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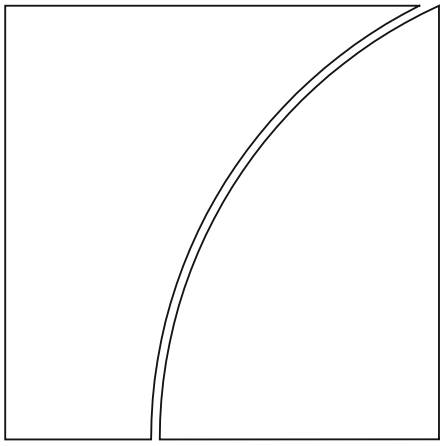

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The size of foreign exchange reserves

Yavuz Arslan and Carlos Cantú

Abstract

This paper assesses the determinants of foreign exchange (FX) reserves in emerging market economies (EMEs). First, it reviews the drivers behind reserve accumulation and the metrics used to evaluate reserve adequacy. We argue that precautionary motives, at least until early 2000s, were the main drivers of reserves accumulation for most of the countries. However, more recently, goals related to monetary and exchange rate policies also play significant roles. Next, the paper evaluates the costs of holding reserves, both at the domestic and global levels. In particular, we highlight the low rate of return on reserves assets and valuation risks that EMEs face. We also discuss the possible role of higher reserves in reducing US long term interest rates. Finally, the paper discusses some supportive and alternative policies such as macroprudential policies and swap agreements, which could alleviate reliance on reserve accumulation.

Keywords: Foreign exchange reserves, reserve adequacy, precautionary demand, export competitiveness

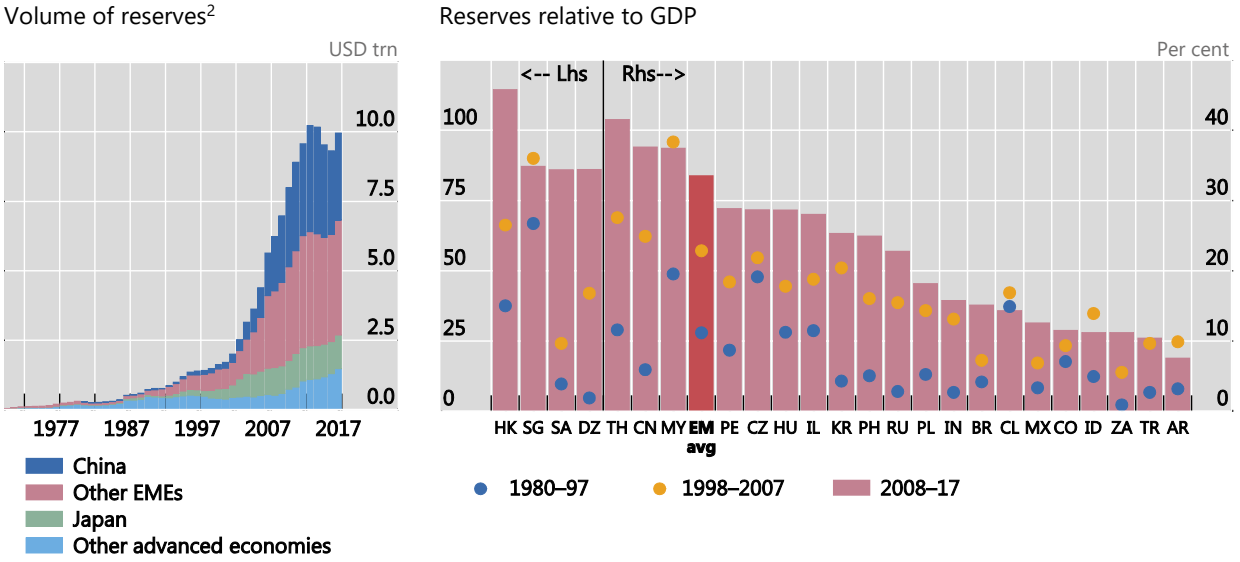
JEL classifications: F3, F31, F36, F41

1. Introduction

The foreign exchange (FX) reserves of emerging market economies (EMEs) have surged since the early 1990s. On average, the level reached almost 30% of GDP in 2018 from about 5% in 1990 (Graph 1). At the same time, cross-country differences are significant (Graph 1, right-hand panel). Even after the slowdown since 2010, Asian EMEs and oil exporters, notably Algeria and Saudi Arabia, hold the largest stocks relative to GDP.

This paper discusses the determinants of the size of EME FX reserves. It first reviews the reasons for reserve accumulation. It then analyses the trade-offs, by considering the main costs. Finally, it considers the extent to which other policies can reduce the need for reserves.

EMEs have accumulated large amounts of reserves[1] Graph 1



[1] AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; DZ = Algeria; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IL = Israel; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU = Russia; SA = Saudi Arabia; SG = Singapore; TH = Thailand; TR = Turkey; ZA = South Africa. [2] Only the EMEs listed in the right-hand panel.

Source: IMF.

2. Reserve accumulation: goals and benefits

Central banks accumulate reserves for a wide variety of reasons. A typical explanation highlights the precautionary role of holding reserves. Nevertheless, and depending on the country, reserves are accumulated also as a *by-product of* other factors, including the pursuit of price and financial stability, and even export competitiveness.[1] In this section, we briefly discuss these goals and some of the benefits of reserve holdings. Annex 1 provides an illustrative econometric analysis that attempts to disentangle and quantify the effects of various goals on reserve

[1] "Export competitiveness" is often referred to as the "mercantilist" motive.

accumulation. *FX intervention: goals, strategies and tactics* prepared for this meeting presents responses to a survey of central banks participating in the meeting regarding their own goals.

2.1 The precautionary motive

EMEs have experienced frequent crises since the 1980s: Latin America in the 1980s, Mexico in 1995, East Asia in 1997, Russia in 1998, Turkey in 1994 and 2001, Brazil in 1999, and Argentina in 2002 and 2018. One salient characteristic of these crises has been sudden stops in capital flows, which have disrupted the financial system and caused large and mostly permanent output losses.[2]

Having been burnt so many times, EMEs have naturally become more cautious. Given also the absence of a fully adequate global safety net, they have accumulated reserves in part as a form of self-insurance (Carstens (2018)). Over the last couple of decades, the rapid increase in gross financial flows, the resulting outsize external stocks in relation to GDP and the growth of domestic financial systems have all strengthened this precautionary motive. True, for most EMEs, current levels are above traditional reserve adequacy measures (Box 1).[3] That said, given the underlying uncertainty, judging reserve adequacy remains very challenging. This, in turn, further encourages prudence (contribution from Mexico).

The experience during and since the Great Financial Crisis (GFC) indicates that reserves help EMEs navigate stormy waters. For example, during the GFC the EMEs that held relatively more reserves experienced smaller currency depreciations (Graph 2, left-hand panel; see also the contribution from Saudi Arabia for a related discussion). This was also the case during the taper tantrum in 2013 and the recent turmoil in Argentina and Turkey (same graph; see also Davis et al (2018)).[4] Such benefits are naturally reflected in other variables: GFC-induced output losses (Llaudes et al (2010), Silva (2011));[5] the probability of facing a crisis (García and Soto (2004)); smoother credit growth during the GFC (Graph 2, third panel); lower borrowing costs (Graph 2, fourth panel; see also the contributions from Korea, Saudi Arabia and South Africa); and more stable credit ratings and access to external funding (contributions from Brazil and Indonesia). Moreover, large stocks of reserves could be deployed under stress in order to provide liquidity in foreign currency to domestic financial

[2] Traditional current account vulnerabilities are related to shortfalls in export earnings or outsize increases in import needs (Ghosh et al (2014)). Capital account vulnerabilities arise from sharp cutbacks in funding by non-residents or capital flight (Obstfeld et al (2010)). Borio and Disyatat (2015) argue that gross flows, and associated stocks, are much more relevant than current accounts for financial stability concerns. Nakamura et al (2013) find that crises, like the ones EMEs have experienced, lower consumption on average by 15% in the long run. For a discussion of the roles of globalisation and that of residents and non-residents, see eg Beck et al (2013), Pereira da Silva (2015) and Obstfeld et al (2010).

[3] Clearly, the more dollarised an economy, the larger the need for a precautionary buffer (contribution from Peru).

[4] Graph 2, like the other graphs in this note, shows simple correlations and does not seek to identify causality. A more systematic analysis is beyond the scope of this note.

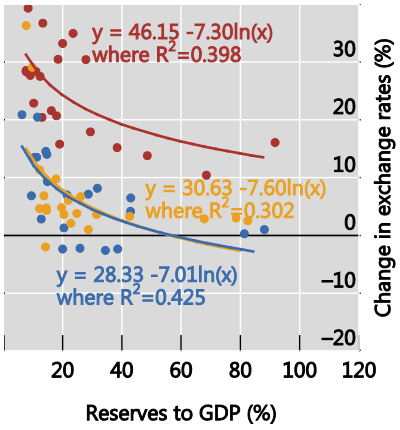
[5] However, benefits tend to diminish rapidly and become negligible at a high level of reserves.

institutions and non-financial companies, thereby preventing or mitigating a credit crunch (contributions from Chile, Peru, and Poland).[6]

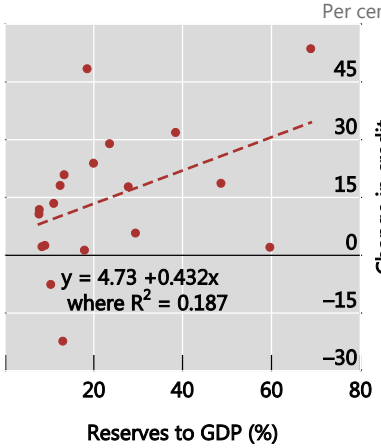
High-reserve countries suffer less from major shocks[1]

Graph 2

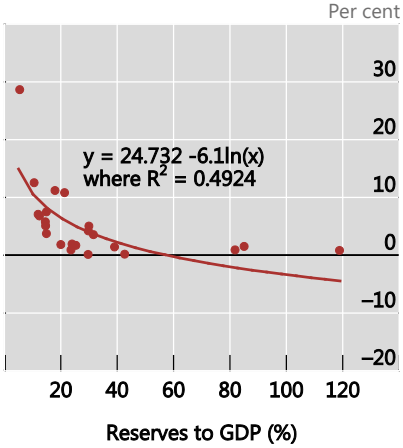
Nominal exchange rates: GFC, taper tantrum and turmoil in Argentina and Turkey[2]



Reserves in 2006 and changes in credit during the GFC[3]



Reserves and three-month borrowing costs[4]



- Great Financial Crisis
- Taper tantrum
- Turmoil in Argentina and Turkey

[1] For some panels, due to data availability, only a subset of the countries presented in Graph 1 is used. A solid (or dashed) regression line refers to significance (or insignificance) at the 5% level. [2] Peak-to-through depreciation in nominal exchange rates between 2006 and 2009, and reserves levels in 2006 are used for GFC. For the taper tantrum episode, exchange rate changes between the first and fourth quarters of 2013, and reserves levels in 2012 are used. For the turmoil in Argentina and Turkey, the exchange rate changes between the second and third quarters in 2018, and reserves levels in 2017 are used. [3] Changes in credit stocks relative to GDP from the first quarter of 2007 to the last quarter of 2009. [4] 2014–18 averages of three-month borrowing rates and reserves to GDP ratios are used.

Sources: IMF; Datastream; national data; BIS; BIS calculations; authors' calculations.

[6] Of course, for this purpose, reserves could be accumulated by borrowing ("borrowed reserves"). FX swap lines perform a similar function.

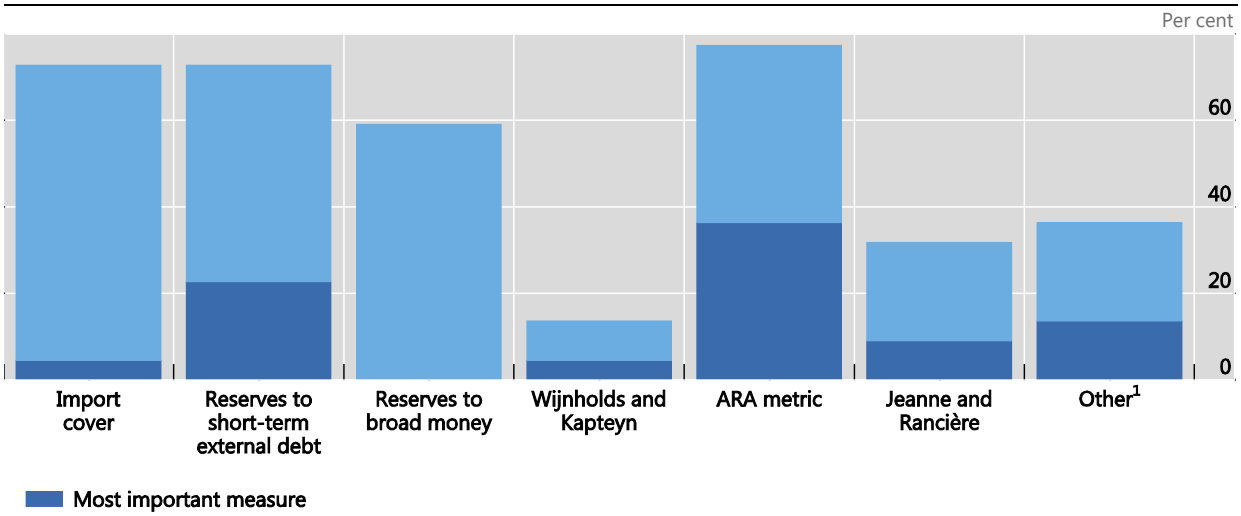
Box 1

Reserve adequacy measures

There is no unique framework with which to assess reserve adequacy for precautionary motives. Central banks follow an array of measures that compare a country's reserve position with proxies for a specific risk or vulnerability (Graph B1). These measures provide a practical starting point, but a complete assessment must consider country-specific factors such as the exchange rate regime and capital account openness as well as financial market depth and liquidity.

Central banks follow an array of reserve adequacy measures

Fraction of respondents that follow each measure — Graph B1



[1] In Colombia, reserves are required to cover at least the expected current account deficit plus external debt amortisations over the following year. Mexico applies the risk model of Ibarra et al (2011). South Africa adheres to the Southern African Development Community convergence criterion, which specifies cover comprising up to six months of imports. Poland has an internally developed indicator that takes into account the structure of short-term debt and the potential outflows of foreign portfolio investments. Argentina, Saudi Arabia and Thailand use scenario analysis based on episodes of extreme capital outflows. Peru applies an extended Jeanne and Rancière (2011) model that takes into account financial dollarisation. Hong Kong SAR and Saudi Arabia also consider a 100% mandatory currency backing.

Source: BIS survey, 2018.

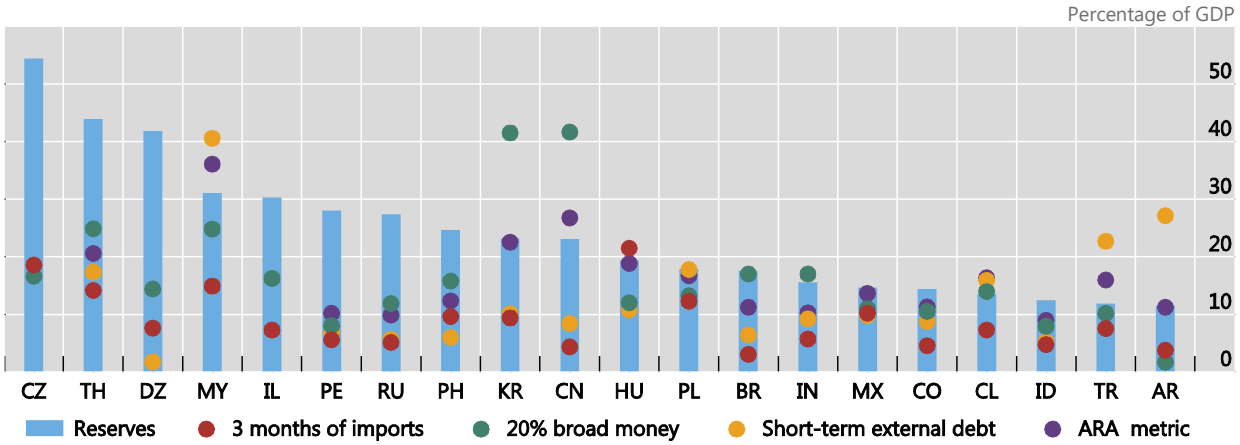
The traditional measures are:

- **Import cover:** measures the number of months that reserves can sustain imports. This indicator is considered relevant for countries with a closed capital account. The benchmark is three months of coverage.
- **Ratio of reserves to short-term external debt:** measures the potential demand for repayments related to a country's short-term external foreign currency borrowing.① The Guidotti-Greenspan rule proposes a 100% cover. This rule can be extended to consider the full potential 12-month financing need, measured by short-term external debt minus the current account balance.②
- **Ratio of reserves to broad money (M2):** measures the potential demand for foreign assets from domestic sources. This indicator is considered relevant for countries with financially developed markets and an open capital account. The benchmark is typically set at 20%.
- **Wijnholds and Kapteyn (2001):** measures both the potential drain on reserves that results from the non-rollover of short-term external debt and that from residents' capital flight. It is the sum of short-term external debt plus an adjusted M2. The adjustment to the second component depends on the exchange rate regime and country risk. The authors propose a 100% reserve cover.③

- **Assessing reserve adequacy (ARA) metric:** measures a broad set of risks reflecting potential drains on the balance of payments. The IMF's metric has four weighted components: short-term external debt; M2; export income; and other liabilities. The last two components reflect potential terms-of-trade shocks and other portfolio outflows, respectively. The measure is adjusted if the country is dollarised, if it has capital controls or if it is a commodity exporter/importer. The benchmark is between 100% and 150% reserve cover.④
- **Jeanne and Rancière (2011):** measure the optimal level of reserves by calibrating a cost-benefit model. The model balances the opportunity cost of holding reserves with the gains from smoothing domestic absorption during sudden stops. The level of optimal reserves varies considerably depending on the assumptions on output loss, probability of a sudden stop, and risk aversion.

In most countries, the stock of reserves in 2017 was higher than the suggested benchmarks of the measures followed by the majority of central banks (Graph B2). However, caution should be exercised when examining the measures individually. A comprehensive assessment of reserve adequacy should consider the consolidated position of the domestic banking sector and the availability of additional external buffers. In addition, as argued in the country contributions for this meeting, reserve adequacy should be used as a reference and not as an explicit goal.

Reserves are in most cases higher than traditional benchmarks[1] Graph B2



[1] Data from 2017.

Source: IMF.

① Short-term external debt on a remaining maturity basis is measured by adding the value of outstanding short-term external debt (original maturity) to the value of outstanding long-term external debt (original maturity) due to be paid in one year or less. ② Foreign liabilities of domestic banks due to operations in foreign markets are not included in this measure. These operations may increase maturity, interest rate and currency mismatches and put additional pressure on potential draws of reserves. During both the Mexican (1982) and Korean (1997) crises, the positions of domestic banks in foreign markets exacerbated the crisis (Álvarez (2015), Blustein (2001)). ③ The weights are between 0.1 and 0.2 for countries with a managed float or fixed exchange rate regime, and between 0.05 and 0.1 for countries with a floating exchange rate regime. Country risk is measured using *The Economist*'s country risk index. ④ The relative risk weights for each component are based on the 10th percentile of observed outflows from EMEs during exchange market pressure episodes.

Sources: IMF (2015); Jeanne and Rancière (2011); Wijnholds and Kapteyn (2001).

2.2 Goals related to monetary and exchange rate policies

FX reserves may also not necessarily be accumulated with a specific adequacy *reference* level in mind, but as a *by-product* of the pursuit of other goals. While, given overlaps, drawing a dividing line between such goals is not straightforward, they

include price stability as well as smoothing output and financial fluctuations.[7] Preserving export competitiveness may also play a role.

Price stability

Accumulating reserves as a by-product of aiming to maintain price stability is not uncommon. This occurs whenever the central bank considers that simply adjusting interest rates and letting the exchange rate float is not sufficient or not the preferred strategy (see Ho and McCauley (2003) for an in-depth discussion). For example, if inflation is below target, and if the currency comes under appreciation pressure and interest rates are already very low then the central bank may prefer to resist the appreciation by intervening rather than cutting interest rates further. This may be especially beneficial if inflation expectations were threatening to dis-anchor or the central bank was concerned about the rapid pace of domestic credit growth and the build-up of financial vulnerabilities (see *FX intervention: goals, strategies and tactics* and the discussion below). Clearly, the more highly managed the exchange rate is, the higher the average level of reserves (Graph 3, left-hand panel). Finally, larger reserves holdings may also help monetary policy to control inflation by lowering exchange rate volatility, hence its pass-through to inflation.

Countries lie along a spectrum. At one end, reserve accumulation is passive in pegged exchange rate regimes, where a country ties its currency to a larger economy from which, in effect, it "imports" the inflation rate (Hong Kong SAR and Saudi Arabia). The Czech Republic set a ceiling to its exchange rate vis-à-vis the euro from November 2013 to April to bring low inflation levels back to target. They implemented this additional monetary policy instrument during a period of zero lower bound on interest rates. Singapore influences inflation through an (undisclosed) path for the appreciation of its currency. At the other end, other countries pursue their inflation objectives with very limited FX intervention (Colombia and Chile).

Smoothing financial and business fluctuations

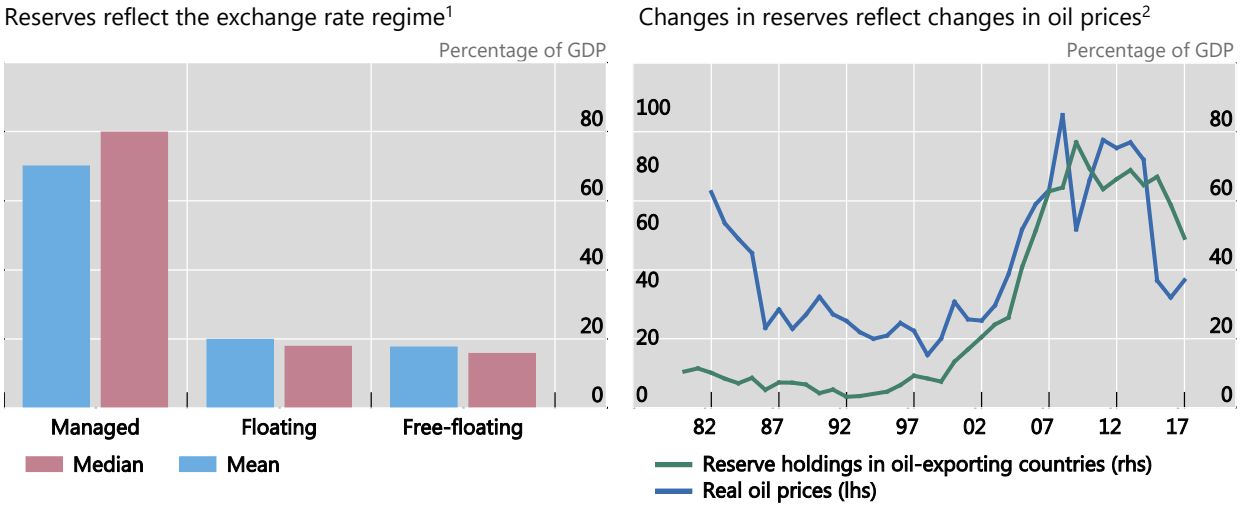
The path of reserve accumulation may also result from a "leaning against the wind" policy. Here, the central bank purchases reserves to contain appreciation, and sells them in the event of a sudden stop (Kiguel and Levy Yeyati (2009)). This would tend to smooth the financial and macroeconomic fluctuations. If the original level of reserves fell short of adequacy benchmarks, the accumulation phase would push it towards the prudential reference. But, depending on the strength and persistence of the exchange rate pressure, reserves could end up well beyond that reference.

Specifically, leaning against the appreciation wind during expansions can be cast as a countercyclical prudential response to procyclical capital flows and real exchange rate fluctuations (Carstens and Shin (2019); see also contribution from China). For one, just as with, say, the countercyclical capital buffer, building up reserves in good times allows the central bank to run them down in bad times, strengthening the economy's resilience. In addition, it may also dampen the easing impact on financial conditions linked to currency appreciation and capital flows. In the presence of currency mismatches and large FX debt in either firm, government or household balance sheets, exchange rate appreciation improves the creditworthiness of borrowers, either because it raises the value of collateral or because it reduces the burden of foreign

[7] *FX intervention: goals, strategies and tactics* (this issue) provides a detailed summary of the central bank goals underpinning FX interventions.

currency debt. Limiting appreciation may thus restrain the expansion in the demand and, above all, supply of credit – the exchange rate or risk-taking channel (Bruno and Shin (2015)). Moreover, it is also possible that the sterilisation leg of the intervention may restrain credit expansion to the extent that it "crowds out" lending in bank balance sheets (Chang (2018), Hofmann et al (2019)).[8]

There are large differences in reserves holdings across FX regimes — Graph 3



[1] For the classification of countries, IMF definitions are used. "Managed" countries: CN, DZ, HK, MY, SA and SG. "Floating" countries: AR, BR, CO, HU, ID, IL, IN, KR, PH, TH, TR and ZA. "Free-floating" countries: CL, MX, PL and RU. See footnote 1 of Graph 1 for a key to the abbreviations. [2] Algeria, Russia and Saudi Arabia are the major oil producers in the sample. Extending the sample with other exporters keeps the shape of the curve intact.

Sources: Federal Reserve Bank of St Louis; IMF; authors' calculations.

Data and recent research provide supportive evidence that reserve accumulation may indeed smooth financial cycles (Graph 4; see also Hofmann et al (2019)). At least since the 2000s, EME central banks have tended to increase their reserves when capital inflows surged. For instance, European Union fund inflows have been the major driver of reserves for European EMEs. Countries that accumulated more reserves experienced slower credit growth (Graph 4, centre panel). More formal analysis confirms these conclusions (BIS (2018); see also Graph 4, right-hand panel).

Partly related to the income- and output-smoothing goal, but over longer horizons, reserve accumulation may be designed to deal with persistent commodity price shifts (or improved terms of trade in broader terms).[9] Fiscal policies of commodity exporting countries have made this goal prominent. For instance, as oil prices surged beginning in 2000, oil exporters' reserves reached around 80% of GDP in 2007 (Graph 3, right-hand panel). Thereafter, as oil prices declined, countries ran down their reserves. For example, in Saudi Arabia, peg aside, the reliance of fiscal policy on oil revenues has influenced the dynamics of the country's reserves, which are more akin to a sovereign wealth fund. Other examples include the structured

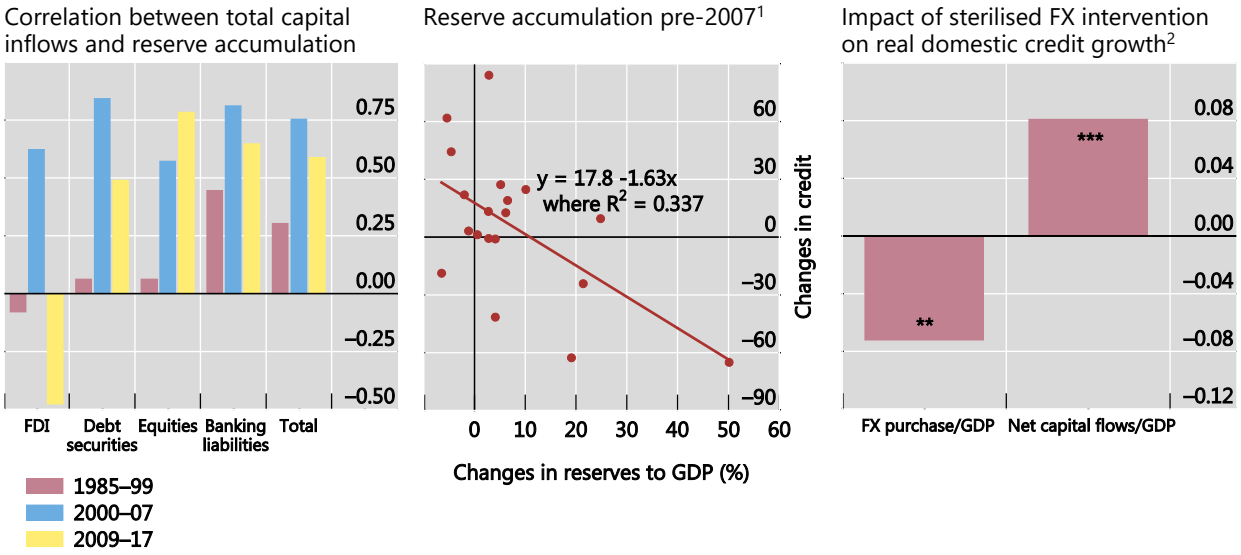
[8] Crowding-out of domestic lending if some of the bank funds are used to finance reserves (Cook and Yetman (2012)) can generate similar dynamics. Hofmann et al (2019) argue that the role of exchange rates is stronger than that of the bank balance sheet channel.

[9] See survey responses reported in *FX intervention: goals, strategies and tactics* (this issue) regarding the role of commodity cycles on reserve accumulation.

balance rule in Chile and the fiscal rule in Russia. In the case of Mexico, the central bank law requires Pemex, and similar non-financial entities that operate with foreign currency, to trade with the central bank. As a result, Pemex has been the biggest contributor to reserve accumulation.

Reserve accumulation goes hand in hand with smoother credit growth

Graph 4



[1] A solid (or dashed) regression line refers to significance (or insignificance) at the 5% level. [2] Panel shows the coefficient of the variables on the horizontal axis from a panel regression analysis for 45 EMEs from 2005 to 2013 reported in specification (7) in Table 9.2 of Ghosh et al (2017). **/*** indicates statistical significance at the 5/1% level.

Sources: IMF; BIS.

Export competitiveness

Preserving or promoting export competitiveness is a more controversial objective. It potentially spans a broad range of options, from intervening only when the currency is seen as blatantly overvalued so as to avoid long-term damage to export and growth potential,[10] to seeking to maintain or gain competitiveness regardless of any overvaluation.[11]

Perhaps the most stringent critique of large EME reserve holdings is that they are accumulated as a by-product of FX interventions to maintain or gain competitiveness. Such an objective may seem more likely in countries where reserves are much higher than conventional "rule of thumb" thresholds (eg Krugman (2008)).

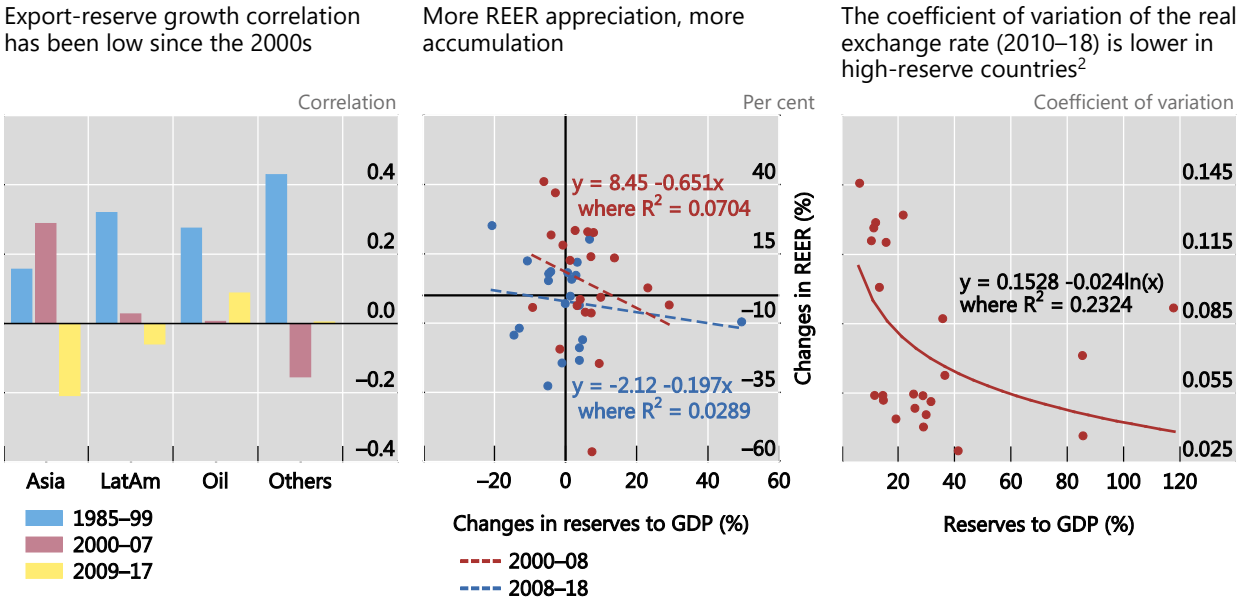
The evidence for this claim is not that strong, however. For most of the countries, the correlation between reserve accumulation and export growth has been low (Graph 5, left-hand panel). And while a weakening real exchange rate tends to go hand in hand with less reserve accumulation, the correlation is weak (Graph 5, centre

[10] See Magud and Sosa (2010) for a literature review.

[11] The export competitiveness motive has been relevant also for several advanced economies, eg Denmark and Switzerland after the GFC.

panel).[12] More formally, Ghosh et al (2014) estimate that, after the 2000s, the cumulative impact of this motive on the countries' stock of reserves increased to 3.5% of GDP (or about 10% of FX reserves) in Asian EMEs – not a very large figure.[13]

Reserve accumulation provides some support for trade[1] Graph 5



[1] Includes all countries presented in Graph 1 except Algeria. A solid (or dashed) regression line refers to significance (or insignificance) at the 5% level. [2] Monthly real exchange rate data after 2010. Average level of reserves between 2009 and 2018. Limiting the sample to the countries with reserves lower than 60% strengthens the negative correlation.

Sources: Datastream; BIS; authors' calculations.

3. Reserve accumulation: costs

Despite numerous and potentially large benefits, holding large reserve chests does not come free. The costs can be at both the domestic and the global level.

Domestic

Countries pay a premium to use reserves as an insurance mechanism (Graph 6, left-hand panel). A simple accounting exercise that uses spreads between the yield on reserve assets and the cost of foreign borrowing suggests that the income loss for

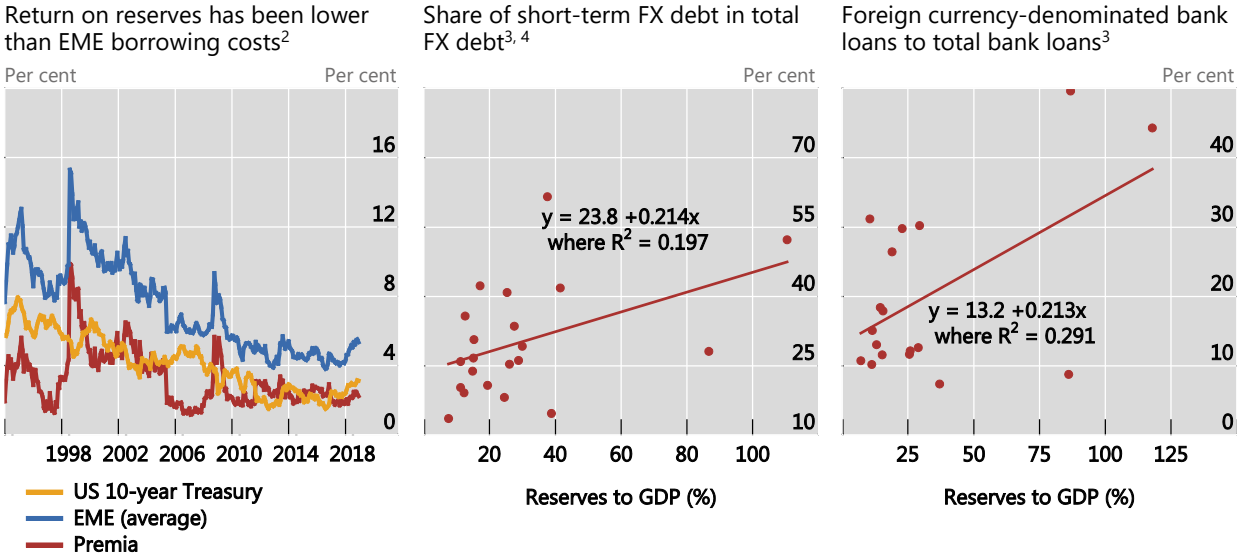
[12] High reserve levels may also help the tradable sector indirectly by limiting real exchange rate volatility, possibly because they lower the risk of crises (Graph 5, right-hand panel).

[13] Ghosh et al (2012) propose proxies for export competitiveness motives following three approaches. The macro balance approach states that the exchange rate is undervalued if a real appreciation is required to close the gap between the actual current account and its norm. The equilibrium real exchange rate approach compares the real exchange rate with its equilibrium value as implied by fundamentals. The external stability approach compares the prevailing exchange with the one that would generate a current account balance that stabilises the net foreign asset position.

these countries may be close to 1% of GDP (Rodrik (2006)). However, this simple calculation does not take into account that, absent reserves, borrowing rates would be higher. As a result, both the spread differentials and the costs are overstated by as much as 50% according to some estimates (Levy-Yeyati (2008)).[14]

High reserve levels often accompany FX risk-taking[1]

Graph 6



[1] Depending on data availability, only a subset of the countries presented in Graph 1 is used. A solid (or dashed) regression line refers to significance (or insignificance) at the 5% level. [2] Return on reserves is proxied by US 10-year Treasury rate. EME borrowing costs are approximated by the average of the EMBI across EMEs with available data. [3] Most recent available data. [4] Sum of government and non-financial corporate FX-denominated debt.

Sources: IMF; Datastream; JPMorgan Chase; national data; BIS calculations; authors' calculations.

Reserves also expose countries to valuation risks. From a macroeconomic perspective, these risks may be second-order, as reserves act precisely as a hedge. Losses will be realised when domestic currencies appreciate, which will be most likely when domestic economies are strong, and gains when currencies depreciate, which is bound to occur, especially when the economy faces stress. That said, losses can give rise to political economy challenges, which could even undermine central bank autonomy (See *Reserve management in emerging market economies: trends and challenges* prepared for this meeting).

While, ceteris paribus, reserve accumulation increases resilience, it may also create perverse incentives. For one, domestic private agents, and sometimes even governments, may take advantage of the improved general sense of safety to assume more risk (Fatum and Yetman (2018); see also the contribution from Thailand). And to the extent that intervention removes the perception of two-way risk, it may encourage further capital inflows in the short run and larger currency mismatches in the longer run. If so, accumulating reserves would be in part self-defeating.

There is some suggestive evidence that such a mechanism may be at work (eg Barajas and Morales (2003) and Berrospide (2008)). Simple cross-country correlations support this conclusion to some extent (Graph 6). In countries with higher

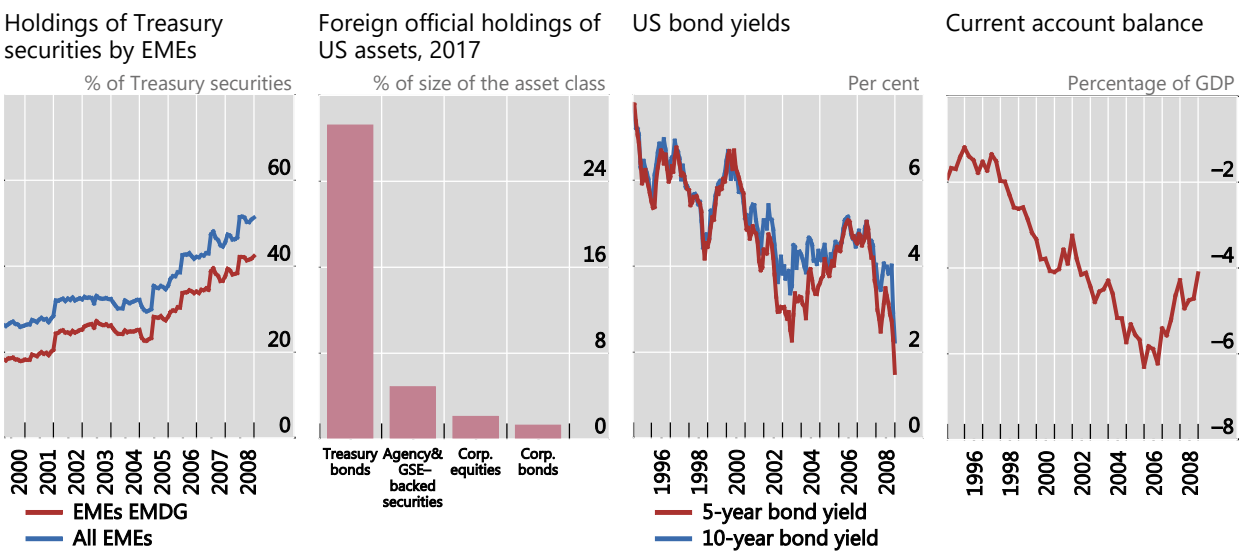
[14] In addition, aggregate EME reserves also affect US Treasury rates, as discussed in the policy section of this note.

reserves, firms and governments tend to finance themselves more with short-term foreign currency debt (Graph 6, right-hand panel). And the share of foreign currency bank loans in the total is also higher (Graph 6, centre panel; see also Ize and Levy-Yeyati (2003)).[15] That said, the direction of causality is ambiguous. Moreover, unfortunately, good statistics on currency mismatches are generally not available, making it harder to test the hypothesis.

Global

While reserves may provide insurance for each accumulating country, globally they may add to vulnerabilities.[16] For instance, several studies find that EME reserve accumulation has reduced US long-term interest rates significantly (Graph 7 and Table A3). According to one view, the resulting low-yield environment fuelled the credit and property price boom that eventually triggered the GFC (Bini Smaghi (2010)). Large current account deficits prior to the GFC were supported by official EME reserve accumulation (Bernanke (2005), Summers (2006)).[17] According to another view, however, the crisis was essentially a transatlantic affair, unrelated to current account surpluses or EME reserves accumulation (Borio and Disyatat (2011), Shin (2012), McCauley (2018)).

EME reserve accumulation and the pre-GFC boom in the United States — Graph 7



Sources: FED Z1 Flow of Funds; US Department of the Treasury; BIS; BIS calculations.

[15] Despite its intuitive appeal, some of the results in Graph 6 are driven by several countries that hold a very high level of reserves. For the centre panel, if the two largest reserve holders are removed, the positive correlation survives; for the right-hand panel, the line becomes flat. We chose to plot the graphs with all the available countries, as the mechanisms referred to in the text are likely to work across all of them.

[16] See *Reserve management in emerging market economies: trends and challenges* prepared for the meeting for a discussion of spillover risks to advanced economies in the event of a joint liquidation of reserves.

[17] Bernanke (2005) coined the term "saving glut" to denote this phenomenon.

4. Supporting and alternative policies

Given the potential costs and the trade-offs, are there policies that could alleviate reliance on reserve accumulation?

Policymakers have a broad set of tools that, to varying degrees, can perform this function. In general, other policies – be they fiscal, microprudential or macroprudential – that strengthen an economy and its financial system would reduce the need for FX reserves as a precautionary buffer. Some of these policies, such as those relying on macroprudential or even capital flow management measures, operate more at the cyclical frequency; others, such as those designed to ensure fiscal space or strengthen microprudential safeguards, have a more structural character. Similarly, reducing the dollarisation of both assets and liabilities may help (contribution from Peru).

At the margin, some innovative FX intervention methods introduced in recent years may also help reduce the costs – and, possibly, lower the required amount – of reserves. For instance, the Central Bank of Turkey's Reserve Option Mechanism (ROM) gives private banks the option to hold some parts of their required reserves in FX. Banks make extensive use of this option, as their cost of borrowing in FX is lower than that in the domestic currency. When it becomes difficult to obtain FX funding, banks may then tap these reserves to alleviate liquidity pressures. This mechanism has two benefits. First, it is market-friendly: depending on market conditions, banks decide how much FX to hold at the central bank. Second, it lowers the cost of holding reserves for the central bank.

Specific use of derivatives to intervene in the FX markets may also to some extent lower the required amount of reserves (see *FX intervention: goals, strategies and tactics* (this issue) for a more detailed discussion).[18] For instance, the Central Bank of Brazil's FX swap policies have aimed at providing FX hedges to corporates by operating in instruments that settle in domestic currency (Kohlscheen and Andrade (2014)). That said, for this policy to be effective, a strong backing from high reserve holdings is still necessary.

More importantly, a way to reduce the need for self-insurance is to provide international insurance. Several arrangements seek to do precisely that, such as swap lines between central banks (Graph 8; see also Allen and Moessner (2011)), regional schemes, such as the Chang Mai Initiative Multilateralization, and the IMF's Flexible Credit Lines.[19] For instance, Mexico has a USD 74 billion flexible credit line agreement with the IMF at a financial cost below that of holding reserves (contribution from Mexico).

These schemes provide a useful complementary form of insurance. They are especially helpful when market participants question the central bank's credibility (contribution from the Philippines) or see reserve buffers as inadequate. For instance, when Korea came under pressure during the GFC, it was the Fed's swap line that finally stabilised the situation (Baba and Shim (2010)).

[18] For instance, the combined net long forward position of seven East Asian countries increased from a mere USD 22 billion in April 2009 to USD 235 billion in mid-2011 (Domanski et al (2016)).

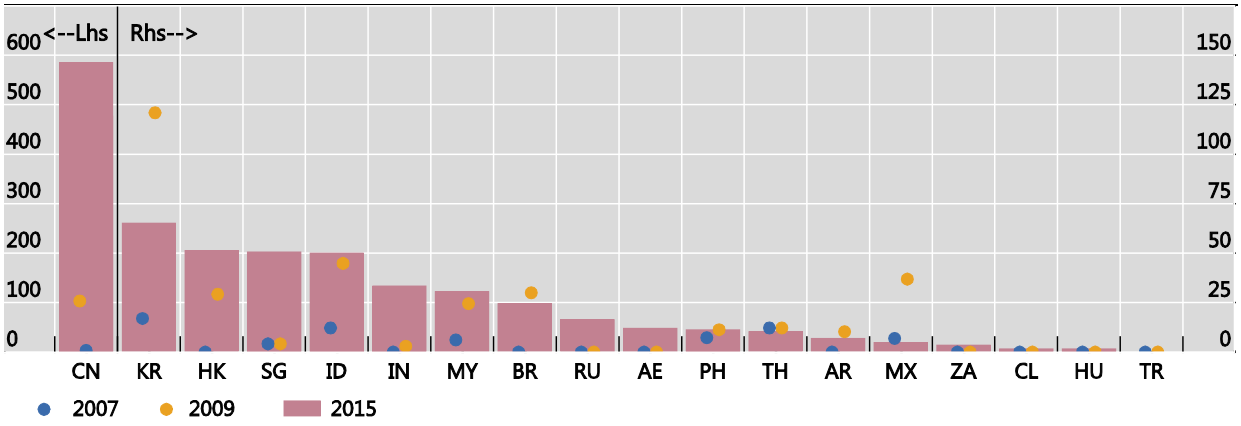
[19] Of course, additional access to IMF resources can be provided under a programme.

That said, these backstops have a number of limitations. Central bank FX swap lines tend to be granted selectively, and their activation is not certain and could be held hostage to political developments (contribution from Saudi Arabia). They are not fully under the control of the country that needs them (contribution from Argentina). All this constrains their size and reach. Similarly, IMF resources fall short of potential needs, given the rapid growth of financial interlinkages reflected in the long-run surge in the external stocks of assets and liabilities (Carstens (2018)). And many countries still see them as bearing a stigma. All these limitations stress that the global safety net is not flexible and large enough to reduce the required level of reserves significantly.

Swap lines have been growing

In billions of US dollars

Graph 8



The size of a country's swap line (from a borrower's perspective) is determined by the sum of all active swap line agreements active in a given year.

Source: Denbee et al (2016).

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Annex 1

Determinants of reserve accumulation: some econometrics

How important are the different factors discussed in the main text as drivers of overall reserve accumulation in EMEs? Following the recent studies (Obtsfeld et al (2010), Ghosh at al (2012, 2014), Aizenman and Lee (2007), Aizenman et al (2014), Delatte and Fouquau (2012)), we perform a regression analysis to estimate how precautionary and exchange rate policy-related motives influence reserves. Since there are no direct measures of the specific motives, we use widely accepted proxies developed in the literature.[20] That said, the proxies are not perfect. As a consequence, the econometric results can be at most as good as the proxies allow.

The econometric methodology is standard. The panel equation we estimate is the following:

$$\ln\left(\frac{Res_{it}}{GDP_{it}}\right) = \alpha + \beta_P Precautionary_{it} + \beta_{ERP} ExRate\ Policy + \beta_O Other_{it} + \varepsilon_{it}$$

where:

$$Precautionary_{it} = \{Curr\ Ac\ Vulnerab_{it},\ Size\ of\ Fin\ System_{it},\ Cap\ Ac\ Openness_{it}\},$$

$$ExRate\ Policy_{it} = \{Overval_{it},\ ExRate\ Stab_{it}\}, \qquad Other_{it} = \{\ln(Pop_{it}), \ln(\mathrm{GDPpc}_{it})\}$$

Proxies related to precautionary motives are the most important (Graph A1). These results are in line with the findings of the literature, country contributions and survey responses reported in *FX intervention: goals, strategies and tactics* prepared for this meeting. Among precautionary motives, current account vulnerabilities matter most, followed by capital account openness. In addition, we find that the share of growth in reserves explained by the overvaluation of the exchange rate has remained stable, while the role of exchange rate stability has diminished over the past 10 years.[21]

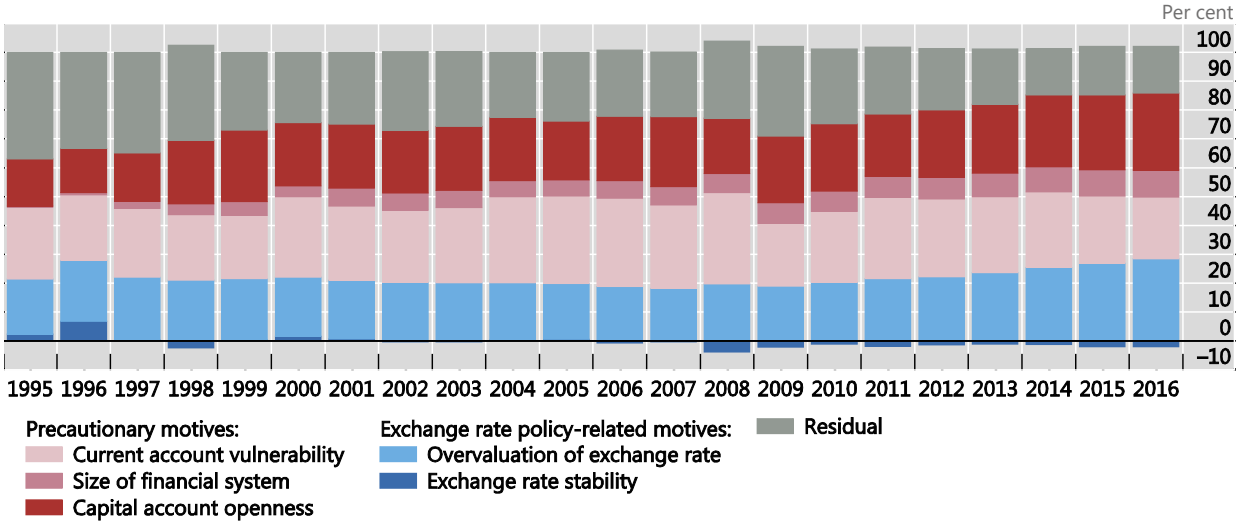
To examine how the drivers of reserve accumulation change over time, we divide the sample into subperiods. The cutoffs are chosen to coincide with the Asian crisis and the onset of the GFC. The importance of each of the factors that influence the demand for reserves has evolved in accordance with developments in EMEs and the global economy (Graph A2, left-hand panel, and Table A1). Within the precautionary motives, current account vulnerabilities have gained importance with respect to capital account vulnerabilities. In particular, financial openness has become increasingly relevant. Consistent with the survey results reported in *FX intervention: goals, strategies and tactics*, the role of overvaluation of the exchange rate has declined. It ceased to be significant in the post-GFC period. Finally, the role of exchange rate stability has remained stable.

