, Roberto. 2018, “Foreign Exchange Intervention Redux.” NBER Working Paper 24463, National Bureau of Economic Research, Cambridge, MA.
- Chutasripanich, Nuttathum and James Yetman. 2015, “Foreign exchange intervention: strategies and effectiveness.” BIS Working Paper 499, Bank for International Settlements, Basel.
- Claro, Sebastian. and Claudio Soto. 2013, “Exchange rate policy and exchange rate interventions: the Chilean experience.” *BIS Papers* No 73: 81–93, Bank for International Settlements, Basel.
- Cowan, Kevin, Erwin Hansen and Luis Oscar Herrera. 2005, “Currency Mismatches in NonFinancial Firms in Chile” *Economía Chilena* 8(2): 57–82, Central Bank of Chile, Santiago.
- Cubero, Rodrigo, Valerie Lankester, and Evelyn Munoz. 2019, Costa Rica: Learning to float. In Marcos Chamon, David Hofman, Nicolas E. Magud, and Alejandro Werner (Eds.), *Foreign exchange interventions in inflation targeters in Latin America* (pp. 155–194).
- Domanski, Dietrich, Emanuel Kohlscheen, Ramon Moreno. 2016, “Foreign exchange market intervention in EMEs: what has changed?” *BIS Quarterly Review (September)*: pp. 65–79. Bank for International Settlements, Basel.
- Faltermeier, Julia, Ruy Lama, and Juan Pablo Medina. 2017, “Foreign Exchange Intervention and the Dutch Disease.” IMF Working Paper 17/70, International Monetary Fund, Washington, DC.
- Flug, Karnit and Amir Shpitizer. 2013, “Rethinking exchange rate policy in a small open economy: the Israeli experience during the great recession.” *BIS Papers* No. 73: 189–204, Bank for International Settlements, Basel.

- Frankel, Jeffrey. 2005, “Contractionary currency crashes in developing countries.” *IMF Staff Papers*, 52 (2), 149–192.
- . 2011, “Monetary Policy in Emerging Markets.” *Handbook of Monetary Economics*, 3B.
- and George Saravelos. 2012, “Can leading indicators assess country vulnerability? Evidence from the 2008–09 global financial crisis” *Journal of International Economics*, 87 pp. 216–231.
- Ghosh, Atish R., Jonathan D. Ostry, and Mahvash S. Qureshi. 2017, “Managing the Tide: How Do Emerging Markets Respond to Capital Flows?” IMF Working Paper 17/69, International Monetary Fund, Washington, DC.
- Gopinath, Gita. 2015, The international price system. In Jackson Hole Symposium, volume 27. Federal Reserve Bank at Kansas City.
- . 2017, Rethinking International Macroeconomic Policy, Working Paper.
- Guinigundo, Diwa. 2013, “A note on the effectiveness of intervention in the foreign exchange market: the case of the Philippines.” *BIS Papers* No. 73: 263–277, Bank for International Settlements, Basel.
- International Monetary Fund (IMF). 2012, “Article IV Consultation with Indonesia.” Staff Report of the IMF Mission. Washington, DC.
- . 2015, “Assessing Reserve Adequacy—Specific Proposals” Board paper. Washington, DC.
- . 2016, “Annual Report on Exchange Arrangements and Exchange Restrictions.” AREAER Online Database. Washington, DC.
- . 2018, “The Global Economic Recovery 10 Years After the 2008 Financial Meltdown.” *World Economic Outlook*, Chapter 2. Washington, DC.
- Herrera, Luis Oscar and Rodrigo Valdes. 2004, “Dedollarization, Indexation and Nominalization.” IADB Economic and Social Studies Series RE1-04-015. Inter-American Development Bank.
- Lízal, Lubomír and Jiří Schwarz. 2013, “Foreign exchange interventions as an (un)conventional monetary policy tool.” *BIS Papers* No. 73: 127–143, Bank for International Settlements, Basel.
- Masson, Paul R., Miguel A. Savastano and Sunil Sharma. 1997, “The scope for Inflation Targeting in Developing Countries.” IMF Working Paper 97/130, International Monetary Fund, Washington, DC.
- McCallum, Bennett T. 2000, “Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates.” *Journal of Money, Credit and Banking* 32 (4): 870–904.
- Mishkin, Frederic S., and Klaus Schmidt-Hebbel. 2001, “One Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know?” NBER Working Paper 8397, National Bureau of Economic Research, Cambridge, MA.
- Mminele, Daniel. 2013, “Note on the foreign exchange market operations of the South African Reserve Bank.” *BIS Papers* No. 73: 317–323, Bank for International Settlements, Basel.
- Mohanty, Madhusudan. 2013, “Market volatility and foreign exchange intervention in EMEs: what has changed?” *BIS Papers* No 73: 1–10, Bank for International Settlements, Basel.
- Monacelli, Tommaso. 2013, “Is monetary policy in an open economy fundamentally different.” *IMF Economic Review* 61(1).
- Moreno, Ramon. 2005, “Motives for intervention.” *BIS Papers* No. 24: 4–18. Bank for International Settlements, Basel.

- Nordstrom, Anna, Scott Roger, Mark R. Stone, Seiichi Shimizu, Turgut Kisinbay, and Jorge Restrepo. 2009, "The Role of the Exchange Rate in Inflation-Targeting Emerging Economies." IMF Occasional Paper No. 267, International Monetary Fund, Washington, DC.
- Ostry, Jonathan D. Atish R. Ghosh, and Marcos Chamon. 2012, "Two Targets, Two Instruments: Monetary and Exchange Rate Policies in Emerging Market Economies." IMF Staff Discussion Note 12/01, International Monetary Fund, Washington, DC.
- Ostry, Jonathan D., Marcos Chamon, Suman Basu, and Ursula Wiriadinata. 2019, "FXI And Monetary Policy Credibility in Emerging Markets." Mimeo, International Monetary Fund, Washington, DC.
- Reinhart, Carmen. 2000, "The mirage of floating exchange rates." *American Economic Review* 90 (2): 65–70.
- Rossini, Renzo G, Zenón Quispe and Enrique Serrano. 2013, "Foreign exchange intervention in Peru." *BIS Papers* No. 73: 243–262, Bank for International Settlements. Basel.
- Ryoo, Sangdai, Taeyong Kwon and Hyejin Lee. 2013, "Foreign exchange market developments and intervention in Korea." *BIS Papers* No. 73: 205–213, Bank for International Settlements. Basel.
- Serena, Jose Maria, Ricardo Sousa. 2017, "Does exchange rate depreciation have contractionary effects on firm level investment?" BIS Working Papers 624, Bank of International Settlements.
- Svensson, Lars E.O. 2000, "The Zero Lower Bound in an Open Economy: A Foolproof Way of Escaping from a Liquidity Trap", NBER Working Paper 7957, National Bureau of Economic Research, Cambridge, MA.
- Warjiyo, Perry. 2013, "Indonesia: stabilizing the exchange rate along its fundamental." *BIS Papers* No. 73: 177–187, Bank for International Settlements. Basel.
- Zelmer, Mark, Andrea Schaechter, Mark R. Stone, and Alina Carare. 2002, "Establishing Initial Conditions in Support of Inflation Targeting." IMF Working Paper 02/102, International Monetary Fund, Washington, DC.