[20] The factors included in precautionary motives are current account vulnerability (proxied by trade (IMF (2015)), size of financial system (proxied by broad money (Wijnholds and Kapteyn (2001)) and capital account openness (proxied by the sum of assets and liabilities (Lane and Milesi-Ferretti (2007)). The factors included in exchange rate-related motives are overvaluation of the exchange rate (Aizenman and Lee (2007)) and exchange rate stability (Aizenman et al (2013)).

[21] We measure the overvaluation of the exchange rate as the deviation of the price level from the trend implied by per capita income (Aizenman and Lee (2007)). The measure does not take into account other sources of currency misalignments or banking system liabilities.

Precautionary motives are the main drivers behind reserve accumulation

Contribution of each factor to the cumulative growth in reserves — Graph A1



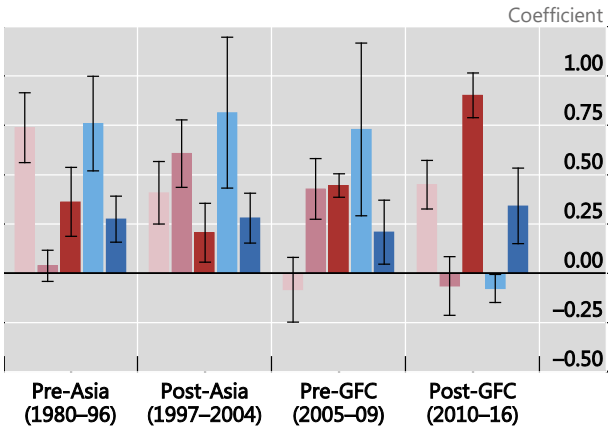
Decomposition of the cumulative change in reserves obtained from the fitted regression of reserves on proxies of precautionary and exchange rate policy-related motives. The contribution of each factor is calculated as the product of the coefficients from the full-sample regression and the time-varying proxy.

Sources: Aizenman et al (2014); Ghosh at al (2014); Obtsfeld et al (2010); BIS calculations using data from IMF, *International Financial Statistics*, and World Bank, World Data Indicators.

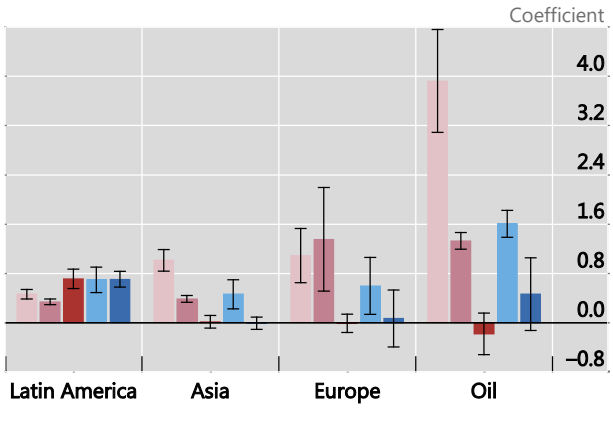
The determinants of demand for reserves shift across periods and regions

Graph A2

Across periods



Across regions



Precautionary motives:
- Current account vulnerability
- Size of the financial system
- Capital account openness

Exchange rate policy related motives:
- Overvaluation of the exchange rate
- Exchange rate stability

Coefficients of the regression of reserves on proxies of precautionary and exchange rate policy related motives. The lines correspond to the standard errors.

Sources: Aizenman et al (2014); Ghosh at al (2014); Obtsfeld et al (2010); BIS calculations using data from IMF, *International Financial Statistics*, and World Bank, World Development Indicators.

Finally, we divide the sample by region (Latin America, emerging Europe, Asia) and also parcel out oil exporters (Graph A2, right-hand panel, and Table A1). The results suggest that while precautionary motives, on average, are significant in all regions, the importance of their subcomponents vary across regions. For instance, capital account openness has been more important in Latin America, a region arguably more prone to external funding shocks. In Europe, a region with fewer currency mismatches, the size of the financial system (ie domestic vulnerabilities) appears to matter more.

Determinants of demand for reserves across periods

Table A1

	(1) Full sample	(2) Pre-Asia (1980–96)	(3) Post-Asia (1997–2004)	(4) Pre-GFC (2010–16)	(5) Post-GFC (2010–16)	(6) Latin America	(7) Asia	(8) Europe	(9) Oil exporters
Precautionary motives									
Current account vulnerability	0.735***	0.739***	0.408**	–0.083	0.450***	0.462***	1.014***	1.089**	3.925***
	(0.183)	(0.177)	(0.159)	(0.164)	(0.123)	(0.077)	(0.174)	(0.442)	(0.837)
Size of financial system	0.266**	0.038	0.607***	0.428***	–0.064	0.337***	0.386***	1.353	1.328***
	(0.134)	(0.079)	(0.171)	(0.154)	(0.148)	(0.045)	(0.054)	(0.841)	(0.137)
Financial openness	0.423**	0.362**	0.206	0.445***	0.902***	0.711***	0.014	–0.012	–0.180
	(0.210)	(0.175)	(0.149)	(0.060)	(0.113)	(0.157)	(0.100)	(0.148)	(0.337)
Exchange rate policy-related motives									
Overvaluation of exchange rate	0.635***	0.759***	0.814**	0.729*	–0.077	0.696***	0.461*	0.596	1.606***
	(0.231)	(0.240)	(0.382)	(0.437)	(0.072)	(0.208)	(0.236)	(0.463)	(0.219)
Exchange rate stability	0.357***	0.275**	0.280**	0.209	0.342*	0.706***	–0.009	0.068	0.464
	(0.112)	(0.117)	(0.126)	(0.162)	(0.191)	(0.128)	(0.100)	(0.462)	(0.591)
Scale variables									
Population	0.394***	0.118	0.098	0.147	0.233**	0.096*	0.353***	0.019	1.079***
	(0.151)	(0.104)	(0.116)	(0.096)	(0.105)	(0.049)	(0.076)	(0.216)	(0.178)
Real GDP per capita	0.145	0.293	0.224	0.354*	–0.323*	–0.852***	0.431***	–1.213	–0.398
	(0.156)	(0.184)	(0.296)	(0.194)	(0.184)	(0.156)	(0.073)	(1.031)	(0.279)
Constant	–5.644***	–5.007**	–4.675	–3.747	1.097	5.071***	–8.870***	4.549	–18.210***
	(1.714)	(2.044)	(3.158)	(2.365)	(1.908)	(1.484)	(1.287)	(9.153)	(6.287)
R^2	0.61	0.60	0.67	0.52	0.45	0.97	0.95	1.00	0.89
Observation	814	334	192	120	168	226	381	108	98
Number of countries	24	24	24	24	24	6	11	4	3

Robust standard errors in parentheses. ***/**/* indicates significance at the 1/5/10% level.

Source: BIS calculations using data from IMF, *International Financial Statistics*, and World Bank, World Development Indicators.

The effect of reserve accumulation on US Treasury yields: literature summary

Table A2

Bernanke et al (2004)	Interventions undertaken by the Japanese Ministry of Finance between 2000 and 2004 could have lowered 10-year US Treasury yields by 66 basis points for every purchase of USD 100 billion.
Jiang and McCauley (2004)	Significant negative relationship between weekly changes in 10-year US Treasury yields and foreign official holdings, with the latter proxied by custodial holdings at the Federal Reserve Bank of New York, but only over two short periods in 2000 and 2003.
Warnock and Warnock (2005)	Had foreign governments not accumulated US government bonds over the 12 months ending May 2005, the 10-year Treasury yield would have been 90 basis points higher.
Beltran et al (2013)	USD 100 billion in foreign official inflows lowered the five-year yield by 40–60 basis points in the short and medium run, and by 17–20 basis points in the long run, over the 1994–2007 period.
Sierra (2014)	Excess returns are negatively associated with foreign official purchases during 1994–2007. The impact of foreign official flows gradually weakens for longer maturities (over six years).
Wolcott (2016)	Foreign official purchases have shifted the entire yield curve down, with the largest and statistically significant impacts at the short end of the curve and more persistent effects at the long end of the curve. An inflow equal to 1% of the amount of Treasuries outstanding lowers the 10-year yield by 6 basis points and the three-month yield by about 80 basis points.

FX intervention: goals, strategies and tactics[1]

Nikhil Patel, Paolo Cavallino

Abstract

Foreign exchange intervention is an important tool for central banks in many emerging market economies (EMEs). Drawing on a recent survey of 21 EME central banks as well as inputs from their contributions published in this volume, this paper summarises the main issues with regard to FX intervention. It focusses on the goals, channels, effectiveness and the different methods and tactics used by central banks. It leverages data from similar surveys conducted in the past to illustrate how central banks' views and conduct have evolved over the years along each of these dimensions.

Keywords: FX intervention, exchange rate, emerging market economies

JEL classification: F31, E58, E52

[1] This note examines "sterilised" FX interventions. "Non-sterilised" interventions alter the level of bank reserves and, all else equal, go hand in hand with a change in the policy rate. The exception is when central banks operate with a floor (excess reserves) system, so that the policy rate is set equal to the deposit facility. But, in that case, bank reserves are effectively perfect substitutes for short-term government paper, making the distinction dubious at best. See eg Borio (1997). Borio and Disyatat (2009) discuss the role of exchange rate policy under the broader umbrella of balance sheet policies.

1. Introduction

FX interventions are extensively used in emerging market economies (EMEs).[2] To explore the goals, channels, effectiveness, methods and tactics of such interventions, this note draws on a survey of the 21 central banks participating in the meeting. It also uses contributions from these institutions, as well as data from previous surveys, to show how central banks' views and actions have evolved over time.[3]

The note begins with a discussion of the main goals and intermediate objectives. It then outlines the different channels through which interventions work and summarises central banks' views and the evidence for their effectiveness. Finally, it discusses methods and techniques.

2. Goals and intermediate objectives of intervention

In order to understand the aims and intentions of FX interventions, it is useful to make a distinction between "goals" and "intermediate objectives". "Goals" refer to the ultimate purposes of the intervention; "intermediate objectives" operationalise the goals. For example, a central bank might intervene with the goal of maintaining price stability, and its intermediate objective could be smoothing the exchange rate path.

2.1 Goals

Curbing excessive FX market speculation is a key concern for most central banks (Graph 1). This motivation is rather broad and, in the strict sense above, not a goal per se; rather, it could be consistent with a number of other goals (see below).

The answers to the survey reflect the fact that intervention often responds to unwelcome financial developments. These include shifts in risk aversion, global liquidity or market sentiment. Depending on their strength and persistence, they can give rise to destabilising exchange rate dynamics that may in turn generate market stress, drive exchange rates away from fundamentals and ultimately threaten macroeconomic and financial stability. For example, as reported in its contribution, Bank Indonesia intervened in 2018 mainly to counteract downward pressure on the rupiah from tighter global financial conditions and risk-off market sentiment. By contrast, if the exchange rate adjusts in response to evolving macroeconomic fundamentals, its movement either tends to be stabilising (eg a depreciation following a fall in export demand[4]) or, if undesirable, is best counteracted by tackling the problem at its root (eg fiscal consolidation in the case of a weak fiscal position).

[2] See for instance BIS (2016), BIS (2013), BIS (2005) and Sarno and Taylor (2001).

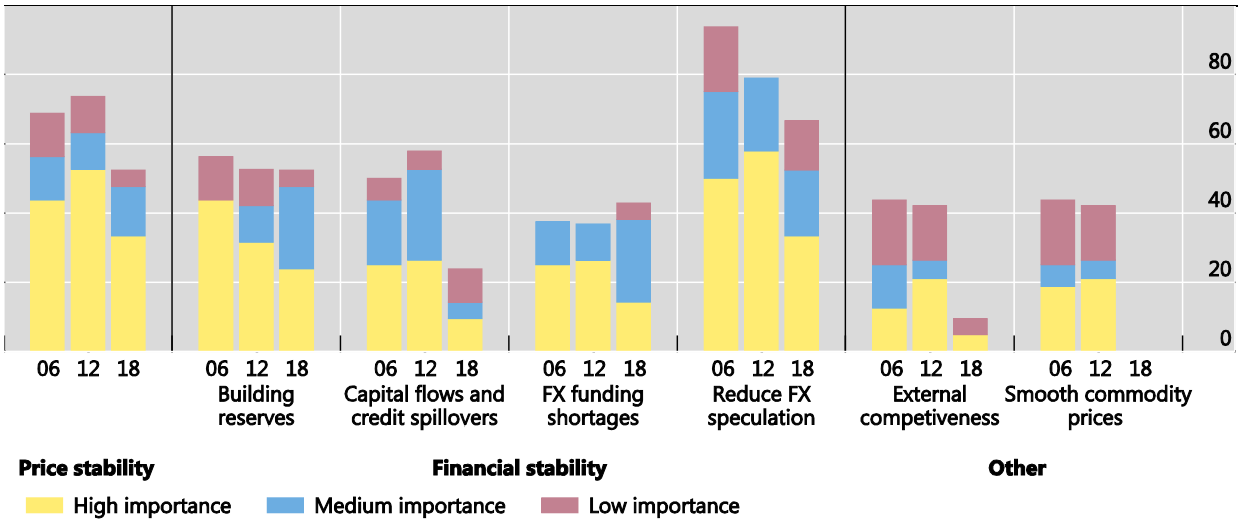
[3] Exchange rate regimes vary substantially across countries and over time. While most EME central banks operate under a managed floating regime, there is wide variation within our sample, including two countries that are classified as "pegged" by the IMF. Recognising the inherent challenges in classifying exchange rate regimes that lie along a continuous spectrum, and to maintain consistency with past surveys, the note does not distinguish between different exchange rate regimes.

[4] This channel is likely to be more important for commodity exporters than manufacturing exporters. See Stevens (2012) for a discussion of the effects of real and financial shocks on the Australian dollar.

Price stability and curbing FX speculation remain key goals for FX intervention

As a percentage of respondents

Graph 1



Source: BIS surveys from 2012, 2018 and 2019.

More than half of the central banks report intervening to maintain price stability (see also *The size of foreign exchange reserves*). This is not surprising, as the exchange rate has a major influence on inflation.[5] Its impact is especially strong when expectations become unanchored (see contribution by Argentina). Furthermore, exchange rate misalignments caused by financial shocks might also shift the domestic Phillips Curve, such as by driving a wedge between production and consumption[6] or changing the prices of intermediate goods. Naturally, the reliance on exchange intervention will depend on the monetary policy regime (*The size of foreign exchange reserves*). And while in theory adjusting the interest rate is the best tool to achieve price stability, exchange rate interventions may be used in support or even as an alternative when the room for manoeuvre on the monetary front is limited.[7]

Financial stability goals lurk behind many of the survey answers, often as part of the broader aim of stabilising output fluctuations (see also *The size of foreign exchange reserves*). This applies to intervention with the aim of accumulating reserves. Two thirds of the surveyed central banks intervene to achieve the desired level of reserves, up from 50% in 2012. Another example is intervention to alleviate FX funding shortages (around 40% of respondents). These interventions are aimed at providing short term liquidity to the FX market or hedges to the private sector, either to avoid stress (Central Bank of Brazil; see below) or for more structural reasons, such as to

[5] The large depreciation of the peso that started in May 2018 caused a sharp increase in inflation expectations and their dispersion. In order to prevent de-anchoring, in October the Central Bank of Argentina introduced a new monetary policy regime, including a clear mechanism for when to intervene.

[6] See Kamin and Klau (2003). For another possible formalisation, see Cavallino (2019).

[7] For example, in response to a capital outflow shock that weakens the domestic currency, tightening monetary policy would further exacerbate the downturn, which may not be desirable.

develop and deepen hedging markets. This is one reason why Bank Indonesia has started conducting domestic non-deliverable forward transactions.[8]

Another way of supporting financial and macroeconomic stability is to curb the build-up of destabilising capital flows or contain the effects of their implosion (*The size of foreign exchange reserves*). That said, only a quarter of the respondents reported intervening to prevent sharp capital flow movements, and none to stabilise domestic credit conditions.

Central banks can use FX interventions to stabilise capital flows and moderate domestic credit growth in various ways. For example, buffering sharp depreciations limits adverse balance sheet effects on domestic borrowers (Bruno and Shin (2015)) and foreign investors (Carstens and Shin (2019)). For this reason, FX intervention may have benefits that go beyond the consequent accumulation of reserves. These balance sheet effects, in turn, could lead to large capital outflows and second-round effects. Similarly, when monetary easing triggers the unwinding of carry trades, FX intervention can increase the currency's expected excess return and limit capital outflows (Cavallino and Sandri (2019)). Conversely, when a capital inflow surge threatens domestic financial stability, interventions can absorb the excess liquidity and help offset its impact on domestic credit growth (BIS (2018)).

Other goals appear to play a less of a role. While exchange rate misalignments from economic fundamentals can also affect exports, only three central banks report external competitiveness concerns as a goal, down from seven in 2012. This decline might be due to the prevalence of depreciating pressures in the past year.[9] Similarly, the moderation in commodity price volatility after the large swings of 2014–15 might explain why only one central bank intervened to smooth the effects of commodity price fluctuations in 2018.

2.2 Intermediate objectives

Central banks set intermediate objectives to operationalise their goals. Restricting exchange rate volatility and providing liquidity to thin markets are particularly important ones (Graph 2).

The aim of providing liquidity to FX markets moved from being the least important objective in past surveys to becoming the second most important (Graph 2), perhaps reflecting the period of weakness for EME currencies in 2018. The increased frequency of market liquidity-driven interventions may be the outcome of two post-GFC trends (BIS (2016)): greater issuance of foreign currency debt, and growth in foreign institutional investors' holdings of EME securities. This is likely to have increased both the need for liquid FX markets and demand for FX hedging.

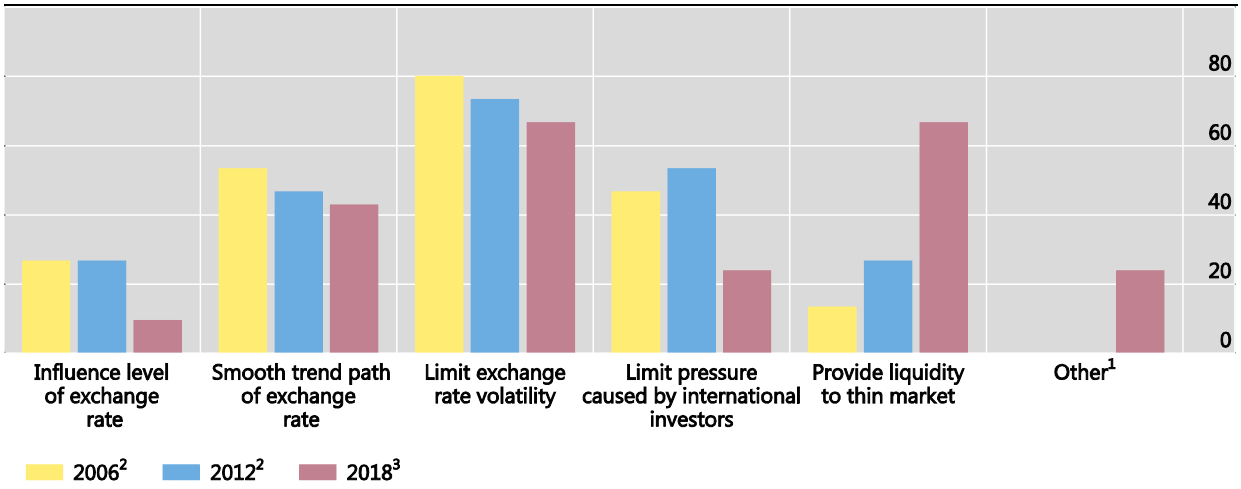
[8] At very short horizons, intervention may be designed to address disorderly market conditions, for example during flash crash episodes.

[9] In line with survey results, *The size of foreign exchange reserves* finds no strong evidence of reserves accumulation to maintain competitiveness in recent years.

Intermediate objectives of FX intervention: Increasing role of liquidity provision

As a percentage of respondents

Graph 2



[1] Mostly non-floating exchange rate arrangements. The "Other" option was not provided in 2006 and 2012. [2] 15 central banks. [3] 19 central banks.

Source: BIS surveys in 2012 and 2018.

By contrast, the number of central banks intervening to limit exchange rate pressures has declined, from more than 50% of respondents in 2012 to fewer than 30% now. But it is unclear whether this reflects a change in central bank reaction functions or is driven by mostly depreciating exchange rates on the back of the strengthening US dollar.

Limiting exchange rate volatility and providing liquidity to thin markets serve as the primary intermediate objectives for most goals (Table 1). Even for the goal of maintaining price stability, limiting FX volatility serves as a more important intermediate objective than influencing the level or the trend path of the exchange rate. While expected inflation dynamics are determined by the trend path of the exchange rate, higher volatility might affect the price-setting behaviour of firms and cause average import inflation to rise.[10] Furthermore, higher volatility may spur financial instability and derail the transmission from monetary policy to inflation. Finally, and not surprisingly, alleviating FX funding shortages correlates highly with liquidity objectives.

[10] Devereux and Yetman (2010) show, in a model with endogenous frequency of price adjustments, that exchange rate volatility can reduce price stickiness and thus increase the exchange rate pass-through.

Limiting FX volatility strongly linked to most intervention goals[1, 2]

The number of central banks that pursue the goal is indicated in brackets — Table 1

	Goals					
Intermediate objectives	Price stability **(9)**	Building reserves **(9)**	Capital flows and credit spillovers **(3)**	FX funding shortages **(9)**	Reduce FX speculation **(12)**	External Competiveness **(2)**
Influence level of exchange rate	1	0	0	0	1	1
Smooth trend path of exchange rate	1	0	0	0	0	1
Limit exchange rate volatility	5	2	1	0	6	0
Limit pressure caused by international investors	0	0	1	2	2	0
Provide liquidity to thin market	0	3	1	7	3	0
Achieve reserve target	0	2	0	0	0	0
Other[3]	2	2	0	0	0	0

[1] 18 central banks. [2] Central banks indicated one objective per objective. [3] Mostly non-floating exchange rate arrangements and combinations of multiple objectives.

Source: BIS survey 2019.

3. Transmission channels and effectiveness

3.1 Channels of influence

The literature identifies two channels through which interventions can affect the exchange rate. A portfolio balance channel operates when agents regard assets denominated in different currencies as imperfect substitutes. A signalling channel, shifts market participants' expectations about macroeconomic fundamentals or future policy.[11]

According to the central banks, the effectiveness of intervention stems mostly from its signalling power (Graph 3). Nearly three quarters identify the signalling channel as often or sometimes important. More specifically, all of these respondents report that intervention affects market expectations of future exchange rates and

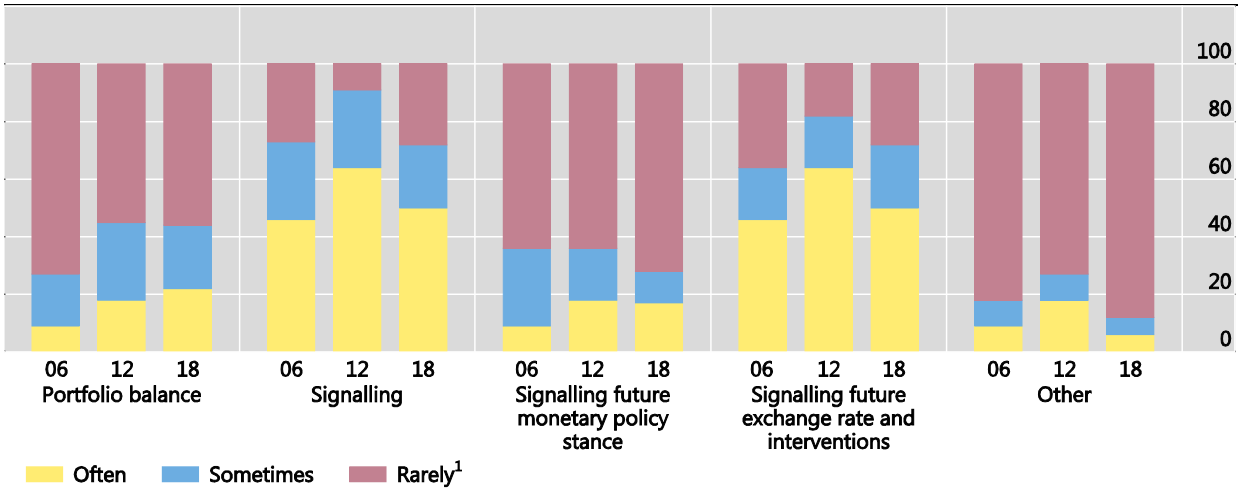
[11] Not surprisingly, these two channels are the same as those identified for balance sheet policies in domestic assets, such as large-scale asset purchases. In addition, the literature has identified a coordination channel. Sarno and Taylor (2001) argue that, in the presence of multiple equilibria, a publicly announced intervention can serve to coordinate market actions. This channel can be seen as a particular case of the signalling channel.

interventions, while only five reported that it alters expectations about the future stance of monetary policy.[12]

Signalling remains most important channel of FX intervention

As a percentage of respondents

Graph 3



2006: corresponds to the "Up to 2007" period in the 2012 survey, based on the responses of 11 central banks. 2012: corresponds to the "After 2008" period in the 2012 survey, based on the responses of 11 central banks. 2018: based on the responses of 18 central banks.

[1] Central banks which did not provide an answer for a channel category but did fill out at least one other category are assumed as "Rarely".

Source: BIS surveys in 2012 and 2018.

In order for the signalling channel to be effective, the signal must be credible. If the intervention is to signal the future exchange rate path, the central bank must provide market participants with new and credible information.[13] Some argue that this may apply to the central bank's better understanding of the future evolution of the domestic macroeconomic and financial forces driving the exchange rate. While this may well be true in some circumstances, it is not easy to reconcile with the view that most currency fluctuations for EMEs reflect push rather than pull factors. More plausibly, the source of informational asymmetry is that the central bank has better information about its intentions and hence the future monetary policy stance. Of course, regardless of the specific source of informational advantage, the signalling channel requires that the central bank reveals the intervention to market participants – which is not a common practice (see below).[14]

The share of central banks that mention the portfolio balance channel has remained broadly constant at around 40%.[15] In the light of more developed financial

[12] In addition, the off-diagonal elements in Appendix Table A highlight a significant increase in the assessment of the importance of the signalling channel by a sizeable number of central banks.

[13] See Battacharya and Weller (1997), Vitale (1999), and Popper and Montgomery (2001).

[14] Market participants might detect the intervention even if the central bank does not wish it, but then any inference, even if correct, would not reflect the central bank's intentions. Vitale (1999) demonstrates that some level of secrecy is optimal if the intervention signals the central bank's exchange rate target when the latter is inconsistent with fundamentals.

[15] Among the central banks that select the portfolio balance channel, all but one also report that intervention provides signals about future exchange rate and interventions. This is not surprising.

markets this may be surprising, as enhanced financial integration should lead to deeper and more complete markets. However, the provision of immediacy services has undergone structural changes over the past years.[16] Many banks and other market-makers have cut back on the amount of risk capital they allocate to trading activities. While alternative liquidity providers have stepped in, this may have exacerbated market segmentation and reduced assets substitutability.[17]

Box A

Effectiveness of FX intervention on the exchange rate and volatility : recent evidence

There is a long-running debate, far from settled, on how effective FX interventions are in influencing the exchange rate or its volatility.

Cross-country studies have mostly found FX intervention to have a strong impact on the level and volatility of exchange rates (see Ghosh et al (2018) and Menkhoff (2013) for an overview). For instance, Blanchard et al (2015) find that FX intervention successfully mitigates the impact of capital flow shocks on exchange rates and capital accounts. Across a sample of advanced economies and EMEs, Fratzscher et al (2019) confirm the effectiveness of FX intervention in taming exchange rate volatility, although they find less convincing evidence of its impact on the exchange rate itself.

Evidence from recent individual country and regional studies, most of which come from Latin America, is less consistent. For instance, using intra-day intervention data from Brazil between 2011 and 2015, Janot and Macedo (2016) report that unexpected interventions influence the exchange rate level to some extent, but not the volatility. Using intra-day data for four inflation targeting Latin American economies, Fuentes et al (2014) find that daily auctions do not affect the level of the exchange rate for more than a few minutes. On the other hand, Durán-Vanegas (2016) shows that the intervention of the Central Reserve Bank of Peru over the period 2003–15 has been effective in moderating volatility. Using daily data from Colombia, Echavarría et al (2017) find that the effect of pre-announced interventions adopted in 2008 is larger than that of discretionary purchases, and Kuersteiner et al (2016) find that volatility options seem to have the largest impact on the exchange rate. Using FX intervention and options market data from the Czech Republic, Disyatat and Galati (2007) find very little impact on the level and volatility.

The high-frequency identification approach used in many of the studies mentioned above is not well suited to analysing the persistence of the effects. That said, the limited number of studies that examine persistence find it to be fairly weak. Survey responses also indicate that the effectiveness of FX intervention is mostly confined to the short run, ie less than one month (Graph 4). This is particularly true for the impact on market liquidity and volatility. The impact on the exchange rate itself, on the other hand, is seen as longer-lasting.

An important caveat applies to many of the studies referenced in this section. As FX intervention is almost always conducted in response to economic developments, precise identification and interpretation of the results with respect to the correct counterfactual are very challenging.①

① Chapter 4, Section II in a forthcoming book on FX interventions by the IMF provides a detailed discussion of econometric challenges associated with estimating the impact of FX interventions and the empirical strategies that can be used to tackle them.

Even when effective through the portfolio balance channel, the effects of future interventions on future exchange rates propagate back in time through the uncovered interest parity relation and affect the spot exchange rate. Fanelli and Straub (2018) formalise this argument.

16 For a more general discussion of the drivers and implications of changing market liquidity, see BIS (2018) Chapter III.

17 For example, the increase in the cost of capital observed since the GFC might have reduced the ability of FX traders to take advantage of arbitrage opportunities, making the portfolio balance channel more potent.

3.2 Effectiveness

The effectiveness of intervention can be judged only against its goals and objectives.

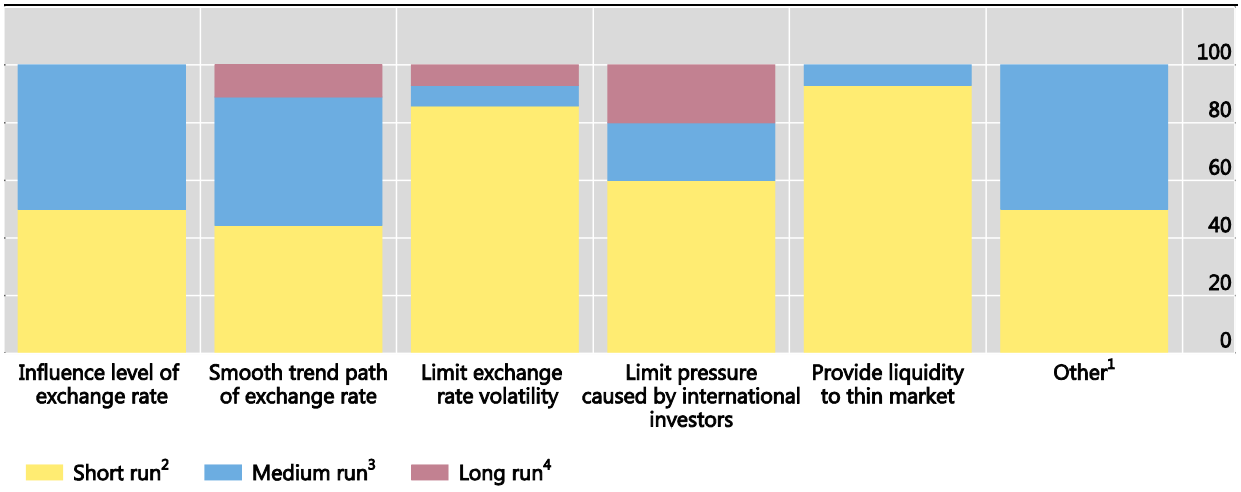
Several central bank goals can best (and in some cases only) be achieved by influencing the path and volatility of the exchange rate – the typical evaluation yardstick in the vast empirical literature (Box A). In particular, this is true of goals such as price stability, maintaining external competitiveness and smoothing the impact of commodity price fluctuations. From a practical perspective, another ex post measure of effectiveness, relevant for many cases where the goal is to stabilise the path of the exchange rate, is whether interventions are on average profitable or not for the central bank over the relevant horizon.[18]

However, this is not the case for other goals, such as managing the stock of FX reserves (eg to reach a reference level of reserve adequacy), providing liquidity in times of market stress, and achieving more structural goals (eg developing deep and liquid financial markets). In fact, in these cases, an intervention can be sufficient to achieve the stated goal. Indeed, the lack of impact on the exchange rate may even be a sign of effectiveness. Building reserves for purely precautionary reasons may be one such example (contribution by South Africa).

The effectiveness of an intervention also needs to be evaluated against the right counterfactual, ie what would have happened had the intervention not taken place? This is an aspect where empirical studies face serious limitations (Box A), and theoretical frameworks become particularly valuable.

FX interventions are mostly effective in the short to medium run, but not beyond

As a percentage of respondents who pursue the respective objective, as indicated in Graph 2 Graph 4



[1] Based on the responses of four instead of five central banks, as one central bank did not make an assessment. [2] Up to one month. [3] One to six months. [4] More than six months.

Source: BIS survey 2018.

Survey responses indicate that FX intervention is effective mainly in achieving objectives in the short run (less than a month), with virtually no impact in the long

[18] For instance, this is likely to be a good metric in cases where the exchange rate is driven by financial shocks that temporarily drive the exchange rate away from its equilibrium value.

run (here defined as beyond a six-month horizon) (Graph 4). This is particularly true with respect to making the market more liquid and exchange rates less volatile. With regard to influencing the exchange rate and smoothing its trend path, central banks' views are roughly evenly split between being effective in the short and medium runs. While it is not straightforward to interpret the responses unambiguously,[19] they suggest that if the authorities wish to have a longer-run impact, they need to intervene repeatedly. Indeed, of the 13 central banks that reported the number of intervention days, the average was close to 30 per year.

4. Strategy and tactics

4.1 Instruments

The FX intervention toolkit has continued to expand, but spot market interventions remain the most common instrument (Graph 5).[20] All central banks except one intervene in spot markets, at least occasionally. More than a quarter also operate routinely in derivatives markets, up from 18% in 2012. Among derivatives, swaps are used most often, followed by forwards. The vast majority of central banks intervene on-shore.

For each of the different objectives, spot interventions are the primary instruments, reflecting their overall dominance in the FX intervention toolkit documented above. That said, the use of derivatives is equally important for the objectives of providing market liquidity and limiting exchange rate volatility. (Table 2).[21] Country contributions confirm that the use of derivatives is increasing. For example, so-called FX swaps,[22] which settle in domestic currency, are the Central Bank of Brazil's preferred instrument for FX hedging.

Three reasons may be particularly important for the more widespread use of derivatives. First, the increasing importance of financial stability considerations. With rising FX debt levels and increased foreign asset holdings, the vulnerability to large FX moves has increased (BIS (2016)). By providing market participants with instruments to self-insure, derivatives may be better suited to mitigate these tail risks. Second, there has been a structural change in FX markets. Non-bank financial intermediaries play a bigger role, and they rely more than banks on FX forwards and other derivatives.[23] Third, at least in the short run, this can help economise on the FX

[19] The survey asked this question in the context of achieving objectives. Even if the impact of FX intervention with respect to an intermediate objective is short-lived, the broader impact can extend beyond. For example, slowing the pace of appreciation over the short run can affect credit growth over a longer horizon. Furthermore, according to the Central Reserve Bank of Peru, intervention reduces volatility in the short run directly, and indirectly in the medium term, through expectations of future central bank interventions.

[20] Many country notes (including those from China, the Philippines, South Africa and Thailand) state that spot market interventions remain the most commonly used instrument in EMEs. This is also in line with previous studies and surveys (see for instance BIS (2013) and BIS (2005)).

[21] The note from Turkey describes in detail the set of instruments in its intervention toolkit together with their costs and benefits.

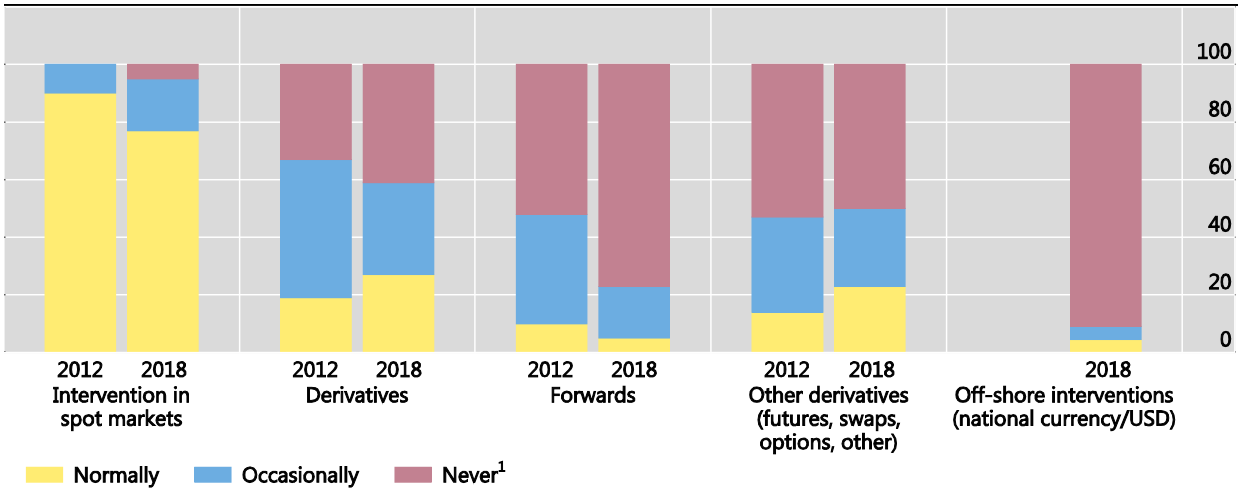
[22] In practice, these contracts are closer to forwards than swaps.

[23] This trend has been particularly pronounced in Latin America; eg BIS (2017).

reserves, which may be needed for funding purposes.[24] In addition, operating outside the spot market reduces the risk of having to report unwelcome changes in FX reserves, which might generate perverse market dynamics. Indeed, economising on reserves is one of the main criteria highlighted by several central banks in their respective contributions.

FX intervention toolkit has continued to expand, but spot market interventions remain most common

As a percentage of respondents — Graph 5



2012: Based on the responses of 21 central banks. 2018: Based on the responses of 22 central banks, answers from one central bank correspond to 2017.

[1] Categories for which a response is lacking are assumed to constitute a "Never".

Source: BIS surveys in 2012 and 2018.

While derivatives can ostensibly economise on gross reserves in the short run, they may lead to a build-up of substantial vulnerabilities on the central bank's balance sheet over time. In the case of South Africa, for example, the frequent use of FX swaps led to the build-up of a large net open currency foreign position on the central bank's balance sheet ($26 billion) in 1995, which took almost a decade to correct (see contribution by the South African Reserve Bank).

In theory, when the intervention is aimed at affecting the path of the exchange rate, spot market operations seem to be the (weakly) better instrument in some circumstances. This is the case in the presence of convertibility risk.[25] For example, FX swaps, which involve exchange of principal at a future date, may be vulnerable to the risk of capital controls.

The survey also touches on the use of complementary tools that could support FX intervention. As expected, macroprudential measures are used more often than capital controls; other tools are rarely employed. Somewhat surprisingly, perhaps,

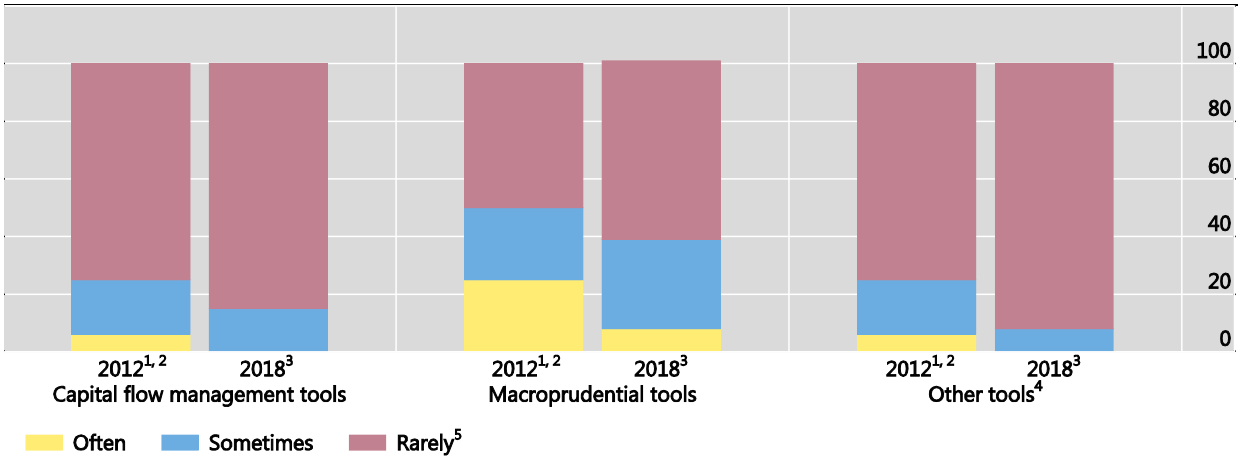
[24] Table 2 in Domanski et al (2016) summarises how much commonly used FX intervention instruments help to economise on reserves.

[25] Eaton and Turnovsky (1984) formalise this point. Nedeljkovic and Saborowski (2016) provide empirical support using Brazilian intervention data.

reliance on such instruments appears to have declined over the past six years, notably in the case of macroprudential measures (Graph 6).

Declining trend in use of measures to complement FX interventions

As a percentage of respondents — Graph 6



[1] Based on the responses of 16 central banks. [2] The figures correspond to the answers provided for the "After 2008" period in the 2013 survey. [3] Based on the responses of 13 central banks. [4] For 2018, liberalisation of existing regulation and capital flow restrictions. [5] Central banks that did not provide an answer for a channel category but did fill out at least one other category are assumed as "Rarely".

Source: BIS surveys in 2012 and 2018.

Cross-product between instruments and objectives[1]

The number of central banks which follow a certain objective are indicated in brackets[2] — Table 2

	Influence level of exchange rate **(3)**	Smooth trend path of exchange rate **(4)**	Limit exchange rate volatility **(10)**	Limit pressure caused by international investors **(5)**	Provide liquidity to thin market **(12)**	Achieve reserve target **(2)**
Intervention in spot market	3	3	8	3	8	2
Derivatives[3]	1	3	5	2	8	1
Futures	0	1	2	0	2	0
Forwards	1	1	2	0	0	0
Swaps	0	1	2	2	4	0
Options	0	0	0	0	0	1
Other	0	0	2	0	4	0
Off-shore intervention (national currency/USD)	0	0	2	2	0	0

[1] Based on the responses of 16 central banks. [2] As most central banks indicated they have more than one instrument per objective, the sum of each column always exceeds the number of central banks that pursue the objective. [3] Central banks are considered to use derivatives if they use at least one derivative for the objective. The sum of derivative sub-categories can exceed the number of central banks which use derivatives, as central banks sometimes use multiple derivatives per objective

Source: BIS survey 2019.

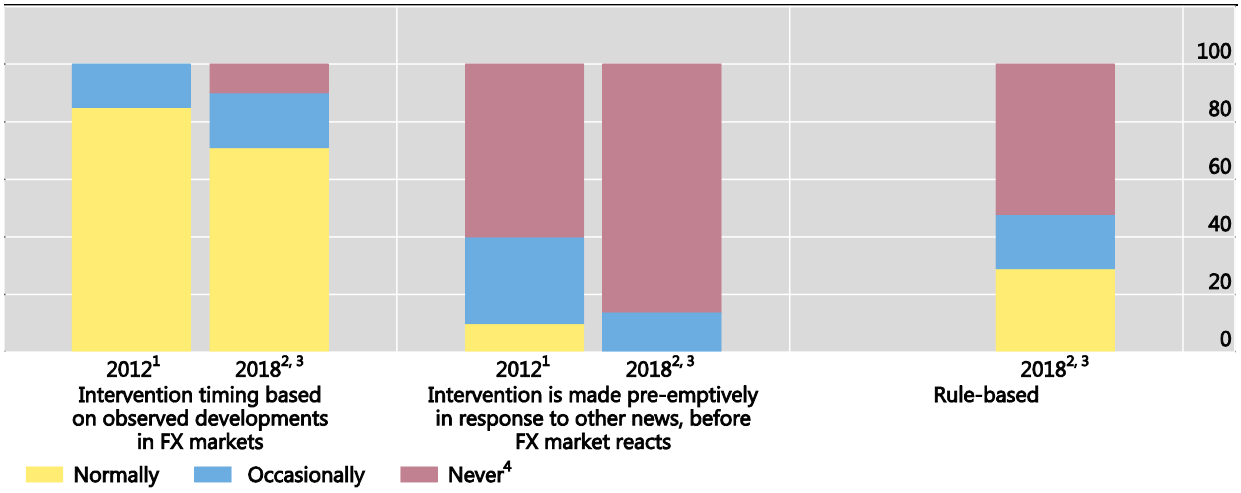
4.2 Timing and amounts, rules versus discretion and communication

The survey results suggest an overwhelming preference for intervening in response to market developments (Graph 7). More than two thirds of the central banks surveyed normally intervene after the market has moved in a certain direction, while only three report that they occasionally intervene pre-emptively. Concerning the choice between rules and discretion, only six central banks report that they normally follow an intervention rule; four additional ones do so only occasionally.

With regard to the choice of timing and amounts in response to market developments, a comprehensive practical and operational knowledge of the functioning of global foreign exchange markets is especially valuable. This underpins the flexibility to calibrate interventions so as to maximise their effectiveness. Market intelligence is key. Such knowledge can help gauge the intensity and likely persistence of pressure on the currency. For example, if the pressure is considered to be broadly based and persistent, it might be better to wait before intervening. Otherwise, the central bank may simply deplete reserves without much impact. Similarly, if the pressure on the currency is seen as reflecting proxy hedging,[26] it is more likely to be self-correcting and hence an intervention may not be needed. Market knowledge may also help the central bank to choose locations and periods with shallow market activity, thereby increasing the intervention's effect, or to exploit technical factors such as market positioning. And it may inform choices on how far to spread trading across different venues or counterparties.

Intervention mostly discretionary and in response to market developments

As a percentage of respondents — Graph 7



[1] Based on the responses of 20 central banks. [2] Based on the responses of 21 central banks. [3] Answers from one central bank corresponds to 2017. [4] Categories for which a response is lacking are assumed to constitute a "Never".

Source: BIS surveys in 2012 and 2018.

[26] Proxy hedging refers to the practice of using a price- or rate-correlated financial instrument to hedge a particular risk when a direct hedge is not available. One example is using a currency which moves in concert with another one to hedge the risk in the second currency.

The predominant use of discretion may be the result of several factors. As discussed below, discretion might be necessary whenever the central bank wishes to prevent detection. It is also the best way of maximising the surprise factor and hence market impact, although it could be calibrated so as to reduce it (see South Africa's contribution). The limited use of rules may also reflect difficulties in formulating simple ones based on real-time information.[27]

Public information provided

As a percentage of respondents[1] Table 3

	Normally		Rarely		Never/no response	
	2012[2]	2018[3]	2012[2]	2018[3]	2012[2]	2018[3]
Does the central bank pre-announce FX interventions?	18	32	9	0	73	68
Latin America	50	83	17	0	33	17
Asia	0	13	0	0	0	88
Emerging Europe	0	20	25	0	75	80
Other emerging economies	33	0	0	0	67	100
Size	23	27	0	0	77	73
Time span	23	27	0	0	77	73
Instrument	23	32	5	0	77	68
Intervention rule	…	27	…	5	…	68
FX intervention data made public ex post	59	59	0	5	41	36
Latin America	100	100	0	0	0	0
Asia	33	25	0	0	67	75
Emerging Europe	60	90	0	0	40	20
Other emerging economies	67	33	0	33	33	33
Size	…	55	…	5	…	41
Time span	…	41	…	9	…	50
Instrument	…	45	…	9	…	45
Intervention rule	…	27	…	9	…	64

If intervention data are made public ex post, what is the reporting lag?	Real time/hourly		Daily		Weekly		Monthly		Annually	
	2012	2018	2012	2018	2012	2018	2012	2018	2012	2018
	14	14	23	18	5	14	27	5	5	0

[1] The regional subcategories within the shaded bands show the percentage of respondents from each region. [2] Based on the responses of 21 central banks for the pre-announcement section and 20 central banks for the ex post information section. [3] Based on the responses of 22 central banks.

Source: BIS surveys in 2012 and 2018.

[27] For example, in a theoretical model, Cavallino (2019) shows that the appropriate measure of exchange rate misalignment is the (cumulated) time-varying wedge in the uncovered interest rate parity (UIP) condition.

Survey responses highlight a marked difference across regions with regard to transparency in communication (shaded rows in Table 3). In particular, a much higher fraction of central banks in Latin America than in Asia, 83% versus just 13%, preannounce their interventions. Similarly, all central banks in Latin America, but only 25% in Asia, make the data public post-intervention. This information is typically released within one week or less, and almost always includes data about the size, instrument and time span.

Transparency has some advantages.[28] Indeed, it is indispensable if the central bank intends to provide a signal. As in the case of domestic balance sheet policies, transparency could strengthen the portfolio balance channel, given that markets are forward-looking. For similar reasons, a credible commitment to a future intervention path could reinforce the effect.

Transparency naturally prevails when central banks rely on rules and wish to anchor expectations. This may be relevant in at least two cases. First, when the goal is to stabilise inflation. This was, for instance, one motivation when the Central Bank of Argentina announced an intervention rule in 2018. Second, when the central bank wishes to enhance market liquidity as expectations about future market liquidity boost current liquidity. For instance, the Bank of Mexico has relied, as directed by the country's FX Commission, on a number of occasions on preannounced, rule-based tools to smooth volatility and provide liquidity to the market.

However, transparency also has limitations. First, by generating predictable returns, it invites FX traders to trade against the central bank. Second, since the central bank is typically a small player in the market, it may make sense at times to conceal its activities so as to lead market participants to believe that the exchange rate is shifting in response to market sentiment. Finally, the central bank may worry that intervention might be interpreted as indicating an exchange rate target.

Whether transparency is useful when the goal is build up reserves is open to debate. On the one hand, the Central Bank of Chile preannounced its interventions to build up reserves in 2008 and 2011, in a move analogous to the current unwinding of central bank balance sheets in advanced economies. On the other hand, to take advantage of favourable conditions and to avoid affecting the exchange rate, South Africa has built up its reserves discreetly, without informing market participants.

4.3 Sterilisation

Survey responses reveal that central bank securities are by far the preferred sterilisation instrument (Table 4). Market-based instruments are on average also seen as very helpful in supporting overall market development (last three columns). The use of changes in reserve requirements and government deposits has seen a sharp decline in the last six years, a development that seems to have started even before this period (Mehrotra (2012) or Filardo and Grenville (2012)).

Several trade-offs are relevant for central banks when choosing the optimal mix between different sterilisation instruments. On the one hand, non-market-based instruments such as changes in required reserves are clearly less costly, but they may hinder smooth market functioning and are likely to have a disproportionately larger

[28] Governance structures and accountability are also important factors determining communication strategies, as discussed in detail in the context of reserve management in Note 3.

negative impact on smaller and weaker banks (Kuttner and Yetman (2016)). On the other hand, market-based instruments may help to achieve longer-term and structural objectives, such as development of deep and liquid domestic bond markets and a local currency yield curve, aspects that are particularly relevant for EMEs (Carstens and Shin (2019)).

Sterilisation instruments: central bank securities remain predominant

Ranked by central banks, as a percentage of respondents, with 1 being the highest score and 3 being the lowest

Table 4

Instrument	Percentage of central banks that use this instrument		Assessment (2018)[1]								
			Effectiveness			Costs			Beneficial to overall market development		
	2012[2]	2018[3]	1	2	3	1	2	3	1	2	3
Market instrument											
Central bank securities	71	73	63	25	6	31	44	19	56	19	13
FX swaps	33	27	67	17	17	67	0	17	67	17	17
Government bonds	29	18	100	0	0	50	25	25	75	25	0
Other	29	32	57	29	14	43	43	14	29	43	14
Non-market instruments											
Reserve requirements	38	18	75	25	0	75	25	0	25	50	0
Government deposits	33	18	75	25	0	50	50	0	25	25	50
Special deposit facilities	10	14	67	0	33	100	0	0	67	33	0
Other	19	27	83	17	0	83	17	0	50	33	17
No sterilisation by monetary instruments	14	9									

[1] As a percentage of those which use the instrument. The sum might not add up to 100% as some central banks did not fill out assessments for the instruments that they use. [2] Based on the responses of 21 central banks. [3] Based on the responses of 22 central banks.

Source: BIS surveys in 2012 and 2018.

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Appendix

Table A summarises the change in the relative importance of different FX intervention transmission channels based on a comparison of survey responses between 2006 and 2018. Each panel corresponds to a particular channel. Within each panel, the shaded diagonal cells indicate the fraction of central banks that did not change their response between the two surveys, whereas off-diagonal elements indicate the fraction of central banks that did change. For instance, with regard to the portfolio balance channel, 8% of central banks considered it as important "often" in both 2006 and 2018. On the other hand, 28% of the central banks which considered it as "rarely" important in 2006 switched to reporting that it is "sometimes" important in 2018.

Relative importance of different channels for FX intervention

Based on the responses of 11 central banks — Table A

Portfolio balance		2018		
		Often	Sometimes	Rarely/no response
2006	Often	1	0	0
	Sometimes	1	0	1
	Rarely/no response	1	2	5

Signalling		2018		
		Often	Sometimes	Rarely/no response
2006	Often	4	1	0
	Sometimes	1	1	1
	Rarely/no response	3	0	0

Signalling future monetary policy stance		2018		
		Often	Sometimes	Rarely/no response
2006	Often	0	1	0
	Sometimes	1	0	2
	Rarely/no response	2	1	4

Signalling future exchange rate and interventions		2018		
		Often	Sometimes	Rarely/no response
2006	Often	4	1	0
	Sometimes	0	1	1
	Rarely/no response	4	0	0

Other		2018		
		Often	Sometimes	Rarely/no response
2006	Often	0	0	1
	Sometimes	0	0	1
	Rarely/no response	1	1	7

Shaded cells indicate respondents who indicated a constant importance level. 2006: Corresponds to "Up to 2007".

Source: BIS surveys in 2012 and 2018.

Timing of FX intervention

Based on the responses of 18 central banks — Table B

Timing based on developments in FX markets		2018		
		Often	Sometimes	Rarely/no response
2012	Often	12	2	1
	Sometimes	1	1	1
	Rarely/no response	0	0	0

Intervention is made pre-emptively in response to other news, before FX market reacts		2018		
		Often	Sometimes	Rarely/no response
2012	Often	0	1	1
	Sometimes	0	1	5
	Rarely/no response	0	0	10

Shaded cells indicate respondents who indicated a constant importance level.

Source: BIS surveys in 2012 and 2018.

Reserve management in emerging market economies: trends and challenges

Jochen Schanz

Abstract

Foreign exchange (FX) reserves are an integral part of emerging market (EME) central banks' policy toolkit. They insure against shocks and complement monetary policy to achieve price and financial stability. But building and holding FX reserves is costly. Drawing on a recent survey of 21 EME central banks and their contributions published in this volume, this paper highlights that most have gradually broadened the range of assets and currencies in their reserve portfolios, to diversify and to raise their portfolios' return. Exposure to credit risk remains very low, and risk-sharing arrangements with the Treasury reduce some central banks' exposure to market and exchange rate risk. While the US dollar dominates most portfolios, the currency composition also shows strong regional patterns.

Keywords: Foreign exchange reserves, central bank balance sheets, emerging market economies

JEL classification: F31, E58, G11

1. Introduction

Central banks in emerging market economies (EMEs) have over time broadened the range of assets and currencies in which they invest FX reserves, and sharpened their focus on generating returns. After reviewing common trends and differences, this note takes up three policy issues. First, under what conditions might EME reserve management practices generate significant spillovers to advanced economy (AE) financial markets? Second, does the impact of reserve holdings on the central bank's balance sheet influence the portfolio allocation? And finally, what trade-offs does the disclosure of reserve management face?

2. Shifts in the composition of reserve portfolios

Common trends

Over the decades, central banks have gradually broadened the range of assets and currencies in their reserve portfolios. This was a reflection of several factors: financial market development; the higher level of reserves (see Note 1 prepared for this meeting); pressure to offset the costs of reserve holdings; and, interrupted by the Great Financial Crisis (GFC) of 2007–09, a certain search for yield.

Investments in the US dollar, the dominant reserve currency, illustrate these trends (Fung and McCauley (2003)). The 1970s saw a shift towards bank deposits and money market instruments, arguably owing to higher returns in the euromarket. In the 1980s, the duration of investments in US Treasuries lengthened, following a long bull market in bonds. And in the 1990s, reserve managers started to accept more credit risk, investing in the bonds of US government-sponsored enterprises (agency bonds).

The GFC interrupted this trend only temporarily. Reserve managers de-risked their portfolios, shifted assets away from both money markets and bank deposits, cut back on securities lending, and reduced investments in agency paper (McCauley and Rigaudy (2011)). In subsequent years, however, monetary policy accommodation in AEs provided a renewed incentive to take on more risk to generate higher returns and diversify portfolios.

By now, most EME central banks are investing in a wide range of currencies and asset classes.[1, 2] Widespread investments in high-grade sovereign and supranational bonds reflect the overriding need to provide a safe and liquid portfolio as insurance against external shocks (Note 1). Safety has typically been required for each position,

[1] To derive the strategic asset allocation (SAA), which defines the broad investment guidelines, central banks typically follow a number of steps (for details, see eg Borio et al (2008a,b), Bernadell et al (2004) and the country notes submitted to this meeting). Most EME central banks divide their portfolio into a liquidity and an investment tranche. Next, they set the currency allocation, benchmark, and risk parameters for each tranche. Finally, they select the assets for each.

[2] See eg the notes from Korea (Table 1), Israel (Graph 2) and Poland in this volume.

but some EME central banks place increasing weight on the safety of the portfolio as a whole by putting a premium on diversification benefits.

Safety considerations also play a key role in currency selection. Investments privilege instruments denominated in currencies from jurisdictions with a credible monetary policy, a reliable market infrastructure and easily enforceable creditor rights.[3] Over the past two decades, most reserves have remained invested in the US dollar (about 60%), while the share invested in the euro has fallen back to about 20% since the GFC.

The desire to invest in assets with higher expected returns without, as far as possible, compromising safety has favoured investment diversification into non-traditional reserve assets, such as corporate bonds and equities.[4] Some central banks also report having broadened the range currencies in their investments,[5] to diversify risks but also to avoid low, sometimes negative, interest rates, particularly in the euro.[6]

Cross-country heterogeneity

Despite these common trends, the composition of reserve portfolios differs substantially across EMEs.

In line with the importance of precautionary motives, one factor explaining such differences is the source of external vulnerabilities. This is most evident for the currency composition of portfolios. The share of a given currency rises in line with its role in trade invoicing, its debt denomination and its liquidity vis-à-vis the domestic currency – factors that are highly correlated within regions. Thus, the US dollar's dominance is particularly pronounced in reserve portfolios in Latin America and Asia, while the euro share is quite high in central and eastern Europe (eg Ito et al (2015, forthcoming)). By contrast, investments in other currencies do not show a marked regional pattern, as they are likely to be included in the portfolios primarily for their return generation and diversification benefits.[7]

The same factors influence the choice of numeraire (unit of account), which in turn exerts a powerful influence on currency composition by determining how returns are measured (Borio et al (2008a), McCauley (2008)). The numeraire acts as a kind of magnet for the currency composition, tilting it in its favour. This is so regardless of whether the numeraire is an individual foreign currency or a basket. For example, the Bank of Israel takes into account the currency composition of Israel's imports in normal and emergency situations, the composition of short- and medium-term external debt, and the liquidity of the respective currencies when defining the numeraire, and limits strategic currency exposures relative to the numeraire to 10% (Bank of Israel (2017)). When the domestic currency is the numeraire, portfolio

[3] See the note from the Czech Republic on this point.

[4] See eg Yue (2017a) and the note from Israel.

[5] See eg the notes from Brazil and Poland (Graph 5).

[6] For the role of negative yields on the currency allocation, see the note from the Philippines.

[7] For example, the central banks of Brazil, Chile and Poland report investing roughly 5% of their reserves in the Australian dollar. See Central Bank of Brazil (2016), Central Bank of Chile (2018) and National Bank of Poland (2018).

allocations tend to be tilted towards those foreign currencies vis-à-vis which the domestic currency is more stable.[8] As a result, currency allocations also reflect the exchange rate regime and the way market forces drive exchange rates.

Reserve adequacy is an additional key factor. The larger the reserves relative to liquidity needs, the higher the risk the central bank can afford to take, in terms of duration, asset class and currency. The degree of reserve adequacy is sometimes embodied in the practice of dividing the portfolio into a liquidity tranche, with short duration, and an investment tranche. Lu and Wang (2019) present evidence that the smaller the investment tranche relative to the liquidity tranche, the greater the role that trade invoicing and external debt play in determining the currency composition, and the smaller the role of returns.

Another possible determinant of asset composition is the correlation of returns with external shocks (Box 1; see also the note from Argentina). However, there is little evidence that this is systematically the case.

Box 1

Selecting reserve assets on the basis of their correlation with economic shocks

Holding reserves is one way of insuring a country's wealth against external risks (Claessens (1993)). It would thus seem appropriate to invest in assets likely to rise in value as a crisis looms or materialises, thereby maximising the central bank's ammunition to fight it (Borio et al (2008a)).

Sturzenegger (2018) shows that the duration of Argentina's reserve portfolio would be longer if assets were selected on the basis of their correlation with external shocks. The central bank constructed a synthetic asset whose return mirrored the impact of terms-of-trade and financial shocks on the country's wealth. This asset was included in a portfolio optimisation model, together with investable financial assets. Roughly speaking, the optimisation algorithm then chose a combination of investable assets that was negatively correlated with the synthetic asset – that is, it favoured those whose value tended to rise when wealth in Argentina declined. The variance-minimising portfolio was mostly invested in 10-year US Treasuries instead of three-month T-bills. Intuitively, the value of the 10-year US Treasury bond rises when EMEs are hit by a sudden stop.

In contrast, including assets whose value increases after a poor harvest of key export commodities might not be necessary. As an example, consider soybeans. Because Argentina is an influential producer of soybeans, the crop's export price tends to rise after a poor harvest there, providing a natural hedge.

Implementation of this approach, however, appears to be rare. One reason might be that investment in assets that are negatively correlated with economy-wide shocks could increase the volatility of the central bank's income and capital, which may expose the central bank to reputational risk (see the section on the financial implications of reserve management). Alternatively, it may reflect the fact that, in some cases, the corresponding assets are more illiquid (eg investment in commodities).

[8] See Borio et al (2008b) for the reasons for choosing a domestic currency numeraire.

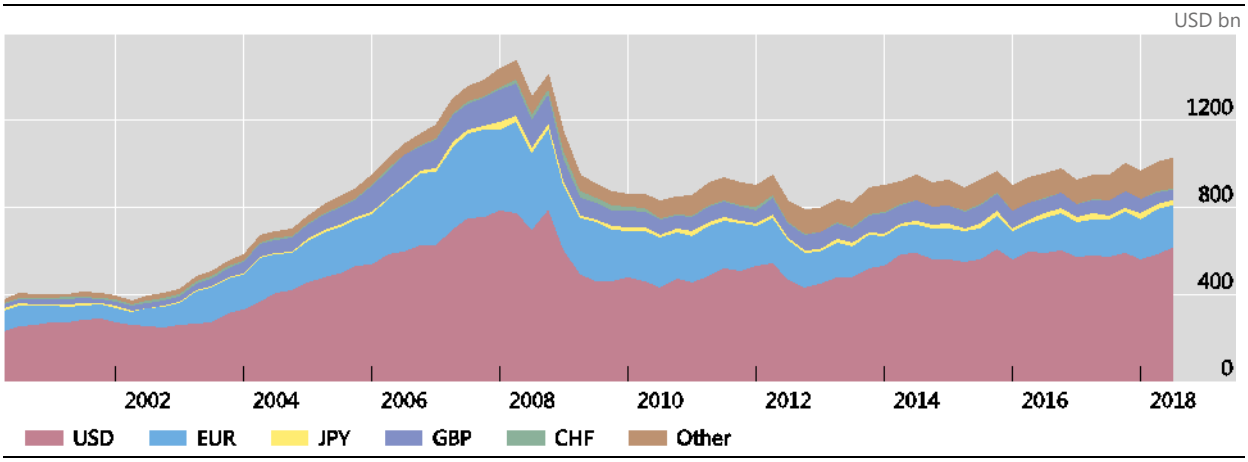
3. Policy issues

3.1 International spillovers and the asset allocation of reserves

There is evidence that the joint and rapid liquidation of EME reserves can under some conditions exert a material influence on global financial markets.[9] Beyond the size of the liquidation, the strength of such an effect depends in part on asset composition.

The effect is likely to be smaller for investments in assets that become more attractive when risk aversion spikes and EME currencies come under pressure. For example, in mid-2015, concerns about excessive debt in China put pressure on various EME currencies, some of which were already under strain owing to country-specific factors (eg Brazil's fiscal position and Turkey's current account deficit). In response, major EMEs intervened in FX markets, apparently selling US Treasury bonds (Sundaresan and Sushko (2015)). This may have contributed to the 10-year Treasury yield rising above the generic private sector yield of 10-year interest rate swaps – an unusual configuration (Clark and Mann (2016)). That said, while visible, the effects of reserve managers' joint liquidations were short-lived. The increase in risk aversion boosted other market participants' demand for US Treasuries, offsetting the effect of the sales.

Central banks withdrew deposits with commercial banks during and after the GFC[1] Graph 1



[1] Cross-border liabilities of banks vis-à-vis central banks. Amounts outstanding at quarter-end. Liabilities denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date. Data do not distinguish between collateralised and uncollateralised deposits.

Sources: US Treasury; Bloomberg; BIS locational banking statistics.

By contrast, the GFC illustrates how the impact of reserve liquidations could be significant, in particular if reserves are held in banks. Reserve managers globally withdrew around USD 550 billion of bank deposits within a year (Graph 1), contributing to AE banks' FX funding shortages (Pihlman and van der Hoorn (2010), Jones (2018)). Other examples are EME reserve managers' divestment in agency bonds in the GFC's aftermath, and the withdrawal of cash received as collateral in securities lending operations. In these cases, official sector interventions in AEs

[9] *The size of foreign exchange reserves* discussed the potential spillovers from EMEs' accumulating large reserves.

arguably ensured that the respective markets remained liquid (McCauley (forthcoming)). Investments in riskier corporate securities could raise similar issues (Borio et al (2018a)) if central banks expand their investments in this asset class.

The impact of joint liquidations can be larger if reserve managers are prone to sell in a falling market to protect the portfolio, ie if they act procyclically. Private sector investment funds, even those with a long-term perspective, tend to behave this way (eg Papaioannou et al (2013), Bank of England (2014)). Reserve managers might act similarly – for example, if prompted by counterparty limits or similar risk management tools. Indeed, Pihlman and van der Hoorn (2010) suggest that this may have happened during the GFC, when their withdrawal of bank deposits seems to have exceeded liquidity needs.

How might EME central banks reduce the impact of their joint sales on international financial markets?[10] The design of internal governance and risk management arrangements could help if it provides incentives to look through market turbulence. One possibility is evaluating fund managers' performance over long periods. Survey results suggest that these range from one month to one year (Annex Table A1). The same may be true for the evaluation of tactical asset allocation (TAA). Another example is accounting methods that smoothen the impact of changes in the market value of the reserve portfolio on central bank capital. Yet another might be risk-sharing arrangements with the government that insulate the central banks from losses (see below).

In principle, and much more ambitiously, another solution might be to coordinate investments or liquidations ex ante. However, just as in the case of monetary policy, coordination faces obstacles, in particular as central bank mandates focus on national interests. Beyond enlightened self-interest, assessing common vulnerabilities of EME economies, and, perhaps, exchanging information about investment and intervention strategies, might help inform the calibration of liquidity risk at the national level.

3.2 Do the financial consequences of reserve holdings influence portfolio allocation?

Because of reputational costs or political exposure, a central bank may find it more difficult to fulfil its core monetary policy and financial stability objectives when faced with major losses or a weak capital position.[11] In this respect, reserves may have a notable influence, as they constitute on average 80% of EME central banks' assets.[12] Accordingly, should a central bank's financial health become a factor in shaping policy choices, financial exposures may have an undesirable impact on investment decisions.

[10] IMF (2013) called on reserve managers to give consideration to the risk of market disruptions induced by their actions.

[11] For the relevance of a central bank's capital strength, see eg Milton and Sinclair (2011) and Archer and Moser-Boehm (2013).

[12] The flip side is that governments may, on occasion, be tempted to decapitalise central banks when reserves appear plentiful (see BIS (2011) for historical examples).

The degree of influence in practice is not clear cut. It depends not only on the financial risks associated with reserve holdings but also on accounting, loss-sharing agreements and other country specific factors.

From a financial perspective, two factors in particular mean that large reserve holdings can affect the central bank's financial position.

The first factor is the inherent risk of the positions. Even those in relatively safe assets such as AE government bonds are exposed to market risk because of changes in exchange rates and interest rates.[13] However, whether the realisation of market risk translates into losses and capital shortfalls depends importantly on accounting rules. For instance, the effects are muted if reserves are accounted for at historical cost (as in Korea) or at the lower of historical and current values (eg in Singapore).[14]

The second is the cost of carry. Given that the focus on safety and liquidity favours large investments in government bonds from AEs, costs of carry can be significant whenever countries have lower credit ratings.[15] These costs can be regarded as the price paid for providing insurance against large macroeconomic fluctuations or accumulating reserves in pursuit of other policy goals (*The size of foreign exchange reserves*). Conceptually, though, it could be argued that some part of these costs should be paid by the government, as the benefits of reserve holding and accumulation are often not only related to monetary policy or financial stability objectives but accrue to the wider economy.

The extent of risk-sharing between the central bank and the government depends on distribution rules. For example, in South Africa, the government absorbs changes in the domestic currency value of the reserve assets due to exchange rate fluctuations and those caused by its gold operations. More comprehensively, the Central Bank of Brazil transfers to the government its entire profits and losses.[16]

Distribution rules often tend to operate asymmetrically, which leaves significant financial risk with the central bank with little upside. In many countries, profits trigger payments to the government; by contrast, losses do not trigger receipts as automatic recapitalisations. Examples of such recapitalisations, such as in Hungary, Korea and Peru, appear to be rare. Thus, even temporary losses on the reserve portfolio can erode capital unless offset by other income streams, such as seignorage or profit retentions in good years.

Moreover, even when rules are symmetrical, central banks may not be insulated from political pressures. Failure to provide a dividend to the government can lead to

[13] The importance of exchange rate risk is strongly influenced by the question of the numeraire (see discussion above).

[14] See Archer and Moser-Boehm (2013) for an overview of accounting practices.

[15] Strictly speaking, whether, on balance, a central bank will make gains or losses over time will also depend on what happens to valuations. A positive cost of carry is the flip side of a carry trade position (borrowing in a currency with a lower interest rate than one is investing in). If such strategies are, on average, profitable, the central bank's position will make a loss once valuation changes are taken into account. But even when the central bank eventually makes a gain as the domestic currency depreciates, it will typically take a long time. Such persistent losses can put the central bank under pressure.

[16] A similar outcome is achieved in the few countries where the reserve portfolio is not part of the central bank's but of the government's balance sheet (eg Canada, Japan, the United Kingdom and the United States).

intense political debates. A clear example is Switzerland, where the dividends help buttress the finances of cantons (states) and the central bank has sometimes found itself in the eye of a storm when dividends have fallen short of expectations. Moreover, political pressure may extend to the way reserves are invested (eg to what degree they should be held in the form of gold or environmentally friendly assets).

As a result, either directly or indirectly, by influencing the central bank's and the government's financial position, exposures stemming from the reserve portfolio may end up having an impact on the central bank's effective risk aversion (eg Ramaswamy (2008)). If so, this would in turn influence portfolio choice.[17] Whether and how far this is the case will also depend on other country-specific circumstances.

3.3 Disclosure and communication

Disclosure influences the effectiveness of both external governance and the central bank's pursuit of monetary and financial stability (Borio et al (2008a)).

There may be trade-offs here. The demand for disclosure to foster accountability has grown alongside the level of reserves, the range of asset classes and the complexity, and hence opaqueness, of investment strategies. More disclosure, however, may sometimes make it harder for the central bank to discharge its responsibilities for monetary and financial stability. For example, information about changes in the currency composition might enable the detection of discreet interventions or even be interpreted as foreshadowing changes in exchange rate regimes.

Disclosure policies reflect how jurisdictions balance perceived benefits and costs. Some central banks publish only a few aspects of the reserve composition (see country contributions). The Bank of Korea, for instance, argues that, if wrongly interpreted, disclosure can trigger unnecessary controversy. Other central banks provide more detailed disclosures to explain reserve management choices and their implications as part of a broader communication strategy. Indeed, a few central banks have explicitly warned that their investment performance might deteriorate if macro-financial conditions become less favourable (eg Yue (2016, 2017)). Clarifying reserve management choices may sometimes be challenging, however, as the Bank of Israel found in explaining the performance of its multi-numeraire, multi-asset class portfolio.[18]

There may be a case for targeting communication at the broader public. As the Bank of Mexico points out, an informed public might be less likely to pressure the central bank to generate higher returns or to distribute its reserves to fulfil objectives other than those assigned. Indeed, a number of central banks, including in EMEs, have started initiatives to raise awareness of the various roles they play in the economy and to strengthen their standing in an environment in which trust in public institutions appears to have fallen globally. However, engaging in a public debate specifically about reserve management is not without risks. Questions regarding the optimal composition of reserves are difficult to separate from those regarding their optimal

[17] This could occur long before the central bank is in any danger of serious undercapitalisation. Clearly, however, the central bank is not confronted with a formal bankruptcy constraint, or a liquidity one (in its own currency). Some central banks have operated comfortably with lengthy periods of negative equity. See Archer and Moser-Boehm (2013) for a discussion of these issues.

[18] Contribution from Israel.

size and the central bank's capital, neither of which has clear answers (*The size of foreign exchange reserves*). Without a good narrative, the central bank might not have much influence over the outcome of the debate.

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Annex

Performance evaluation of reserve managers

Table A1

Performance evaluation	Criteria			Frequency			
	Excess return over benchmark	Risk-adjusted return	Other	Monthly	Quarterly	Annually	Less than annually
Internal portfolio managers	100	43	14	48	62	38	0
External portfolio managers	71	29	29	38	33	43	0
TAA	73	36	9	41	55	27	0
SAA	41	50	27	23	45	45	9

[1] Percentage of respondents, based on the replies received from 21 of the 22 countries approached.

Source: BIS survey of meeting participants.

Foreign exchange intervention and reserve accumulation in an emerging market economy: selected issues

By Horacio Aguirre, Gustavo Cañonero and Mario Torriani[1]

Abstract

The exchange rate plays a substantial role in the monetary and financial stability frameworks of emerging market economies. We look at the motivation behind foreign exchange intervention, including a thin foreign exchange market, high pass-through and foreign exchange as a determinant of inflation expectations. We examine how these features are reflected in the design of the new monetary regime in Argentina. Finally, we look at how reserve management policy can also incorporate the particular shocks faced by the economy.

JEL classification codes: E58, F31, G11

Keywords: monetary policy, foreign exchange, reserve management

[1] Central Bank of Argentina

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1. Introduction

The role of the exchange rate in the monetary and financial stability framework is substantial in emerging market economies (EMEs), well beyond what is articulated in conventional schemes, including inflation targeting (IT) ones. In this note, we look at the motivation behind foreign exchange intervention in an economy like Argentina, including: thin foreign exchange market, high pass-through and foreign exchange as a determinant of inflation expectations. These factors can help rationalise Argentina's new monetary and FX regime, which is comprised of a monetary base growth target together with FX intervention and non-intervention zones. Just as monetary and FX policy design recognises the particular shocks the economy faces, reserve management policy should also incorporate them.

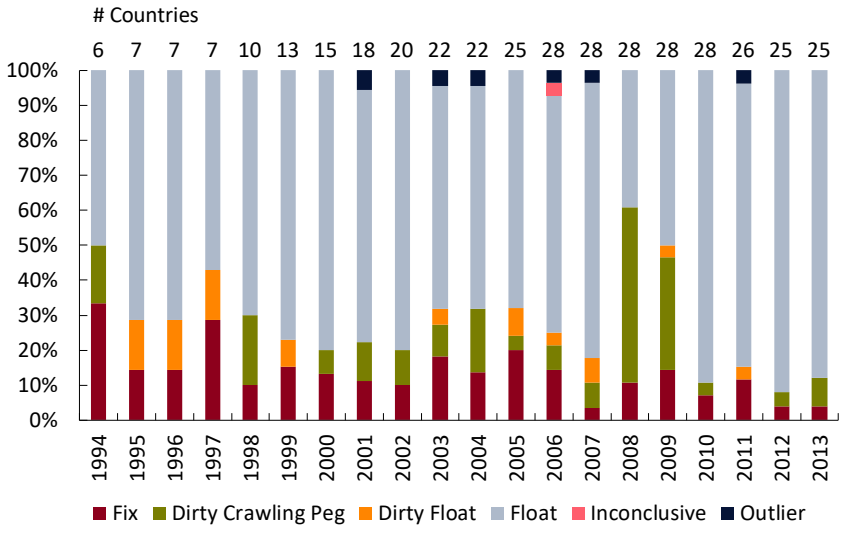
2. FX interventions and monetary policy

2.1 What countries do and how they perform

Measures like systematic FX intervention have long been part of the policy toolbox in developing countries, even in those that implement IT regimes. Actually, around 20% of IT countries do not have a purely floating exchange rate regime (Figure 1, with data as of 2013, the latest year available for the de facto exchange rate regime classification of Levy-Yeyati and Sturzenegger (2016)). This has changed over time, but what is just as revealing is that none of the 28 countries that have implemented IT since 1991 have always kept a purely floating exchange rate.

Inflation targeting countries and FX regime

Figure 1



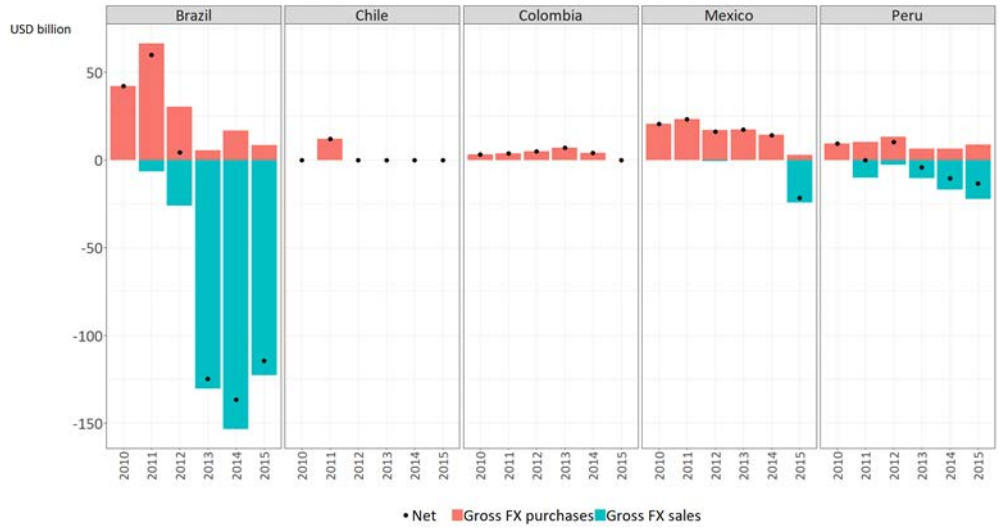
Sources: Own elaboration based on Levy Yeyati and Sturzenegger (2016). IT adoption dates taken from Mishkin and Schmidt Hebbel (2002), Hammond (2011) and central banks' information.

Figure 1 also reveals that periods during which several IT countries were not pure floaters coincide with events of high market volatility, generally unrelated to those economies' fundamentals, such as the Asian financial crisis in 1996-97 and the global

financial crisis in 2008. Latin America has been no exception to this behaviour; Chang (2008) points out that IT in Latin America differs systematically from the "Taylor rule cum pure floating" formula. Far from being a deviation from best practice in monetary policy by the countries in the region, it obeys to the need to shield their economies from abrupt changes in international financial conditions. In 1991, Chile adopted IT with FX bands; when it moved to pure floating in 1999, it left the door open to occasional interventions – as did the central bank in 2008 when it announced its decision to virtually double the stock of international reserves, and in 2011. In the face of the taper tantrum episode, the Central Bank of Brazil has implemented FX interventions through daily swaps of up to USD 3 billion a week since August 2013. In 2015, following plummeting oil prices, Colombia defined a rule to intervene as daily FX volatility exceeded a certain threshold. In Mexico, the central bank has intervened on several occasions; in 2017, as uncertainty linked to the North American Free Trade Agreement (NAFTA) renegotiation loomed, the central bank implemented a programme of future auctions for up to USD 20 billion. In Peru, a highly financially dollarised economy, the central bank has intervened in the FX market since IT was adopted. These are all examples of IT Latin American central banks that have intervened as exchange rate volatility was detrimental to their aims (Carrière-Swallow et al (2016a)); Figure 2 details the amount of such operations in recent years.

Latin America: FX intervention, selected central banks

Figure 2



Source: Carrière-Swallow et al (2016a).

Central banks intervene in the FX market for a variety of reasons, including price stability, financial stability and international reserve accumulation. Exchange rate pass-through (ERPT) has declined in Latin America in recent decades as monetary policy has gained credibility (Carrière-Swallow et al (2016b)), but these and other emerging regions continue to show higher ERPT coefficients than advanced economies. In countries with high and volatile inflation history, or in those subject to external shocks, FX intervention can help dampen the impact on the local prices of exchange rate fluctuations.

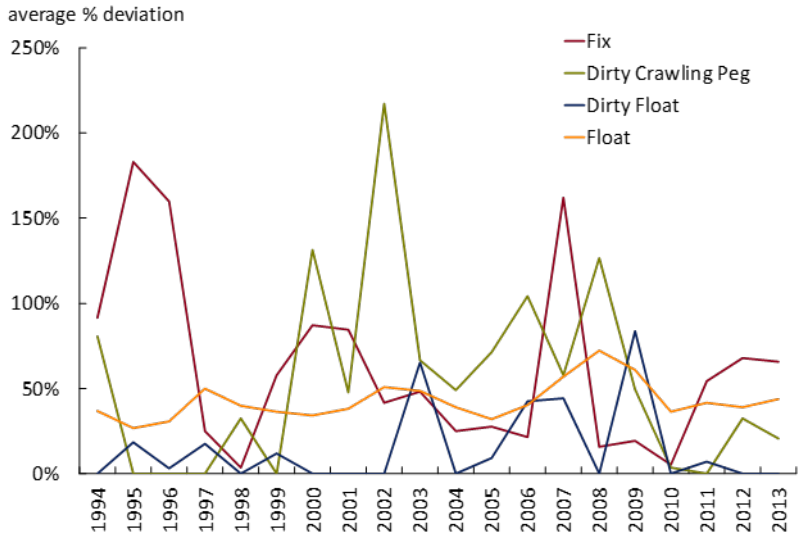
Dollarised assets and liabilities in the banking sector may also amplify exchange rate swings, jeopardising financial stability. There are multiple episodes in which a lack of FX liquidity was associated with large-scale financial crises with huge output

costs. In close relation to this, central banks intervene to accumulate international reserves: between 2010 and 2015, for example, Brazil, Colombia, Chile, Mexico and Peru accumulated reserves by amounts that range between 2 and 7 GDP points (Figure 2).

What is the inflation performance of countries that intervene in the FX market? Among IT countries, regimes that can be labeled as "dirty" floats tend to show over time lower deviations from target than purely floating ones (Figure 3). Indeed, during the 1994–2013 period, pure floats deviated from targets by 43% on average, while dirty floats did so by 30%.

IT countries: deviation from inflation targets and FX regime

Figure 3



Source: as in Figure 1. We computed percentage deviations from point targets, or from mid-point targets in the case of ranges, and averaged them across countries and years, for each de facto regime as classified by Levy-Yeyati and Sturzenegger (2016).

2.2. Analytical and empirical motivation for intervention

To gain a better understanding of the link between exchange rate regime and inflation, econometric studies control for different macroeconomic variables and possible endogeneity. Using a panel of 22 countries that adopted IT between 1990 and 2006, Aguirre and Burdisso (2008) find that developing countries with intermediate exchange rate schemes show some 2% to 3% lower annual inflation than pure floaters. In contrast, intermediate regimes appear to be associated with higher inflation than purely floating ones in advanced economies. Pourroy (2012) extends the analysis to IT countries during the global financial crisis, and finds that exchange rate intervention contributed to limiting the extent to which both inflation and excess inflation over the desired target increased, also dampening the loss of credibility in the face of an external shock. He concludes that the most credible central banks were not those that did what they said they would (ie follow "strict" IT with a Taylor rule and floating exchange rate), but those that enlarged their toolkit with other goals and tools (ie following "hybrid" IT). Berganza and Broto (2012) also find that while IT entails higher exchange rate flexibility, exchange rate intervention in IT countries has been more effective in reducing exchange rate volatility than in non-IT countries.

Thus, rather than relating exchange rate intervention to a higher or lower degree of monetary autonomy, it should be understood as one more tool that the central bank may use to smooth the volatility of the business cycle. For instance, Escudé (2009) builds a dynamic stochastic general equilibrium (DSGE) model to show that FX intervention together with interest rate policy are optimal for a large set of alternative policymakers' preferences, that give different weights to the volatility of different variables. For a broad set of preferences regarding growth, inflation and the current account, the model always yields that FX intervention, together with interest rate policy, deliver lower volatility than just using the latter tool with a floating exchange rate, or putting in place a peg (Table 1). Comparable results are obtained in smaller models that can b estimated more easily (Elosegui et al (2007)). Aguirre and Grosman (2010) use a structural model to assess empirically whether a managed floating regime is associated with lower volatility of key macroeconomic variables than under a pure floating or fixed exchange rate regime; their findings suggest lower volatility under managed floating in the case of Argentina.

Exchange rate regime and macroeconomic volatility in a DSGE model of Argentina Table 1

		Highest weight in policymaker's preferences given to:			
		Inflation	Growth	Trade balance	Equal weights
Monetary policy instruments	Interest rate and exchange rate	1	1	1	1
	Interest rate only (floating exchange rate)	2	2	2	2
	Exchange rate only (peg)	3	3	3	3

[1] 1=Minimum value for loss function

Source: Escudé (2009).

These models are part of general research literature aimed at reflecting analytically the way in which central banks use tools beyond the interest rate and assessing the advantages of managed floating in EMEs. Benes et al (2013) build an open economy new Keynesian model with a Taylor rule and sterilised interventions that operate through balance sheet effects in the financial system. They find that such policy combination allows the economy to be better cushioned to sudden changes in international financial conditions. In turn, Airaudo et al (2016) build an open economy model with two sectors and imperfect substitution between local and foreign assets. They find that pure floating involves a higher risk of multiple equilibria, which can induce volatility driven by self-fulfilled expectations and unrelated to fundamentals; and that small shocks may give way to much higher inflation. Both problems are solved by complementing interest rate policy with FX intervention.

These findings on FX regimes are in line with recent policy discussions in international financial institutions. Under certain conditions, EMEs may profit from employing intervention so as to contain excessive exchange rate volatility, unrelated to macroeconomic fundamentals (Ostry et al (2012)). In addition, both interest rate and intervention should be employed; Stone et al (2009) find that just including an

FX term in the interest rate rule may help reduce volatility of the exchange rate, the interest rate and the trade balance, but with higher volatility of inflation and output; see Annex I for a compilation of recent evidence on the effectiveness of intervention. The actual performance depends on the specific circumstances of each economy, but there are reasons to believe that FX intervention actually enhances the possibility of achieving policy objectives.

2.3 An integrated monetary policy framework: price stability and financial stability

While ERPT is endogenous and dependent on the monetary policy stance (see Palleja (2018) for an analysis of selected Latin American countries)), in an economy with a high inflation history and recurrent crises like Argentina, it continues to be a source of concern for inflation. ERPT coefficients for Argentina have declined in recent decades, but they continue to be four to eight times higher than other Latin American countries. The role of the exchange rate for expectations formation also stands out in estimated Phillips curves for Argentina in different periods (D'Amato and Garegnani (2009) and Krysa and Lanteri (2018)), where the coefficient for the exchange rate is several times higher than that for the output gap. As noted before, calibrated/estimated DSGE models of the Argentine economy also reveal a crucial role of the exchange rate in inflation dynamics.

In economies where the degree of financial dollarisation is significant, FX also has a financial stability dimension. Measures like intervention can also be understood as part of the macroprudential package (Agenor and Pereira da Silva (2018)). One way in which financial stability considerations may be incorporated into monetary policy making is by adding a credit growth gap to the conventional interest rule, thus making interest rate decisions dependent not only on inflation and output conditions, but also on excessive credit growth that can jeopardise financial stability. But in underdeveloped financial markets, the credit gap may not be a sufficient statistic of future financial distress. Financial intermediation is fundamentally about maturity transformation; but in shallow financial markets, maturity decisions may be compressed to, say, less than a year, with scarce long-term credit to speak of. Thus, the decision of lenders and borrowers may not be so much about how to smooth intertemporal consumption over a long period of time (through maturity transformation), but about how to allocate wealth in local or foreign currency (ie currency substitution). In the latter case, exchange rate swings may weigh on financial stability much more than could be expected, and may be a better indicator of financial distress.

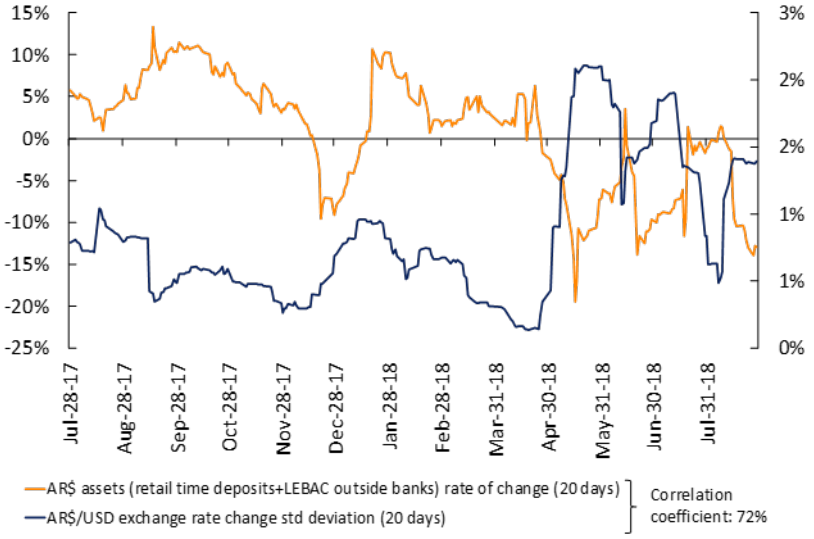
To take one example from Argentina: over time, exchange rate volatility is negatively associated with savings decisions in local currency. In recent years, for instance, the sum of time deposits and private non-financial sector holdings of central bank bills shows a negative correlation of 72% with nominal exchange rate volatility (Figure 4). Thus, in EMEs with an underdeveloped financial system and high dollarisation, augmenting the policy rule with the exchange rate may be just as relevant in terms of financial stability than by adding a credit gap.

In a relatively small FX market like that of Argentina, very small movements can become easily amplified. This reinforces the motivation for central bank intervention when such movements are unrelated to economic fundamentals. To give an idea of relative size: the daily turnover in the Argentine FX market represents 2% of the

volume traded in Mexico, 3% of that in Brazil, 15% in Chile, 24% in Colombia and 50% in Peru[2]. In such a small market, the difference that FX intervention makes is substantial (Figure 5). Between June and November 2018, the average daily gross turnover in the Argentine interbank FX market amounted to almost USD 600 million, but the net supply was USD 100 million on average, with net demand being almost twice that amount. This implies that even modest trades can be potentially disruptive (eg market turbulence that broke off in late May 2018 was triggered by sales of central bank bills from foreign investors in the order of USD 5 billion). FX intervention can make the difference between disruption and stability. Indeed, it is the absence of intervention that can be destabilising in such markets (Agenor and Pereira da Silva (2018)).

Argentine peso asset holdings by the public and exchange rate volatility

Figure 4



Finally, as nominal exchange rate variability translates into the real exchange rate, this may distort relative price signals to domestic producers. Much research has been devoted to examining EME central banks in the 2000s that intervened systematically to resist the real appreciation of their currencies in the face of capital inflows or positive terms of trade shocks. Levy Yeyati et al (2013) find evidence suggesting a robust, persistent and economically important effect of intervention on economic growth; a 10% intervention is associated with roughly a 0.11% increase in growth the following year, and to 0.22% increases in long-run growth over four years.

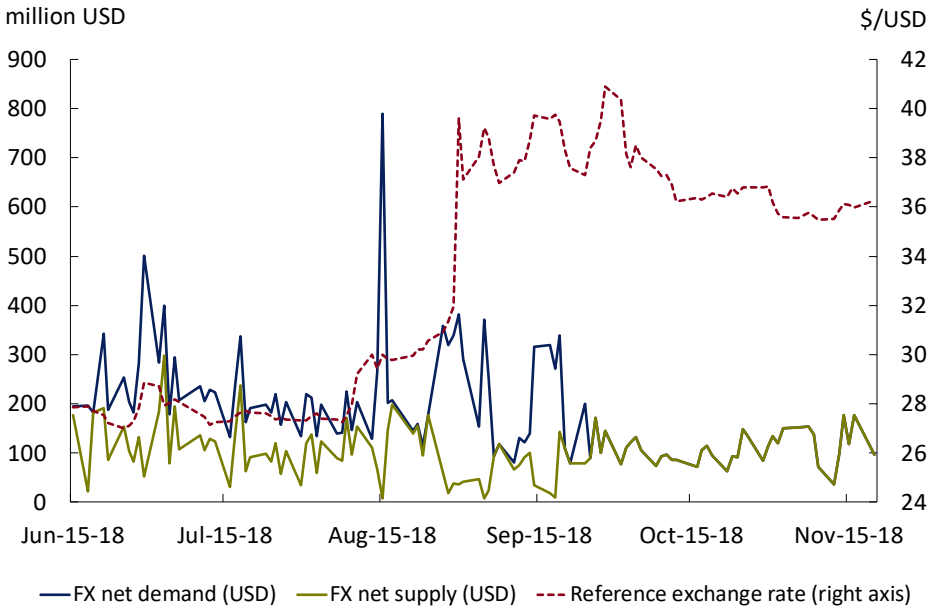
All things considered, monetary policy regimes that allow for some degree of FX intervention are based on the presence of one or more of the following conditions: (i) the high impact of nominal exchange rate movements on inflation or inflation expectations; (ii) the real exchange variability that distorts consumption and investment decisions; (iii) the impact of portfolio shifts between local- and foreign currency-denominated assets on financial stability; and (iv) underdeveloped FX markets. These conditions are summarised in Figure 6. As all four of them are met, a monetary policy regime that adds intervention as a tool is favoured. Whereas in countries where (i) ERPT is low, (ii) financial markets are developed and all risks on

[2] Data as of April 2016: see Table A1 in BIS (2017).

balance sheets (especially foreign currency ones) are moderate, and (iii) the real exchange rates act as a shock absorber rather than an amplifier, conditions tend to favour a purely floating exchange rate regime. In the following section, we link these concepts to the changes in monetary regime in Argentina that took place during 2018.

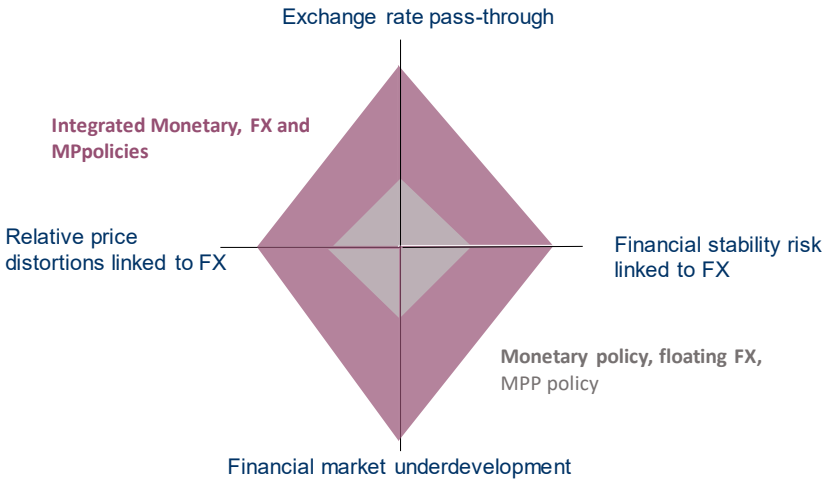
Argentina: interbank FX market net supply and demand

Figure 5



Conditions for the implementation of integrated and standard monetary and FX regimes

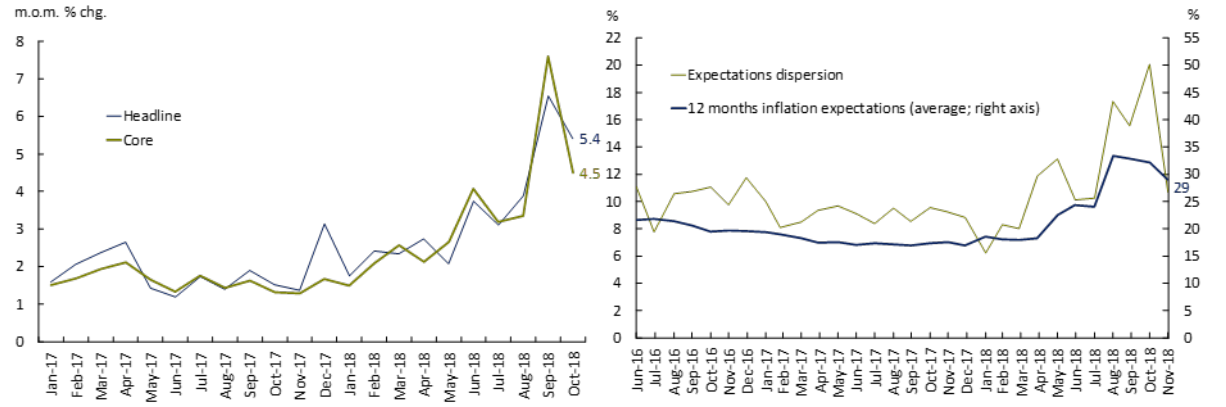
Figure 6



3. The new monetary policy scheme in Argentina

Argentina was among the countries that suffered the most from the tightening of financial conditions for EMEs that began in late April 2018. The local currency depreciated, with the US dollar gaining over 100% against the Argentine peso from April to September. This impacted both inflation and inflation expectations. Monthly inflation reached very high rates in September and October (6.5% and 5.4% month on month, respectively), while inflation expectations rose sharply, together with a higher dispersion of inflation expectations. All this pointed to a significant risk of de-anchoring of inflation expectations (Figure 7).

Argentina: inflation and inflation expectations — Figure 7

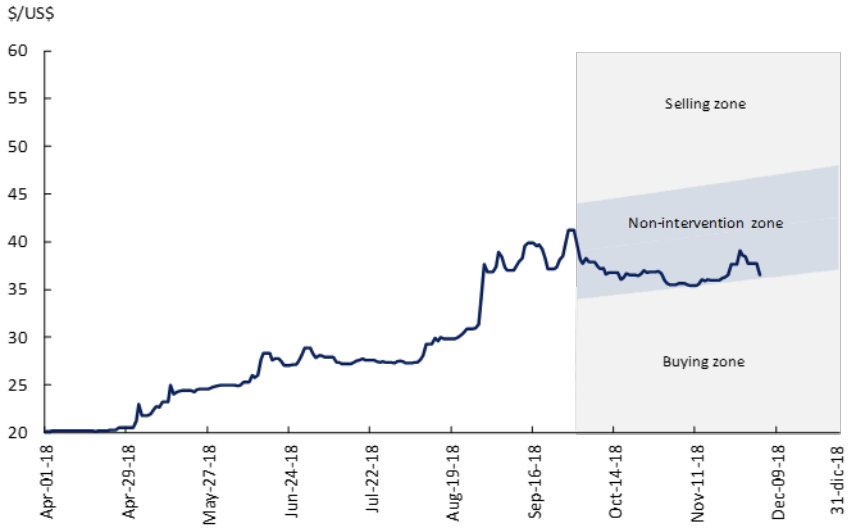


Deep changes in the monetary policy regime were initiated by the Central Bank of Argentina in response. The IT scheme was suspended, as it no longer ensured price stability. Since October 2018, the BCRA has been committed to a 0% growth target of the average monthly monetary base ; the growth target will be seasonally adjusted in December and June when money demand increases. As base money is under direct control of BCRA, the commitment to a monetary target is strengthened. Controlling liquidity limits both inflation acceleration and excessive FX depreciation. It is a very strict yet easy-to-follow target aimed at producing an expectation shock.

The 0% monetary growth target is complemented by FX intervention and non-intervention zones. The non-intervention zone is initially defined between ARS 34 and ARS 44 per 1 USD (as from 1 October 2018 and adjusted daily by a 3% monthly rate until end-2018; from January until March 2019 the monthly rate will be 2%). Within that band, the currency floats freely (Figure 8).

In the case of excessive depreciation of the peso, the central bank may sell FX reserves through daily auctions for up to USD 150 million. This makes sense in the face of decreased demand for peso assets; and entails a tighter policy stance as forex market intervention mops up excess peso liquidity. Should the peso appreciate strongly, the central bank may buy international reserves: monetary growth may become positive only in the face of increased confidence and higher demand for pesos. This scheme combines the benefits of floating with those of preventing excessive exchange rate volatility.

Argentina: exchange rate intervention and non-intervention zones Figure 8



The results since the implementation of the monetary growth target have been positive:

> In October and November 2018, the target was overachieved, as the average monetary base was 1.5% and 1.2% below the target, respectively. The exchange rate has also appreciated within the non-intervention zone since implementation. This plan is sustainable for several reasons: (i) the real exchange rate is competitive; (ii) there is no fiscal dominance; and (iii) the central bank's balance sheet is stronger.

- The design of the non-intervention zone is consistent with external competitiveness. The real exchange rate at the upper bound is comparable to 2003, when the local currency was at record levels of depreciation. In turn, the lower bound involves a real exchange rate comparable with that of 2010–11, consistent with a balanced current account.
- Fiscal dominance has been eliminated, ie central bank financing of the Treasury decreased from 4.6% of GDP in 2015 to 0.2% in 2018 and 0% henceforth. The fiscal balance in 2019 and surplus in 2020 guarantee zero transfers to the Treasury; the Treasury financing needs are already covered by the standby agreement with the IMF.
- The new monetary policy has been implemented with a stronger BCRA balance sheet. Interest-bearing liabilities have dropped by more than one half in terms of GDP. The coverage ratio between interest-bearing liabilities and international reserves has more than doubled.

The central bank has adopted this plan in order to signal the strongest possible commitment to price stability, taking into account the importance of the exchange rate in inflation expectations and financial stability. Over time, IT may be re-implemented as inflation goes down and conditions for its adoption are met. But at this point, the priority is to recover a nominal anchor.

Just as the monetary policy regime recognises the type and magnitude of shocks that hit the economy, so does the reserve management strategy. The next section deals with this issue.

4. International reserve management and external shocks

Central banks hold reserves for a variety of reasons, but mainly as a liquidity insurance to mitigate country exposure and vulnerability to external shocks. For EMEs, the exposure to capital flows is high, as they are more dependent on external savings. As soon as a sudden stop occurs, the country's current consumption capacity is significantly reduced and the marginal value of an extra unit of reserves increases.

Although insurance arrangements (eg contingent credit lines and bilateral swap agreements) could help address these precautionary needs, the decision to hold a large amount of international reserves has been an attractive self-insurance mechanism, as it is under the full discretion of the country that holds them. This decision has challenged central banks and reserve managers' jobs.

Central banks usually focus on three pillars to manage their reserves: safety, liquidity and return. The investment of international reserves that covers precautionary purposes generally privileges safety and liquidity, whereas the investment of "excess balances" places a greater weight on returns.

Caballero and Panageas (2004) analyse the (non-contingent) reserves' management strategy typically followed by central banks, and conclude that the strategy of immobilising large amounts of cash to insure against jumps in volatility and risk-aversion is clearly inferior to one in which portfolios may include assets that are negatively correlated with external shocks, such as terms of trade and capital flows' volatility.

In oil-producing countries, for example, a sharp drop in the price of oil can significantly affect not only the growth of the economy but also the fiscal balance. Therefore, the correlation between changes in the oil price variations and in the price of financial assets should also be considered to construct a portfolio of financial assets whose main purpose is to provide a liquidity insurance against shocks. Sometimes countries have natural hedges that reduce the need for a sophisticated investment strategy. For example, Argentina produces soybean, which tends to increase in price when the crop falls. This type of adjustment may explain why some countries, particularly commodity economies, find little incentive to buy insurance or assets that provide hedging against these kind of shocks. But in many cases, this is patently suboptimal.

In 2017, the BCRA started to develop a new model to set up its strategic asset allocation decision. Under the new model, the optimisation is run in a different risk/return framework, one where risk is not limited to the volatility of financial assets but expanded to consider the volatility in the reserves' portfolio caused by external shocks.

This type of model considers the role of FX reserves within the balance sheet of the economy as a whole, where contingent liabilities may arise due to both the role of the central bank acting as a financial agent of the national government, as well as the interaction that the central bank has with the private sector, for monetary and exchange regulation purposes (see the Annex for more details of the model).

The introduction of external shocks in the process of optimising the asset allocation of international reserves generates very important changes in the composition of the efficient frontier. These changes depend, to a large extent, on the relative importance of each shock within the balance sheet of the economy (see Annex II for details).

For example, financial shocks (captured as changes in Argentina's country risk index) account for two thirds of the variability produced by external shocks, and real shocks (changes in terms of trade) explain the third remaining part. Therefore, the hedge of financial shocks is one of the main factors that started to influence the strategic allocation decision for BCRA reserves.

Once hedge properties are considered, the asset allocation decision might drastically change. For example, under a traditional optimisation, where the objective is to minimise the volatility of financial assets, a highly risk-averse fixed income investor should tend to choose short-term bonds, as they tend to provide lower volatility for the financial asset's portfolio. However, once the definition of risk is expanded to include the volatility from external shocks, the optimisation will tend to give more preference to hedge assets like long-term bonds and, paradoxically, the greater the weight of these assets within the portfolio, the lower the volatility of the portfolio (due to the hedge provided).

Under stress scenarios, when reserves are more needed, US Treasuries tend to rally, especially in the long end, and the US dollar tends to appreciate. In contrast, other currencies tend to depreciate, being less attractive for those EMEs looking to reduce their vulnerability in terms of trade shocks. This kind of relationship is usually ignored in traditional optimisations. Moreover, gold, a traditional safe haven asset for most central banks, has usually been underestimated in traditional efficient frontiers, as their hedge properties are ignored.

Although this general idea is very straightforward, empirical or practical implementations are rare, probably due to reputational risks. An efficient strategy in terms of immunisation may be suboptimal in terms of the efficiency observed in the central bank's balance sheet, since it will be exposed to greater volatility.

The implementation of these strategies in practice is not simple. However, central banks should try to improve their risk management strategies when investing FX reserves in assets that yield the highest returns at the time when most needed or, at least, that do not correlate positively with negative shocks.

5. Concluding remarks

The importance of the exchange rate in EMEs' monetary policy formulation cannot be overemphasised. A country should be closer to adopting an integrated framework of interest rate policy, FX intervention and macroprudential policy depending on the importance of (i) exchange rate pass-through; (ii) financial stability risks due to foreign exchange volatility; (iii) financial market underdevelopment; and (iv) relative price distortions linked to FX volatility.

Argentina is a case in point, with a thin FX market, high ERPT and foreign exchange as an important determinant of inflation expectations. These features are reflected in the design of Argentina's new monetary and FX regime, which is comprised of a monetary base growth target that is complemented by FX intervention

and non-intervention zones. While the central bank remains committed to bringing down inflation, it recognises the important role the exchange rate plays in price and financial stability.

Finally, just as in the case of monetary policy design, reserve management strategies should also incorporate the particular shocks the economy is subject to and the tools to deal with them. This includes developing investment strategies that consider assets that yield the highest returns at the time when they are most needed, or that do not correlate positively with negative shocks.

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Annex I: Selected papers on the effectiveness of FX intervention

Paper	Period	Region/country	Results
Berganza and Broto (2012)	1995–2010	37 countries (emerging market and developing economies)	Using a panel data model, they find that although IT leads to higher exchange rate instability than alternative regimes, forex interventions in some IT countries have been more effective in lowering volatility than in non-IT countries.
Blanchard et al (2015)	1990–2013	35 countries (emerging market and advanced economies)	Using VAR estimations, they find that larger FX interventions lead to less exchange rate appreciation in response to gross capital inflows.
Fratzscher et al (2018)	1995–2011	33 countries (advanced, emerging market and developing economies)	They find that FX market intervention has been very effective in smoothing the path of exchange rates, and in stabilising the exchange rate in countries with narrow band regimes.
Daude, Levy Yeyati and Nagengast (2016)	2003–2011	18 countries (emerging market economies)	Using an error-correction model approach, they find that on average, intervention is effective in moving the real exchange rate in the desired direction, controlling for deviations from the equilibrium and short-term changes in fundamentals and global financial variables. Also, they find some evidence of more effective interventions for large deviations from the equilibrium.
Chamon, Garcia and Souza (2017)	2013–2015	16 countries (emerging market and advanced economies)	In the aftermath of the taper tantrum, the Central Bank of Brazil announced a major programme of sterilised FX intervention. They use a synthetic control approach to estimate its impact on the level and volatility of the exchange rate. The counterfactual results, based on the experience of other emerging market economies, indicate the programme led to an appreciation of the Brazilian real in excess of 10%.
Oliveira (2018)	2006–2016	Brazil	They find that both spot interventions FX swaps are capable of affecting the conditional mean of the process of the nominal exchange rate in all the sample period. They estimate continuous time models using a GMM analysis.
Nedeljkovic and Saborowski (2017)	2008–2013	Brazil	Using instrumental variable regressions, they find that the Central Bank of Brazil appears to use spot intervention more than derivatives-based intervention in reaction to daily movements in the exchange rate and to capital flow pressures. Conversely, it is more likely to use futures-based intervention to smooth trend movements in the exchange rate and when price pressures dominate.
Claro and Soto (2014)	Two event study: 2008 and 2011	Chile	They analyse two central bank interventions that occurred in 2008 and 2011. Although successful in terms of mitigating exchange rate volatility, these interventions entailed some costs. Before these intervention episodes, the balance sheet position of the central bank was already weak. With the amount of reserves accumulated following intervention (of the order of 5.5% of GDP), the balance sheet mismatch has increased, and the cost of carrying reserves has amplified the negative profits of the central bank.
Kuersteiner et al (2018)	2001–2012	Colombia	They apply regression discontinuity methods to identify the surprise component of rules-based interventions and use this variation to measure how they affect exchange rates and capital flows. The results indicate that interventions had significant effects on the exchange rate, albeit short lived (2–3 weeks).
Tobal and Yslas (2016)	2000–2013	Mexico and Brazil	By applying the VAR methodology, they conclude that FX interventions only have had a short-lived effect on the exchange rate in both economies.
Rossini, Quispe and Serrano (2014)	2007–2013	Peru	The sterilised intervention in the FX market and the use of reserve requirements on local banks' foreign currency liabilities have contributed significantly to reducing excessive exchange rate volatility in Peru.
Durán-Vanegas (2016)	2003–2015	Peru	They examine the interventions in the spot FX market with two methodologies: event study and a threshold econometric model. The results indicate that interventions reduce exchange rate volatility and change the trend of the exchange rate in periods of extreme volatility.

Annex II: The BCRA's new model for reserves' allocation decision

In Argentina, the two most common sources of external volatility are real terms of trade shocks and financial shocks. These shocks are quantified into a time series of cumulative wealth shocks by constructing a synthetic asset proportional to the size of the BCRA's FX reserves, which is then detrended to avoid biases and expected returns different than zero in order to focus only in the correlation of this synthetic asset with the financial assets' portfolio (Figure 9).

This synthetic asset is then incorporated into an optimisation framework similar to the one proposed by Gintschel and Scherer (2008), which seeks to minimise the variance of a portfolio of reserves $Var(r)$ allocating an omega ω proportion to a synthetic asset and the remaining $1-\omega$ to a portfolio of financial assets whose weights are described by the vector w:

$$min\ Var(r) = \omega^2\sigma^2_{Act.Sint.} + (1-\omega)^2 w^T \Sigma w + 2\omega(1-\omega)\sigma^2_{Act.Sint.} w^T \beta$$

The variance to be minimised is composed of a first term that reflects the volatility of the synthetic asset, a second term that reflects the volatility of the portfolio of financial assets $w^T \Sigma w$ and a third term $2\omega(1-\omega)\sigma^2_{Act.Sint.} w^T \beta$ that reflects the correlation between synthetic assets and the portfolio of financial assets. The beta β contains the sensitivities of each financial asset in relation to the synthetic asset.

The problem is solved subject to the following restrictions:

$$1^T w = 1$$

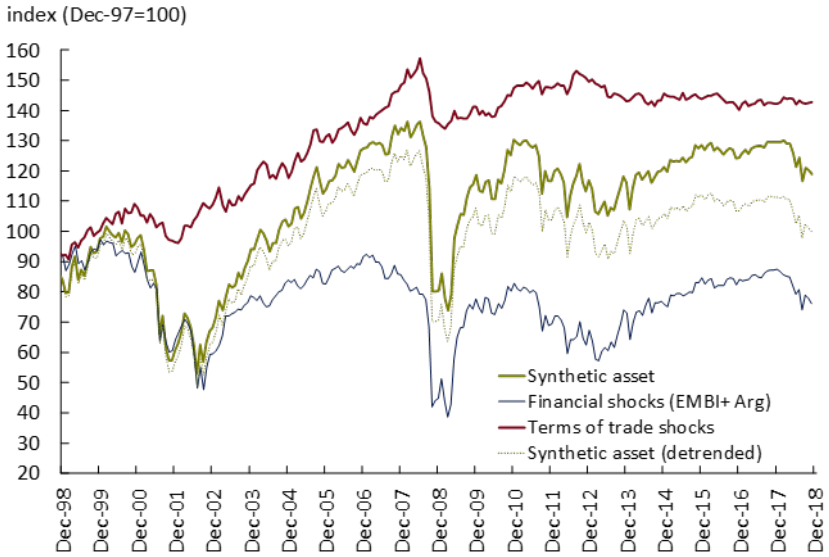
$$E(r_i)^T w = \mu$$

$$w_i \geq 0\ \forall w_i$$

$$CVaR_{95\%}(r^T w) < CVaR_{limit\ 95\%}$$

That is, the optimisation must comply that the sum of the weights assigned to each asset total 100%, that the assets have a non-negative weight, that the financial assets have the expected yield (μ) that has been projected based on their risk factors, and that changes in the market value of the portfolio of financial assets do not exceed a given threshold set in terms of its Conditional Value-at-Risk ($CVaR$).

Synthetic asset (cumulative shocks) Figure 9



Reserves management and FX intervention

Central Bank of Brazil

Abstract

Over the last decade, emerging market economies have faced shocks arising from both external events and idiosyncratic factors. Brazil took advantage of benign conditions in the first decade of the century to substantially increase its foreign reserves, achieving reserves adequacy on several different criteria in the view of the IMF 2018 External Sector Report. These reserves served as macroeconomic insurance, reducing FX volatility and the risk premium during periods of market turmoil, while underpinning monetary and financial stability. In addition to accumulating reserves from interventions to "lean against" capital inflows, Brazil's FX interventions have been designed to address liquidity shortages and excess volatility, and to provide hedging. To these ends, the Central Bank of Brazil has used instruments that range from regular spot transactions through forwards, repo lines of credit to FX swaps – or synthetic futures. The ultimate aim of these interventions is to guarantee a properly functioning FX market.

Keywords: Foreign reserves accumulation, FX intervention instruments, FX intervention motivations.

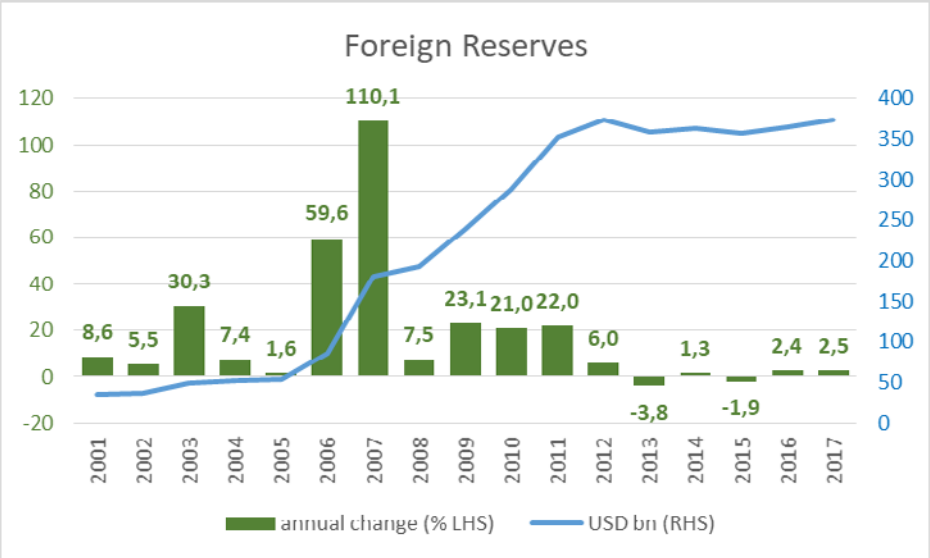
JEL classification: E5, E6, E60, H1, H12, O2, O24.

Drivers of reserve accumulation from a policy perspective

1. What have been the determinants of reserve levels in the past decade? To what extent have FX reserves been accumulated for precautionary reasons and as a by-product of other policies (eg maintaining competitiveness, limiting exchange rate overshooting, maintaining financial stability, supporting market liquidity)? Has there been peer pressure to increase reserves? What are the costs of reserve holdings? To what extent have low returns on reserves influenced their accumulation?

Brazil's foreign reserves have increased by more than 100% over the past decade, especially in 2009–11.[1] The most recent occasion on which Brazil intervened to buy or sell foreign currencies outright was in April 2012. Since then, the Central Bank of Brazil (BCB) has been active in the FX derivatives market via FX swaps, which do not involve the interchange of foreign currencies, as contracts are settled in domestic currency (BRL), paying the exchange rate change (while receiving the domestic interest rate). Foreign reserves have been accumulated for precautionary reasons and have worked as macroeconomic insurance, reducing exchange rate volatility and the risk premium, especially in periods of market turmoil. Despite various shocks over the last few years, there has been no major impact on trade or capitals flows. There has been no pressure to increase reserves in Brazil and, despite criticism about their supposedly elevated levels, Brazil has managed to keep the level of its reserves relatively stable since 2012. Considering the relatively long time span (of around 10 years), the realised cost of holding reserves has been low and, at times, even negative, due to the BRL's depreciation. This has occurred despite high interest rate differentials during most of this period. Although the expected return on reserves is a concern, safety and liquidity, in that order, are regarded as more important. Hence, low expected returns on reserves have not substantially influenced past decisions to accumulate them.

Graph 1



[1] Reserves reached USD 373.97 billion in 2017 (USD 180.33 billion in 2007), according to the BCB Time Series (SGS 3545).

2. How does the cost-benefit trade-off for reserves depend on structural features of the economy (eg exposure to terms of trade shocks, degree of dollarisation)?

The expected cost of holding reserves would fall if the interest rate differential between Brazil and the rest of the world were lower, given that open market operations (reverse repos) have been used to sterilise the BCB's purchases of foreign currencies. In this regard, a consistent fiscal policy is key to reducing the risk premium, by lowering the volatility of the local currency and the possibility of sudden capital outflows. Therefore, the implementation of reforms, especially those related to fiscal policy, such as the pension system reform, is crucial for improving macroeconomic conditions.

3. What is the best way to assess reserve adequacy? Are the best measures country-specific? Is it better to consider several measures simultaneously?

Countries have specific characteristics that make it difficult to propose a universal and adequate cross-country assessment of reserves. Despite a body of economic literature and some measures proposed by the IMF,[2] there is no standard measure for assessing an optimal level of reserves.

It is noteworthy that over the last few decades, emerging market economies (EMEs) have tended to prefer self-insurance as the Global Financial Safety Net (GFSN) has been unable to provide timely and sufficient liquidity when needed.

Approaches to assess reserve adequacy should consider not only balance of payments statistics but also exchange rate flexibility. A higher level of reserves is necessary if (i) the exchange rate is managed; (ii) short-term debt is high; (iii) external indebtedness is high; (iv) financial regulation and supervision are insufficient; and (v) the current account is susceptible to external shocks. We consider that it is appropriate to take into account several measures simultaneously.

One approach is to compare reserves holdings between countries in relative terms (eg in relation to a country's imports or GDP). Another method is to use coverage rules, such as the ratio of the reserves to variables such as foreign debt, exports, imports and monetary aggregates. A third approach is to assess the optimal relationship of costs and benefits in carrying a given holding of reserves.

As mentioned above, it is important to note that there are country-specific characteristics that can distort the assessment. When analysing the ratio of reserves to imports, for example, the Brazilian case suggests that this measurement is not reliable, since Brazil's imports have historically been low (in comparison with those of other EMEs), distorting this measure. In this case, the ratio of reserves-to-GDP would offer a better way to compare different countries.

There are different approaches to assessing reserve adequacy using coverage rules, as a measure of how far capital outflows would be covered. Wijnholds and Kapteyn (2001)[3] proposed the coverage of short-term debt plus a percentage over M2, multiplied by a country-risk measurement. The IMF's adequacy measure, known

[2] IMF, *Guidance Note on the Assessment of Reserve Adequacy and Related Considerations*, June 2016, source: https://www.imf.org/external/np/spr/ara/.

[3] J Wijnholds and A Kapteyn, "Reserve adequacy in emerging market economies", *IMF Working Papers*, no 01/143, 2001.

as ARA (assessment of reserve adequacy), suggests that Brazil´s FX reserves are slightly above the suggested range of 100–150% of the ARA metrics, reaching 160% in 2017.[4]

Another way of assessing reserves adequacy is to evaluate the opportunity costs involved in holding reserves, considering the interest rate spread between domestic and international rates.

It is advisable to use a variety of approaches to assessing reserves adequacy, in order to avoid arriving at a misleading conclusion based on only a single criterion. It is also important to acknowledge that the level of foreign reserves is not an isolated policy decision, as the operations of buying and selling foreign currency affect the exchange rate policy.

4. What are the alternatives to reserve accumulation? To what extent can macroprudential tools or capital flow measures help? How have changes in the global financial safety net and regional arrangements influenced the optimal level of reserves?

Changes in the Global Financial Safety Net and regional financing agreements have not influenced the optimal level of reserves. According to the IMF 2018 External Sector Report, Brazil´s level of reserves is considered adequate relative to various criteria, including the IMF's reserve adequacy metric.

Macroprudential tools and capital flow measures could help to mitigate financial risk, requiring a lower level of reserves, but should be used only under very specific conditions. Accordingly, we do not see them as a substitute for reserves accumulation.

Additionally, a consistent fiscal policy can strengthen the sovereign rating and reduce the volatility of capital flows. We consider that exchange rate flexibility has been important in absorbing external shocks, but that reserves accumulation has helped to achieve a more predictable path.

5. Have there been any unintended consequences of reserve accumulation? Does reserves accumulation support or weaken monetary policy or financial stability objectives? For instance, has reserve accumulation helped to "lean against" capital inflows or has it reinforced them by being perceived as a form of insurance? Do these implications vary with the time horizon?

Reserves accumulation has supported monetary policy and financial stability – and economic policy more broadly – by serving as a buffer against adverse shocks. In the case of Brazil, reserves have helped to reduce the volatility of the exchange rate and strengthen the sovereign rating, improving access to external financial markets and reducing funding costs for Brazilian companies and financial institutions. Additionally, lower FX volatility has helped to reduce inflation volatility.

[4] www.imf.org/en/Publications/CR/Issues/2018/08/03/Brazil-2018-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-46154.

FX interventions: motivations, strategies and tactics

6. How important are different motivations for intervening in FX markets (eg smoothing out volatility, acting as a circuit breaker, provide liquidity, leaning against capital flows, containing excessive credit growth)?

Motives for intervening in the FX market vary according to market conditions. Historically, the BCB has intervened mainly to deal with liquidity shortages and/or volatility spikes. It has also taken advantage of capital inflows to accumulate international reserves.

Over the last 18 months, liquidity has been the main factor to decide whether an intervention is advisable. The BCB assesses the local FX market by monitoring key variables to gauge liquidity in the spot and derivatives markets, as well as volatility.

Leaning against capital flows was useful during the period when international reserves were being accumulated, from 2005 to 2012, with an interruption during the Global Financial Crisis (GFC) between September 2008 and March 2009, when the BCB focused on providing liquidity to the FX market.

7. What factors, including objectives or circumstances (eg nature of the shocks, appreciation or depreciation pressures), influence the choice of (i) instruments and markets; (ii) timing, market conditions and size; (iii) counterparty choice or platform; (iv) rules vs discretion; and (v) the degree of transparency (ex ante and ex post)? To what extent are interventions influenced by the operation of other public sector entities (eg sovereign wealth funds, commodity stabilisation funds)?

(i) instruments and markets:

The BCB may intervene in the interbank market – using spot, forward or repo lines – and in the derivatives market, using FX swaps. To decide on the appropriate market for an intervention, the BCB assesses whether the observed distortion was caused by imbalances in the spot market or in the derivatives market.

Since 2012, the main instrument for intervening in the interbank market has been auctions of repo lines of credit. This provides liquidity when the BCB believes that market conditions are temporary and are likely to normalise by the time its instruments mature, although rolling over these transactions is not unusual. On the other hand, if the imbalance is assessed to be extreme and the overshooting of the exchange rate has the potential to affect FX flows, spot auctions are judged to be more efficient. Forward operations are unusual but have been used to deal with significant occasional flows deriving from transactions such as those associated with mergers and acquisitions.

When the BCB perceives imbalances in the derivatives markets, Brazilian FX swaps are the appropriate tool to deal with price asymmetries. These offer an FX hedge through swaps when the market supply for hedging is scarce. Alternatively, FX hedges can be absorbed through swaps in periods of abundant supply. Brazilian FX swaps are adequate to meet the demand for hedging and speculative exposure in the derivatives segment amid excessive price volatility as long as convertibility risk is low. Given the large amount of foreign reserves and

the belief that convertibility will be maintained, Brazilian FX swaps are an appropriate substitute for spot market intervention. It is noteworthy that the Brazilian FX derivatives market is large and more liquid than the FX spot market. This is the reason why swaps have become the most used FX instrument in the BCB's FX interventions.

(ii) timing, market conditions and size:

Changes in liquidity and volatility variables are important in estimating the scale and timing of an intervention. A key measure of liquidity in the spot market is the short-term "cupom cambial" rate, or the local USD interest rate, whereas bid-ask spreads and intraday volatility are important gauges of liquidity conditions in the USD futures market, where price settlement in USDBRL takes place.

In continued intervention actions, the bidding process in each auction is also used to evaluate the adequacy of the auctioned amount; this assessment is used to size subsequent auctions. Maturing amounts versus current market liquidity is also considered when deciding amounts to be offered in rollover auctions in both markets.

Seasonality is also a key variable in repo lines of credit auctions. The BCB usually offers this instrument in December, when dividend remittances and other large balance sheet-related outflows typically occur.

(iii) counterparty choice or platform:

By regulation, the BCB may intervene in the interbank market only with authorised FX dealers, unless there is a public offer. In this case, any institution authorised to deal in the FX market may participate. Historically, public offers in the interbank market have happened only during an extremely acute crisis, such as that of 2008–09. The choice of counterparty in the interbank market determines the platform. When intervening in the interbank market exclusively with FX dealers, the BCB does so by means of electronic auctions; when intervening with a broader set of participants, the BCB uses telephone auctions. All FX swaps auctions are executed using an electronic platform, and they are always directed to a broad set of participants.

(iv) rules vs discretion:

The Deputy Governor on Monetary Policy is responsible for implementing foreign exchange and monetary policy operations. When the economic environment may result in greater volatility and less liquidity in the domestic foreign exchange market, with a potential impact on other domestic markets, such as for interest rates, and in the real economy itself, the Deputy Governor on Monetary Policy may ask the Governor to convene the Foreign Exchange Advisory Group, which comprises the Governor; and the Deputy Governors on Monetary Policy; Economic Policy; and International Affairs and Corporate Risk Management.

For its part, the BCB's Board of Directors is responsible for defining and approving the Bank's strategic guidelines, including those on the foreign exchange market, for formulating and monitoring exchange rate policy; and for deciding on any measures necessary for the smooth functioning of the foreign exchange market. Whenever the estimated amount of operations exceeds 2.5% of international reserves over five working days, among other possible market conditions, the Board is called upon to fulfil these responsibilities.

(v) the degree of transparency (ex ante and ex post):

Transparency and objective communication by the Board of Directors have proven to be important tools in addressing FX market volatility and turmoil. Hence, the BCB has used only a limited degree of discretion in its transparency policy regarding the publication of data on FX intervention. For auctions in the interbank market, the BCB always publishes communiqués announcing the start of auctions. The auctions of repo lines of credit are also announced on the previous day but, depending on market conditions, the announcement may also be made in the course of the day. Communiqués are also published immediately after each auction with details of the cut-off rate. Traded volumes may or may not be published in the same communiqué. The total amounts of FX interventions in the interbank market are published weekly. For FX swaps, the BCB announces auctions on the previous day, but, if needed, the announcement can also be done in the course of the day. The BCB publishes the results, rate and volume immediately after the auctions. The outstanding amount of FX swaps is published monthly.

To what extent are interventions influenced by the operation of other public sector entities (eg sovereign wealth funds, commodity stabilisation funds)?

Other public sector entities have little influence over interventions. Such entities have played an occasional role in FX interventions when dealing with significant one-off flows, such as payments made from or to state-owned companies. However, this is unusual, as these companies have active and experienced financial departments that are usually able to plan such flows to mitigate their market impact, unless there is a contractual provision to make or receive such payments on a specific date.

8. To what extent have the modalities of intervention changed? If so, why?

Since the free-floating regime was established in January 1999, FX intervention has gone through major changes in Brazil, going from exclusively direct telephone orders to electronic auctions. As different types of auction have been added to the BCB's repertoire, the approach towards FX interventions is now to observe the needs of the market and adapt the style of intervention accordingly. If necessary, this includes the adoption of new types of operation to address specific imbalances. Recently, the BCB has adapted its repo lines for credit auctions in order to prevent the hedging of the outstanding amounts from causing additional stress in the yield curve during turbulent market conditions.

9. How effective have interventions been? Why? How do the tactics used affect effectiveness? Does it matter whether the exchange rate is appreciating or depreciating? What are the main economic mechanisms through which intervention operates?

The BCB does not publicly assess the effectiveness of each intervention, but it monitors a variety of market stress indicators, such as volatility and liquidity, and the effects of FX interventions.

Historically, FX interventions have been carried out to address issues that have spanned several months or years and have dealt with both currency appreciations and depreciations.

During the period of international reserves accumulation, which lasted from 2006 to 2012 (with a pause during the most acute period of the GFC), the BRL appreciated and the interventions did not aim to reverse this trend. As the main objective of the buy auctions was to accumulate reserves, the amount of external flows to the country was the targeted volume of the auctions. This approach also had a secondary effect of smoothing out the appreciation trend. This round of interventions was considered very effective as international reserves reached USD 370 billion in December 2012.

During the 2008–09 crisis, the main objective of FX intervention was to address extreme liquidity scarcity. Besides the sharp depreciation in the exchange rate, data showed a drop in exports and rollovers of external debt by private agents. Facing this scenario, the BCB acted through a diverse set of instruments – FX swaps, spot, repo lines of credit and loans earmarked to finance export transactions – and through assertive communication to the market of its determination to provide the necessary means to guarantee market functionality during the period of setbacks brought by international circumstances. The speed of market normalisation, given that this round of interventions lasted only from September 2008 to March 2009, demonstrated the effectiveness of the early start to the intervention, as well as the significant volumes offered and the simultaneous use of different instruments.

The most recent round of continued interventions started in 2013 to deal with the effects of the Fed-induced taper tantrum. After trying discretionary intervention actions without effectively smoothing out volatility, the BCB decided to announce an intervention programme. Making a predictable amount available to market participants tamed the turmoil that was beginning to develop in the domestic market and, consequently, volatility returned to acceptable levels.

10. To what extent has FX intervention hampered or supported the day-to-day implementation of monetary policy (eg sterilisation operations, control of the interest rate)? How does this depend on the context (eg normal times vs crises)?

In the context of the inflation targeting regime, monetary policy has sterilised the effects of the FX reserve accumulation on money markets through open market operations (reverse repos) in order to keep the overnight interest rate close to the Selic target rate, as defined by the Monetary Policy Committee (Copom). As a consequence, the mechanisms for overnight interest rate control have not been affected by these interventions, as there has been a very good coordination between FX interventions and monetary policy implementation. In terms of liquidity management, all the effects of FX interventions have been forecast and sterilised through the open market desk. In this sense, the FX interventions have supported the implementation of monetary policy.

FX interventions have been more supportive for monetary policy during a crisis than in normal times due to the greater exchange rate volatility during crises. In a crisis, the BCB's FX interventions have been crucial in stabilising fixed income markets. In recent years, the bulk of interventions have been conducted via FX swaps in the derivatives markets. In general, the aim has been to dampen exchange rate volatility in order to keep markets functioning properly. However, it should be noted that there is no direct or mechanistic relationship between monetary and exchange rate policies. The effects of external shocks, such as exchange rate depreciation, on monetary policy are related to their secondary effects on inflation.

Reserve management

11. Which overall motivations guide the composition of reserves portfolios? How can the various motivations best be balanced? How does the strategic asset allocation reflect that balance? Is there any link between the portfolio composition and intervention strategies?

The BCB holds reserves for various purposes, one being the precautionary motive of signalling a lower economic cost of adjustment in the case of a severe balance of payments crisis. In addition, a relatively large level of reserves boosts financial market confidence and provides funding for Brazilian sovereign bond cash flow payments when necessary.

The strategic asset allocation also aims for a countercyclical profile. This functions as insurance against a balance of payment crisis or exacerbated foreign exchange volatility, thus assuring a sufficient cushion when excessive foreign exchange volatility argues for intervention by the central bank. Brazil has a deep local exchange derivatives market, which allows certain types of FX intervention to be conducted without actually drawing on the reserves.

Consequently, safety, liquidity and return, in this order of priority, are the key principles behind the central bank's strategic asset allocation. Those guidelines are applied via a mean-variance framework focusing on the long-run strategic preferences, leading to an allocation highly concentrated in USD (82.3%) and some allocation to other G10 currencies, mainly the euro and Canadian dollar. Regarding asset class distribution, the bulk of reserves are allocated to G10 sovereign fixed income bonds and US agencies with a relatively short duration.

This allocation reflects the expected conservative nature of the international reserves, the asset-liability management profile, its countercyclical behaviour and the potential need for FX intervention.

12. What have been the most important shifts in the composition of reserves over the past decade (eg expansion into new asset classes, shifts in currency composition)? Along which dimensions, such as market, liquidity, or credit risk, has risk-taking changed? In prompting these shifts, what has been the role of changes in mandates/laws, in risk preferences, in the macro-financial environment, and in other factors? Has the search for yield been a significant consideration?

Over the past decade, the reserves composition has been diversified, even though the US dollar is still predominant. Currencies such as the SEK, DKK, CAD and AUD have been added to the benchmark. More recently, this movement has been partially reversed over the last three years, with the US dollar regaining importance.

In terms of asset classes, a very small allocation to equity indices has been added to the benchmark composition, and authorisation sought for equity futures and ETFs for active positioning. The same applies to commodities contracts, such as Brent and WTI.

Regarding risk-taking, there have been no significant changes over the past decade, as the central bank has kept to its conservative approach, especially regarding credit risk. The main driver for the changes on reserves composition were

changes in financial markets and the economic environment after the subprime crisis, and, as a consequence, the risk preferences of the Board of Directors. The search for yield has played a role, but this has been secondary to liquidity and volatility.

13. Have there been important changes in risk management, remuneration, or the degree of outsourcing? If so, why? Can governance arrangements, including remuneration policies, help to limit procyclical investment behaviour, in particular when selling into a stressed market?

The BCB has made no significant changes to its risk management and remuneration policies in recent years. The tools used to manage risk were established many years ago and they have been continually improved. Remuneration policies are stable and, as public servants, staff are subject to the laws that apply to all federal employees.

In regard to outsourcing, the external asset management programme in place since 2000 was suspended in early 2017. The reason was to assess the benefits of the programme against its objectives: knowledge transfer, diversification and expanded scope for investing in new asset classes. Previously, the BCB outsourced the management of around 1.6% of its reserves, but it currently outsources just one mandate, to the BIS in CNY (assets under management: USD 250 million). Surveys indicate that around 70% of central banks outsource part of their reserves.

A governance arrangement has been implemented recently to enhance the process of investing reserves. A committee has been set up with responsibility for implementing strategic and tactical allocations. The committee meets regularly, and includes technical staff, as well as governors, from three different areas of the Bank: reserves management, international and economic affairs, and risk management. In our opinion, this is one way of guarding against procyclical investment behaviour.

14. Have there been important changes to disclosures (eg their granularity and frequency) over the past decade? If so, why, and what have been the trade-offs? What effect have they had?

The BCB has increased the transparency of its international reserves management process. In 2009, the Bank's webpage started to periodically publish the International Reserves Management Report describing historical data and performance, both in Portuguese and English. The response was positive, and aligned the BCB's reserves management with international best practice. We have received positive feedback from market participants who are impressed with the level of transparency and professionalism displayed in this publication.

15. How far are reserve management practices constrained by political economy considerations (eg impact of losses on the central bank's reputation, equity or profit distribution)? What arrangements or practices can help manage these risks (eg communication vis-à-vis the Treasury or the general public; involvement of loss-sharing arrangements)?

The reserves management practices have gained a great level of autonomy over political economy considerations, both Brazilian society and its policymakers accept the principle that the reserves management must play a specific role and that it should be seen as an insurance against external turbulence. It is true that, from time to time, the BCB faces some questioning from politicians regarding the cost of

holding the reserves, given the high interest rate differential between domestic and external assets and the negative carry that it implies.

In that context, the Brazilian Senate has recently approved changes to the legislation governing the accounting for profits and losses from the foreign reserves, which will no longer be transferred to or from the Treasury, but will be accumulated in a separate account on the central bank's balance sheet. The new legislation is expected to increase transparency for reserves management but it still has to be approved by the legislature.

Reserves management and FX intervention: Chile's experience

By Joaquín Vial[1]

Abstract

The paper reviews the impact of Chile's reserves policies and intervention on the country since it moved into a free floating scheme in 2001. During this period, there have been just a few interventions, with all but one focusing on building up reserves, characterized by preannounced targets, duration, frequency and amounts of purchases. The one exception was an intervention to provide liquidity in US dollars to the banking system in 2008–09.

Reserves adequacy is evaluated periodically using standard models such as the International Monetary Fund's Assessing Reserve Adequacy, and the latest exercise conducted in 2018 concluded that the current level of reserves (about 14% of GDP) is adequate. This figure does not include the sovereign wealth fund managed by the government.

Finally, the paper describes the governance structure within the central bank to define and manage international reserves.

JEL classification: F31, E52, N26

Keywords: international reserves, Chile, exchange rate markets, central bank interventions, central bank governance

[1] Deputy Governor, Central Bank of Chile

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1. Introduction

During the second half of the 20th century, Chilean authorities experimented with many alternatives to manage the exchange rate and international reserves (IRs). Almost all of the alternatives included some form of exchange rate controls (fixed, crawling peg, multiple rates, intervention bands with crawling peg etc) and the use or accumulation of reserves, which impacted monetary policy given the limited scope for sterilization prior to the late 1980s. All of them ended badly, in most cases due to a balance of payments crisis and/or rising inflation. In the late 1980s and 1990s, some measure of stability was gained, with a combination of restricted floatation within an adjustable band, combined with capital controls on short-term capital inflows. The creation of a Copper Stabilization Fund (CSF) helped to reduce the volatility of public expenditures and also to build IRs and reduce public external debt. Unfortunately, the Asian/Russian crisis of the late 1990s made evident how difficult it was for the central bank to tackle the dilemma of fighting inflation and "defending" a value for the real exchange rate with just one instrument (capital controls had been phased out at that time, in part because they had lost effectiveness).

After a very painful monetary adjustment and recession in 1998–99, the central bank liberalized the exchange rate and introduced full-fledged inflation targeting in September 1999. In April 2001, all capital controls were abolished, while regulations were adapted to support the development of derivatives markets. Coincidentally, the government moved towards an explicit structural balance rule more or less at the same time. This regime has been in place since then. We will concentrate on the effects of the central bank's reserves management and FX interventions in Chile during these last two decades.

2. FX interventions and the evolution of IR

During the period covered in this note, there have been only two major interventions by the central bank in an effort to accumulate reserves: the first was in 2008 from April to September (it was cut short due to the global financial crisis); and the second was in 2011 and covered the entire year[2]. Both were very similar in terms of their rationale and implementation; ie they were (i) preannounced, with a given amount of reserves accumulation (USD 8 billion in 2008 and USD 12 billion in 2011; (ii) gradual (with daily purchases of USD 50 million through competitive auctions); and (iii) sterilized and justified by the need to increase FX reserves. In both cases, the real effective exchange rate was significantly below the historical average.

In addition to these two major interventions, which explicitly aimed at building up FX liquidity in the central bank, there were also interventions to provide FX liquidity through swap lines to the local banks during the global financial crisis in 2008–09. These were very important at a time when access to credit lines with US banks was interrupted by the crisis and some key banks for this market (Wachovia, for instance) faced government intervention and/or were sold. Beginning in October 2008, the central bank began auctioning up to USD 500 million per week with repurchase agreements at 60 and 90 days (swaps). It initially was designed to last one month but

[2] There were two additional interventions, selling USD 2 billion in August 2001 and June 2002.

was later extended until the end of 2009. The initial commitment was for USD 5 billion (about 20% of total IRs) but, in fact, the total amount of operations reached just USD 1.1 billion. That same month, the central bank also allowed Chilean pesos and other currencies to replace US dollars to fulfil reserves requirements for currency operations within its banking system. This was a transitory measure that lasted for six months. The impact on the local financial market was very quick; after a few weeks the situation reverted to pre-September conditions (García, 2009).

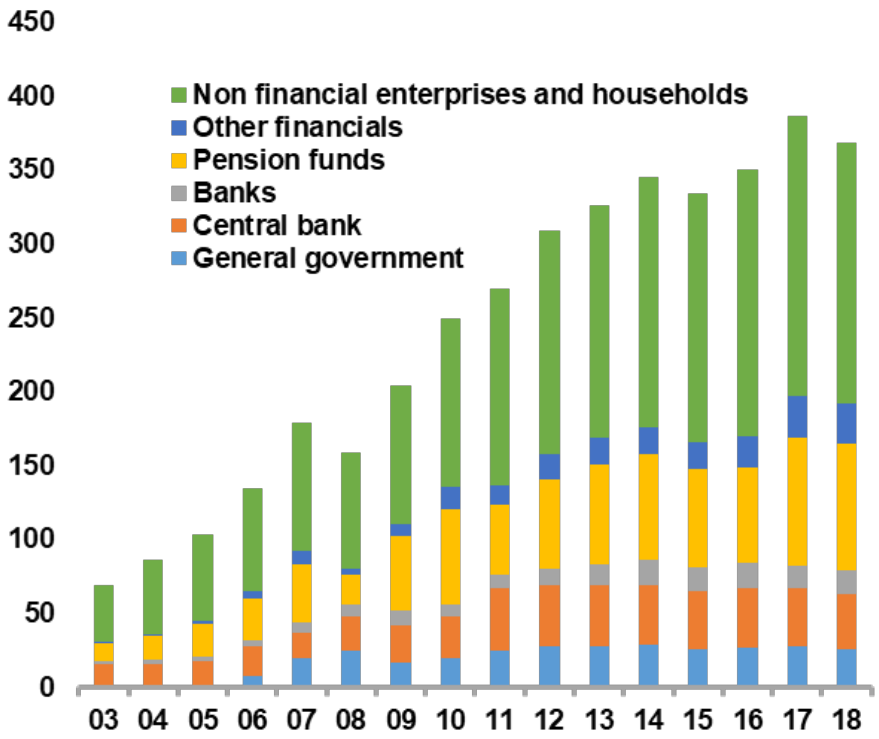
In addition to these interventions, during this period there were smaller changes in the value of IRs in the central bank, due to a number of reasons, but mostly as a result of fluctuations of the value of the US dollar vis a vis other currencies eligible for investments of Chilean reserves. In addition to these valuation issues, commercial banks were also facing fluctuations in liquidity (sometimes due to regulatory issues), which provoked large (transitory) changes in their deposit levels. These eventually ended up as US dollar-denominated short-term deposits in the central bank.

There were also some parallel developments in financial markets during this period that had a significant impact in this area. First, the pension reform of 1981 replaced the fragmented "pay as you go" system built up over the previous decades with a fully funded privately managed system of individual mandatory savings. As the new system began accumulating sizable savings, the need to open the borders to allow for investments of these funds abroad increased. Begining in 1993, pension funds were allowed to invest a fraction of their portfolio abroad, starting with a very low limit (5%). Initially, these pension funds invested very little abroad, but that changed in 1999 after the Asian financial crisis when the FX market was liberalized. Second, the development of a derivatives market (following changes in regulations) allowed pension funds to hedge the FX risks associated with their funds when investing abroad.

A final element to consider is the role of the government's sovereign wealth funds (SWFs) – most of which had been invested abroad – which provided the government with a form of self-insurance against FX liquidity problems. This started with the establishment of the CSF in 1987, the resources of which were initially used to repay foreign currency debt obligations of the Chilean government. Following the repayment of all outstanding foreign currency-denominated debt, funds began to accumulate and were invested abroad, using the central bank as the agent to do so. With the replacement of the CSF for a structural balance rule in 2002, the investment agent role for the central bank was formalized and greatly expanded during the commodity boom, when the accumulated resources by these government SWFs reached almost 14% of GDP[3].

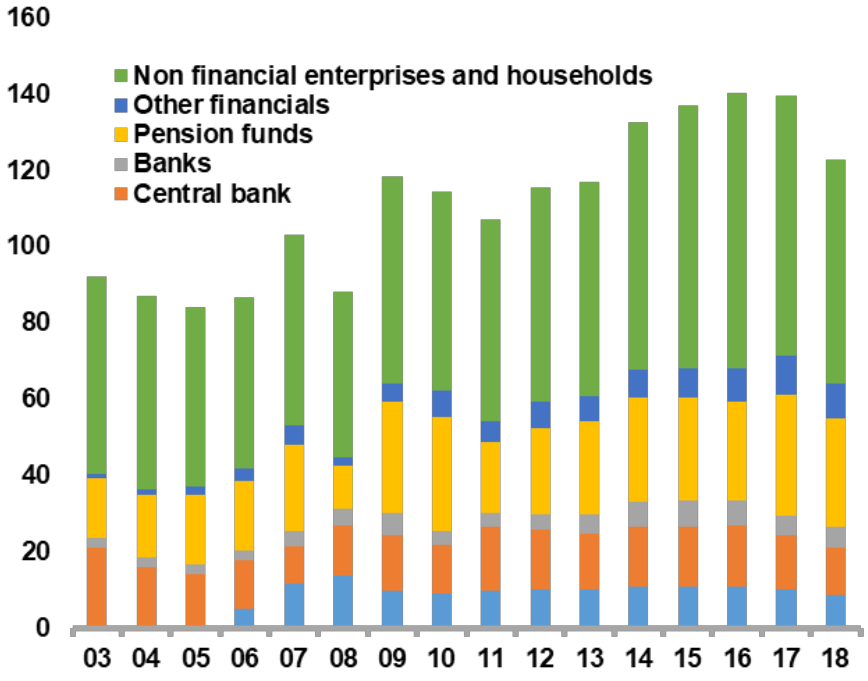
[3] The Chilean fiscal rule introduced a cyclical adjustment to government copper revenues (along similar lines to that of the CSF) in addition to the traditional cyclical correction of domestic revenues.

Chile: Foreign assets position by institutional sectors (in million USD) Graph 1

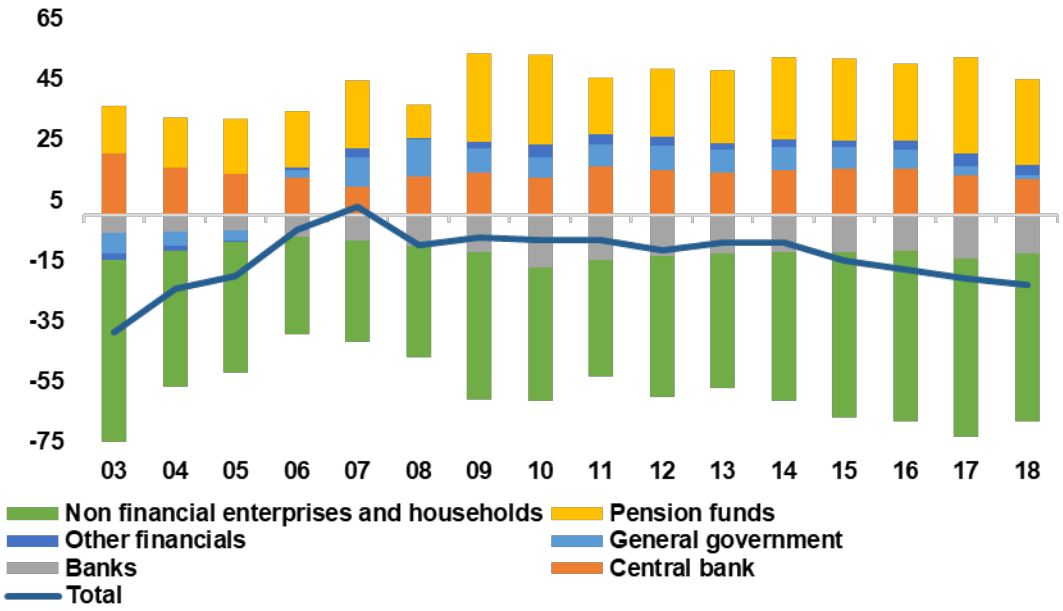


Chile: Foreign assets position by institutional sectors Graph 2

(% of nominal GDP in USD)



Chile: Net foreign assets position by institutional sectors (in % of GDP) Graph 3



In summary, during this period a number of major developments led to a reduction in the central bank's role as a provider of FX liquidity to the Chilean economy in the event of a crisis. Before the opening of the capital account in the late 1970s, the central bank was almost the exclusive provider of this form of insurance through its holdings of international reserves. In the 1980s, the domestic banking system began accumulating international assets, given their growing role in the intermediation of foreign resources in the Chilean economy. In the 1990s and 2000s, we saw the development of government self-insurance against foreign shocks, as well as the growing amount of households' mandatory savings invested abroad by pension funds and, more recently, insurance companies. On the other hand, the internationalization of the Chilean economy (Vial, 2018) also meant larger flows of trade and capital (in and out) of the country, raising the demand for FX liquidity. By the end of 2017, the main domestic holders of foreign financial assets in Chile were the institutional investors (61% of GDP), the central bank (14%), the government (10%) and the banks (5%).

3. Governance and management of international reserves

IRs are among several policy tools the Board of the Central Bank of Chile uses to achieve its main objectives, namely safeguarding the stability of the currency and the normal functioning of internal and external payment systems. In floating exchange rate regimes like Chile's, IRs are used exceptionally to limit unwanted parity fluctuations beyond their fundamentals (as part of the currency stability objective) and/or to intervene during periods of market malfunction or turmoil (as part of the financial stability objective). In accordance with the powers assigned to it by the central bank's Constitutional Act, the board determines the bank's general policies,

establishing the administrative structure of the institution and dictating the norms to which it must adjust its operations.

The ultimate decision-making authority is the Central Bank of Chile's Board of Governors, who define the objectives for reserves management and risk tolerance levels, and approve the parameters of the reserves investment policy (IP). Said IP sets the guidelines for reserves administration – including those concerning their composition of currencies and maturities – and credit risk management. The first line of reporting to the board is responsible for implementing the bank's general strategy and providing timely information and advice to the board on economic, financial and other administrative matters. This hierarchical level of the administrative structure is in charge of proposing to the board the investment and financial risk management policy, including the proposal of the benchmark comparator contained in the IP. This level also proposes to the board an overall strategy for the bank's balance sheet and assesses its expected effects on its net worth.

To ensure a proper level of control of operational and financial risks, functions must be handled separately. These include investment strategy design and implementation, risk management and performance measurement, investment payment, recording and reconciliation of operations, and compliance activities. On another level, the central bank's comptroller, who reports directly to the board, periodically evaluates the effectiveness and efficiency of internal controls, the management of operational and financial risks and the governance of the integrated reserves management process. In addition, the bank's financial statements, which because of their level of materiality include the administration of IRs, are audited by independent firms on an annual basis. The Audit and Compliance Committee (CAC) provides advice to the board and is made up entirely of professionals external to the bank. Among other functions, the CAC issues a report on the effectiveness of the internal control systems and procedures used by IR management, and evaluates the reliability, integrity and timeliness of the information included in the financial statements. The legal department, whose senior leadership reports to the board, in general and under the Basic Constitutional Act, is responsible for ensuring that all agreements, resolutions and contracts of the bank comply with the legal regulations in force, which applies to any agreements adopted or entered into with the purpose of investing, managing and disposing of IRs. To this end, the legal department oversees all agreements, resolutions and contracts, as well as any other actions requiring legal analysis in the field of IRs.

Upon establishing the level of reserves, the board approves an IP that defines the strategic framework that is used for its management process. The law provides that IRs can only be invested in foreign currencies, gold or credit instruments, securities or bills of exchange, issued or guaranteed by foreign governments, central banks or foreign or international banking or financial entities. The IP defines the desired return and risk profile and is designed, mainly, to meet the potential needs for liquidity in foreign currency and its impact on the results and risks of the bank's financial balance sheet.

IR management requires investing in assets of high credit quality, and the portfolio must have sufficient liquidity to allow the bank to achieve its policy objectives[4]. The main risks for the balance sheet are mitigated by having a diversified

[4] The constitutional chart of the central bank limits eligible instruments to government guaranteed debt, and financial institutions debt.

composition of loans, rates and currencies. Specifically, two reserves portfolios are defined: one with the purpose of ensuring an adequate level of liquidity, the other to diversify risks and yield profits. The process of investing IRs is governed by a benchmark structure, which represents the bank's best estimate of the combination of investments in foreign currency that maximizes long-term yield, subject to having an acceptable risk level the general requisites of safety and liquidity. In this context, the IP defines the composition of currencies, asset categories, eligible operations and the size of each subportfolio, among other relevant parameters. Additionally, the IP contemplates eligibility criteria and maximum exposure limits to countries, currencies, issuers, instruments and others necessary to rein in exposure to the investments' inherent risks. These criteria and limits are established within the context of a general benchmark framework, to maintain a comprehensive, watchful eye on financial and operational risks.

Benchmark structure of the international reserves investment portfolio, by type of risk and benchmark

Table B1

Structure	Credit risk	Share	Benchmark
Short-term liquidity portfolio	Sovereign	24%	ICE BofA Merrill Lynch Index: Treasury Bills Index (unhedged) 0-1 year duration (100%) (USD)
Medium-term liquidity portfolio	Sovereign	61%	Bloomberg Barclays Capital Global Aggregate Index: Treasury Bond Index (unhedged) 1-3 year duration (90%) 3-5 year duration (10%) (USD, EUR, CAD, AUD)
Diversification portfolio	Sovereign and bank	15%	Bloomberg Barclays Capital Global Aggregate Index: Treasury Bond Index (unhedged) 5-7 year duration (70.6%) 7-10 year duration (9.4%) (USD, EUR, JPY, KRW,CHF, NZD, GBP) Bloomberg CGDRC Index: Customized for deposits in CNH (20%)
Total portfolio	Sovereign and bank	100%	

Source: Central Bank of Chile.

The risks relating to financial intermediation services, custodies and clearing houses, among others, are protected in the IP through minimum requirements defined according to the quality of the required services, operating and financial risk considerations, and legal aspects. Every year, the board evaluates the performance of the benchmark comparator from the perspective of achievement of the bank's more general objectives.

To facilitate and expedite the decision-making process, the IP specifies the powers that the board will delegate on management and the particulars of the reporting procedures. The use of the delegated powers is periodically reported to the board.

In an effort to add value to internal management and serve as an active comparator for the central bank's management, the investment process includes

bringing in external portfolio administrators. For these purposes, the board approves the program's goals, the number of administrators and the amount to be outsourced.

Furthermore, with the purpose of adding economic value to the management of reserves, the investment process contemplates securities loan programs (PPV), which are implemented with custodian institutions acting as brokers of the securities that are loaned and the guarantees that are received in exchange. In general, the board approves the PPV's operating policy, ensuring that they contribute to reserves management objectives, properly balancing the expected benefits with the associated risks.

In general, the central bank makes a continuous effort to be aligned with international best practices. In matters of reserves management, it regularly submits its practices to peer review, and these exercises are generally carried out by other central banks or multilateral organizations.

The board periodically assesses the performance of reserves management based on different reporting instances. In this way, the board knows in detail the evolution of absolute and relative returns, compliance with the rules, and the different investment strategies and related risk parameters.

In addition, the board has established as part of the bank's policies to present information on the administration of IRs to the President of the Republic, the Senate and the general public, by including this information in each September's Monetary Policy Report, in its Annual Report and on the bank's website[5]. This decision consolidates the current practices of the central bank on the matter, which comply with the transparency guidelines recommended by the International Monetary Fund (IMF).

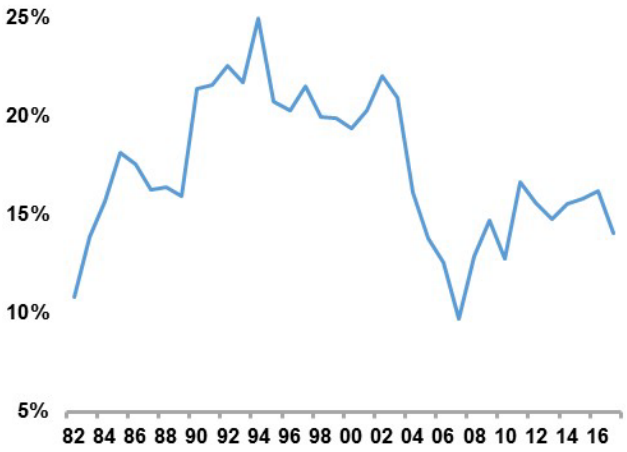
4. Determinants of the level and composition of IRs

The traditional practice in Chile has been to use standard metrics of coverage of liquidity risks to assess the adequacy of IRs. The main risks to cover were funding of imports and short-term debt payments, and the specific metrics to determine the level of reserves were coverage of three months of imports and of the size of the banks' foreign debt maturing within one year. This led to an estimate of the adequate size of reserves of about 15% of GDP. This reasoning informed the decision to increase the size of IRs in 2008 and 2011. As Chart 4 shows, IRs fluctuated around 20% of GDP in the 1990s up to the mid-2000s, when their ratio to GDP began falling steadily, to a minimum of 10% in 2007. In addition to the USD 4 billion sale of IRs in 2001 and 2002, this trend resulted mostly from nominal GDP growth and the appreciation of the currency during the "super cycle" of commodity prices. After the latest two periods of IR accumulation, the reserves came back to about 15% of GDP.

[5] The latest report on IR management can be found as Annex B in the Monetary Policy Report published in September 2018 (http://www.bcentral.cl/en/web/central-bank-of-chile/-/monetary-policy-report-september-2018-summary).

One additional consideration for the decision to intervene in the FX market to adjust the level of IRs is the impact on the central bank's net worth[6]. Chile is a peculiar case since its net worth has been negative for several decades. Since the sterilization of IR accumulation entails issuing central bank debt at a loss, given interest rates spreads between the local market and the returns on IR, this has to be evaluated carefully.

Chile: International reserves (in % of GDP) Graph 4



The composition of the IRs and their investment guidelines were based on both liquidity considerations as well as the protection of the capital of the bank (denominated in pesos). With this in mind, the stock of IRs was divided into three portfolios: short term (15% of the total, minimum risk), medium term (61%, highly liquid, very low risk) and diversification portfolio (24%, longer maturity, low risk).

Beginning in 2017, in the context of the five-year Strategic Planning process, there has been a major revision of the above mentioned criteria. The resulting proposals were presented to the board and approved last June. The size and composition of IRs were defined in terms of the contributions to the Constitutional Charter of the bank and the adequacy of reserves was measured according to different criteria proposed in the literature. The models based on trade risks for liquidity gave results in the range of 5–10% of GDP; those based on coverage of debt payments were in the range between 15–20% of GDP[7]. Three different variants of the Assessing Reserve Adequacy model proposed by the IMF[8] showed results in the range between 10–15% of GDP. On the basis of these estimates, it was decided that the current level of IRs was adequate.

[6] In accordance with international accounting standards "segniorage" cannot be included in the official balance sheet of the bank. The central bank publishes short-term projections of its balance sheet (see Annex A of the Monetary Policy Report) and also regularly performs internal long-term projections of its balance in order to assess economic solvency.

[7] On this group, the estimate based in Jeanne and Ranciere (2006) gave a number of 37% of GDP.

[8] See IMF 2014 and IMF 2016.

Composition of IRs

Table B4

Portfolio	Currency	2017		2018	
		Dec.	%	Jun.	%
Investment portfolio		**35,071.0**	**90.0**	**34,759.6**	**94.0**
Currencies and deposits	US dollar	23.3	0.1	15.9	0.0
	Euro	0.3	0.0	4.2	0.0
	Canadian dollar	0.2	0.0	0.3	0.0
	Australian dollar	1.2	0.0	0.1	0.0
	Other currencies	810.7	2.1	772.3	2.1
Securities	US dollar	22,260.3	57.1	22,055.6	59.6
	Euro	5,832.8	15.0	5,860.1	15.8
	Canadian dollar	1,662.1	4.3	1,661.4	4.5
	Australian dollar	1,679.9	4.3	1,497.3	4.0
	Other currencies	2,800.2	7.2	2,892.5	7.8
Total	US dollar	22,283.6	57.2	22,071.5	59.7
	Euro	5,833.2	15.0	5,864.3	15.9
	Canadian dollar	1,662.2	4.3	1,661.7	4.5
	Australian dollar	1,681.0	4.3	1,497.4	4.0
	Other currencies	3,610.9	9.3	3,664.8	9.9
Cash portfolio		**2,877.0**	**7.4**	**1,152.3**	**3.1**
Currencies and deposits	US dollar	2,877.0	7.4	1,152.3	3.1
Other assets		**1,034.6**	**2.7**	**1,074.9**	**2.9**
Monetary gold	Other currencies	10.2	0.0	9.9	0.0
IMF SDRs	Other currencies	770.3	2.0	760.2	2.1
IMF reserves position	Other currencies	251.1	0.6	304.8	0.8
Reciprocal credit agreements	US dollar	2.1	0.0	0.0	0.0
Currencies and deposits	US dollar	0.9	0.0	0.0	0.0
Total international reserves		**38,982.6**	**100.0**	**36,986.9**	**100.0**
	US dollar	25,163.6	64.6	23,223.8	62.8
	Euro	5,833.2	15.0	5,864.3	15.9
	Canadian dollar	1,662.2	4.3	1,661.7	4.5
	Australian dollar	1,681.0	4.3	1,497.4	4.0
	Other currencies	4,642.6	11.9	4,739.7	12.8

Source: Central Bank of Chile.

One important point to take into consideration to evaluate the size of the IRs in Chile, which is rather exceptional in the case of emerging markets, is the fact that both the government and the households (through their pensions savings) hold positive net international assets positions, which could shift in the event of major external shocks. In the case of the government, its main external exposure comes

from copper export revenues (directly through profits in CODELCO and indirectly from the taxation of private miners' profits) and they are covered by the sovereign wealth funds. The case of households is more complicated, since their pension savings cannot be used to cover short-term liquidity problems given they are managed by privately operated Pension Fund Administrators (AFPs) with a clear mandate to maximize the value of pensions. However, the evidence of the actual portfolio shifts in the event of external shocks, suggesting that they tend to behave countercyclically, at least during the period of a free floating currency. This is something that should be brought into consideration in future evaluations of adequate IR levels.

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Reserves management and foreign exchange intervention

People's Bank of China

Abstract

In recent years, emerging market economies (EMEs) have built up their foreign reserves. On one hand, this has been driven by accommodative monetary policies of advanced economies. On the other hand, EMEs have accumulated reserves to cope with potential financial market shocks and to strengthen domestic market resilience. This note suggests that the monetary policy impact of central banks' FX spot market interventions depends on whether they can be fully sterilised. We also touch on the practices of the People's Bank of China in diversifying its FX reserves and outline various ways in which the effectiveness of its reserves management will be further improved.

Keywords: foreign reserve, FX interventions, emerging market economies and China.

JEL classification: E58, F31.

Foreign reserves in EMEs are on the rise

Accommodative monetary policies of advanced economies have driven the growth of foreign reserves in emerging market economies (EMEs). In recent years, especially after the 2007–09 Great Financial Crisis, the advanced economies adopted ultra-easy monetary policies to boost liquidity, which caused a surge in international capital flows. With the uneven recovery in the advanced economies, international capital poured into EMEs for speculative reasons, driving up their foreign exchange reserves.

China's FX reserves are not immune from the significant impact of international capital flows. From the early 2000s to 2014, large international capital inflows quickly pushed up China's foreign reserves. These increased from USD 154.7 billion in 2000 to a peak of USD 3.99 trillion in June 2014, representing an average annual growth rate of more than 26%. Since 2015, China's reserves have been falling owing to stronger dollar and capital outflows, stabilising at around USD 3 trillion. In October 2018, China's foreign reserves amounted to USD 3.05 trillion, remaining the largest in the world.

EMEs accumulate reserves to protect themselves from financial market shocks and to strengthen the resilience of their domestic markets. In recent years, growing cross-border capital flows have confronted EMEs with increasing exchange rate risks. As a result, many EME monetary authorities have chosen to maintain large FX reserves to fulfil their international payment obligations and mitigate financial risks.

Generally speaking, the level of FX reserves in EMEs is determined by factors such as their economic size, current account status and external debt. Against the backdrop of increasingly intertwined financial markets worldwide, countries are highly exposed to risks arising from exchange rate fluctuations and capital flows regardless of their economic scale, current account status and external debt levels. Therefore, it is important for EMEs to maintain reserves that are sufficient to safeguard themselves against such risks.

FX interventions in EMEs

EME central banks conduct FX interventions mainly in the spot market, but the use of derivatives is becoming increasingly common. By using reserves to intervene in the spot market, central banks can counter a sharp depreciation or overshooting of their currencies. However, this will also reduce the liquidity in local currencies and incur sterilisation costs. By comparison, the use of FX derivatives has the advantage of not affecting the money supply. It can also buy time for economic restructuring. Moreover, once the economic fundamentals recover and depreciation pressures are gone, central banks can close their position by executing a reversing transaction in order to slow the appreciation of their currencies. It has become common in Brazil and many other EMEs to use currency swaps and other FX derivatives to intervene in the market in the past few years.

FX interventions might reduce FX volatility, but they are difficult to sustain at a given level in the longer run. In the short term, central banks can use their reserves to intervene in the market and prevent excessive trading of their currencies,

which can lower the probability of abnormal short-term exchange rate fluctuations. But as exchange rates in the long run are determined by international capital flows, interest rate policies and other factors, it is difficult to keep the rate stable only through FX interventions. Further, EMEs find it difficult to keep exchange rates stable while maintaining an independent monetary policy and free capital flows, as schematised in the "impossible trinity" concept.

The impact of an FX intervention on monetary policy depends on whether central banks can fully sterilise it. If full sterilisation can be achieved, an intervention's impact on policy implementation is limited, although it can still increase capital flows and therefore reduce the policy effectiveness. But if full sterilisation cannot be achieved, an intervention may increase or reduce liquidity in the market, thus hindering the implementation of interest rate policies and reducing the effectiveness of monetary policy. Moreover, during financial crises, the effect of FX intervention on liquidity is often inconsistent with the aim of monetary policy, so that the latter's effectiveness is reduced.

China's practices in reserves management and FX intervention

The objective of China's reserves management is to ensure safety and liquidity, after which a certain level of return is also sought. In recent years, China's reserves investment has been constantly improving in terms of size, currency structure and diversification.

The PBC continues to explore ways to use its reserves in a diversified manner. In recent years, new channels for investing reserves such as entrusted loans and equity investment were explored. In the process, foreign exchange was placed with financial institutions such as commercial banks and policy banks, as well as with the real sector. With these, a new mechanism for the use of reserves has gradually been developed, with a clear mandate, clear objectives and multiple layers. Meanwhile, the PBC actively provides funding resources to international organisations and cooperates with several bilateral/multilateral funds and multilateral financial institutions. China's reserves investment now covers a range of products including bonds, equities, funds and multilateral co-funding arrangements.

The PBC is also committed to building a comprehensive risk management system and an internal governance framework in line with its expanded reserves management activities. Safeguarding market security and providing liquidity when necessary are the priorities of reserve management. China has attached great importance to protecting its reserves from potential risks and to enhancing the capabilities of its reserves manager in managing risks and maintaining internal controls, so as to better respond to developments in the international financial markets. Over the past few years, the transparency of China's reserves has been steadily increased. In July 2015, China adopted the IMF's Special Data Dissemination Standards. The IMF then began to publish information about central banks' holdings of renminbi. This has further enhanced the transparency of China's reserves management.

The PBC also seeks to enhance its credibility in improving the effectiveness of its reserves management. Any reserves management activities can exert a

profound influence on the decisions of market participants. As the manager of China's reserves, the PBC closely monitors developments in the global financial regulatory environment, constantly strengthening its internal controls and prudential management, with a view to strengthening its credibility in the FX market and enhancing its reserves management capabilities.

International reserve policy and the effectiveness of sterilized FX intervention in Colombia

By Hernando Vargas, Pamela Cardozo and Mauricio Villamizar[1]

Abstract

Two FX policy issues are discussed based on the recent Colombian experience. First, the increased participation of foreign investors in local bond markets since 2014 induced a reassessment of international reserve adequacy. We present the resulting Liquidity Coverage Ratio-type methodology to evaluate adequacy, together with a brief description of the international reserves management strategy in Colombia. Second, we shed some light on the debate regarding the effectiveness of sterilized FX intervention, showing that exchange rate effects depend on the "flimsiness" of exchange rate expectations or their fundamental determinants. To support this, we provide empirical and theoretical evidence.

JEL classification: F31, E58

Keywords: sterilized FX intervention, international reserves, Colombia

[1] Banco de la República´s Deputy Technical Governor, Deputy Governor for Monetary Operations and International Investments, and Deputy Governor for Economic Studies, respectively. The opinions contained in this document are the sole responsibility of the authors and do not necessarily represent those of Banco de la República nor its Board of Directors.

1. Introduction

The FX intervention strategy of the Central Bank of Colombia (BR) considers a clearly specified set of objectives, which include preserving adequate levels of external liquidity, alleviating illiquidity episodes in the FX market, overcoming shortages of short-term external funding for the country, curtailing excess volatility of the exchange rate and correcting exchange rate misalignments that could risk de-anchoring inflation expectations. Each of these motivations has specific triggers, conditions and associated instruments for the intervention (Cardozo, 2019). In any case, FX intervention is sterilized so that the short-term interest rate does not deviate from the policy interest rate, which is determined within the Inflation Targeting scheme used to guide monetary policy in Colombia.

In this context, the increasing importance of foreign investors in Colombian capital markets over the last four years led to a revision of the gauges of international liquidity adequacy. Since 2014, the participation of foreign investors in the local public bond market has risen from 6% to around 25%. While this is appreciated in terms of the development of domestic capital markets and a reduced FX risk exposure of the government, it poses some challenges with regards to the stability of the local public bond market and the adequacy of the international liquidity position of the country. The latter has been recently analyzed by the BR, resulting in the definition of a new methodology to assess international reserves adequacy and a program of reserve accumulation. This is described in some detail in the first part of this document.

The stock of international reserves (USD 51.5 billion as of April 2019) is managed in two tranches with very low credit risk. A "liquid" tranche of approximately 60% of the stock has a duration of 2.6 and its currency composition is set to track the price index of imports and the currency composition of other outlays of the balance of payments. The second tranche has a higher duration and is mostly invested in US dollar-denominated assets. The definition of the size and the characteristics of these tranches is explained in the second part of this document.

On the other hand, the effectiveness of sterilized FX intervention (SFXI) to affect the level or the volatility of the exchange rate has been a permanent matter of debate in Colombia, even though intervention with this purpose has been negligible in the last four years. In the third part of this document, we postulate a new determinant of effectiveness that has to do with the "flimsiness" of exchange rate expectations or their fundamental determinants. We posit a partial equilibrium model to explain this channel and present empirical evidence.

2. International liquidity adequacy in the context of large foreign participation in the domestic capital markets

A tax reform at the end of 2012 substantially reduced and simplified the withholding taxes on foreign portfolio investment in the local debt market. After the taper tantrum subsided, these tax incentives prompted some emerging market (EM) bond indices to increase the share of Colombian domestic public bonds in their benchmarks. As a result, about USD 9 billion flowed into the local public bond market in 2014, driving up the participation of foreigners from 6% in January 2014 to 16% in January 2015.

Afterwards, further inflows continued, albeit at a slower pace. Today that participation stands at 25%.

This is a phenomenon that is welcome, for it reduces the FX risk exposure of the government (as it is transferred to foreign investors) and helps alleviate the "original sin" problem (Eichengreen and Hausmann, 1999). It may also contribute to the development of local capital markets. However, it poses challenges in terms of both the stability of the local public debt market and the adequate level of the country´s international liquidity. Although foreign investors have not been particularly volatile so far (or at least more volatile than domestic investors), there is the risk that they may flee more easily in the face of adverse conditions of the economy or public finances. Also, some foreign investors are known to exit a country rapidly after the domestic macroeconomic policy framework becomes less orthodox.

Consequently, the growing presence of these investors in local capital markets requires rethinking the criteria to set the adequate level of a country´s international liquidity. This has been the case at the BR. Previously, the BR established the adequate level of international reserves by setting combined targets for four traditional reserve coverage indicators (the ratios of reserves to imports, current account deficit plus external debt amortizations, broad monetary aggregate, and GDP). Reserve purchases were concentrated in those periods of time when the estimated probability of an exchange rate misalignment was highest.

After the jump in foreign participation in local capital markets, a new methodology akin to the Liquidity Coverage Ratio was developed. It requires international reserves to cover at least the expected current account deficit plus external debt amortizations over the next year. Moreover, the sum of international reserves and the International Monetary Fund (IMF) Flexible Credit Line (FCL) must cover the abovementioned expected outlays plus an estimation of potential portfolio outflows from residents and non-residents. The latter are calculated for a one-year period assuming stressed prices in all financial and FX markets. Currently, the stock of international reserves exceeds the current account deficit plus external debt amortizations, and covers part of potential portfolio outflows. The sum of reserves and the FCL covers all estimated outflows.

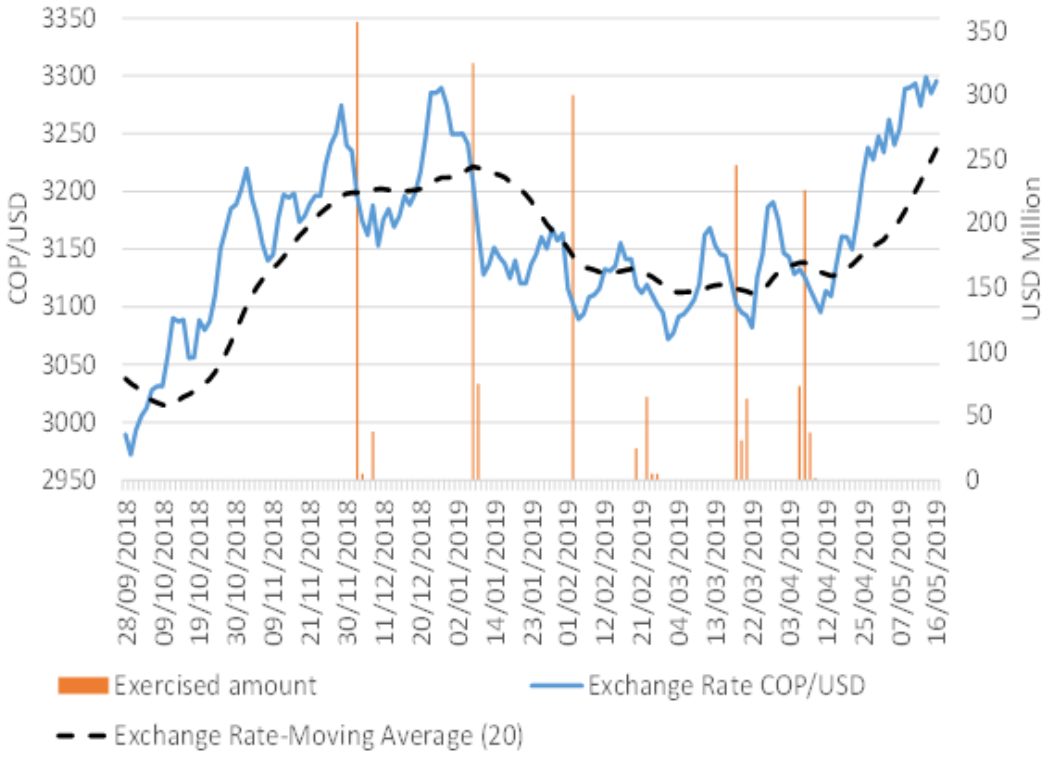
The IMF FCL is a temporary instrument and Colombia has agreed to gradually reduce its access; external risks permitting. This implies that probably Colombia´s renewal of the FCL in 2020 would be for a lower amount and, therefore, that international reserves must be accumulated. In consequence, at the end of September 2018 the BR announced a program to purchase USD through monthly auctions of put options. This instrument had been used in the early 2000s with the same purpose, and was chosen to minimize the impact of the FX intervention on the exchange rate. This is so because these options can only be exercised when the average exchange rate (COP/USD) of the previous day is below its 20-day moving average. Thus, purchases occur only when there is an appreciation of the COP. This is an important feature in the current context of fundamental-driven pressures for COP depreciation (monetary policy normalization in advanced economies and highly volatile terms of trade), since it is deemed undesirable that the reserve accumulation program induces excess volatility of the exchange rate.

In September 2018, the BR announced the start of the program, but not its end date nor the total amount to be purchased, so that the authorities could retain flexibility given potential risks of a sharp depreciation of the COP. Since October 2018, the BR has held eight auctions of put options at the beginning of each month, each

for USD 400 million. Options have a one-month maturity. In total, USD 1,878 million has been exercised (Figure 1).

Recent USD purchases through put options

Exchange rate & central bank's USD Purchases Figure 1



Source: Banco de la República

3. International reserve tranches in Colombia

The BR manages its international reserves with very low credit risk. To date, the minimum accepted rating for sovereigns is A– and for corporates A+. Given a substantial increase in the stock of international reserves since 2010 (USD 21,857 million) and the low return stemming from global liquidity conditions, in 2015 a new two-tranche approach to manage reserves was introduced.

The first tranche maximizes its return, given a currency composition, subject to the constraints that i) its return cannot be negative in a one-year period with a probability of 95%, and that ii) the conditional value at risk (CVaR) cannot be above 1% in the same period. Its currency composition seeks to mimic the price index of imports and the currency composition of other outlays of the balance of payments.[2] The second tranche maximizes its return in US dollars, subject to the constraints that

[2] An index is constructed, as the weighted average of the good import price index, the currency index of the external debt service and the currency index of service imports, all in US dollars. The weights correspond to the participation of those items in their sum.

i) its three-year return cannot be negative with a probability of 95%, and that ii) the CVaR cannot be above 1% in the same period.

Eligible currencies for the indexes of both tranches must have a reserve currency status for the BR[3] and the public debt of the currency issuer must satisfy the following three conditions: i) it must have positive interest rates; ii) the BR should be able to invest directly in it; and iii) the BR´s participation in that market should not exceed 5%. Currently, the duration of the first (short term) and second tranches is 2.6 and 4.2, respectively. The currency composition of the short-term tranche is USD 82%, AUD 9%, CAD 5%, NZD 2% and NOK 2%. For the second tranche, the currency composition is USD 93%, GBP 3% and AUD 4%.

The objective of the first tranche is to be able to address the potential balance of payments outflows in cases of periods of stress during a one-year period (hence its currency composition). To determine its size, the BR uses a modification of the Adequate Reserve Adequacy (ARA) metric proposed by the IMF.[4] The original ARA methodology sums FX shortfalls stemming from external debt payments, foreign portfolio investment, reductions in M3, and lower inflows from exports, during periods of exchange market pressure. The BR´s modification takes into account the correlations among these variables during those periods. This way, the BR´s approach is less conservative than the IMF´s, considering that the methodology does not seek to determine the adequate level of total reserves, as is the case in the IMF´s methodology, but to establish the size of the first (liquid) tranche. The second tranche is the difference between the stock of international reserves and the short-term tranche.

4. Effectiveness of sterilized FX intervention and the "flimsiness" of exchange rate expectations[5]

The BR has had a rich history of SFXI in terms of objectives, modalities and market conditions.[6] Consequently, there has been a growing strand of empirical work centered on its effectiveness, i.e. the ability to alter the level or volatility of the exchange rate.[7] Results are mixed but, in general, when SFXI is found to be effective, the size of the effects are small and short lived (less than one month).

Nevertheless, it is well known that isolating the effect of SFXI is empirically difficult and that many studies in the field are plagued with identification problems. In addition, previous studies have overlooked the influence of uncertainty about the future path of the exchange rate or its fundamentals when evaluating the

[3] DKK, NOK, SEK, AUD, CAD, USD, NZD, EUR, CHF, GBP, JPY, CNH/CNY, HKD, SGD, KRW. External Resolution 1, 2018. Article 1.

[4] https://www.imf.org/external/np/spr/ara/

[5] This section is taken directly from Vargas-Herrera and Villamizar-Villegas (2019). In some cases, entire excerpts are used.

[6] For an in-depth view of the regulatory framework on exchange rate intervention conducted by the Central Bank of Colombia, see Nota Editorial (2016) and Circular Externa DODM-143 (2011).

[7] Studies that center on the Colombian case include: Mandeng (2003), Kamil (2008), Toro and Julio (2005), Rincon and Toro (2010), Echavarria et al. (2010, 2014, 2018), Fuentes et al. (2014), Villamizar (2015), Ocampo and Malagon (2015), and Kuersteiner et al. (2018). See Table 9.2 of Cardozo, 2019.

effectiveness of SFXI. This is an important factor, for it affects the strength of investors' responses to central bank intervention. Thus, we posit a partial equilibrium model to illustrate this and present empirical evidence based on a discontinuous regression model that provides a clear-cut identification strategy within a quasi-experimental framework, taken from Vargas-Herrera and Villamizar-Villegas (2019).

4.1 A model of SFXI and the "flimsiness" of exchange rate expectations

In this section, a model with frictions in the FX market is put forward in which the degree of effectiveness of SFXI is related to the uncertainty of market participants on the future exchange rate. When uncertainty on the future exchange rate or its fundamentals is low, SFXI is likely to be less effective, for agents would be willing to "bet more money" against it if it runs against the expected exchange rate or its fundamentals. By contrast, if uncertainty on the future exchange is high, SFXI will face a weaker countervailing force from speculators and arbitragers. In this case, there will be less certainty about the inconsistency between SFXI and exchange rate fundamentals, and, consequently, less money will be "bet against" intervention. The concept of uncertainty about the future exchange rate is, in this context, understood as the variance of the investors' distribution of the future exchange, which is related to the variance of exchange rate fundamentals.

Suppose a FX market had the following features:

- A very short period of time in which macroeconomic aggregates like foreign and domestic income and price levels are taken as given. Foreign and local interest rates are assumed to be constant as well.
- A "net supply" of foreign currency that has two components. A first component, *NX,* depends positively on the real exchange rate defined as *p*e/p*. *e* is the price of the foreign currency in domestic currency units. In the short run, both foreign and domestic price levels are assumed to be constant, so that this component of the FX "net supply" depends positively on the nominal exchange rate, $NX = NX(e)$, $\frac{dNX(e)}{de} > 0$. The second component, *K*, is exogenous and does not depend on the exchange rate. It may be thought to include the autonomous and income-dependent parts of the current account balance and those net capital flows that do not respond to the exchange rate. Thus, the FX "net supply" is given by:

$$NX(e) + K \tag{1}$$

- A group of "speculators" with no financial constraints, who bet on a future appreciation or depreciation of the local currency using the forward market[8]. The speculators choose the amount of forward net sales of FX, *F*, aiming at maximizing the expected utility of their profits in the future, *F (f - e_1)*. *f* is the forward price of the FX and e_1 is the future spot exchange rate. The speculators face uncertainty on the latter and, consequently, on the future return of their bet. *f* is known (taken as given from the market), but e_1 is not. More specifically, e_1 is assumed to have a normal distribution, so that:

[8] Much like the "off-shore" agents in the Colombian FX market.

$$f - e_1 \sim N(f - E[e_1], \sigma_{e_1}^2) \quad (2)$$

- Uncovered interest rate parity (UIP) does not hold, thereby rendering SFXI effective by construction in the model. However, covered interest rate parity (CIP) does hold. There are non-financially constrained agents that arbitrage interest rate differentials using the forward FX market, so that:

$$f = \frac{e(1+i)}{(1+i^*)} \quad (3)$$

- It is assumed that these agents do not hold open net FX positions[9], so that any shift in their forward position is matched by an opposite shift in their spot position. In particular, these agents are the counterparty of the speculators and, therefore, any net forward purchases by the speculators produce net spot purchases by the arbitragers of the same amount.
- Equilibrium in the spot market requires that:

$$NX(e) + K = -F \quad (4)$$

Recall that F are the speculators' net forward sales. Thus, -F are their net forward purchases. The latter produce net spot purchases of the same amount by arbitragers, as explained above. Thus, the LHS and RHS of equation (4) may be interpreted as the spot FX net supply and demand, respectively. The nominal exchange rate, e, adjusts to clear the spot FX market. Based on the types of agents assumed, this model could be considered a simplified characterization of the Colombian FX market in the short run.

To complete the description of equilibrium, the optimal level of F must be derived from the "representative speculator's" problem:

$$\max_F E\{U[F(f - e_1)]\}$$

Assuming a CARA utility function, $U = -exp^{\lambda W}$, and using the normality assumption in (2), the above problem may be stated as a mean-variance optimization model. Notice that $F(f - e_1) \sim N(F(f - E[e_1]), F^2\sigma_{e_1}^2)$. Hence, the optimization problem may be expressed as:

$$\max_F F(f - E[e_1]) - \frac{\lambda}{2} F^2 \sigma_{e_1}^2$$

The first order condition of this problem implies:

$$F = \frac{f - E[e_1]}{\lambda \sigma_{e_1}^2} \quad (5)$$

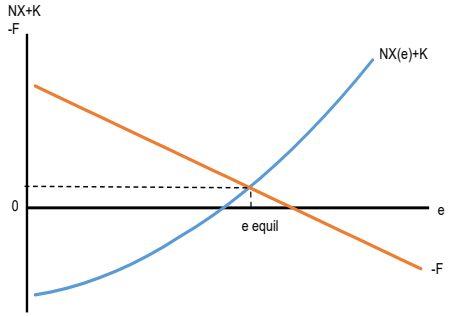
Notice that the magnitude of the speculators' net forward sales, $| F |$, depends negatively on the variance of the speculators' distribution of the future exchange rate, $\sigma_{e_1}^2$, and the degree of risk aversion, λ. The greater the uncertainty on the future exchange rate, the lower the magnitude of net forward sales or purchases of the risk-averse speculators.

The equilibrium level of the spot exchange rate, *e*, is obtained by substituting (3) and (5) into the equilibrium condition (4):

$$NX(e) + K = \frac{E[e_1]}{\lambda \sigma_{e_1}^2} - \frac{e(1+i)}{\lambda \sigma_{e_1}^2 (1+i^*)} \quad (6)$$

[9] Much like banks in the Colombian FX market.

The LHS of equation (6) depends positively on *e*, while the RHS depends negatively on *e*. Graphically the short-term equilibrium in the FX market may be depicted as follows:



To explore the impact of changes in $\sigma^2_{\dot{e}_1}$ on the effectiveness of SFXI, the equilibrium condition (6) may de differentiated as follows:

$$NX_e de + dK = -\frac{(1+i)}{(1+i^*)\lambda\sigma^2_{\dot{e}_1}} de$$

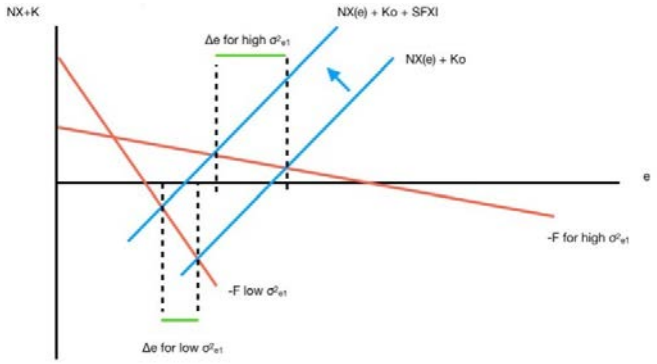
Here $NX_e \equiv \frac{dNX}{de}$ and dK represents the variation in the autonomous component of the FX net supply due to central bank FX sales. This differentiated equation implies:

$$\frac{de}{dK} = -[NX_e + \frac{(1+i)}{(1+i^*)\lambda\sigma^2_{\dot{e}_1}}]^{-1} < 0 \qquad (7)$$

and $$\frac{\partial^2 e}{\partial K \partial \sigma^2_{\dot{e}_1}} = \frac{-(1+i)}{(1+i^*)\lambda(\sigma^2_{\dot{e}_1})^2}[NX_e + \frac{(1+i)}{(1+i^*)\lambda\sigma^2_{\dot{e}_1}}]^{-2} < 0 \qquad (8)$$

Equation (7) measures the response of the equilibrium nominal exchange rate to the increased supply of FX by the central bank. Notice that the currency appreciates, even though the domestic interest rate is kept unchanged (the FX intervention is sterilized). Hence, SFXI is effective. Equation (8) shows that the response of the exchange rate to SFXI increases in magnitude with the variance of the investors' distribution of the future exchange rate. The greater this variance, the larger the reduction of the exchange rate (the more effective is the SFXI).

Graphically:



Intuitively, a high value of $\sigma^2_{\dot{e}_1}$ implies that small movements in *F* shift the "marginal cost" of risk significantly. Consequently, *F* does not react strongly to changes in the marginal benefit, $f - E[e_1]$. Thus, the speculators' offsetting response to SFXI is weak and the latter becomes more effective. For example, if the central bank

sells FX in the market, it will produce an appreciation of the currency ($\downarrow e$). Given the interest rate differential, by arbitrage this will reduce the forward exchange rate ($\downarrow f$), resulting in lower expected returns to forward sales ($\downarrow (f - E[e_1])$) and reduced net forward sales by the speculators. However, the size of this response will be smaller, the greater the variance $\sigma^2_{e_1}$, since any drop in F will significantly decrease risk. Ultimately, the reduction in the speculators' net forward sales is substantially lower than the central bank FX sales, increasing SFXI effectiveness.

Importantly, the foregoing results assume that the SFXI does not change the speculators' distribution of the future exchange rate.

Hence, the "flimsier" the expectations of the future exchange rate (the higher $\sigma^2_{e_1}$), the more effective is SFXI. If the speculators' distribution of the future exchange rate is related to the distribution of its fundamentals, then the "flimsiness" of fundamentals will have an impact on SFXI effectiveness. In the empirical tests of this channel shown below, the time-varying variance of exchange rate fundamentals is used as a proxy of the uncertainty of market participants about future fundamentals behavior.

4.2 Empirical evidence

4.2.1 Data

The empirical application focuses on the rule-based FX options put in place by the BR from 2002 to 2012, aimed at stemming exchange rate volatility. In brief, the BR issued FX options whenever the exchange rate vis-à-vis its last 20-day moving average exceeded an established cutoff value, generally set at ±4% (–4% for puts and +4% for calls), as seen in Figure 2 (Panel a). This cutoff was temporarily modified to ±2% from December 19, 2005 to June 24, 2008 and to ±5% from October 7, 2008 to October 27, 2009. The mechanism was temporarily suspended from June 26, 2008 to October 6, 2008 and from October 28, 2009 to October 30, 2011. It was permanently suspended on February 6, 2012.

During the sample period, the rule was triggered 231 times. If options from a previous auction were outstanding, then market participants could exercise existing options. If no options were outstanding, then the rule triggered a new auction. As seen in Figure 2 (Panel b), 38 auctions were triggered by these 231 events, and options were exercised in 75 cases. Purchases through put options totaled USD 2.4 billion, and sales through call options totaled USD 2.3 billion dollars. Daily average of exercised options sales when (USD 68.5 million) were only slightly higher than average purchases (USD 57.9 million).

Figure 1A (Appendix A) depicts the measures of flimsiness employed in our empirical exercise. They include: (a) the one-month COP/USD exchange rate volatility, (b) the one-month-ahead exchange rate forecast dispersion of market participants,[10] (c) the overnight Colombia-USA yield spread volatility, (d) the VIX index, (e) the implicit oil price (Brent) "IVOLCRUD", (f) the MOVE index which captures expected risks in US Treasury yields, and (g) the EM risk index "MXEFOCXO".

[10] The one-month-ahead exchange rate forecast dispersion is constructed from the BR's Expectations Survey. Intuitively, high values of this flimsiness variable indicate greater disagreement about the future exchange rate. The relationship between forecast disagreement (dispersion in expectations) and market uncertainty is made explicit in Lahiri and Sheng (2010).

COP-USD exchange rate and rule-based mechanism Figure 2

Panel (a): Exchange rate vis-a-vis moving average

Panel (b): Options issued and exercised

Source: Banco de la República.

4.2.2 The Impact of "flimsiness" on the effectiveness of SFXI

An evaluation of the degree in which uncertainty about the future path of the exchange rate or its fundamentals either magnifies or lessens the effectiveness of SFXI is presented. This is done by extending Kuersteiner et al. (2018)´s work, which studies the effects of the rule-based SFXI, described in the previous sub-section, within a localized approach. The authors compare episodes in which the intervention rule was barely missed with episodes in which it was barely triggered. Hence, exchange rate variation within the vicinity of the triggering threshold is *as good as randomly assigned* and hence forms the basis for identifying causal effects.

For the case of Colombia, the BR issued FX options whenever the assignment variable (exchange rate vis-à-vis its last 20-day moving) exceeded a given threshold: $X_t \geq x_0$.

The empirical contribution is thus to extend the RDD exercise in Kuersteiner et al. (2018) to allow for an incremental effect of policy, by including an interaction term between exchange rate intervention and a measure of "flimsiness". As such, Jorda (2005)´s method of local projections is used to estimate the following model:

$$\arg\min_{\theta} \sum_{j=1}^{J} \sum_{i=2}^{T-J} (y_{t+j} - a_j - \theta_j D_t - b_j(X_t - x_0) - \tau_j D_t(X_t - x_0) - \psi_j Flim_t - \delta_j D_t Flim_t)^2 K\left(\frac{X_t - x_0}{h}\right) \quad (11)$$

where $\delta = (\delta_1, \delta_2, \delta_3, .., \delta_J)'$ accounts for the incremental impact of the flimsiness variable, j periods after treatment, and $K(\cdot)$ is a kernel function with bandwidth h.[11] The inclusion of the term $\tau_j D_t(X_t - x_0)$ allows for different specifications of how the running variable affects the outcome, at either side of the cutoff.

Table 1 shows the main estimation effects, as reported in Vargas-Herrera and Villamizar-Villegas (2019). Essentially, the estimated Impulse Response Functions (IRFs) plot the vector δ of equation (11) across the different time horizons: j=1-21 working days. All of the flimsiness measures are standardized in order to make the effects comparable (i.e. the impulse shock corresponds to one standard deviation). Finally, the focus is on the effects of put options since, as noted in Kuersteiner et al. (2018), call options sometimes coincided with other methods of SFXI, in some cases offsetting purchases with sales of foreign currency.

Incremental effect of the different flimsiness variables — Table 1

	1 Day	3 Days	6 Days	9 Days	12 Days	15 Days	18 Days	21 Days
Benchmark	0.009***	0.010*	0.024**	0.016*	0.016**	0.011	0.010	-0.002
Kuersteiner et al. (2018)	(0.003)	(0.006)	(0.011)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Exchange rate volatility	-0.0001	0.004	0.016***	0.011**	0.010**	0.011**	0.009*	0.003
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)
1-month dispersion	0.004	0.012***	0.026***	0.020***	0.016***	0.020***	0.016***	0.010*
	(0.002)	(0.004)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
Yield spread volatility	0.002	0.006*	0.011**	0.005	-0.004	0.001	0.0003	-0.003
	(0.002)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
VIX	0.003	0.010**	0.019***	0.016***	0.013***	0.015***	0.011*	0.005
	(0.002)	(0.004)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Implicit oil volatility	0.001	0.005	0.016**	0.011**	0.007	0.010*	0.009	0.007
	(0.002)	(0.005)	(0.007)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
US Treasury yields risk	0.002	0.006**	0.014***	0.014***	0.015***	0.014***	0.012**	0.008
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Emerging market risk	-0.001	0.006	0.02	0.023*	0.032**	0.029**	0.036**	0.028
	(0.006)	(0.012)	(0.017)	(0.013)	(0.015)	(0.012)	(0.016)	(0.017)

Source: Table taken from Vargas-Herrera and Villamizar-Villegas (2019).

As a benchmark comparison, an initial model without "flimsiness" is estimated and reported in the first row of Table 1. Namely, the exchange rate depreciates (i.e. values in COP-USD increase) by up to 2% during the first week of intervention before the effects subside. This effect is the same result as the one found in Kuersteiner et al. (2018).

The remaining variables (rows) correspond to the incremental effect of the different "flimsiness" variables based on market conditions. Specifically, the second row shows that the one-month exchange rate volatility magnifies the effect of the intervention by about 1% during a period of three weeks (20 working days). Similarly, the third row shows a significant incremental effect by up to 2% during a period of approximately three weeks. The fourth row shows that the effects of SFXI increases by 1% in periods of high yield spread volatility, although in this case the duration of the effects remain significant only during the first week. The fifth row shows that high

[11] In the exercises that follow, a triangular kernel is used with the optimal bandwidth as described in Imbens and Kalyanaraman (2012).

values of the VIX index augment the effect of intervention by almost 2% during a period of three weeks.

The remaining flimsy variables show similar results. The sixth row of Table 1 shows that high values of implicit oil price volatility increase intervention by 1% during the second week. The seventh row shows that volatility in US Treasury yields captured by the MOVE Index augment the effect of intervention by 1.5% during a period of three weeks. Finally, the eighth row shows that high values of the EM risk index amplifies intervention effects by close to 2% during the second and third week.

5. Conclusion

The adequate level of international reserves, reserve management and the effectiveness of SFXI have been important policy topics in Colombia in recent years. These topics are briefly reviewed in this document. The relevance of an adequate level of international liquidity increased after the participation of foreign investors in Colombia´s local capital markets rose markedly beginning in 2014. A new methodology akin to the Basel LCR was developed in this respect. The new approach requires international reserves plus the IMF FCL to cover the sum of the expected current account deficit, external debt amortizations over the next year and an estimation of potential portfolio outflows from residents and non-residents during one year. Consequently, a program of reserve accumulation was put in place in October 2018.

Given a substantial increase in the stock of international reserves since 2010 and the low return stemming from global liquidity conditions, in 2015 a new two-tranche approach to manage reserves was introduced. The first tranche has low duration and a currency composition that mimics the price of imports and the currency composition of other balance of payments outlays. The second tranche has longer duration and is mostly invested in US dollar-denominated assets.

Finally, we posit a new channel of SFXI effectiveness in which the greater the uncertainty of the future path of the exchange rate (driven by the "flimsiness" of its fundamentals), the larger the impact of intervention on the level of the spot exchange rate. We provide both theoretical and empirical evidence to support the relevance of this channel.

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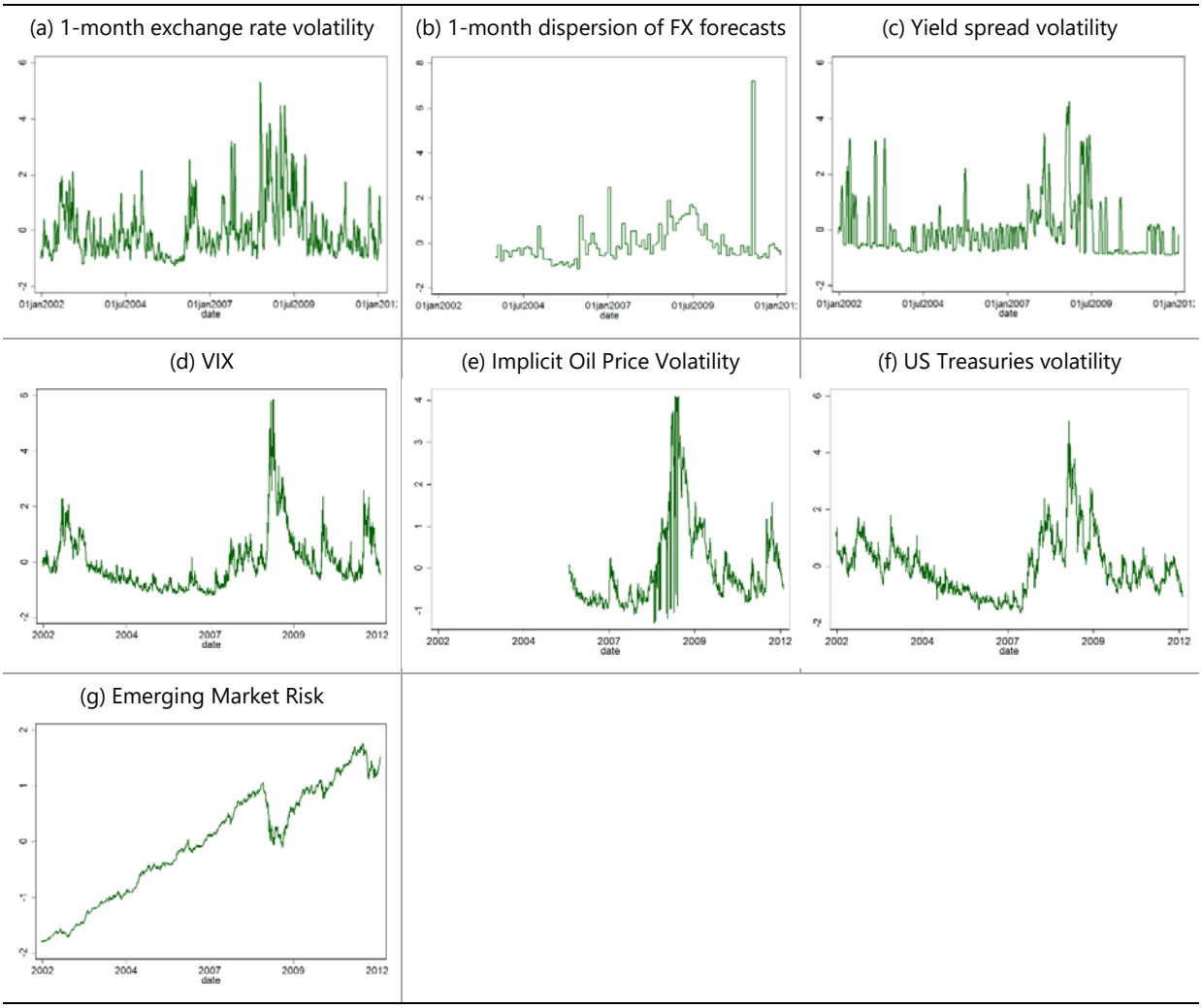
Appendix: Flimsiness variables

Standardized volatility in exchange rate and fundamentals

Figure 1A



Sources: Banco de la República and Bloomberg. Authors´ calculations.

The CNB's foreign exchange reserve management and changes to it since 2017

By Marek Mora and Jan Schmidt[1]

Abstract

The foreign exchange reserves of the Czech National Bank (CNB) increased roughly three and a half times to EUR 124.6 billion while the exchange rate commitment was in place between November 2013 and April 2017. This unprecedented growth has led the CNB to review how the reserves are managed. This article explains the functions of the foreign exchange reserves, the way they are recorded in the central bank's accounts and the related impact on its net profit or loss. It also describes the CNB's reserve management principles and the changes it has adopted in this area since 2017.

JEL classification: E58, F31, G11, G32

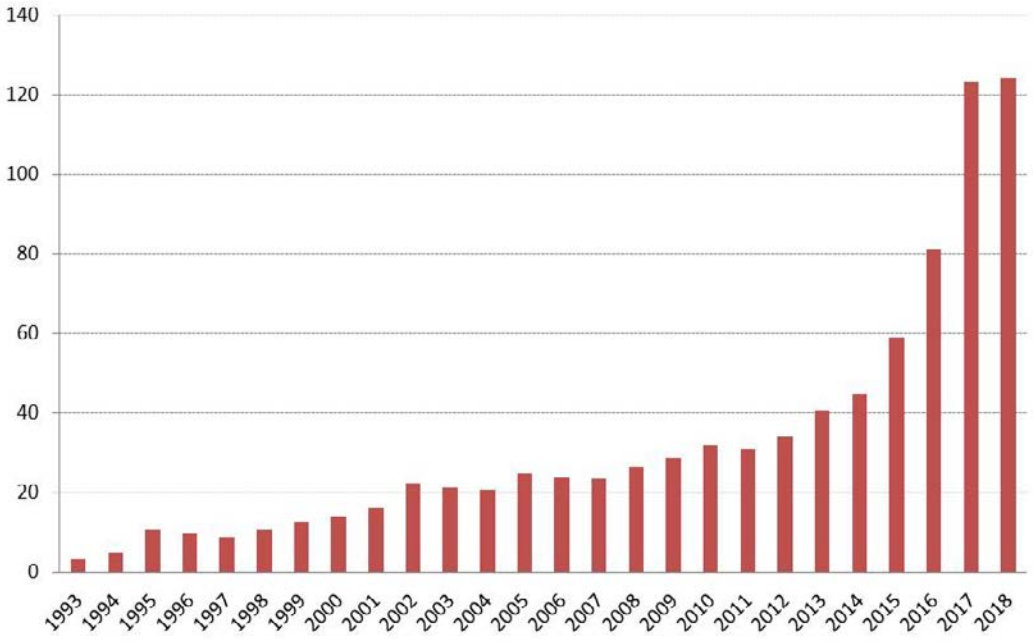
Keywords: Czech National Bank, foreign exchange reserves, foreign exchange reserve management

[1] Marek Mora, Deputy Governor, Czech National Bank, Na prikope 28, 115 01 Prague 1, e-mail: marek.mora@cnb.cz.
Jan Schmidt, Executive Director, Risk Management and Transactions Support Department, Czech National Bank, Na prikope 28, 115 01 Prague 1, e-mail: jan.schmidt@cnb.cz.

1. Introduction

Foreign exchange reserves are the foreign currency financial assets owned by the Czech National Bank (CNB). They can be either purchased (in which their liability-side counter-items are Czech koruna liabilities) or borrowed (in which their liability-side counter-items are foreign currency liabilities). Almost all of the CNB's reserves are purchased. The purchases take two main forms – purchases of foreign currency from clients having the right to trade with the CNB (mostly government institutions) and purchases from commercial banks during interventions to affect the koruna exchange rate. The CNB decides on intervention purchases, whereas client purchases are independent of the CNB. At the end of December 2018, the CNB owned reserves totalling EUR 124 billion (see Chart 1). The reserves have increased sharply in size several times since the independent Czech Republic was established in 1993. The biggest-ever increases relate to intervention purchases made in 2013 and 2015–2017 and to the privatisation of banks and state-owned enterprises around 2000 and in the mid-1990s. The inflow of euros from purchases from CNB clients, of which subsidies from EU funds are the most significant, is substantial and evenly spread over time. The FX reserves have been increasing by EUR 2 billion a year on average in this way.

The CNB's FX reserves (in EUR billions, end of period) Chart 1



Source: CNB

2. What are FX reserves used for?

FX reserves perform a range of important functions. They are used primarily to fulfil the monetary policy objective of price stability. They can be used to affect the exchange rate of domestic currency and thereby tighten or ease monetary conditions.

Examples include interventions whereby the central bank prevents the currency from weakening or strengthening. The second important role of the reserves is as a source of foreign currency liquidity for payments made by the central bank's clients. If, for example, a client possesses a sufficient amount of korunas, the CNB guarantees to make an equivalent foreign currency payment. No less important is the function of maintaining and supporting financial stability. During a financial crisis, Czech banks can hypothetically experience a shortage of foreign currency. The CNB is prepared to make up for this shortage by providing foreign currency loans against collateral. After the 2008 global financial crisis, the size of FX reserves started to be used as an input for assessing countries' creditworthiness. For example, a country with relatively low FX reserves may be identified as being prone to problems. As financial assets, reserves are also a source of revenue for the central bank.

Table 1 shows the returns on the CNB's FX reserves over the past 10 years, calculated as volume-weighted averages of the returns on the individual currency portfolios. They are not the koruna returns that enter the CNB's net profit or loss and are hence affected by the koruna's exchange rate against the reserve currencies (appreciation of the koruna generates accounting losses). The downward trend in the total return after 2012 is related to a drop in interest rates abroad.

Total returns on FX reserves in % (net of valuation changes) Table 1

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Return	5.72	7.17	3.72	2.48	1.94	2.96	2.04	1.69	1.1	1.01	1.13	-0.40

3. Investment rules and risks

FX reserves are invested on foreign markets. Given the two-sided nature of the trading relationship with foreign counterparties, the CNB does not disclose information on specific transactions. Investments can be characterised using parameters that define the return and risk profiles of the reserves. The main risks include: (i) exchange rate risk, where the value of an investment changes due to changes in exchange rates; (ii) interest rate risk, where the value of an investment changes due to changes in interest rates; (iii) credit risk, where the value of an investment changes due to changes in the debtor's creditworthiness; and (vi) market risk, i.e. the risk of changes in share and gold prices. In addition to these main risks, liquidity risk, settlement risk and operational risk are monitored.

The CNB invests its FX reserves in accordance with strategic asset allocation (SAA). SAA consists of a set of instructions and rules. It primarily involves setting limits on each type of risk. For exchange rate risk, SAA defines the reserve currencies in which the reserves are invested and their representation in the total reserve volume. In the case of interest rate risk, the maximum duration is set. This is a coefficient determining the change in the price of a bond given a particular change in market interest rates. For credit risk, a minimum debtor rating and other restrictions regarding the risk of the counterparty to the transaction going bankrupt are set. The restrictions include, for example, an obligation for each creditor position to be backed by financial collateral.

It is crucial that SAA is not used for speculating on future market conditions. The aim of SAA is not to predict the future, but to build up a portfolio of currencies and financial instruments with stable returns and resilience to risks at the long-term investment horizon. When formulating SAA, there is therefore no room for considerations such as "the dollar will weaken, the euro will strengthen, share prices will rise and bond prices will fall". The only exception is the treatment of credit risk. Whereas SAA defines a minimum acceptable rating (an assessment of debtors' ability to meet their obligations), the future outlook is taken into account when setting limits for specific debtors. For example, if there is a risk of a debtor's rating being downgraded, the limit for that debtor is lowered commensurately in good time.

There is one more important fact linked with SAA. Regardless of any stimulus SAA might respond to, such as changes in the function or size of FX reserves or changes in monetary policy, the CNB always invests the reserves with professional care. This is its statutory duty when handling its assets, which include FX reserves. Professional care means that the central bank always acts so as to prevent damage and loss while simultaneously managing its financial assets in a manner that generates an adequate return. Return is always connected with risk. An adequate return can only be achieved if non-zero risk is accepted. The bank therefore proceeds in such a way as to be capable of performing its core functions regardless of the situation on financial markets and to minimise the risk of irreversible loss from trading in financial markets, even at the cost of a lower return. This means that some financial market investments may temporarily lose value in the course of their lifetime. A typical example is a fall in bond prices. The CNB seeks to minimise the risk of any investments being written off forever, while a temporary decline in bond prices due to a rise in interest rates is an acceptable risk.

The FX reserves are used to form independent portfolios denominated in the euro, the US dollar, the Canadian dollar, the Australian dollar, the Swedish krona, the British pound and the Japanese yen. The choice of these reserve currencies is derived from their fundamental properties. These include the credibility of the country, free convertibility of the currency, the size and liquidity of the government bond market, free access to the market, barrier-free repatriation of earnings and a functioning infrastructure such as securities safekeeping, banking services and enforceability of secured creditor protection in the event of insolvency. The Swiss franc and the Danish krone are also used to take advantage of short-term market opportunities to generate higher interest income.

Currencies themselves are not investments. Investment instruments, the selection of which is closely tied to credit risk, can be regarded as investments. Credit risk is managed on three levels. The first level is the choice of the general class of assets, such as government bonds, agency bonds, bank bonds, corporate bonds, supranational bonds, shares and commodities (gold is the only commodity in the CNB's FX reserves).[2] The second level is the treatment of the credit risk of specific issuers – bonds issued by Germany and the United States, for example, are selected. The third level is credit policy towards counterparties to transactions. Counterparties – mostly banks entering into transactions with the CNB – are obliged to meet various

[2] At the end of December 2018, the CNB held 8.8 tonnes of gold which was 0.3 % of the reserves. With respect to currently high FX reserves (see Chart 1), the CNB assessed during 2018 the possibility of increasing its gold holdings in the reserves. Due to high volatility of gold prices and the limited role of gold for diversification purposes, the CNB decided to keep its gold holdings at the current level. Slight decreases in CNB's gold holdings are due to the production of commemorative coins.

financial obligations arising from these transactions, such as supplying cash or securities and pledging collateral. Consequently, these counterparties may also cause the CNB to incur a loss if they go bankrupt. At the central bank, all these levels are addressed by limits assigned to both debtors (securities issuers) and counterparties. The CNB does not disclose the specific limits. However, there are minimum requirements expressed in terms of ratings.

Persons authorised to trade on the financial market (portfolio managers) implement SAA by buying specific financial products, such as bonds, shares and derivatives, on the market. If, under SAA, the maximum portfolio duration is limited, say, to five years and the permitted products are government bonds in a given currency, it is up to the portfolio manager to form a portfolio from the dozens to hundreds of government bonds with an average duration of five years available on the market. Such a portfolio mostly contains bonds (a few dozen of them, depending on the size of the portfolio and the size of the market) with maturities of between one and 30 years in volumes that ensure compliance with the limit on interest rate risk, i.e. duration in this case. The portfolio managers are allowed to deviate from SAA within permitted limits. This is known as tactical asset allocation. The managers use slight deviations to at least partly incorporate their own speculation on future market developments into the investments. Unlike strategic allocation, tactical asset allocation involves elements such as predictions of future prices, expectations of short-term market changes and the use of market dysfunction.

4. Changes in FX reserve management since 2017

On 6 April 2017, the CNB discontinued the exchange rate commitment it had introduced in November 2013 as an additional instrument for easing monetary policy in a situation where the Czech economy had been in danger of slipping into deflation. The reserves had recorded extraordinary growth as a result of the FX interventions undertaken to defend the exchange rate commitment. Since the exit from the commitment, the central bank has had far more money than it needs for FX reserves to perform their functions and for it to meet its potential obligations. The logical consequence is for it to extend the investment horizon in order to increase the expected investment return. Moreover, the CNB's reserves are now so high that excessive concentration on individual asset classes is becoming an important factor in addition to the return. The CNB does not specialise in specific investment opportunities but seeks to build a diversified portfolio of financial instruments. High concentration is a risk, so the central bank applies maximum exposure limits in individual financial market segments so it does not become a dominant investor on any given market. The size of the reserves and the need to diversify them led the CNB to adopt several important changes in the management of its FX reserves in 2017.

The first change is an extension of the investment horizon. A longer investment horizon is generally linked with a higher expected return, lower investment liquidity and higher risk, reflected, in turn, in greater volatility in the short-term return. For the reserves to continue to perform their function, they had to be divided into two parts – a liquidity tranche and an investment tranche. The liquidity tranche is used for the potential immediate mobilisation of FX funds for monetary policy purposes, while the investment tranche is used for long-term investment. The IMF reserve adequacy measure (IMF 2011, 2013, 2015, 2016) was used to estimate the appropriate size of

the reserves in the liquidity tranche. The CNB put all its euro and US dollar investments maturing in less than one year into the liquidity tranche. The other investments form part of the investment tranche.

Further changes have ensued from the extension of the investment horizon and the division of the reserves into tranches, specifically an increase in interest rate risk and the introduction of new asset classes. The higher interest rate risk is connected with purchases of bonds with longer maturities. This is due to the positive slope of the yield curve; the longer bond maturity and, hence, the higher interest rate risk, is balanced by a higher expected return. The new asset classes contain covered bonds in the European Union and agency-guaranteed mortgage-backed securities (MBSs) in the United States. They were included in the investment tranche for two reasons. First, the CNB regards them as a safe investment and, second, they yield higher returns. However, their liquidity is lower than that of government bonds.

The final change in FX reserve management since 2017 is an increase in the share of US dollars. As interventions and client transactions are both conducted solely in euros, the shares of other currencies are shrinking significantly. The US dollar is meanwhile regarded as the most commonly used reserve currency, and the market for dollar assets is simultaneously the largest and most liquid. Despite the greater volatility of the USD/EUR exchange rate and, hence, the greater volatility in the valuation changes affecting the CNB's net profit or loss, diversifying into the US dollar and reducing concentration on the euro is a necessary change for the pursuit of independent monetary policy from a long-term perspective. The arguments in favour of this change in management also include the current ambiguity regarding the Czech Republic's compliance with the commitment to adopt the euro and the traditionally higher nominal interest rates in the United States.

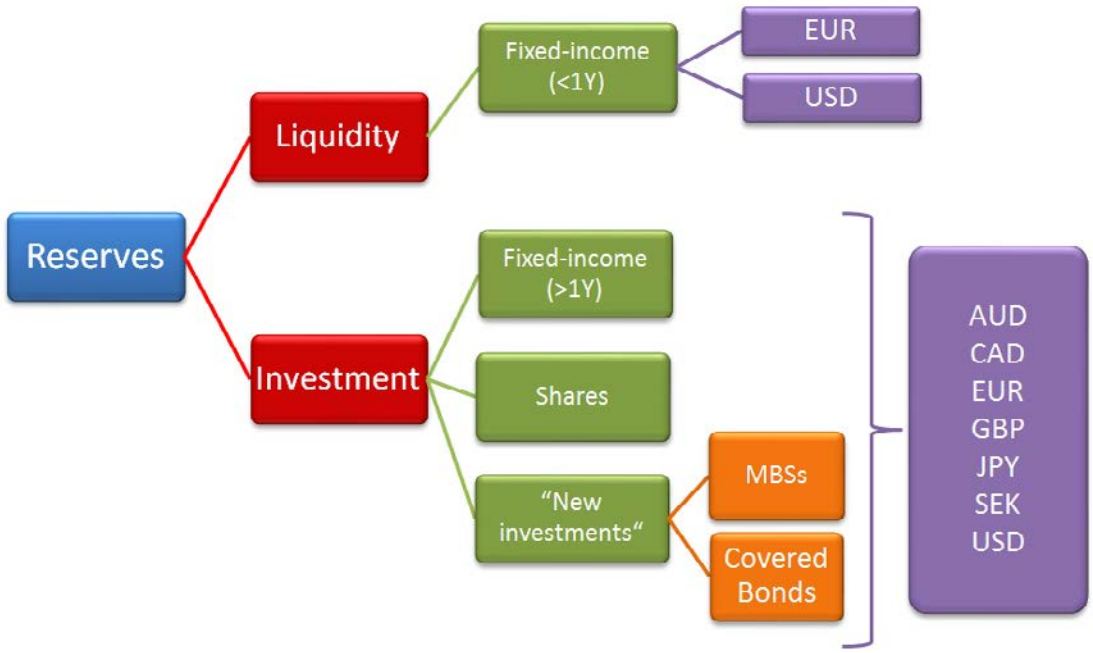
After the changes introduced in 2017, the CNB's FX reserves have the structure depicted in Chart 2. The changes should ensure a higher return in the longer term. For this reason, the total return may, for a short time, display greater volatility than that shown in Table 1. This is because the longer investment horizon is connected with higher short-term volatility of prices of the financial instruments used in reserve management. Short-term, one-off capital losses may occur in the period when the main central banks end their accommodative monetary policy regimes and interest rates go up. These losses will be gradually offset by higher interest income spread over time.

Exchange rate appreciation is reducing the koruna value of the foreign currency assets in the CNB's balance sheet. This cannot be prevented in any way. However, the koruna's pace of appreciation is likely to slow significantly in the future. In such case, the returns on the FX reserves can be expected not only to start reducing the initial accounting losses, but also to generate a profit over time. Despite this link between the koruna exchange rate and the FX management results, it is important to repeat that the purpose of the changes made to the structure of the FX reserves in 2017 was not to look for a way to reduce exchange rate losses. FX management is independent of both the current and expected exchange rate path and the domestic monetary conditions.

On top of the changes in the CNB's FX reserve management introduced in 2017, the CNB assessed in 2018 the possibility of using the Chinese renminbi as an additional reserve currency. Investments into Chinese assets have several advantages, such as a scope for diversification and higher returns. The advantages are corroborated by the continuing internationalisation of the renminbi. On the other

hand, investments into Chinese asset classes are specific as the market represents a different and so far little explored legal system. Based on this assessment, the CNB started exploratory and preparatory steps to make itself ready for potential future decisions to launch a portfolio denominated in renminbi.

Structure of the CNB's reserves after the changes adopted in 2017 Chart 2



5. Summary

The CNB's FX reserves, like those of other central banks, perform a number of important functions. They are used mainly to support the conduct of monetary policy, a function fulfilled by the liquidity tranche since 2017. The CNB manages the FX reserves with professional care. It regularly publishes its FX management results in its Annual Report. More detailed information is given in two other annual publications – the Financial Statements and the Financial Report. They can be found on the CNB website at www.cnb.cz/en/about_cnb/performance/.

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Foreign exchange market operations and reserve management: the recent experience of Hong Kong

Hong Kong Monetary Authority

Abstract

This note reviews the recent experience of the Hong Kong Monetary Authority's foreign exchange market operations and illustrates why such operations are a passive and mechanical process under the currency board arrangement. This note also discusses whether Hong Kong is well prepared for capital outflows following massive inflows that began in 2008, and concludes by discussing the rationale of the Hong Kong Monetary Authority's reserve management.

JEL classification: E52, E58, N1

Keywords: linked exchange rate system, convertibility undertaking, exchange rate system credibility, reserve management

1. Introduction

Since the Linked Exchange Rate System (LERS) has been in operation since 1983, it has undergone two major refinements, namely the "seven technical measures"[1] and "three refinements"[2]. The latter has brought the Hong Kong dollar exchange rate regime into a narrow-band target zone with a currency board arrangement. Through these changes, the system has evolved into a simple and rules-based system with a high degree of credibility and transparency. Given that the LERS has experienced both capital inflows and outflows since 2008, this note investigates how the rules-based mechanism of LERS works under such capital flows and whether Hong Kong is well prepared for capital outflows. This note finishes by discussing the Hong Kong Monetary Authority (HKMA)'s approach in reserve management.

2. Overview of the current system and recent LERS operation

2.1 Overview of the system

The Currency Board in Hong Kong requires the monetary base (MB) to be fully backed by foreign currency reserves.[3] This means that any changes in the MB are fully matched by corresponding changes in foreign reserves at a fixed exchange rate. In fact, the MB has historically been more than fully covered by the reserve assets (Graph 1). This greater than 100% reserve backing represents a powerful insurance for the HKMA's ability to defend the LERS, significantly enhancing the system's credibility.

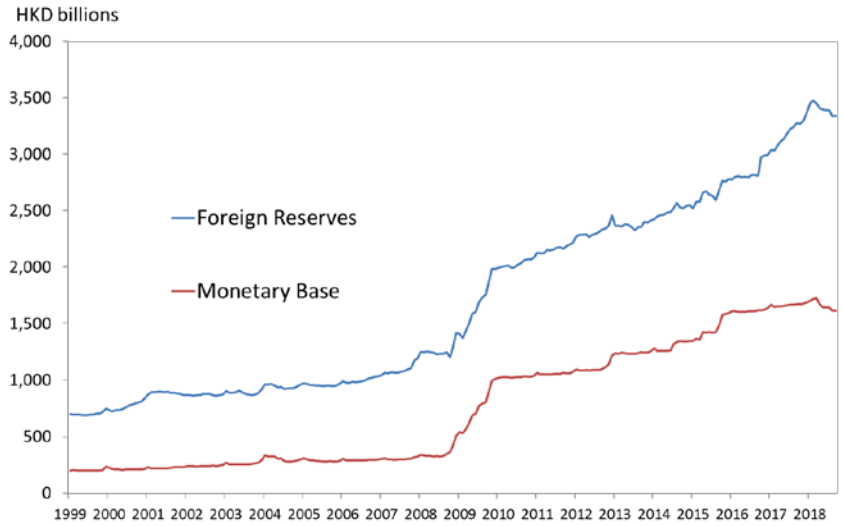
Under the LERS, interventions in the currency market are a mechanical and passive process of the HKMA. When there are capital inflows (or outflows) in Hong Kong, causing the exchange rate to rise (or fall) to the extent that it touches the boundaries of the Convertibility Zone, the Convertibility Undertakings (CUs) are triggered. Upon requests from banks, the HKMA would undertake to buy US dollars from licensed banks at HK$7.75 to US$1 (under strong-side CUs) and sell US dollars at HK$7.85 to US$1 (under weak-side CUs). The CUs are available to all licensed banks in Hong Kong, including their overseas offices outside Hong Kong. The HKMA offices in Hong Kong and New York jointly provide 24-hour coverage of the CUs. These interventions cause the MB to expand (or contract), putting downward (or upward) pressure on interbank interest rates, which in turn counteract the original capital flows to ensure that the exchange rate remains stable. In other words, it is interest rates, rather than the exchange rate, that adjust to capital inflows and outflows in Hong Kong under the LERS.

[1] See Hong Kong Monetary Authority (1998) for details.

[2] See Hong Kong Monetary Authority (2005) for details.

[3] The MB consists of certificates of indebtedness, notes and coins in circulation, the aggregate balance of the banking system in Hong Kong, and outstanding Exchange Fund Bills and Notes (EFBNs).

Foreign reserve assets of the HKMA and MB in Hong Kong Graph 1



Source: HKMA

2.2 LERS operation and triggering of strong-side CUs during late 2008–2015

Graphs 2 and 3 illustrate the HKD exchange rate, HIBOR-LIBOR spreads, MB and the aggregate balance (AB) of the Hong Kong banking system. As both HKD and USD interest rates approached the zero lower bound after the Global Financial Crisis (GFC), their negative interest rate differentials narrowed considerably, which diminished the carry trade activities and were unable to provide a counteracting force against the strong demand for the HK dollar. As a result, the HKD exchange rate strengthened considerably, with repeated triggering of the strong-side CUs from late 2008 until 2015. These continuous inflows amounted to US$130 billion or HK$1 trillion and can be attributed to our stable banking system and positive outlook.

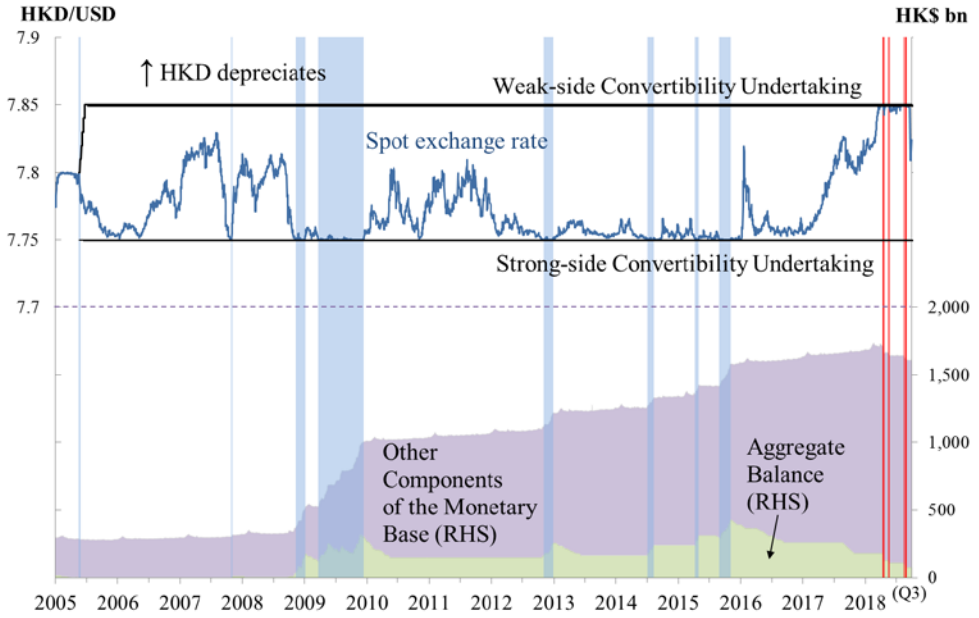
2.3 LERS operations during US rate hikes and triggering of weak-side CUs

Following the United States' rate hike in December 2015, the spread between the HKD and USD interest rates began to widen, but not large enough to induce sufficient carry trades to exert downward pressure on the HKD exchange rate.[4] After pausing for a year, the Fed brought rate hikes back on track in December 2016 and raised its policy target to 2%–2.25% as of September 2018. The sufficiently large enough negative interest rate differential eventually attracted more selling HKD pressure from carry trades, which counteracted the demand for the HK dollar induced by equity related fund inflows and gradually pushed the exchange rate towards HK$7.85. The weak-side CU was triggered on 12 April 2018 for the first time since it was set at this level in May 2005.

[4] The sharp movement from HK$7.75 towards HK$7.8 in January 2016 in Graph 2 was mainly due to the short-term turmoil in emerging market exchange rate markets.

HKD spot exchange rate, MB and AB

Graph 2

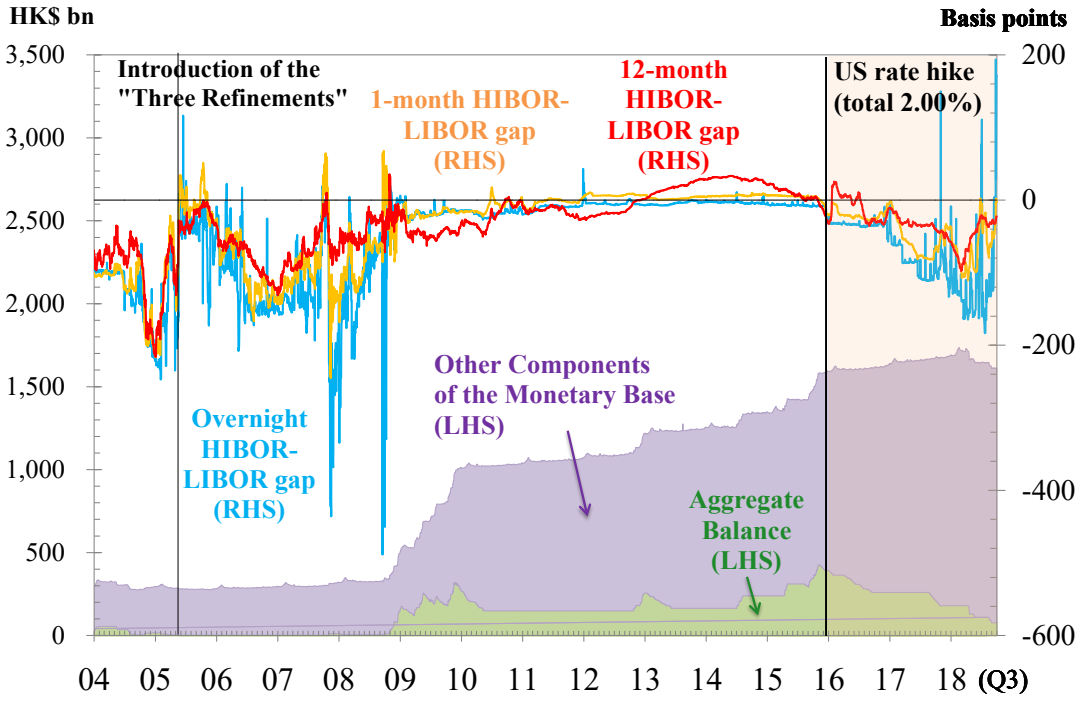


Note: Blue- and red-shaded lines in the chart represent the triggering of the strong and weak-side CUs respectively.

Source: HKMA.

HIBOR-LIBOR spreads, MB and AB

Graph 3



Sources: Bloomberg and HKMA.

With the weak-side CUs triggered repeatedly in April, May and August 2018, the HKMA purchased a total of HK$103.5 billion from the market. The AB subsequently reduced to HK$76.6 billion, which created a more conducive environment for HKD interest rate normalisation. As HKD interest rates increase, the negative interest rate spreads narrow, which slows down capital outflows and maintains the HKD exchange rate stability within the band. The HKD foreign exchange and money markets continued to function smoothly and in an orderly manner throughout the weak-side CU operations, which have been effective in maintaining the stability of the HK dollar.

3. Is Hong Kong well prepared for outflows?

Under the currency board system, the entire MB is backed by USD liquid assets; the HKMA is fully capable of meeting the CU requests and maintaining the stability of the HKD exchange rate. It is worth noting that the cumulative outflow of HK$103.5 billion since the first triggering of weak-side CU in April 2018 only represents around 10% of the total inflows of HK$1 trillion recorded since 2008. Moreover, it is expected that the kind of financial stress that Hong Kong experienced during the Asian financial crisis in 1997/98 is unlikely to repeat for the following reasons:

- **The resilience of Hong Kong's monetary system has greatly enhanced:** prior to the enhancements in 1998, our MB was comprised of only currency in circulation and the AB, which was relatively small and volatile, meaning domestic interest rates were more sensitive to fund flows. With the inclusion of the Exchange Fund Bills and Notes (EFBNs) in the MB in 1998 and the substantial inflows in the last few years, our MB now stands at over HK$1.6 trillion even after the last round of outflows. This is almost eight times larger than the level in 1998. It is now much harder to attack the peg through spiking HKD interest rates by shorting the HK dollar**.**
- **Strong financial buffers:** at end-October 2018, Hong Kong's foreign currency reserve assets amounted to over US$423 billion, representing about seven times the currency in circulation and twice the size of our MB, one of the highest levels internationally. Banks in Hong Kong are also well-capitalised, with the average capital adequacy ratio at 19.4% in June 2018, a very high level by international standards. These banks also held more than HK$4 trillion in highly liquid assets (over HK$3 trillion being foreign currency assets). These assets serve as a strong buffer during extreme cases of significant fund outflows within short periods of time. In addition, banks hold a sizeable amount – about HK$1 trillion – of EFBNs. When liquidity tightens, banks can use EFBNs to obtain HKD liquidity via the discount window. The HKMA also conducts stress tests on banks regularly to ensure they are capable of meeting such scenarios.
- **Strengthened market surveillance:** the HKMA continuously strengthens its surveillance efforts in view of changing market structure and developments. Based on our cross-market surveillance work, including in cooperation with the Securities and Futures Commission on the stock market, the HKMA does not see notable speculative positions on the HK dollar nor "double play" activities such as that Hong Kong experienced in 1997/98 (ie manipulation and profiteering in the money market and stock market through massive short-selling of the HK dollar and stock market).

- **High transparency of LERS operation**: Monetary operations under the LERS are carried out with a high degree of transparency. The HKMA makes constant efforts to educate the public about the system and provides market participants with relevant information about the rules governing its operation. Market operations conducted by the HKMA are announced immediately, with relevant data published daily. The HKMA also releases the meeting minutes of the Currency Board Governing Committee. Currency Board Account data and other relevant statistics are also published every month. This high degree of transparency gives the market confidence in the HKMA's operation and enhances the credibility of the system.

While it is understandable that people tend to feel more positive about fund inflows but a bit uneasy when it comes to outflows, it is important to note that Hong Kong is a fully open economy and financial hub with free capital movement. The HKD exchange rate may strengthen or weaken because of capital inflows or outflows. What really matters is the orderly operation of the LERS as designed, so that the HKD exchange rate remains within the range of HK$7.75 to HK$7.85 against the US dollar, thus maintaining market confidence in the robustness of the monetary and financial systems of Hong Kong.

4. A glimpse into the HKMA's foreign reserves management

In conducting the LERS operation through the CUs, the foreign reserves in Hong Kong will adjust with the corresponding changes in the MB. Meanwhile, the HKMA also accepts placements by fiscal reserves, government funds and statutory bodies from time to time. The HKMA, under the delegated authority of the Financial Secretary, manages the foreign reserves through the Exchange Fund. The Fund's statutory role, as defined in the Exchange Fund Ordinance (Chapter 66 of the Laws of Hong Kong), is primarily to affect, either directly or indirectly, the exchange value of the currency of Hong Kong. Its functions were extended with the enactment of the Exchange Fund (Amendment) Ordinance 1992 by introducing a secondary and subsidiary role of maintaining the stability and integrity of Hong Kong's monetary and financial systems, with a view to maintaining Hong Kong as an international financial centre.

To meet the objectives of preserving capital, providing liquidity to maintain financial and currency stability and generating an adequate long-term return, the Fund is managed as two distinct portfolios: (i) the Backing Portfolio ensures that the MB is fully backed by highly liquid US dollar-denominated securities, while (ii) the Investment Portfolio preserves the fund's value for future generations in Hong Kong.

It is noteworthy that the Fund is not a sovereign wealth fund or an ordinary investment fund, nor is it a hedge fund. As opposed to short-term trading, the Fund adopts a prudent asset allocation aimed at relatively stable medium- and long-term returns. Of the Funds' liabilities, over HK$1.3 trillion constitutes the MB and about HK$1 trillion belongs to fiscal reserves of the government and placements by various government and public funds. It is therefore imperative for the Fund to maintain sufficient liquidity to support the exchange value of the HK dollar by selling the US dollar when there are fund outflows, and to meet the cash needs of the government for public expenditure through the withdrawal of fiscal reserves. More importantly,

we must have a robust armoury in terms of reserves to fend off unforeseeable shocks and attacks so as to maintain the financial stability of Hong Kong. Therefore, capital preservation and a high degree of liquidity are crucial. Because of these considerations, a substantial part of the Fund is invested in safe and highly liquid assets such as the US Treasury securities. Bonds and cash currently account for about 80% of the Fund's assets. The remaining 20% mainly consists of equities and, since 2009, a small portfolio called the Long-Term Growth Portfolio (LTGP) started investing in private equity and real estate investments. These investments had low return correlation with the conventional asset classes such as bonds and equities.[5] This helps spread risks and enhance the Fund's overall medium- and long-term returns. In addition to private equity and real estate, LTGP also started investing in infrastructure projects to broaden the spectrum of asset classes.[6]

5. Conclusion

The LERS has been the anchor of Hong Kong's monetary and financial stability for more than 30 years. It has stood the test of two major financial crises and it continues to function smoothly as a rules-based system with a high degree of transparency and credibility. The foreign exchange intervention through the CUs is passive in nature as it is upon the requests of licensed banks in Hong Kong, including their oversea offices. The resultant changes to the MB are automatically matched by changes in the foreign reserve assets.

To maintain the currency stability, the LERS inevitably requires a significant portion of Hong Kong's foreign reserves to invest in highly liquid US dollar-denominated securities. Although the Exchange Fund also carries the mandate of preserving the fund's value, which allows a more diversified approach in its investment portfolio, it is important to stress the investment principle of the Fund, which is "Capital Preservation First, Long-Term Growth Next". While remaining prudent, the HKMA will also be flexible and proactive in managing the Fund with a view to achieving a better long-term return.

[5] The cap for the market value of investments under the LTGP is set at one third of the accumulated surplus of the Exchange Fund, with further capacity arising from the allocation of part of the Future Fund to long-term assets. For a more detailed description of the LTGP, see Yue (2015a, 2015b).

[6] The typical investment profile of infrastructure projects is relatively stable cash flows with low loss ratios. The returns are less affected by economic cycles and have lower correlation with those of traditional assets. See Yue (2017, 2018) for an explanation as to why infrastructure investment is an attractive asset class for the Exchange Fund and a more detailed analysis on the risks and returns of infrastructure projects.

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The new conceptual risk budget framework and implementation of the new FX reserves investment strategy at the Central Bank of Hungary

By Márton Nagy, Éva Paulik, Norbert Kiss M., Péter Vereszki-Varga and Sándor Ladányi[1]

Abstract

Reserve portfolios prior to the Global Financial Crisis provided positive (low) returns for central banks or had extremely low probabilities of earning negative returns. In the wake of the crisis, expansionary monetary policy created a low yield environment at a scale that was never seen before. Central banks like the Central Bank of Hungary (MNB)[2] had to make a decision: either continue reserve management based on the traditional approach or increase their risk tolerance for higher yields. The Bank decided to embrace a new approach, i.e. put in place a risk budget framework in reserve management. This framework aims to find the optimal strategic asset allocation of the institution based on the risk appetite and capacity of the Bank and to prudently keep the risk of the portfolio within the predefined levels. In practice, the risk budget is a risk measure expressed in nominal terms that cannot be exceeded by the portfolio. This paper presents the implementation process of the MNB's risk budget framework, including the determination of the risk budget size and the new strategic asset allocation.

JEL classification: E58, F31, F32, F33, G11

Keywords: risk budget, risk management, expected shortfall, international reserves, strategic asset allocation, reserve adequacy

[1] Márton Nagy (nagymar@mnb.hu) is the Deputy Governor of the Central Bank of Hungary (Magyar Nemzeti Bank). Éva Paulik (paulike@mnb.hu), Norbert Kiss M. (kissn@mnb.hu), Sándor Ladányi (ladanyis@mnb.hu) and Péter Vereszki-Varga (vereszkip@mnb.hu) are, respectively, Analyst, Head of Department and Senior Risk Managers at the Directorate Monetary Policy Instruments, FX Reserves and Risk Management of the MNB). The views expressed are those of the authors and do not necessarily reflect the official view of the MNB."

[2] MNB – Magyar Nemzeti Bank i.e. the Central Bank of Hungary

1. Motivation behind the changes

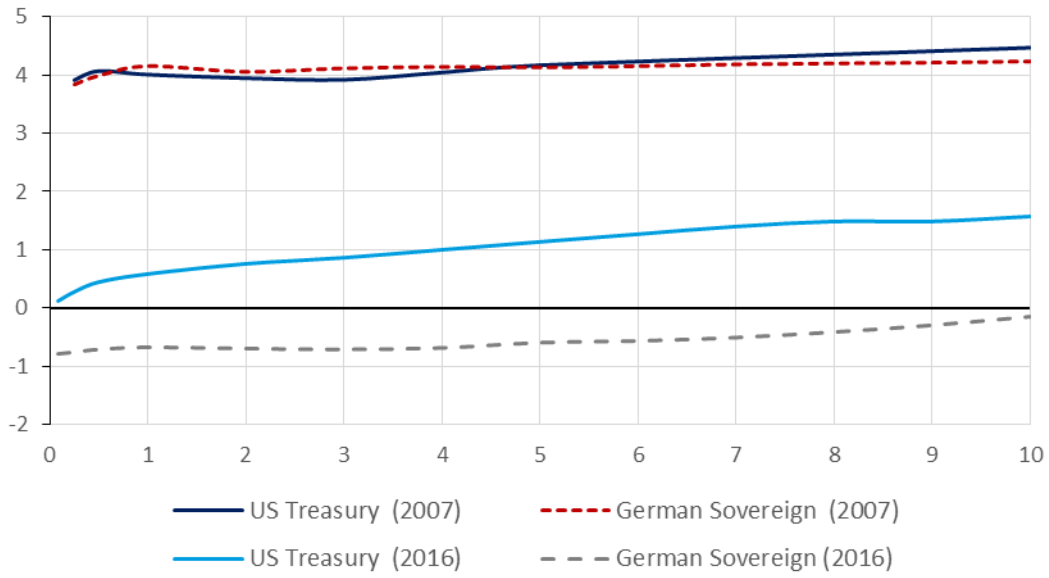
1.1 Traditional pre-crisis approach of safety-liquidity-return

Reserve management in the traditional sense is characterised by a safety-liquidity-return approach best expressed in the IMF guidelines for foreign exchange reserve management.

The first aspect of reserve management – i.e. safety – seeks to ensure that (i) the reserve portfolio is made up of high-quality assets with low volatility, (ii) risks are prudently controlled and (iii) the central bank faces very low probability of negative return. The purpose of the second aspect – the liquidity requirement – is to ensure that reserve assets can be converted into a major currency (for intervention, liquidity needs or other purposes) when they are most needed, while also avoiding significant financial losses. The final aspect – generating a reasonable return on the reserve portfolio over the medium to long term – is sought after provided that priority is given to the first two requirements.

This trade-off between the safety-liquidity pair and investment return usually results in a conservative asset allocation containing safe but lower yielding financial assets. The job of finding a balance, which is considered more of an art than a science by some, was more feasible prior to the Global Financial Crises (GFC) of 2007–08, given the higher (and positive) yields available on high-quality instruments (Graph 1).

Yield curves before and after the GFC — Graph 1



In general, reserve portfolios before 2007 provided moderate positive returns for central banks or had extremely low probabilities of earning negative returns. The return distribution of the reserve portfolio was characterised by an expected value located in the positive territory, low standard deviation and low probability of extreme values.

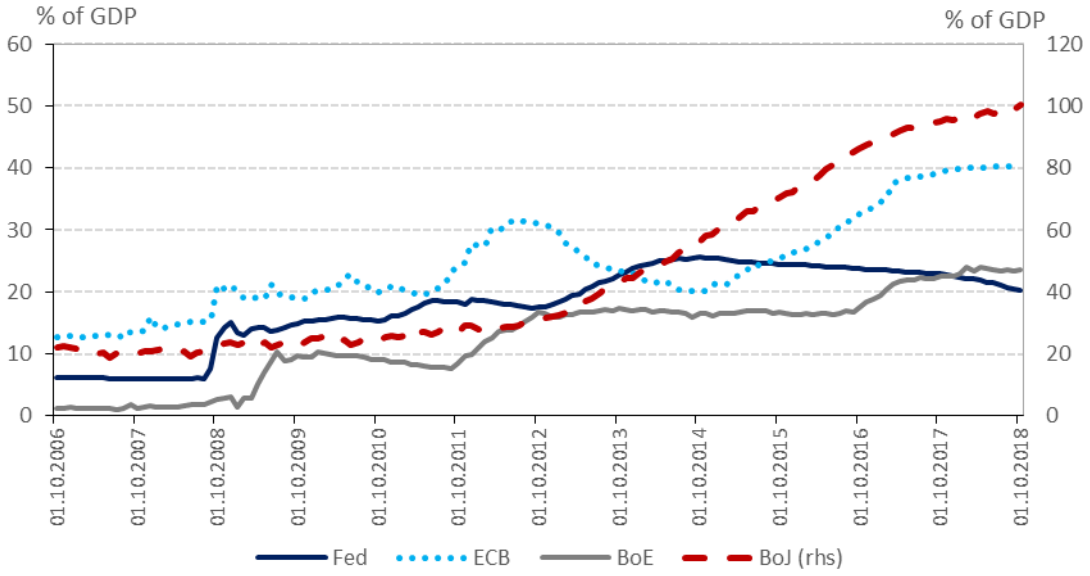
1.2 Changes in the market environment regarding safety, liquidity and return since 2008

In the wake of the GFC, central banks initially used conventional monetary policy tools to stimulate their economies, however lowering interest rates close to zero (or even lower) between 2008 and 2010 had limited effects.

Sustained weak economic activity and high unemployment rates forced central banks to turn to unconventional monetary policies. Quantitative easing and asset purchase programmes implemented after 2010 by major central banks – i.e. the Fed, European Central Bank (ECB), Bank of England (BoE) and Bank of Japan (BoJ) – had unintended, negative consequences for central banks in emerging market economies (EMEs). Due to the rapid growth of the major central banks' balance sheets, reserve managers of EMEs faced the challenge of a shrinking investment universe (Graph 2). Reserve managers were forced up the risk curve as the so-called portfolio rebalancing effect impacted not only the private sector but also smaller central banks. Furthermore, combining these asset purchase programmes with the different kinds of regulations imposed after the crises resulted in a declining market liquidity.

All things considered, expansionary monetary policy created a low yield environment at a scale never seen before.

Balance sheet growth of major central banks — Graph 2



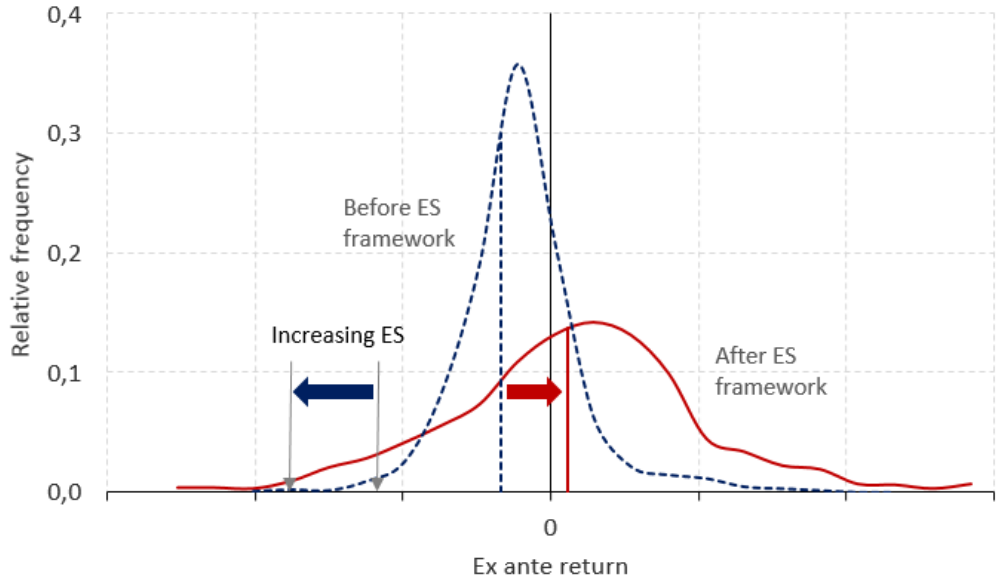
1.3 Rethinking the traditional FX reserves asset allocation concept

In this new market environment, the traditional safety–liquidity–return concept had to be reconsidered by central banks. Worsening liquidity and low or even negative yields on conventional reserve assets paved the way for new asset classes and markets. Regarding the safety aspect, expected returns on the reserve portfolios had turned into negative territory for many central banks. As a consequence, capital preservation has since become a paramount concern, especially for central banks heavily invested in the euro zone government bond market.

As negative expected return threatened the preservation of capital, the importance of avoiding certain or highly probable negative return increased, especially compared to the importance of strictly focusing on limiting extreme losses on the portfolio.

Naturally, increasing the expected return to positive levels requires higher risk-taking from the central bank. In this trade-off, higher expected returns or, in other words, an increased first momentum (in the expected value) of the return distribution comes at a higher financial risk and a return distribution with a higher standard deviation, and increased kurtosis (Graph 3).

Hypothetical changes in the return distribution — Graph 3



Looking at long-term international trends, it is clear that as an immediate response to the GFC central banks narrowed the range of financial instruments they invested in, but this process has reversed in the era of permanent low yields. An argument could be made that central banks tend to have some level of procyclicality in their reserve management behaviour.

Central banks like the MNB had to make a decision: continue reserve management based on the traditional approach or increase their risk tolerance for higher yields, i.e. having a return distribution with a higher standard deviation, and increased kurtosis. Facing this trade-off, the MNB decided to embrace a new approach in reserve management. The decision was partly triggered by a special, unfavourable development. Though both the ex ante and ex post returns on the FX reserves were shrinking after the GFC, prior to 2015 they remained in positive territory. But as the front end of the relevant yield curves declined significantly below zero, the ex ante return became negative by 2016.

In order to control additional risk-taking, the MNB decided to implement a new risk budget framework for its reserve portfolio.

2. The MNB's risk budget framework

2.1 Different definitions of risk budgeting

Financial literature provides a couple of definitions related to risk budgeting and capital budgeting, e.g. Rahl (2000), Denault (2001), Tasche (2002), Kalkbrener (2005)[3]. Keeping in mind that finding a definition everybody agrees upon is not easy as the meaning varies throughout the financial world.

Over the past 65 years, most of the literature has focused on the allocation of funds from an asset class perspective, i.e. how the portfolio should be divided between different asset classes in order to maximise return. This approach is often referred to as the capital budgeting exercise.

Risk budgeting is different from capital budgeting in that it is concerned with how risk is distributed in the portfolio. Instead of asset classes, risk factors and risk measurement are at the core of the concept.

2.2 Risk budgeting at the MNB

Risk budgeting at the MNB aims to find the optimal strategic asset allocation of the institution based on the risk appetite and risk capacity of the bank, and to prudently keep the risk of the portfolio within the predefined levels. The risk budget seeks to ensure that risks are taken in a controlled and conscious manner.

In practice, the risk budget is a risk measure expressed in nominal terms that cannot be exceeded by the portfolio. This new reserve portfolio level limit is not meant to replace, but rather supplement the traditional limits already applied to reserve management.

During the strategic asset allocation process, a strategic benchmark is created representing the beta exposure wished to be taken by the MNB as an investor. Active management allows portfolio managers to deviate from this strategic benchmark when they deem to do so.

In reality, portfolio managers can under- or over-weight the different kinds of risk factors of the benchmark, creating active risk in the hope of outperforming the benchmark. Active portfolio management without the appropriate restrictions can significantly alter the risk characteristic and risk level of the portfolio from the strategic benchmark, therefore investors utilising active managers must take this aspect into account when setting the risk budget.

The most obvious solution is to set the risk level targeted with the strategic benchmark below the maximum risk limit. By doing so, the risk budget remains intact, but investors can provide as much leeway as they are comfortable with for active portfolio management.

[3] Denault, M. (2001): Coherent Allocation of Risk Capital, Journal of Risk 4(1), 1-34.

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3. Implementation of the risk budget framework

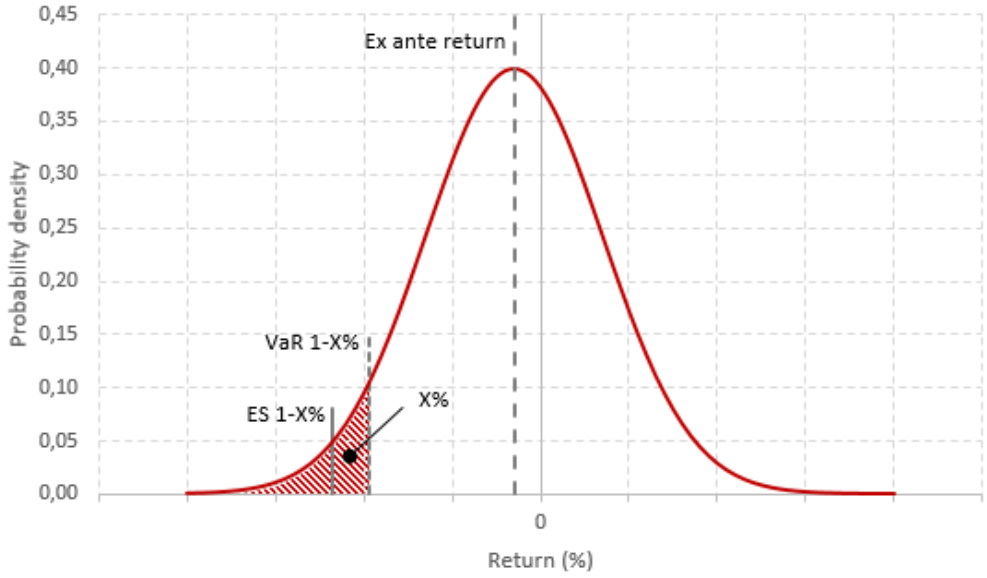
3.1 Defining and calculating the main risk measure

In the context of a low yield environment and the need for capital preservation, it was obvious that the traditional low level of market risks could not be maintained any longer. Potentially increasing market risks raised the need for an "umbrella tool" i.e. a higher-level risk control.

The first step for this kind of higher-level risk measurement and control was to find a risk measure. In our case, for reserve management the most relevant market risk factors are the currency and interest rate risks. These kinds of market risks can be measured by different tools like value-at-risk (VaR) or expected shortfall (ES), the latter of which is a coherent measure with more weight on the tails of the return distribution. We thus chose ES because of its tail sensitivity – in the sense of market risks – and not like a black swan event.

The definition of coherent refers to several desirable properties, both mathematical and intuitive. The VaR, in comparison, is not coherent and is indifferent to the shape of the risk distribution's tail.

Hypothetical VaR vs. ES — Graph 4



Once we chose ES as our risk measurement, it was necessary to decide on the calculation parameters. There are several ways to quantify ES, but our decision was mainly driven by the need for longer stability of the methodology.

There are several things to consider when specifying the model, as changing the model parameters can have a considerable effect on the ES value. Do we model the distribution of the returns or do we use a historical method? In the case of the latter how long history should the model use? What should be the time horizon of the returns? In which currency should we quantify the risks? Deciding on the parameters can be challenging. There is no one set of optimal parameters to use; it is up to the discretion of the user which one(s) to apply.

Increasing the confidence level of the ES calculation increases the value of the ES. At a 95 percent confidence level, the calculation will take into account the worst 5 percent possible outcomes in quantifying the losses, but at a 99 percent confidence level, the model uses the worst 1 percent of returns, where the model uncertainty is the highest due to the low amount of data. It is easy to see that using lower confidence level can create a false sense of security by underestimating potential losses, while applying an excessively high confidence level will result in an unreasonably restrictive risk budgeting process.

Selecting the appropriate lookback period for the historical model is not less of a challenge. If we calculate daily returns for a 10-year horizon, then we will have a rich data set with which to work. The downside of using longer periods is that the further we go back in time, the higher the chances the data loses its economic relevance and thus its predictive power. As the financial world is in a constant state of change, historical data can become obsolete and outdated in a couple of years, not to mention that disruptive periods during regime shifts can reshape the whole system. On the other hand, using short (and more recent) periods carry the risk of over-emphasising recent events and trends that carry very different characteristics from more common ones, and the model output can vary significantly. The user of the model has to decide which period will fit the expected investment environment the best.

The investment horizon is influenced by the top management's preferences, and the confidence level is somewhat arbitrary.

The MNB has a target value of ES and two upper bounds – a yellow flag and a red flag – controlling the overall market risk level of the reserve. In the case of a breach, the deputy governor in charge of reserve management (who oversees the yellow flag), and the Monetary Policy Committee (who oversee the red flag) have the responsibility and authority to decide how to act to reach the target level by decreasing the total market risk of the portfolio.

3.2 Defining the risk budget size

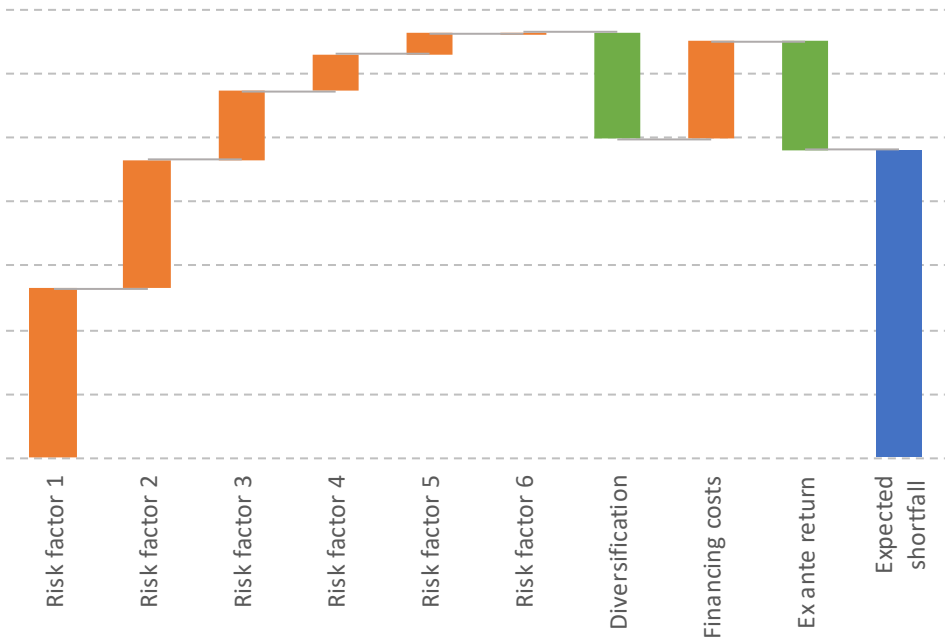
The determination of the budget size (i.e. the maximum tolerable loss at the given period) was based on a complex system taking into account four main considerations: (i) historical data; (ii) institutional constraints; (iii) scenario-analysis; and (iv) subjective elements.

First, we analysed the time series of the selected risk measure in the case of the reserve portfolio and decomposed the changes in the main ES number into its most relevant components, namely: portfolio size, market volatility, ex ante return and duration as probably the most decisive risk factor. That is to say, while analysing the historical data we controlled for internal (e.g. duration), partly internal (e.g. portfolio size) and external factors (e.g. volatility and ex ante return) separately.

Minimum/maximum values of the series served as good starting points for the boundaries of the budget size. In this way, we were able to evaluate the subsequent proposals in historical context. However, this method has its own limitations and it is useful to keep in mind that the same value of risk could imply considerably different interpretations under different market circumstances.

Second, we specified the institutional constraints by quantifying the risk-bearing capacity of the bank. In the process, we used heuristics related to the central bank's

ES decomposition (illustration) Graph 5



balance sheet. The most important measure was the effect of a potential loss to reserve adequacy. In addition, ratios such as potential loss to total FX reserves, to (elements of) equity (i.e. retained earnings, revaluation reserves and total), to total balance sheet were calculated. The downside of this approach was that the range based on balance sheet heuristics was still extensive.

Third, putting different budget sizes into contemporaneous context we used scenario-analysis. Using a "what if" approach, we created dozens (close to 100) of hypothetical portfolios and scenarios along the following dimensions:

- The usage rate of the limit system and potential ease-off: portfolios compatible with the current limits vs. portfolios created by moderate or strong easing of the limits.
- The return target: how can we achieve the goal of improving the return?
- Institutional factors: what room do we have for change, taking into account institutional constraints (e.g. balance sheet restrictions)?

Before the implementation of the ES framework and the new asset allocation, the FX reserve of the MNB was already well-diversified, safe and liquid. The MNB, just like many other central banks, is primarily an international bond investor. The bank managed its reserve in five currencies (in order of importance: EUR, USD, JPY, GBP and CNY) organised in a variety of portfolios. The strategic target duration of the reserve was around one year.

The euro risk-free portfolio represented the core of the reserve only containing highly rated government, government guaranteed, and supranational securities. The euro investment portfolio was the second largest portfolio, where high-quality corporate, financial, and covered bonds were eligible. The reserve portfolios were predominantly actively managed, except for the Japanese yen government portfolio

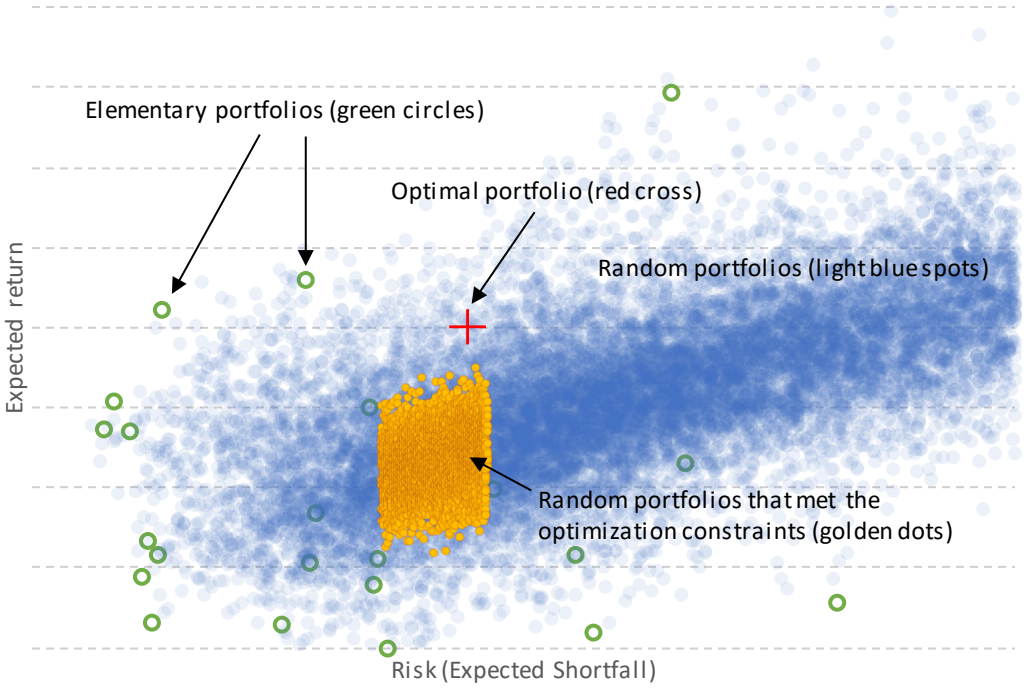
and US agency mortgage-backed securities (MBS) portfolio. In case of the MBS exposure, the bank relied on the expertise of external asset managers. Apart from the core portfolios, a small portion of the reserve was dedicated to Chinese government securities.

The MNB assumed the exchange rate exposure mainly in euros but had minor open currency positions in different currencies as well. The gold reserve of the central bank was extremely low in nominal terms compared to central bank peers.

In addition, we analysed the effect of changes in different risk factors on the risk-return profile. Some examples that were considered included:

- increasing duration;
- entering new bond markets (e.g. AUD and CAD);
- changing open FX positions; and
- new assets, increasing exposure (e.g. MBS and equity portfolio).

Sample portfolios in the risk-reward profile — Graph 6



With the abovementioned proposals, the ex ante return of the reserve portfolio was successfully increased into the proximity of zero. Nevertheless, using these scenarios we were able to narrow the risk tolerance range that provides acceptable risk and return characteristics at the same time and to find the short list (of 3–5 items) of the most promising sample portfolios.

As a final element, we considered some subjective elements, such as preferences, personal views, judgements and the risk appetite of the decision makers. As risk willingness and attitude of the decision makers cannot be calculated quantitatively – and are not entirely necessary – they are considered subjective, however unavoidable

and important constraints. The risk-return preferences of the management played a crucial role throughout the process.

The output of this process resulted in an evaluation matrix of different ES ranges, which summarised the pros and cons for different risk budget sizes.

Risk budget ranges and evaluation matrix

Table 1

Risk Budget ranges	Historical data	Institutional constraints		Scenario-analysis Sample portfolios	Summary
		Reserve adequacy based on the Guidotti-measure	MNB's financial result		
<A	- Provides a narrow range - Portfolio could breach it easily	- Meets the adequacy requirement easily	- Retained earnings is solely enough - Room provided by reserves is not utilized	- No room for improvement	- Portfolio management is bounded - No effective change - Does not meet the expectations
A-B	- Portfolio stayed in this range based on the historical data - Could provide a long-term reference level	- Meets the adequacy requirement easily	- Tolerable risk taking into account the revaluation reserves	- Moderate portfolio rebalancing - Moderate risk and return increase	- Keeping risk at a tolerable level while increasing return moderately - Moderate change - Meeting expectations more or less
B-C	- Normalization of market volatility will not limit the portfolio - Assuming higher level of risk than historically	- Meets the adequacy requirement easily	- Tolerable risk taking into account the revaluation reserves	- Significant change - Expected return increasing considerably - Risk staying at a managable level - Relatively effective risk/return trade-off	- Significant change - Increasing return significantly given the institutional constraints - Meeting expectations
>C	- High risk in historical context	- Meets the adequacy requirement	- Tolerable risk depending on the willingness to take risk - At the limit of the reserves in equity	- Palpable return improvement - Significant jump in the risk profile	- Possibly higher return... - ... but increasing risk largely

In this way, we ended up with a relatively narrow range for proposals of the maximum and the strategic/target/benchmark value of the ES measure.

3.3 Defining the new strategic asset allocation

As we set up our risk target and tolerance, we should change the strategic asset allocation (SAA) of FX reserves. The goal of our optimisation is to maximise the expected return of the investments given the market risk (and other risks, e.g. liquidity and credit) constraints. The expected returns as input parameters are arbitrary of course – representing our experts' and management's view.

FX-hedges against the numeraire currency and its costs (the FX-basis) were also accounted for during the optimisation process. In addition to quantitative considerations, we also applied qualitative ones as well, which included:

- accounting for moderate and gradual changes in the currency composition;
- accounting for low transaction/transition costs;
- avoiding concentration in the risk factors; and
- keeping the major exposure toward the euro zone in credit, interest rate risk, etc.

We then simulated more than 100-thousand portfolios with the applied constraints. We examined the composition and concentration of portfolios around our risk targets. The qualitative constraints were accounted for as well, and the management selected the desirable composition. Some other tools we used as a supplementary analysis included:

- a risk factor model;
- scenario analysis; and
- portfolio sampling and concentration quantifications.

The results showed that the strategic benchmark was affected.

Due to the potential changes in the investor's ability and willingness to take risks, both periodical and event-based revisions of the risk budget size is recommended:

- reviews on an annual basis in accordance with the MNB's practice;
- reviews in the case of external shocks, including a sudden and considerable change in the market environment that is deemed to be persistent;
- reviews in case of a significant increase/decrease in the major balance sheet items affecting the Bank's loss-absorbing capacity (FX reserve, retained earnings);
- reviews following a large movement in the portfolio's or the benchmark's risk.

The level of risk is influenced by internal portfolio management decisions and exogenous market developments:

- Internal factors – independent decisions of the portfolio managers.
- External factors – economical events, changing correlations/volatilities.
- Partly internal, partly external factors – e.g. the size of the portfolio is managed through the reduction or increase of the MNB's balance sheet, but this means a constraint for reserve management.

If the risk of the benchmark or the portfolio moves out of the range specified by the decision-makers, different actions are required depending on the magnitude of the change: informing upper management, proposing recommendations and/or initiating immediate responses to reduce risk. Breaching the wider tolerance range of the strategic benchmark requires the action of the Monetary Policy Committee. Breaching the narrower tolerance range of the strategic benchmark requires the action of the deputy governor.

Overview of the new framework

The new risk budget framework and the ES limits provide a coherent structure for the risk-taking and investment decisions. This can be considered as an "umbrella" risk management tool with yield enhancement elements, and is supplementary to the current limit system focusing only on risk control.

It limits the maximum risk taken while also providing flexibility in choosing the risk factors in active management. The applied risk measure (ES) is more conservative than VaR, the measure previously used. The size of the budget is based on quantitative and qualitative considerations, and on a number of different aspects. The

main advantages of the framework – which is based mostly on quantitative methods but also includes qualitative criteria – include the following:

- controlled risk-taking;
- efficient risk allocation;
- return maximizing at a given risk level; and
- active responses to the changing risk environment.

However, the framework has its own risks and challenges. Setting up the system requires an increased workload, especially at the initiation of the system due to the learn-by-experience process, the more frequent decisions and the monitoring activity. The implementation is also resource intensive, as it requires a lot of expert judgement and subjectivity at initiation. It could also be a demanding challenge to mitigate the risk of "over-controlling" and deal with potential conflicts among the different rules. More intense monitoring is thus essential.

Reserve management and FX intervention

Bank Indonesia

Abstract

Bank Indonesia's main aim is to safeguard the stability of the rupiah. To this end, the Bank maintains foreign reserves that are sufficient in amount to achieve this monetary policy objective and also to meet international foreign currency obligations. Reserves are accumulated mainly from traditional sources, such as capital inflows, foreign bond issuance and government export proceeds. Like most central banks, Bank Indonesia applies the principles of security, liquidity and profitability in pursuing its reserves investment objectives. The Bank has recently implemented a new investment and diversification strategy for its reserves. In terms of investment strategy, the Bank has recently started to apply a currency immunisation approach, which aims to match the reserves currency allocation to the composition of the country's liabilities and therefore mitigate the currency risk in the reserves portfolio. Furthermore, the Bank's reserves management style has evolved from a traditional model into a more sophisticated multi-asset and multicurrency approach, optimising the balance between the need for reserve accumulation and the cost of holding these reserves.

JEL classification codes: E58.

Keywords: central bank policy; monetary operation; adequate foreign reserves; reserves management; currency immunisation approach; diversification strategy.

Drivers of reserves accumulation from a policy perspective

Bank Indonesia's main objective is to achieve and maintain the rupiah's stability. The currency's stability is defined, among other criteria, as price stability for goods and services as reflected in inflation. Bank Indonesia implemented an inflation targeting framework in 2005, in which inflation is the primary monetary policy objective, while adhering to a floating exchange rate system. Exchange rate stability plays a crucial role in achieving price and financial system stability. For this purpose, rather than pegging the exchange rate to a particular level, Bank Indonesia operates an exchange rate policy designed to mitigate excessive rate volatility. The Bank maintains the exchange rate in line with its fundamental value, while maintaining market mechanisms and deepening domestic financial markets. This policy is focused on moderating the rupiah's volatility and sustaining adequate market liquidity, thus mitigating risks to macroeconomic and financial system stability.

As stipulated in Article 13 of the Act of the Republic of Indonesia concerning Bank Indonesia, the Bank seeks to maintain foreign reserves in an amount considered sufficient (i) to carry out monetary policy in order to achieve and maintain the rupiah's stability in value terms (with respect to both inflation and the exchange rate); and (ii) to fulfil international obligations in foreign currencies.

Monetary policy is carried out with the aim of maintaining an optimal balance between the "impossible trinity" objectives, in terms of moderate capital mobility and a more flexible exchange rate, while maintaining Bank Indonesia's independence in setting monetary policy (with respect to the policy mix). This requires that FX reserves are adequate. Hitherto, reserves for Bank Indonesia have been accumulated mainly from traditional sources, such as capital inflows, foreign bond issuance and government export proceeds.

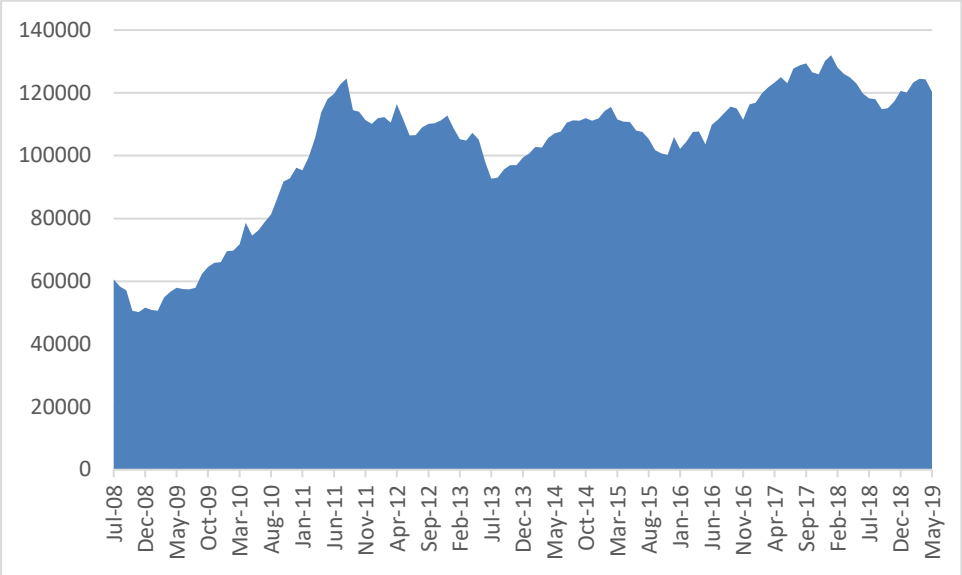
Past crises have shown that adequate foreign reserves help to enhance a country's economic resilience. In conjunction with sound policies, adequate foreign reserves can help reduce the likelihood of a balance of payments crisis and safeguard economic and financial stability. This is also the case for Indonesia. An adequate amount of foreign reserves bolsters market confidence that the country can meet its current and future external obligations and strengthens its perception as a better credit risk in the view of rating agencies and market participants. This has helped to maintain stable and healthy capital flows, and to prevent the snowballing effect of market shocks. In addition, foreign reserves also help to protect the domestic financial markets and economy against the potential risks of sudden stops and capital flow reversals.

At USD 123.8 billion (in June 2019), Indonesia's reserves have significantly increased from USD 50.58 billion at the time of the Global Financial Crisis (October 2008) (Graph 1). Their current level would finance 7.1 months of imports or 6.8 months of imports in addition to servicing the government's external debt, well above the international standard for reserve adequacy of three months of imports.

Of course, no single measure of reserve adequacy fits all cases. The best measure for each country depends on their respective situation and condition, both internally and externally. Bank Indonesia currently assesses reserve adequacy based on (i) months of imports and short-term external debts, and (ii) the IMF Assessing Reserve Adequacy (ARA) metrics. Based on both reserve adequacy measures, the Bank

considers that the official reserve assets position is able to support external sector resilience and to maintain macroeconomic and financial system stability.

Indonesia's foreign reserves from 2008 to 2019 Graph 1



Source: Bloomberg, July 2019.

FX interventions: motivations, strategies and tactics

Global financial conditions have tightened since early 2018. The rupiah has experienced downward pressure amid US dollar strength, risk-off sentiment and contagion risk in emerging market economies, which have resulted in capital outflows. In Q3 2018, the rupiah depreciated against the US dollar and continued to do so until early Q4 2018. In response, Bank Indonesia has applied stabilisation measures in both the FX market and the government bond market (dual intervention) to mitigate any rapid and excessive depreciation of the rupiah.

Bank Indonesia implements a forward-looking monetary operations strategy that seeks to maintain adequate liquidity in the foreign exchange market. These efforts include improvements to the effectiveness of foreign exchange swap hedging by setting efficient prices. In order to accelerate forex market deepening while providing an alternative hedging instrument for banks and corporations, Bank Indonesia also conducts domestic non-deliverable forwards (DNDF) transactions, which consist of an outright forward transaction with netting settlement in the domestic forex market, in local currency (the rupiah). The reference rates are JISDOR for USD against IDR and the Bank Indonesia FX Transaction Mid-rate for non-USD against IDR. DNDF transactions can be conducted by banks with customers and foreign parties to hedge FX movement risks, and must be supported by an underlying transaction in the form of trade in goods and services, investments or bank loans in foreign currencies. In addition to irregular auctions, Bank Indonesia regularly holds FX swap auctions as part of its monetary operations to help banks manage their liquidity.

Monitoring market conditions and domestic liquidity are the key elements in conducting interventions. Several factors, including short-term exchange rate

movements, market liquidity and market sentiment, are taken into consideration prior to an intervention. Other features, such as instrument, size, counterparty and intervention methods, comply with internal guidelines.

As an independent institution, Bank Indonesia has its own regulations and decision-making process and cannot be influenced by other parties including the government, public sector entities and the banking sector. However, Bank Indonesia emphasises policy coordination with the government and other relevant authorities in order to maintain economic stability and reinforce external resilience, including the promotion of exports and the reduction of imports, with a view to reducing the current account deficit.

Bank Indonesia regularly reviews the effectiveness and efficiency of its FX interventions. The main criterion in this respect is the proper functioning of financial markets. Volatility is considered significant in the case of both the appreciation and depreciation of the domestic currency. FX interventions are aligned with the day-to day implementation of monetary policy during both normal and crisis periods. In addition, the Bank ensures sufficient rupiah liquidity by implementing a series of monetary operation tools such as term repos to mitigate the liquidity effects of FX interventions.

Reserves management

As mandated by the Bank Indonesia Act, Bank Indonesia's main objectives are to maintain the value and adequacy of its foreign reserves, in particular, to support the effectiveness of monetary policy and the fulfillment of international obligations. Like many central banks, Bank Indonesia applies the principles of security, liquidity and profitability in pursuing its reserves management objectives.

These objectives and principles are then translated into two portfolio tranches:

(i) a liquidity tranche that is used to address short-term liquidity needs for monetary policy and the payment of short-term international obligations, with a focus on security and liquidity, and

(ii) the investment tranche (which includes internally and externally managed portfolios), which meets the need for a return and capital preservation by balancing security, liquidity and profitability.

In response to challenging external and internal circumstances, Bank Indonesia employs several strategies: (i) conducting investment strategy through currency immunisation and asset diversification, (ii) adopting best practices in reserve management through information technology (IT), including a new front office, middle office, and back office system and enhanced human resources capabilities, as well as strengthened governance and business processes, and (iii) cooperating through bilateral and multilateral arrangements to strengthen the financial safety net, including bilateral swap arrangements and bilateral repo lines.

Regarding the currency immunisation approach, the main aim is to match the foreign reserves currency allocation to the composition of the Bank's liabilities, and therefore mitigate the currency risk in its portfolio. On the other hand, diversification via the more sophisticated multi-asset portfolio will enhance returns and diversify the reserves portfolio risk. These strategies are intended to optimise the balance between

the need for reserve accumulation and the cost of holding reserves. Furthermore, Bank Indonesia has made organisational changes in recent years, particularly in separating the functions of the front, middle and back offices into separate departments, with the aim of improving governance in reserves management. The Bank has also implemented the "three lines of defence mechanism" in its reserves management activities, applying the concept of instilling risk management as a culture. The first line of defence is the Internal Control Officer (ICO), which is performed by an officer of the Reserve Management Department, as part of ex ante risk management. The second and third lines of defence are performed by the Risk Management and Internal Audit Departments, respectively. Based on the new organisational structure, as well as an enhanced decision-making process, the potential for procyclical investment behaviour can be limited.

The challenges of managing large FX reserves: the case of Israel

By Golan Benita, Nadine Baudot-Trajtenberg and Amit Friedman[1]

Abstract

This paper describes the Bank of Israel's investment philosophy and policy. The paper focuses on the strategic asset allocation framework and the role of the Monetary Policy Committee in setting the investment strategy. The abundant FX reserves in recent years, and falling yields on traditional reserve assets, called for reform in reserves management. Institutional changes – the enactment of a new central bank law – made reform possible. The result was a dramatic shift in the BOI's investment policy. In seven years, the BOI moved from a classic reserves portfolio to a multi-asset diversified portfolio that includes a sizeable allocation of equities and corporate bonds. These riskier assets significantly increased the returns on reserves in recent years. For example, between 2012 and 2017, investment in equities was the source of 64% of the total return, which was 9.2%. The contribution of equities to total return allowed the BOI to preserve the purchasing power of reserves at times when traditional reserve assets yielded negative real returns.

Keywords: asset allocation, diversification, risk return, value at risk, international reserves.

JEL classification: G11, F21.

[1] Baudot-Trajtenberg is deputy governor of the Bank of Israel. Benita and Friedman are both from the Department of Market Operations at the Bank of Israel. We thank Francoise Ben-Zur and Andrew Abir for providing important comments and insights on the dynamics of policy committees.

1. Introduction

The Bank of Israel (BOI) manages a sizeable foreign exchange reserves portfolio, which stands today at approximately $115 billion as of November 2018, or about 31% of GDP. It has grown threefold in a decade, mainly due to FX purchases that totalled $85 billion. While the BOI was accumulating reserves above and beyond the adequate level associated with precautionary purposes, the yields on traditional reserve assets dropped to near zero levels and even to negative territory. These changes called for a revised approach to reserve management.

The first step was to change the legislative framework defining the management of the foreign exchange reserves. Within the new BOI law that was legislated in 2010, the BOI's potential investment universe was expanded to include for the first time not only the traditional reserve assets, such as high-grade government bonds, but also equities and corporate bonds. In addition, the law induced a major institutional change with the establishment of a Monetary Policy Committee (MPC), while previously decision-making was solely in the hands of the BOI's governor. The motivation for establishing the MPC was to improve the quality and consistency of monetary policy, the major role it still fulfils. In addition, it has come to be over time the high-level investment committee of the BOI.

These two processes, ie the institutional changes at the BOI and the rapid growth in FX reserves, led to a shift in the BOI's investment policy, which although implemented gradually, facilitated a radical change in hindsight. While a decade ago reserves included "classic" reserve assets only, nowadays the BOI manages a diversified, multi-asset portfolio of which about 20% is allocated to other assets.

This paper describes the BOI's current investment policy and the driving forces behind it. We start by describing the background conditions – the level of reserves and the fall in yields on traditional reserve assets. Next, we lay out our investment philosophy – our attitude to financial markets' behaviour and idiosyncratic attributes as an investor in those markets, with the implications for our investment strategy. Next, we describe the diversification process from the perspective of the MPC, and its impact on the process of moving toward a reserves portfolio with a higher expected return and a higher risk. We conclude with remarks on the contribution from a broader asset class and our capacity to bear reputational risks in case of a loss.

2. Managing abundant reserves when the risk-free real rate is negative

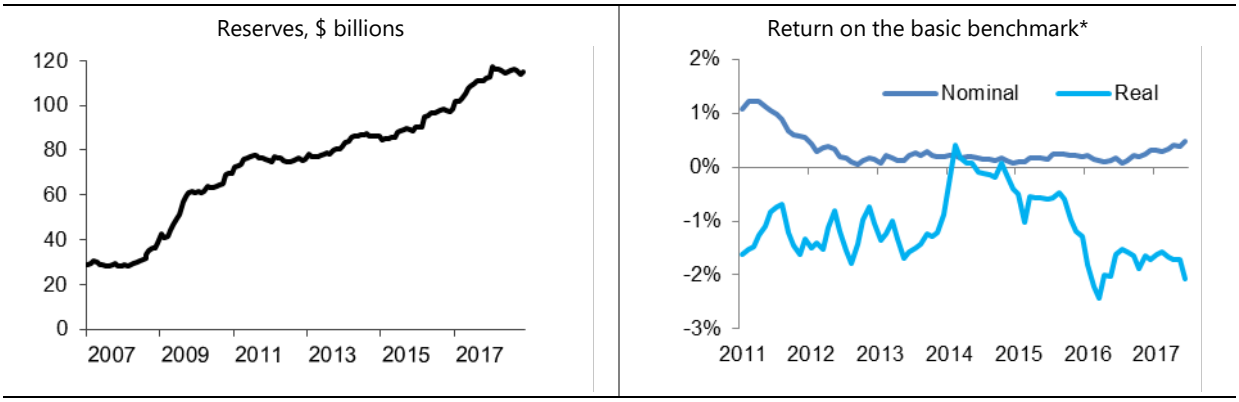
The assets of a central bank are typically managed according to the priorities of (1) safety, (2) liquidity and (3) return. The implications of these preferences are strict: many assets are entirely excluded from a central bank's investment universe when the first two preferences are dominant. Therefore, when the level of reserves is relatively low, return is not only the least important goal of a central bank, it is also one which is hard to achieve, as many of the assets that could potentially generate higher returns are not eligible for investment.

These considerations change with the level of reserves. When reserves are below the adequate level which is a function of the precautionary needs, the central bank cannot

afford sharp fluctuations and therefore has to mitigate the risk associated with reserves management. This is typically done by adhering to a basic, "risk-free" benchmark, which depends on the structure and exposures of the economy.

The most important factor behind the behavioural change of the BOI as a reserves manager is probably the accumulation of reserves up to and beyond a level that ensures the first target of reserve management – safety. The systematic, preannounced FX purchases that were conducted between March 2008 and August 2009 (see the left-hand side of Graph 1) brought the reserves to a level that was deemed sufficient at the time. As FX discretionary purchases continued, the BOI started to assign a higher and increasing weight to the next and last goal in its priority list – rate of return.

The BOI's reserves and the return on the BOI's basic benchmark Graph 1



* The basic benchmark of the BOI, the numéraire, is defined as a six-month duration portfolio comprising US government bonds (67%), euro area bonds (30%) and UK government bonds (3%). The figure presents the annual minimal rolling returns. Real return is adjusted for inflation in numeraire countries.

Amid the reserves accumulation process, the yield on the BOI's basic benchmark, which is composed of short-duration US and European countries treasuries, fell to a near zero level.[2] The outcome of these two developments, which are not mutually exclusive,[3] is that the *real* yield on the BOI's basic benchmark fell into negative territory. This means that sticking to the benchmark portfolio would have eroded the purchasing power of reserves and hence would have violated the major objective of reserve management – safety.

The extent and persistence of a negative real rate of return is shown on the right-hand side of Graph 1. Note that the BOI did not stick exactly to the basic benchmark even before equities and corporate bonds were introduced to the portfolio. Some risk was taken – either in the form of a longer maturity than the benchmark or by allocating a fraction of the portfolio to various "spread products" – assets that can be classified as close substitutes for the benchmark "risk-free" assets, but generate some excess returns, usually due to their lower liquidity. However, such an investment

[2] The BOI's basic benchmark reflects the fundamental exposures of the economy to various real and financial shocks that might require a draw of reserves. For the composition of this benchmark see Graph 1.

[3] The drop of the yield on the basic benchmark reflects the ultra-expansionary monetary policies of the Fed, the ECB and the BOE, which contributed to capital inflows and a continuous upward pressure on the NIS. This exchange rate overvaluation has been the main driver for the BOI's discretionary FX purchases since August 2009.

strategy can only partially mitigate the erosion of purchasing power, while expanding the asset universe to alternative assets has at least the *potential* of addressing this problem in full.

3. The BOI's investment philosophy and strategy

A coherent set of investment principles that reflect the investor's preferences and beliefs regarding financial markets behaviour, is always useful, and even more so in the case of a central bank, which invests in a broader asset universe and adheres to the general principles of sound public policy. We refer to these principles as our *investment philosophy*.[4]

As investors, central banks have several distinct attributes: first and foremost, modern central banks hold reserves mainly for precautionary reasons, specifically to be able to supply the demand for foreign currency if necessary so as to fulfil their mandates and ensure financial stability and the smooth functioning of the FX market. This is the motivation for the preference structure previously mentioned. Second, central banks are exposed to a unique reputational risk: the risk that a large loss on reserves will damage their institutional credibility, which could have repercussions for the entire economy. Indeed, the independence of the central bank is a direct function of its credibility in fulfilling its mandates. In Israel, the BOI is an independent institution operating under an inflation targeting regime, for which credibility is key. Thus any reputational damage could have far-reaching macroeconomic consequences.

An additional problem that magnifies the BOI's reputational risks is that the reserves portfolio's basic benchmark – the numéraire – comprises a synthetic currency (see the note below Graph 1 for details). The BOI's annual financial report is published in local currency; and to add confusion, the level of reserves is also reported on a monthly basis in US dollars, and as a percentage of GDP.

These several indicators on reserves are rarely aligned and thus present a challenge for managing communication on that front. These challenges depend not only on the inclusion of riskier assets in the portfolio, but might be exacerbated when the level of risk in numéraire terms increases.

The importance of the precautionary motive and the reputational risk was translated into a clear measure of risk appetite, which can then be used to define the set of appropriate portfolio allocations, as will be described below.

Under these limitations, and given the abundant level of reserves, the BOI chose two asset classes so as to extract premia over time: equities and investment-grade corporate bonds, in both cases those of developed economies. Equities were chosen for their excess return over long horizons, their negative correlation with government bonds and their relatively high liquidity, and corporate bonds for their risk-return ratio and the fact that, given the current level of reserves, the BOI is in the position to extract a liquidity premium.

[4] Some of these principles below were officially adopted by the BOI while others simply reflect its prevailing preference.

A central question in formulating an investment philosophy, and especially when equity investment is considered, is whether the investor believes in market efficiency. In an efficient market, asset prices should reflect all available information, including historical data, public and private information. In this case, one cannot exploit any such information to achieve abnormal returns, systematically. This in turn implies that an investor who believes in market efficiency has no reason to attempt to time the market, as prices follow a random walk. This also implies that such an investor has no reason to engage in security selection, as all information is already reflected in the securities' prices.

The BOI's general attitude is that financial markets are close to being efficient, and this attitude *dominates* the BOI's investment strategy. Hence, when allocating funds to alternative assets, the BOI is guided by a market-cap approach, and invests in global benchmarks such as the MSCI-developed market stock index,[5] the Barclay's US Corp IG etc. The actual allocation to these assets is determined through an annual strategic asset allocation process, in which efficient diversification is an important consideration, and is vetted by the MPC. The result is an "MPC benchmark", which the actual portfolio tracks relatively closely. This is not to say that only strategic considerations affect the actual portfolio. Tactical decisions, for example in the form of long/short positions vs the MPC benchmark, are regularly taken by the department of market operations; however the relative size of these positions is usually small.[6] In the equity market, selection is applied at a country level only, ie not on at the individual security level. As to corporate bonds, some deviation from the benchmark is allowed at the individual security level, with a limited degree of tracking error.

Holding claims on corporates rather than on other sovereigns is a big conceptual change for a central bank. In order to develop the necessary competence, and especially to test the risk management framework, the diversification process has been applied gradually over several years, during which the total allocation to the new asset classes was augmented continuously and the assets were allocated to additional markets.[7]

The overall results of this diversification process are shown in Graph 2, where the "before and after" 2010 vs 2017 breakdowns of reserves are presented. The green shades, which denote riskier assets, make up almost 20% of the reserves portfolio today. These assets were added at the expense of government bonds, while the allocation to cash, money market, and other assets has remained almost unchanged.

The risk framework to monitor and control the risks associated with investment in alternative assets contains several layers. The guidelines set constraints on the maximum allocation to equities (15%), and to corporate bonds (15%), while the total allocation to these assets, combined, is limited to 25%. Investment in corporate bonds is limited to investment grade bonds, and is allowed in US and European bonds only. The risk appetite of the MPC was translated as follows: the total risk of the portfolio

[5] This benchmark was slightly modified due to several adjustments that were done because not all the assets that are included in the index are investible according to the BOI's guidelines. For example, the BOI does not invest in Israeli companies that are included in this benchmark.

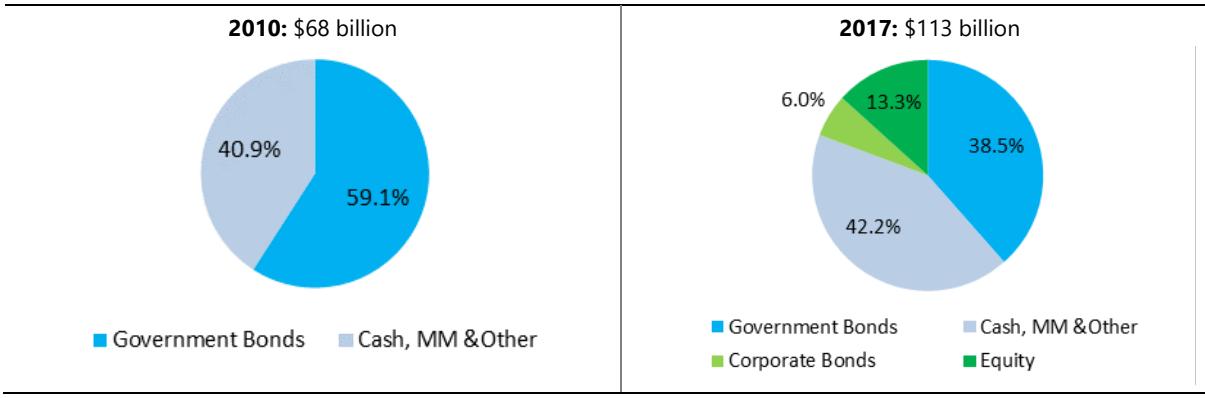
[6] For example, a typical position in equities is of the size of 0.5% of total reserves, while the allocation to equities in the end of 2017 was 13.3%. In addition to tactical positions, strategic allocation changes create timing issues that cannot be completely avoided.

[7] See Abir and Benita (2018) for a fuller account of the adjustment process and the considerations behind it.

is constrained by a maximum expected tail loss of 400 bp in the worst 5% of the outcomes. This measure, aka the conditional value-at-risk (CVaR), provides a useful instrument for evaluating the risk in real time.

From a classic to a contemporary reserve portfolio

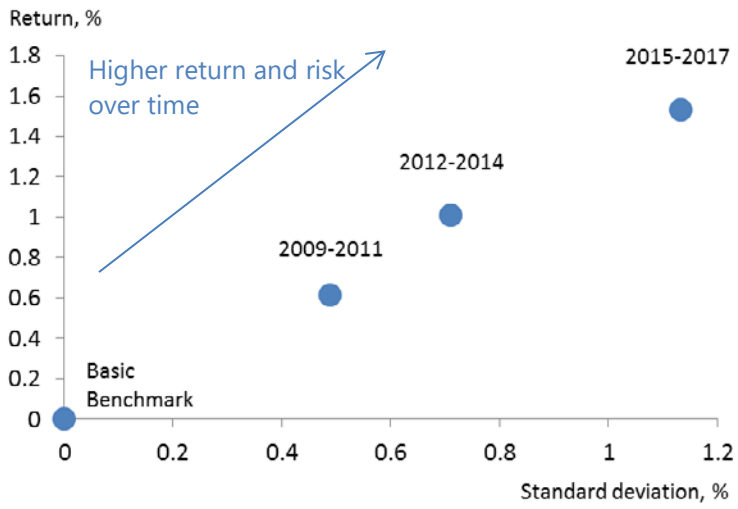
The composition and level of foreign reserves, year end — Graph 2



The gradual increase in the share of riskier assets within the portfolio is expected to yield higher returns over time. However, over short periods of time – even up to one year – the ex post results are not always associated with higher returns. Thus the horizon used to evaluate the risk-return trade-offs is crucial for measuring the CVaR: for instance, with the same level of CVaR, a longer horizon will allow for a larger proportion of riskier assets in the portfolio than it would for a shorter time horizon. This reflects the fact that the prices of riskier assets tend to recover over a longer period of time. Graph 3 presents the risk-return space over a three-year moving average compared with the basic benchmark (which is defined as the risk-free asset, and hence located at the origin of the axes in the graph). The results show the steady increase in actual returns and risks since the BOI has started to invest in riskier assets.

The contribution of adding new asset classes to risk and return* (%)

Graph 3



* The figure presents three-year averages of excess return and volatility relative to the basic benchmark. Volatility is measured by the standard deviation of weekly returns in annual terms.

Although the risks have definitely risen, our experience in equity investment implies that it is less risky than meets the eye. Due to the negative equity-bond correlation, drops in equity prices are usually compensated by price increases for fixed income assets and vice versa. The counterintuitive result is that adding a small allocation of equities to a fixed income portfolio reduces rather than increases the volatility of the portfolio while increasing its expected return. In other words, the traditional reserve portfolio that contains fixed income assets only is simply inefficient, at least over a one-year horizon.[8]

4. The strategic asset allocation process

In recent years, the BOI has developed a well structured strategic asset allocation (SAA) process, which aims at achieving efficient diversification of the reserves portfolio, as well as robustness under different market outcomes. Our SAA process starts by assessing the global macroeconomic environment; next, we outline a central-tendency base scenario, and also optimistic and pessimistic scenarios, focusing on growth, inflation and monetary policy. In each scenario, we forecast the expected returns on the assets that are part of our investment universe set. Given our forecast for the assets' expected returns, we derive the efficient frontier using the mean-variance (MV) approach. This is a useful starting point, but is very sensitive to the assumptions made about the distribution of assets' returns, and it tends to generate optimal portfolios with a small number of assets.[9]

To address these limitations we use two analytical tools, which have been developed internally. The first analyses the portfolios that are located near the efficient frontier, and the second maps the risks to the optimal portfolio within a range of expected returns. These tools enable us to have a more productive and robust investment decision process.

4.1 The portfolios near the efficient frontier

Generally, the reserves portfolio is exposed to four main risk factors: currency risk, duration risk, credit risk and equity risk. Similar portfolios in risk-return terms can sometimes be obtained by using different combinations of risk factors. For instance, there may be two portfolios with a similar expected performance under the baseline scenario where the risk in one is mainly due to its allocation to equities, while in the other it is mainly due to its duration exposure. However, these portfolios may have substantially different performance under the alternative scenarios. In such cases, we would prefer to invest in a portfolio which is slightly below the efficient frontier, if by doing so we can obtain a higher degree of robustness to different scenarios. This is the reason why it is important to also assess "near-optimal" portfolios – that is, portfolios that are close to the efficient frontier.

For example, we present the efficient frontier for 2017 based on the BOI's forecast as of December 2016 (the red line on the left-hand side of Graph 4). The portfolios

[8] Many central banks refrain from equity investment, yet at the same time invest in gold, which is at least as volatile as equities. Historical, cultural and political explanations are probably behind this phenomenon.

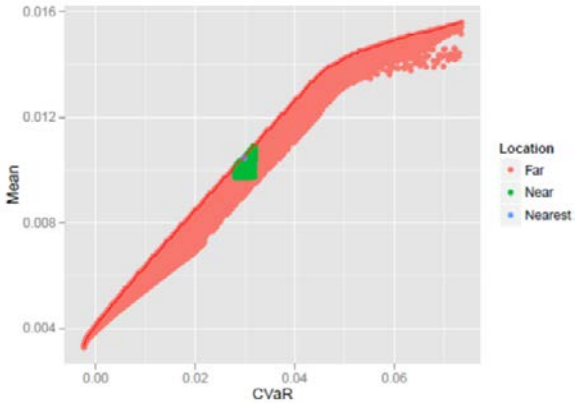
[9] Mainly as a result of imposing a "no-short-sales" constraint on the optimisation process.

close to the target risk (in green), which was set by the MPC to a CVaR of 3%, represent about 1,000 different but similar portfolios in terms of risk and expected return. Within this set, we inspect those portfolios that are most different in their composition from one another and from the optimal portfolio. These portfolios are shown on the right-hand side of Graph 4.

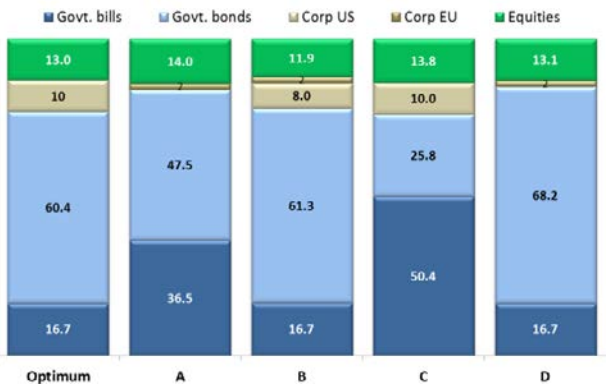
The portfolios presented in Graph 4 have very similar expected performance under the base scenario, but they have very different compositions. This means that their performance under the alternative scenarios can be substantially different.

Optimal asset allocation for 2017 Graph 4

The efficient frontier and the near-efficient zone



The composition of the optimal and near-optimal portfolios



[1] The portfolios A–D are near-optimal, and are compared to the optimal portfolio. The different composition of bonds vs bills in between the portfolios reflects different maturities. The investment in equities follows closely (but not identically) an MSCI-DM-like index.

4.2 Sensitivity analysis

After setting the risk level, the next main three strategic decisions to be taken by the MPC are the weight of equities, the weight of corporate bonds, and the portfolio's duration. We examine the robustness of these decisions for a range of outcomes around our base scenario. Specifically, we check deviations from (1) the expected structure of the yield curves; (2) the expected return on equity; and (3) the expected change in credit spreads. These deviations can be associated with two risk factors – a curve risk and a business cycle risk, where the later reflects the correlated performance of equities and corporate bonds.[10]

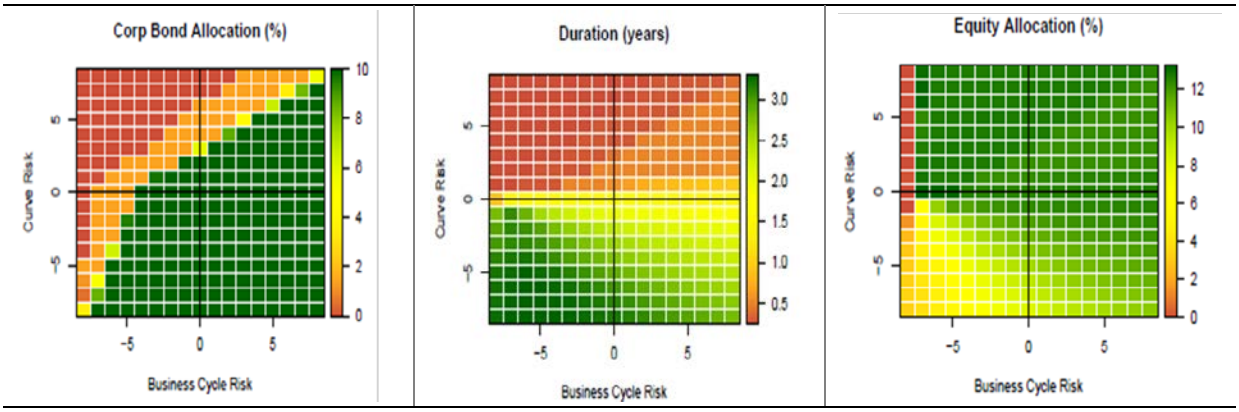
The heat maps in Graph 5 show the sensitivity of the three main strategic decisions to the main risk factors. Each portfolio is represented by its portfolio duration, its allocation to corporate bonds and its equity allocation. The characteristics of the optimal portfolios – duration, weight of equities and weight of corporate bonds – are presented in three graphs of the space defined by curve risk (vertical dimension) and business cycle risk (horizontal dimension).

The MPC's role is to set the risk level and to select the SAA benchmark. The analysis above lets the MPC members to review a wide set of eligible portfolios. This allows them to apply judgment, to take into consideration factors such as reputation,

[10] The fourth risk that we mentioned – currency risk – is not analysed through the SAA process.

and even to express personal preferences before making the strategic decisions, and facilitates a robust investment decision process.

The optimal duration and allocation to risk assets under different scenarios for 2017 Graph 5



[1] Reading the heat maps: the origin in the three heat maps above represents the optimum under the base scenario. Weak growth is represented by a negative business cycle risk, where higher interest rates are represented by a positive curve risk.

5. The impact of the Monetary Policy Committee on the BOI's risk appetite[11]

Although the motivation behind the establishment of the MPC was primarily to improve the quality and autonomy of monetary policy, over time, it has practically turned into the BOI's investment committee. As such, nowadays, the MPC discusses and approves the major strategic decisions affecting the management of reserves. This includes, for example, adjusting the MPC benchmark composition annually, approving the inclusion of new assets, setting the level of the CVaR etc.

This involvement of the MPC was not bound to happen. The BOI law is a primary law, and as such is a high-level law that does not detail the responsibilities of the MPC regarding reserves management, beyond its duties to formulate investment guidelines and report to the government and the general public.[12]

The composition of the committee, its size, and the intensity of the interaction of its members, probably contributed to the process. The BOI's MPC comprises three internal BOI members and three external, independent members.[13] This balanced

[11] This section benefited from conversations with Esti Schwartz and Eddie Azulay, who were involved in the early stages of the MPC's work, in which none of the authors took part.

[12] According to the law, the MPC is in charge of formulating the guidelines for reserve management (40.b), reporting biannually to the Minister of Finance (40.c) and reporting to the public on the composition of the reserves portfolio, annually (40.d). Initially, the intention was to leave the management of reserves within the guidelines to an internal BOI committee – an advisory committee in which the Governor was the sole decision-maker. The investment guidelines are subject to consultation with the Ministry of Finance.

[13] In case of a tie, the Governor of the BOI, who is one of the three internal members of the MPC, can cast a decisive vote. This option, however, has never been exercised.

structure is uncommon (BIS (2009)). Unlike central banks where the MPC meets only around interest rate decisions, the BOI's MPC convenes on a weekly basis in order to discuss development in the local and international markets. These ongoing deliberations allow the MPC members to be briefed continuously on the factors that determine the performance of the reserves portfolio. The size of the BOI's MPC, according to the literature, is well within the optimal range for decision-making, and its size encourages constructive dialogues between group members,[14] which are important for information-sharing given the varying degrees of expertise of different committee members of the subjects at hand.

What was the impact of the migration of strategic investment decisions from the governor of the BOI to its MPC, on the risk-return profile of reserves?

On the one hand, the interaction between the MPC and the BOI's Market Operations Department staff creates the impression that the MPC slowed the process of moving towards a riskier portfolio. The reason is that the usual dynamics of decision-making at the BOI is based on bottom-up proposals to increase the allocation to riskier assets, expand the eligible asset classes and so on. The MPC accepts, modifies or rejects the proposals, but so far the demand for higher risk has never been initiated by the MPC. In addition, it is important to note that the initial decision to break the concept of traditional reserve management and to allocate 2% of reserves to equities was in fact implemented in 2011 by the governor at the time, Stanley Fischer, before the MPC was established later on that year. It is unclear if a committee would have made such a dramatic decision.

On the other hand, it is doubtful whether 20% of reserves would have been allocated to riskier reserve assets – equities and corporate bonds – by a single decision-maker if an MPC had not existed. As reserves are currently higher than those required due to precautionary motives, the effective constraint on the BOI's risk-appetite is the reputational risk it faces in case of a loss on a potentially macroeconomic scale. The MPC in this context creates a mechanism for sharing the reputational burden, which might have been too heavy for any single decision-maker to bear. In addition, such a decision would have been probably sensitive to the identity of the specific governor in office and to regime changes.

Psychological research indicated long ago that groups tend to accept greater risk than do their individual members (Bem and Madaras (1968)). This phenomenon was also validated later in the field of experimental economics, and particularly in settings that emulate investment decisions under risk. For example, within a well known design that generates results that are in line with the myopic loss-aversion of individuals,[15] it was found that decision-making by teams rather than individuals attenuates loss-aversion and yields higher risk-taking (Sutter (2007, 2009); Nieboer (2015)). Thus, keeping in mind the caveats associated with the abyss between experimental economics and real-world investment decision-making, and the impression generated by the dynamics between the MPC and staff that point to the

[14] See Erhart et al (2007) for a review of the literature in economics as well as other disciplines on the optimal size of decision-making groups.

[15] In this experiment, individuals have to decide repeatedly on the amount they are willing to invest (x) in a lottery that yields –X on a probability of 2/3, and 2.5X on a probability of 1/3. The results show that the more frequently returns are evaluated, the more risk-averse investors will be. This phenomenon, coined "myopic loss-aversion" can also help to explain the equity premium puzzle. See Gneezy and Potters (1997).

restraining role of the MPC, it is equally possible that the MPC promoted a higher risk-return profile for the reserves portfolio.

6. Conclusions

The abundant level of FX reserves in recent years, and the falling yields on traditional reserve assets, called for reform in reserve management. The institutional changes that took place in the BOI made reform possible. The result was a dramatic shift in the BOI's investment policy. In seven years, the BOI moved from a classic reserves portfolio to a multi-asset diversified portfolio in which the allocation to equities and corporate bonds is sizeable.

This shift has materialised despite the BOI's character as inherently a conservative institution with a culture dominated by risk-aversion. The BOI's duty to preserve financial stability contributes to a cautious attitude that is usually focused on the downside rather than on the upside of risk. This sometimes creates a dissonance between the BOI's investment behaviour and its other roles.

The riskier assets significantly increased the returns on reserves in recent years. For example, between 2012 and 2017, investment in equities was the source of 64% of the total return, which was 9.2%. The contribution of equities to return allowed the BOI to preserve the purchasing power of reserves at times when traditional reserve assets yielded negative real returns. This, however, did not come for free. The short-term volatility of reserves has risen, but so far the BOI has not dealt with a major reported loss on its riskier assets.

One of the challenges of investing in riskier assets is the reputational damage a loss might inflict. The BOI is fully aware that given the range of its asset classes, such a loss, for example in a single year, is inevitable. The mostly passive investment behaviour of the BOI provides a partial hedge against reputational risks if losses were to materialise. In addition, the BOI's MPC, which functions as an investment committee, provides a mechanism for sharing the reputational burden and supports consistent investment policy during rotations in the governor's office.

In addition, the successful track record of the investment in riskier assets may have created some leeway for absorbing losses without reputational implications. The performance of the reserves portfolio in 2018 might put this expectation to a test sooner than we had hoped.

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Reserves management and FX intervention

Bank of Korea

Abstract

Korea's FX reserves have increased steadily since 2008, to a total of $404 billion as of the end of 2018. This has helped reduce private foreign currency funding costs and exchange rate volatility by contributing to a stable sovereign credit rating. In turn, this has helped to stabilise domestic financial and economic conditions.

Korea's FX authorities have consistently adhered to the principle that the exchange rate should be determined by market forces that reflect economic fundamentals and FX supply and demand. Measures to stabilise the market are carried out only in exceptional circumstances, when there are excessive fluctuations in the exchange rate over a short period of time. FX market intervention is believed to effectively reduce market volatility by calming market sentiment through the use of intervention tools customised to specific circumstances such as temporary herd behaviour. Details of interventions are not disclosed, as they might affect market participants' expectations. However, the authorities have recently decided to release the net dollar-won trading volumes, in order to increase transparency of FX policies in line with global standards.

The Bank of Korea (BOK) decides on the composition of the FX reserves based on its investment objectives, the neutral currency composition and market forecasts. The BOK also has worked to improve its risk management techniques for each type of risk factor and it has expanded its use of external managers to enhance the efficiency of its reserve management.

Keywords: Korea's FX reserves, FX reserves accumulation, FX market intervention, disclosures, FX reserves portfolio.

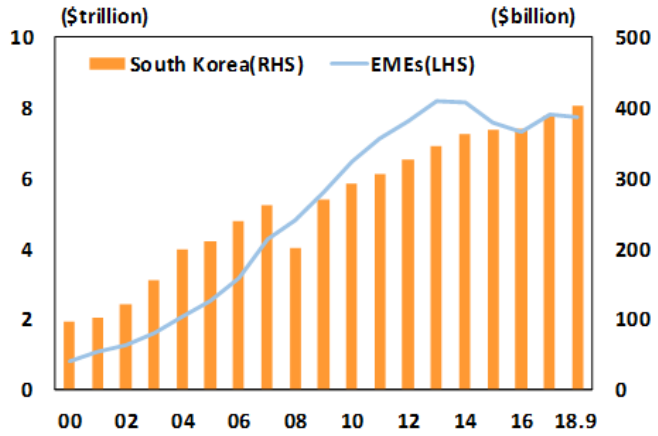
JEL classification: E58, F31, G11

1. FX reserves

1.1 Factors behind the increase in FX reserves

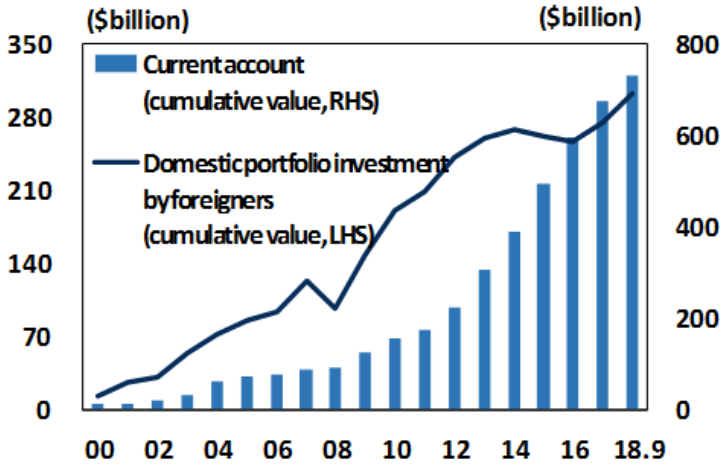
Korea's FX reserves have increased steadily since 2008, amounting to $404 billion as of the end of 2018. This increase has been driven mainly by expansions in Korea's external trade and capital flows, in line with the growth in the Korean economy. The returns on FX reserve investment have also contributed to this increase.

Official foreign reserves in Korea and EMEs — Figure 1



Sources: IMF; Bank of Korea.

Current account and foreign portfolio investment fund — Figure 2



[1] TableNote

Source: Bank of Korea.

1.2. Cost and benefits of FX Reserves

Korea's FX reserves have helped reduce foreign currency funding costs and exchange rate volatility by contributing to a stable sovereign credit rating. This has helped to stabilise domestic financial and economic conditions. Although an opportunity cost arises due to the low returns from holding liquid assets, this is viewed as inevitable given the nature of FX reserves. Meanwhile, the losses due to the difference between the Monetary Stabilization Bond issuance costs incurred in the process of sterilisation and the returns on FX reserves investment have fallen significantly, due to the relative decline in domestic interest rates.

1.3 Assessment of the adequacy of FX reserves

International organisations and academic circles have undertaken various studies[1] on the adequate size of FX reserves. The Bank of Korea refers to these studies, taking into consideration the strengths and weaknesses of each study. Since Korea is an open economy, its general indicators related to external transaction such as trade volumes and capital flows are important in calculating the size of FX reserves adequate to Korea. However, it is also necessary to also take into account its unique characteristics, including the geopolitical risks on the Korean Peninsula.

1.4 Alternatives to FX reserves accumulation

In addition to FX reserves, Korea also places great importance on swap agreements with major central banks. As of December 2018, Korea holds bilateral currency swap agreements with seven countries, and is a member of one multilateral (Chiang Mai Initiative Multilateralisation) swap arrangement. During the global financial crisis in 2008, a currency swap agreement with the US Federal Reserve is assessed to have helped greatly to ease the FX market instability. Strengthening global financial safety nets such as IMF lending facilities as well as regional financial cooperation can help reduce the need for the accumulation of FX reserves.

1.5 Impact of FX reserves accumulation

In managing the FX reserves, the first considerations must be safety and liquidity. The resulting lower returns are thus regarded as inevitable. Meanwhile, it is difficult to quantitatively evaluate the impact of accumulating FX reserves on the domestic economy and financial markets, because the real economy and the financial markets are affected through various channels.

[1] Including those of Greenspan, A (1999): "Currency Reserves and Debt", remarks before World Bank Conference on Recent Trends in Reserve Management, Washington DC, April; Wijnholds, J and A Kapteyn (2001): "Reserve adequacy in emerging market economies", IMF Working Papers, no WP/01/143; and International Monetary Fund (2015): "Assessing reserve adequacy-specific proposals", IMF Policy Papers, April.

2. FX market intervention

2.1 Purpose and principle of market intervention

Korea's FX authorities have consistently adhered to the principle that the exchange rate should be determined by market forces which reflect economic fundamentals and FX supply and demand. Measures to stabilise the market are carried out only in exceptional circumstances, when there are excessive fluctuations in the exchange rate over a short period of time. The authorities are especially prepared for the possible situation of a dollar liquidity crunch due to sudden capital outflows during periods of global financial market volatility.

2.2 Intervention method and information disclosures

The Korean FX authorities consider various factors when conducting market interventions, including the nature of the market shock concerned, and the up- and downside pressure on the exchange rate. Market interventions are conducted in the following ways:

1. Market stabilisation measures are carried out to help restore market functioning when volatility increases due to temporary supply and demand imbalances.
2. Transactions are made at bid/ask prices in the market, without designating any specific trading counterparty.
3. Decisions to intervene in the market are made at the FX authorities' own discretion, rather than based on rules.
4. The details of the authorities' FX trading are not disclosed, as they might affect market participants' expectations.

However, the authorities have recently decided (in May 2018) to release the net dollar-won trading volumes, with a view to increasing the transparency of FX policy, in line with global standards. Information for the second half of 2018 and the first half of 2019 is scheduled to be disclosed in March and September 2019, respectively. From then on, quarterly disclosures will be made three months after the end of each quarter.

2.3 Changes in the approach towards market intervention

Korea has consistently maintained the stance that, in principle, the exchange rate should be left to market forces, and has strengthened market-friendly intervention tools based on FX supply and demand.

2.4 Effects of market intervention

FX market intervention is believed to effectively reduce market volatility, by calming market sentiments through the use of intervention tools customised to specific circumstances such as temporary herd behaviour. In times of severe fluctuations in the exchange rate, market pressures tend to be asymmetrical. Especially when market sentiment is weak, a careful approach to the timing, size and tools of intervention is required to ensure that intervention is effective.

2.5 Impact of market intervention on monetary policy

The effectiveness of monetary policy is rarely undermined by FX market interventions, now that the changes in the money supply resulting from intervention are sterilised through the issuance and redemption of Monetary Stabilization Bonds.

3. Reserves management

3.1 Determinants of foreign reserves portfolio

The composition of the foreign reserves is decided based on the Bank of Korea's investment objectives, the neutral currency composition and market forecasts. The Bank of Korea sets its investment objectives and neutral currency composition as the constraints that the strategic asset allocation results should satisfy, and the quantitative market forecasts based on econometric models and qualitative judgment are used as input variables (expected return and covariance) in determining asset allocation.

The Bank of Korea's investment objectives for its foreign reserve management are set with the aim of increasing profitability while securing safety and liquidity. Although profitability is an important factor in deciding the asset allocation, safety and liquidity are prioritised.

The neutral currency composition is determined based on the currency composition of Korea's current payments, Korea's external debt, the global fixed income market and global foreign reserves.

The Bank of Korea maintains a short-term liquidity tranche that is separate from its investment tranche to manage routine capital flows. The investment tranche also consists of highly liquid and safe assets, which if necessary can be transferred to the short-term liquidity tranche.

3.2 Major changes in the portfolio over the past decade

The major change in the portfolio over the past decade is the continuous increase in the share of equities since 2007, the first year of equities investment. This is part of the effort to increase the rate of return through stock investment, while also achieving a more stable rate of return by taking advantage of the low correlation with bonds.

BOK foreign asset composition[1] Table 1

%

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<By purpose>											
Short-term liquidity tranche	3.9	5.8	1.9	3.2	4.5	3.9	3.1	4.3	4.5	4.7	3.2
Investment tranche											
Internally managed	84.5	76.1	84.0	82.5	79.7	79.4	81.6	80.5	80.0	77.3	77.7
Externally managed	11.6	18.1	14.1	14.3	15.8	16.7	15.3	15.2	15.5	18.0	19.1
<By currency>											
US dollars	64.6	64.5	63.1	63.7	60.5	57.3	58.3	62.5	66.6	70.3	68.1
Others	35.4	35.5	36.9	36.3	39.5	42.7	41.7	37.5	33.4	29.7	31.9
<By asset class>											
Deposits	7.4	8.4	4.0	6.0	6.6	4.8	4.4	3.8	5.9	6.5	6.8
Securities											
Government bonds	35.5	31.8	38.1	35.8	36.8	38.0	36.8	37.1	35.7	36.9	37.5
Agency bonds	28.8	22.4	22.3	21.8	20.1	21.5	22.0	22.5	22.7	21.0	19.2
Corporate bonds	15.4	16.9	15.1	16.5	14.1	12.9	15.9	17.5	16.4	14.8	14.7
ABS	11.6	17.0	17.4	16.1	17.0	17.1	14.8	13.0	13.1	13.1	13.2
Equity	1.3	3.5	3.1	3.8	5.4	5.7	6.1	6.2	6.3	7.7	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] First disclosed in 2007 Annual Report (published in March 2008); year-end basis.

Most of the progress in diversification into financial products qualified for foreign reserves was made in the years up to 2011, when Korea's foreign reserves surpassed USD 300 billion. Thereafter, the focus has come to be on adjusting the shares of investment in the existing products rather than investing in new ones. The Bank of Korea makes minor adjustments in the composition of assets based on forecasts for macro-financial conditions and the global financial market, as well as the Bank's risk preference in terms of market, credit and liquidity risks.

3.3 Major changes related to risk management and externally managed asset

As the quantitative risk management framework assuming normal conditions has become less effective since the global financial crisis, the Bank of Korea has worked to improve its risk management techniques for each type of risk factor. Rather than depending solely on credit rating agencies to assess credit risk, the Bank of Korea has strengthened its analysis of market indicators such as CDS premiums, and of the credit of individual issuers, as well as concentration risk management. It has meanwhile also established a framework for legal risk management. The Bank of Korea has also improved its market risk assessment models so as to strengthen its tail risk management, and introduced Bloomberg LQA (Liquidity Assessment) to closely manage liquidity risks such as the time and costs required for the liquidation of its asset holdings.

The Bank of Korea has expanded its use of external managers to enhance the efficiency of its reserve management. To enhance profitability, it actively utilises global asset management companies and the Korea Investment Corporation for new investments that require high levels of expertise, such as stocks and EME-related assets. The Bank is also working to diversify its sources of excess returns by reorganising its externally managed funds based on their aims and functions.

Meanwhile, the compensation system for the Bank of Korea staff responsible for reserves management has not been changed. The Bank of Korea staff in the Reserve Management Group are subject to the same evaluation criteria and compensation system as those for other employees. It is judged that this compensation system has helped to ease the procyclical investment behaviour that can arise in times of market unrest.

3.4 Major changes in information disclosure over the past decade

The Bank of Korea has continued to expand the scope of its disclosure of information about its reserves management in an effort to strengthen its transparency and accountability for reserve management. In 2008, it began to disclose in its Annual Report the foreign asset composition by purpose, currency and asset class, as well as the factors behind any changes in the composition. Since 2014, additional information has been disclosed on the management process and framework, covering the annual investment planning process, the risk management framework, and the selection process for trading partners and external managers.

The Bank of Korea's efforts to expand the scope of its information disclosure has had both positive and negative effects. When issues or criticisms arise related to its foreign reserve management, the Bank of Korea can provide objective explanations or take proactive measures on the basis of this public information. On the other hand, unnecessary controversy can take place when those lacking in expertise make arbitrary interpretations of the disclosed information or cite it inaccurately.

Despite such trade-offs resulting from its disclosure of information on its foreign reserves management, the Bank of Korea is continuing its efforts to expand the scope of its information disclosure, in order to satisfy the public's right to know and to enhance the transparency of its foreign reserve management.

3.5 Major political economy consideration related to FX reserves

It is true that, in managing its foreign reserves, the Bank of Korea has been constrained to some extent by political economic risk, including the risk of reputational damage due to losses on the reserves. Nevertheless, the Bank of Korea adheres to the principle of pursuing profitability while placing the highest priority on safety and liquidity in its FX reserves management. In order to mitigate the political economic risk, the Bank of Korea continuously communicates this principle to the general public, through channels such as our annual reports and the audits of the Bank by the National Assembly.

The Bank of Korea uses the historical cost accounting method and has in place an arrangement with the government for the replenishment of losses. The Bank of Korea believes that this system has helped manage the political economic risks related to its FX reserve management. The historical cost approach helps to ease the volatility of net income, which will tend to fluctuate as price variables such as interest

rates and stock prices change. The Bank of Korea retains the earnings generated from its foreign reserves management. The Bank of Korea resorts first to its accumulated earnings to replenish any loss, but if these are not sufficient to cover the loss, the government can reimburse the loss pursuant to the relevant laws.

Reserve management and FX intervention

By Norzila Abdul Aziz[1]

Abstract

The shift in global monetary policy from quantitative easing (QE) to the subsequent policy normalisation has led to volatile two-way capital flows for the emerging market economies (EMEs). Many EMEs' central banks have faced considerable challenges in maintaining monetary and financial stability given the limitations of traditional macroeconomic policy tools and relatively small financial markets. This necessitated a pre-emptive FX intervention policy and capital flows management to contain the risks from volatile capital flows. To shed some light on these issues from Malaysia's perspective, the paper first highlights the Bank's motivation for holding reserves, followed by an assessment of the reserve adequacy framework. The paper then expands on the principles behind the Bank's FX intervention activities as well as the reserves management strategies. Finally, the paper concludes by highlighting the importance of international cooperation among EMEs and market development initiatives in addressing the perennial challenges of large capital flows.

JEL classification: E58, E61, F31, F32.

Keywords: capital flows, reserves accumulation, reserve adequacy, FX intervention, liquidity management, volatility, market development, reserve management.

[1] Central Bank of Malaysia.

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Introduction

Global financial developments, particularly quantitative easing (QE) in the advanced economies after the Global Financial Crisis (GFC), have significant implications for the direction and pattern of capital flows in emerging market economies (EMEs) over the last decade. During the QE period, EMEs in Asia experienced capital inflows of USD 597.7 billion between 2009 and 2014[2] while regional currencies[3] appreciated by an average of 18% against the US dollar. The subsequent normalisation of QE witnessed large capital outflows from EMEs amid strong pressure on the exchange rates and reserves.

Large two-way capital flows coupled with significant currency movements posed considerable challenges to EME central bank mandates of maintaining monetary and financial stability as well as supporting sustainable economic growth for some central banks. Given the limitation of traditional macroeconomic tools, many EMEs adopted a combination of pre-emptive foreign exchange (FX) intervention policy and capital flows management to mitigate the risks from capital flows. The trend in FX reserves is a by-product of EME central banks' policy responses to large and volatile capital flows that could not be absorbed by their relatively small domestic financial markets.

This paper discusses the trade-offs and policy options for central banks' responses to capital flows, before turning its attention to reserve management practices at the Central Bank of Malaysia.

1. Trend in reserves for EMEs over the past decade

1.1 Motivation for holding reserves during large two-way capital flows

The motivation for holding reserves has been a point of contention between theorists and central banks in the economic literature. The academics argued that reserves accumulation is a deliberate policy to support mercantilist[4] or precautionary[5] motives,

[2] Graphs from the Bank Negara Malaysia 2013 Annual Report. Regional emerging market economies include Chinese Taipei, India, Indonesia, Korea, Malaysia, the Philippines, the People's Republic of China, Singapore and Thailand.

[3] Regional currencies include the South Korean won, Indonesian rupiah, Singapore dollar, Malaysian ringgit, Japanese yen, Thai baht, Taiwanese dollar, Indian rupee, Philippine peso and Chinese renminbi.

[4] Intention to devalue currency and accumulate reserves to support export-led growth (Dooley et al (2004))

[5] Reserve accumulation is an insurance contract, approximated by a state-contingent contract with international investors. See O Jeanne and R Rancière, "The optimal level of international reserves for emerging market countries: a new formula and some applications", *The Economic Journal*, vol 121, no 555, pp 905–30, September 2011.

with some evidence to suggest more support for the latter. Other studies have argued that the motivation for holding reserves[6] has evolved over time.

From a Malaysian perspective, the central bank's priority is to ensure orderly adjustment in the exchange rate especially in a period of large and volatile two-way capital flows for a small open economy. At the onset of volatile capital flows, FX market disruptions will first affect domestic financial markets, before adversely affecting the real economy if heightened volatility persists. With a highly developed domestic bond market, representing 98% of GDP in Q3 2018, and significant holdings by global investors, Malaysia faces an added dimension of risks from heightened global volatility. A key consideration for the Bank[7] therefore, is to ensure volatility is managed to preserve confidence and overall financial stability. As a result, reserve accumulation becomes a by-product from the FX policy aimed at maintaining financial stability. At the same time, it is recognised that precautionary reserves can serve as an important market signal on the strength of a country's external position,[8] therefore deterring undesirable speculative attacks on the currency and contributing to monetary and financial stability. For resource-rich economies, precautionary buffers can also act to buffer sharp movements in commodity prices that can amplify the effect of capital flows, inducing disorderly market conditions. The optimal level of precautionary reserves is a subject of considerable academic debate, drawing a correlation between the size of precautionary reserves and the degree of economic and financial integration of a country with the global economy, among other things. This is highly dependent on a country's specific condition.

When capital flows surge to a level that is likely to result in disruption to the domestic financial markets, the central bank will need to deploy capital flow management measures as an additional tool to counter the effect of volatile capital flows. During the period of large capital inflows from 2009 to 2014, like most emerging economies, Malaysia relaxed rules for domestic financial institutions, institutional investors and firms to invest abroad as part of their regionalisation strategy. The decentralisation of reserves has helped to broaden Malaysia's external position. Therefore, the assessment of the level of reserves for a particular country as a measure of external resilience must take into account the context within which reserves are held by the private sector; for example, the degree of reserves decentralisation that has taken place beforehand. During periods of large capital outflows in recent years, several emerging economies have taken capital flow management measures to smoothen the volatility of capital flows as neither exchange rate nor reserves can withstand excessive capital outflows in a short period of time. These measures tend to be temporary and specific to address a particular issue although some measures, which are prudential in nature, may be retained for an extended period to counter risks. The Bank also recognises the importance of improving the liquidity of the onshore FX market as a credible alternative to the offshore FX market as a strategy to promote trade- and investment-related flows while minimising the probability of speculative activity in the offshore market. Nevertheless, none of these are substitutes for sound macroeconomic policy

[6] The IMF in April 2015 identified five reasons for holding reserves: (1) to engender confidence in currency, (2) to counter disorderly market conditions, (3) to support monetary policy, (4) to facilitate inter-generational transfers and (5) to influence exchange rates

[7] The Central Bank of Malaysia Act (CBA) 2009 prescribes the duty of the Bank to hold and manage foreign reserves for the purposes of carrying out its functions and maintaining public confidence.

[8] As well as an indicator for credit ratings

management, in which credible monetary and fiscal policy coordination should be pursued to instil foreign investors' confidence in the country's economic outlook and domestic financial markets.

Trade openness and financial market openness indices of Malaysia and regional peers

Table 1

Indices	Singapore	Malaysia	Thailand	Philippines	India	Indonesia
Trade openness*	3.2x	1.4x	1.2x	0.7x	0.4x	0.4x
Financial market openness**	1.0	0.2	0.05	0.1	0.1	0.3

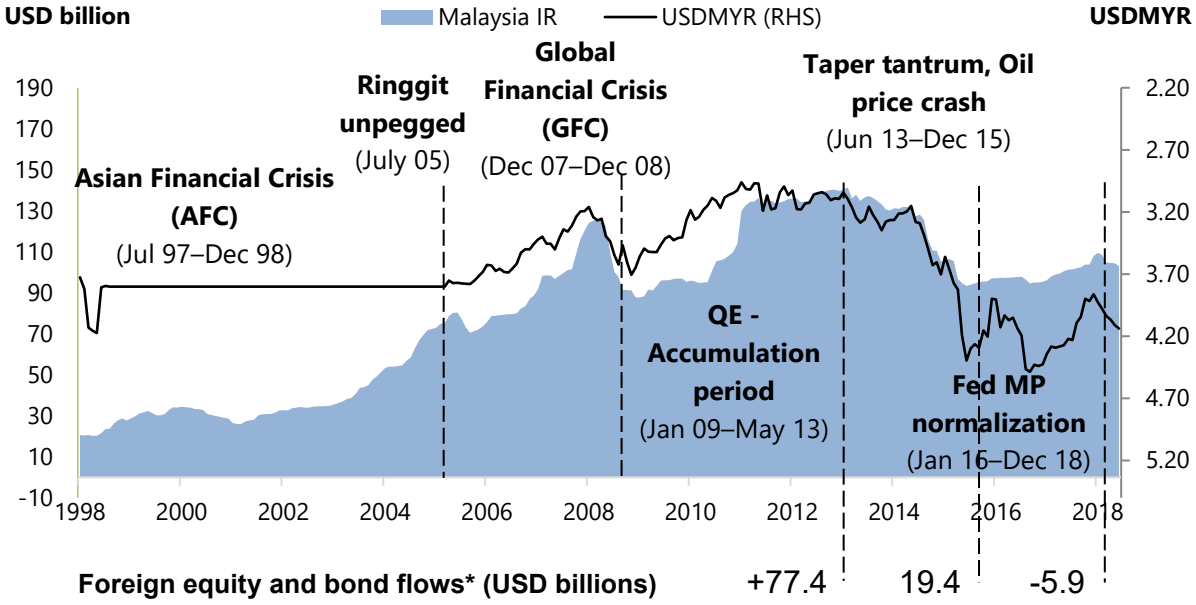
* Calculated based on sum of exports and imports of goods and services measured as share of GDP.

** 1.0 denotes full liberalisation; latest data as at 2013

Sources: IMF, World Bank.

Official international reserves level and USDMYR movement

Graph 1



* Bond flows are calculated based on changes in foreign holdings of total Malaysian debt securities.

Sources: BNM website, Bloomberg, Monthly Statistical Bulletin.

1.2 Assessment of reserve adequacy depends on market structure and stage of development

Notwithstanding the debate on precautionary reserves, the assessment of reserves adequacy has become increasingly sophisticated[9] in recent years. Traditional benchmarks such as import cover, ratios of reserves to short-term external debt and ratios of reserves to broad money continue to serve its analytical purpose to some extent but they need to consider country-specific considerations for a forward-looking estimation of reserve adequacy. Beyond reserve adequacy, regional

9 IMF, *Assessing Reserve Adequacy – Specific Proposals*, December 2014.

cooperation liquidity initiatives[10] may also be considered as a source of liquidity for the Bank as and when needed during periods of uncertainty.

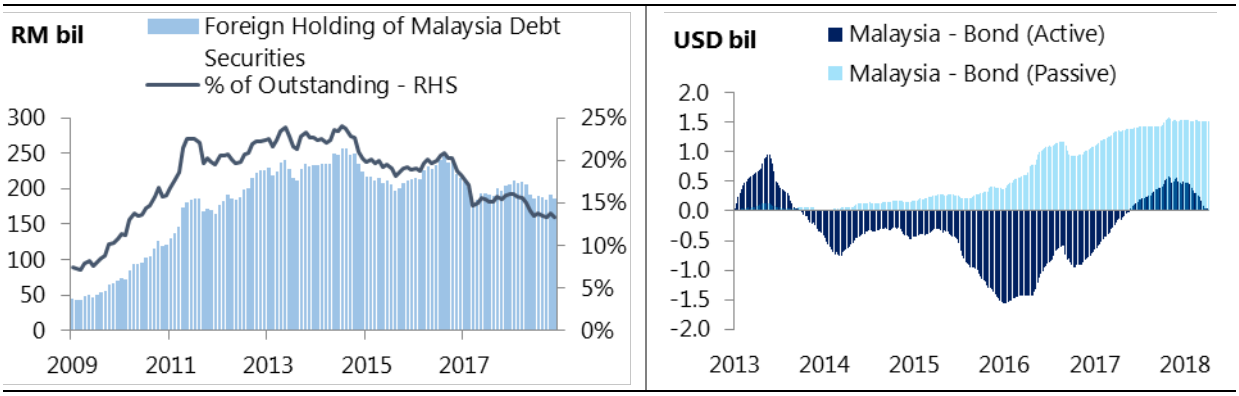
As mentioned earlier, the sizeable external assets held by domestic private sector entities[11] over the last decade has allowed them to manage their own external assets and liabilities, rendering traditional measures of reserve adequacy such as ratios of reserve to short-term external debt less meaningful. This can be more pronounced in economies that are host to financial institutions with a large international presence or a large presence of foreign investors in domestic financial markets. Therefore, indicators of reserve adequacy may not be comparable across countries due to the differing market structures and stages of development. Such measures of reserve adequacy therefore should not be viewed under a one-size fits all approach even for EMEs that share the same rating buckets or geographical proximity.

2. FX intervention: motivations, strategies and tactics

2.1 FX intervention undertaken to ensure orderly adjustments of the exchange rate

In the case of Malaysia, capital inflows related to the QE in advanced economies led to a growing proportion of foreign investors holding bonds in the Malaysian market (see Graph 2). This was further reinforced by positive investor sentiment associated with the inclusion of Malaysia in global major bond indices such as the World Government Bond Index (WGBI) and the JPMorgan Government Bond Index. Consequentially, the large composition of foreign holdings during the period of capital inflows heightened the potential risk associated with the (inevitable) reversal of portfolio flows with any future shift in investor sentiment.

Foreign holdings of Malaysian debt securities and cumulative foreign bond flows — Graph 2



Sources: Monthly Statistical Bulletin, Emerging Market Portfolio Fund Research (EPFR).

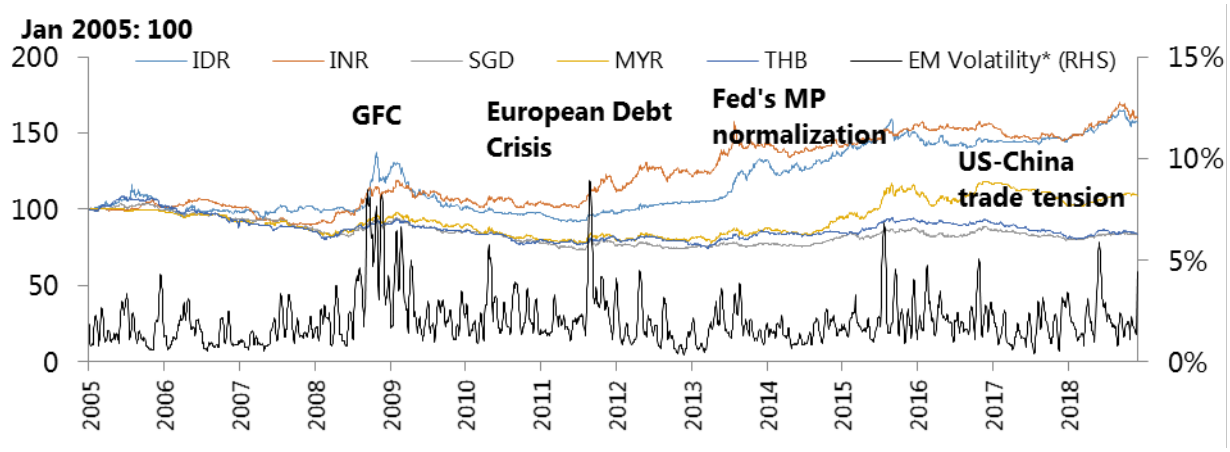
[10] This includes bilateral currency swap arrangements with China, and Korea, Chiang Mai Initiative Multilateralizations (CMIM), ASEAN Swap Arrangement and EMEAP repo lines amounting to a total of USD 59.1billion.

[11] Domestic external assets held by local banking groups and corporations currently stand at RM1.3 trillion.

Another point worth noting is the skewness of capital flows: inflows tend to extend over a sustained period, while outflows tend to be sharp and sudden. In the 2009–18 period, the average change in foreign bond holdings recorded an increase of MYR 3.0 billion/month during periods of inflows as compared with a decrease of MYR 5.4 billion/month during outflows.

In recognising the skewness of capital flows above, the Bank made FX market interventions only as necessary to ensure orderly ringgit adjustments to support price discovery (see Graph 3 below). As a result, it is observed that the changes in ringgit will be smaller than the changes in reserves during both periods of large and volatile capital inflows and outflows. For instance, reserves grew by 55%, or approximately 19% of annual GDP, from USD 91.3 billion as at January 2009 to a peak of USD 141.4 billion in May 2013.[12] During the same period, the ringgit appreciated against the US dollar by 12.0% from 3.7280 to 2.9390, a smaller appreciation than the 14.8% recorded pre-GFC (2005–07), when reserves increased by 29% or USD 22.5 billion.

Indexed regional currencies' performances and 20-day EM currencies' volatility Graph 3



[1] 20-day EM currencies volatility derived based on the Bank's internal calculation using ADXY index.

Source: Bloomberg.

Following capital outflows from EMEs prompted by the Fed-induced taper tantrum and declining oil prices, Malaysia experienced a combination of abrupt reversals[13] and heightened volatility in the FX market, posing a risk of market dysfunction and putting upward pressure on onshore yields. The Bank intervened judiciously to ensure market adjustments remained orderly and therefore posed no risks to financial stability. As a case in point, the Bank intervened the most when there was significant volatility (highest at 14.99[14] on 24 August 2015) as the ringgit breached the USDMYR 4.00 level for the first time since the unpegging of the ringgit.

[12] In addition to FX intervention, the increase in reserves also reflected investment income, which comes in the form of interest payments, dividends and capital gains.

[13] Some of the RM 21.5 billion of Malaysian bonds sold in March 2017 by foreign asset managers was triggered by the act of portfolio rebalancing according to the index's weight for Malaysia. This represented a drop of around 3.7% in the non-resident holdings. Central Bank of Malaysia, www.bnm.gov.my/index.php?ch=en_publication&pg=en_staffinsight&ac=46&bb=file.

[14] USDMYR 1M at the money implied volatility as measured by Bloomberg.

The reserves declined by over 30% or USD 44.7 billion from the high of USD 141.4 billion in May 2013 to USD 96.7 billion in July 2015. This decline far outweighed the changes in the exchange rate, reflecting the large degree of intervention during abnormal times. This also triggered the implementation of FX-related measures by the Bank in December 2016 to preserve orderly market conditions. The resumption of capital inflows in subsequent years[15] accorded some temporary policy relief following an eventful 2015 and 2016. However, since 2018, a combination of external factors ranging from US-China trade tensions to the Fed's monetary policy normalisation has renewed pressure on capital flows and exchange rates for EMEs, including Malaysia.[16]

2.2 Mode of FX intervention remains flexible with a broad range of tools to sterilize the impact

The Bank tailors its FX intervention strategies to market conditions. The Bank intervenes using primarily the USDMYR spot due to the fact that this is the most actively traded FX pair. However, this can give rise to the perception of a USD dirty peg, especially among the academics. For central banks, a pragmatic approach is to utilise the most liquid segment of the FX market to achieve its objectives. From time to time, the Bank also deploys the use of other currency pairs [Not publicly available] and instruments such as FX swaps and forwards, depending on market requirements and relative effectiveness of these tools.

The interlinkages between the FX and ringgit markets also require the Bank to manage the corresponding fluctuations in domestic liquidity via several monetary instruments. For instance, the current net short FX swap position[17] is to manage ringgit liquidity due to the current outflows, as compared with 2005–15 (during the unpegging of ringgit until QE), whereby the Bank held a mainly net long position to remove the excess ringgit liquidity.[18] Utilisation of FX swaps as a sterilisation tool has the added benefit of being cost-effective for the Bank while simultaneously facilitating efficient funding operations for onshore banks.

In the light of tightening liquidity and rising interbank rates following the taper tantrum in 2013, the Bank also enhanced the reverse repo facility for better facilitation of ringgit liquidity injection. The facility's purpose was twofold: a development initiative to enhance the depth of the Malaysian repo market as well as to increase the number of effective sterilisation tools available. Usage of reverse repos increased during the 2014–15 oil price decline with liquidity imbalances due to portfolio outflows being partially addressed by injecting liquidity equivalent of USD 3.2 billion to the market to aid the normalisation of market conditions.

[15] Malaysia recorded foreign equity and bond flows of –USD 429 million and +USD 570 million respectively in 2016 and 2017

[16] For example, during the period of inflows of 2010–13, the spread between the Overnight Policy Rate (OPR) and the 10-year Malaysian Government Securities narrowed by 2,276 basis points (bp). The spread subsequently widened by 566 bp when the flows reversed from May 2013 till December 2015 (2013 taper tantrum and oil price decline in 2014).

[17] The Bank's net forward position is disclosed on its website.

[18] Net selling of foreign currency through foreign exchange swaps reached a peak of USD 16 billion during the 2010–11 period in an effort to sterilise the large inflows arising from QE.

2.3 FX intervention policy strengthened by onshore market development and better surveillance

Managing risks to financial stability has been the key priority for the Bank when undertaking its intervention operations to manage both exchange rate volatility and domestic liquidity conditions. The effectiveness of interventions can be observed in the improvement in domestic liquidity as reflected in the narrower USDMYR bid-ask spread, which has recorded a lower average of 23 points in 2018, relative to an average spread of 35 points post-taper tantrum (2016–17). In addition, the USDMYR daily volatility recorded a decline by more than half throughout the decade (see Table 2).

Malaysia's international reserves, USDMYR and regional currencies daily volatility — Table 2

Events	GFC	QE	Taper tantrum, oil price crash	Oil price recovery	Fed's MP normalisation
Period	Dec 07–Dec 08	Jan 09–May 13	Jun 13–Dec 15	Jan 16–Nov 16	Dec 16–Dec 18
Reserve volatility	1.22%	0.55%	0.55%	0.50%	0.32%
USDMYR volatility	0.43%	0.43%	0.54%	0.59%	0.20%
Regional currencies volatility*	0.54%	0.39%	0.33%	0.35%	0.28%
Events	GFC	QE	Taper tantrum, oil price crash	Oil price recovery	Fed's MP normalisation
Period	Dec 07–Dec 08	Jan 09–May 13	Jun 13–Dec 15	Jan 16–Nov 16	Dec 16–Dec 18

* Basket is derived from equally-weighted currencies including THB, IDR, PHP and KRW.

Sources: Bloomberg, Central Bank of Malaysia's staff calculations.

The effectiveness of FX intervention depends on the stage of market development, which in turn requires continuous feedback from market players, counterparts and effective surveillance. For instance, the Financial Market Committee (FMC), comprising representatives of the Bank and market players, was established in 2016 as a platform to encourage sharing of information and feedback on financial market developments and policies. On the international front, continuous engagement with regional counterparts such as the Executives' Meeting of Asia-Pacific Central Banks (EMEAP)[19] also provided an avenue for sharing knowledge on regional capital flows, market development initiatives and capital flow management policies.

The Bank's market development efforts[20] have recently been concentrated more on shifting activities from offshore NDF market to the onshore market as a way to enhance onshore market liquidity. This resulted in an increase of onshore FX volumes,

[19] EMEAP comprises central banks and monetary authorities of 11 economies: the Reserve Bank of Australia, People's Bank of China, Hong Kong Monetary Authority, Bank Indonesia, Bank of Japan, The Bank of Korea, Central Bank of Malaysia, Reserve Bank of New Zealand, Bangko Sentral ng Pilipinas, Monetary Authority of Singapore and Bank of Thailand.

[20] Central Bank of Malaysia, *Statement by Financial Markets Committee: Initiative to Develop the Onshore Financial Market*, 2016, www.bnm.gov.my/index.php?ch=en_press&pg=en_press&ac=4316&lang=en.

which have grown by 33% from a daily average of USD 8.0 billion in January – November 2016, to USD 10.6 billion in December 2016–December 2018. To enhance the attractiveness of the onshore market, the Bank granted flexibility for market participants to manage their FX exposures[21] such as in the dynamic hedging framework (introduced in 2016). Additional hedging flexibilities[22] were eventually provided to institutional investors to allow the active hedging and unwinding of their FX positions. Since the inception of the framework in 2016, the daily average of FX forward transactions has increased by USD 0.4 billion or 70%. The Bank has also introduced a new instrument, namely USD Bank Negara Interbank Bills (BNIB)[23] as an additional tool to facilitate short-term foreign currency liquidity management. All in all, these measures have helped to increase onshore market participant capacity to effectively intermediate market flows.

The Bank has also reinforced market integrity via the adoption of an improved market code of conduct. The prudent management of financial market conditions during "risk-off" events continues to be complemented by a sustained focus on strengthening domestic fundamentals and macroprudential measures. This requires the Bank to preserve access to a broad policy toolkit necessary to address financial imbalances and strengthen Malaysia's resilience to volatile capital flows.

3. Reserves management strategies

3.1 Stronger focus on liquidity amid volatile market landscape

Reserves management practices at the Bank are guided by the long-term investment objectives of capital preservation, ensuring sufficient liquidity to meet foreign obligations, as well as maximising risk-adjusted returns to ensure the sustainability of reserves. During periods of market stress, the value proposition of having a large stock of reserves increases. Conversely, during tranquil times, the opportunity cost of holding reserves rises. In other words, the cost-benefit of holding reserves changes over the business cycle. This in turn influences the Bank's reserves management strategies with a tendency to err on the side of conservatism and prudence.

The strategic asset allocation process serves to ensure sufficient liquidity and capital preservation. Investments in shorter-term and high-grade assets ensure ample liquidity in meeting trade and financial flows while asset class diversification allows the Bank latitude to seek higher risk-adjusted returns. Liquidity is one of the biggest factors taken into consideration in the Bank's strategic asset allocation process. To reflect this, the Bank is selective in its investments that exhibit characteristics that provide the Bank the greatest flexibility to enter and exit with minimal transaction costs while maintaining a reasonable risk-return profile.

[21] Prior to the introduction of dynamic hedging framework, all hedging transactions had to be backed by an underlying asset to prevent unfunded FX trading activities of the ringgit. The liberalisation was the Bank's gradual approach in further developing the domestic market.

[22] Ibid.

[23] This instrument has also the added benefit of High-Quality Liquid Asset (HQLA) classification for the Basel capital ratio computation

The strategic asset allocation process also determines the currency composition of the reserve portfolio. In determining the appropriate level of currency composition, the Bank takes into consideration opportunities to enhance the overall reserve yield against a backdrop of Malaysia's trade patterns. For example, as the size of Malaysia's trade profile with other Asian countries increased, the conviction to hold Asian currencies as part of the reserves universe grew.

3.2 Greater asset diversification to reduce cost of holding reserves and enhance return

The cost of holding reserves is reflected in the differential between interest-bearing foreign currency assets and local currency liabilities, which is closely related to the OPR. Since 2010, the cost of holding reserves has increased, given widening differentials between the relatively low-yield foreign assets (predominantly in USD) and the relatively higher yields of local currency liabilities.

In line with many reserve and sovereign wealth fund asset managers,[24] the Bank has gradually expanded its investment universe to encompass assets other than developed market sovereign bonds.

The steady growth of reserves since the Asian Financial Crisis amid a secular decline in global interest rates prompted the diversification of assets. The low yield environment following unconventional monetary policies in the advanced economies added further impetus to the trend in search for better returns. While the majority of reserves exposure remains liquid with a strong overall credit profile, the investment universe includes a small exposure to assets that have higher relative credit, market and liquidity risks for yield enhancement purposes. Furthermore, the increase in credit risk appetite was also reflective of the Bank's strengthened relationship with other central banks through regional cooperation, which helped improved the Bank's confidence in investing in these countries. Going forward, changes in the operating environment, especially following the normalisation of monetary policy in the advanced economies, will require a reassessment of the portfolio allocation to ensure it remains optimal in terms of balancing risk-return and liquidity.

3.3 Outsourcing as means of diversification and knowledge transfer

An element of the Bank's diversification strategy is the outsourcing of a portion of the managed reserves to external fund managers. The External Fund Management (EFM) programme, which started in 1995, was aimed at enhancing returns and providing a benchmark for the Bank's internal investments. In 2005, the EFM programme was enhanced to achieve further diversification benefits and build internal capacity in new asset classes and instruments, through knowledge transfer and enhanced infrastructure and processes in new areas of investment. The programme also served a developmental role in supporting market and industry development. Over time, the EFM Programme has expanded its investments into more sophisticated asset classes and markets such as ABS/MBS, commodities and equities. As internal capacity grows, overlapping mandates were terminated,

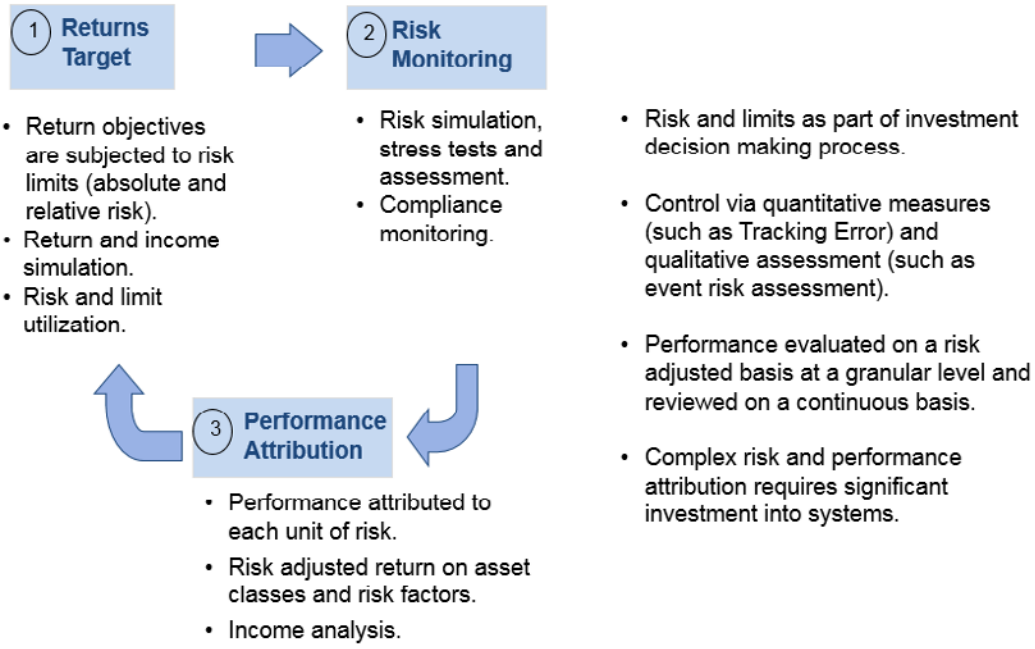
[24] For example, see the 2018 UBS Annual Reserve Manager Survey.

reflecting effective knowledge transfer from the EFMs to the Bank's internal investment team.

3.4 Risk management framework evolved with asset class expansion

The Bank's risk management framework has also evolved in tandem with the expansion of asset classes and the associated risks. Improvements were made in the governance structure, systems and staffing. First, in terms of governance, the Board of Directors determines the investment benchmark, which clearly defines the risk-return appetite of the Bank and serves as a yardstick for performance measurement.[25] Subsequently, investment decisions within the allowable risk parameters are made to achieve better risk-adjusted returns versus the investment benchmark. Investments are subjected to further stringent risk controls and limits to ensure no excessive risk-taking. A treasury risk section which reports independently to a Deputy Governor on risks and performance of the reserves provides an additional layer of internal control. Periodic reporting of risk indicators, investment exposures, portfolio return and performance as well as compliance with respective limits, are submitted to the management and the Board to ensure that any emerging risks are highlighted and sufficiently mitigated.

Risk Management Framework — Graph 1



Source: Central Bank of Malaysia.

Second, risk measurement and monitoring continue to be enhanced with the implementation of new Treasury systems and the increased technical rigour of risk

[25] Under the CBA, guidelines in managing reserves, including the types of assets, must be approved by the Board, which comprises a majority of independent non-executive directors. The Board also provides ongoing oversight on the Bank's reserve management practices and performance.

assessments. For example, in managing market risk, the use of tracking error (TE) is complemented with other risk measures such as value-at-risk (VaR), portfolio return volatility and information ratio. In managing credit risks within the Bank, greater focus has been given to strengthening the Bank's internal analysis to complement external rating agencies' assessments. This also acts to counter procyclical investment behaviour. There is also more extensive use of stress testing and scenario analysis for a more forward-looking and comprehensive assessment of all emerging risks. This is to address the increased complexity of new asset classes and the potential for risk correlation within the reserves.

Third, the expansion of the investment universe and increased risk profile have been accompanied by strengthening the technical capabilities of staff to manage more complex asset classes. This has been supported by increased investments in staff training and development.

These enhancements and controls have ensured that, despite the foray into higher-yielding asset classes, the overall risk profile of the investment portfolio has remained appropriately conservative. Graph (1) shows the Bank's risk management process.

4. Conclusion

EMEs have continued to deal with the large and volatile two-way capital flows arising from the QE measures in the advanced economies. As the financial markets in EMEs do not have sufficient breadth and depth to absorb the volatility in capital flows, EME central banks have to use a combination of FX tools and capital flow management measures to mitigate risks to its overarching mandates of monetary and financial stability in ensuring a conducive environment for sustainable growth. As a result, the changes in reserves have become a by-product of these measures, although there is some element of precautionary reserves that serve to shore up external resilience during periods of uncertainty.

The Bank recognises the importance of greater international cooperation among EMEs to deal with volatile capital flows. Access to regional financing arrangements has broadened the Bank's range of toolkits to manage these flows. At the same time, initiatives were undertaken to further deepen and broaden the onshore financial market, which will allow for more effective policy transmission to better serve the Bank's goal of promoting financial stability. The Bank also undertook efforts to diversify the composition of international reserves to achieve a better balance between liquidity and risk-adjusted return. This saw the expansion of asset classes with higher relative risks, accompanied by the strengthening of regional cooperation as well as the Bank's investment capabilities and risk management framework.

Reserve management and FX intervention in Mexico

By Javier Guzmán Calafell[1]

Abstract

This note outlines Mexico's recent experience with three closely interrelated issues. First, on the basis of a legal framework regulating transactions in foreign currency between the central bank and government entities, and preannounced market-based mechanisms, the stock of international reserves has reached adequate levels. Second, interventions have been made to restore orderly operating conditions in the FX market whenever this has been needed, with satisfactory results and consistent at all times with the free-floating exchange rate regime in place. Third, the continuous improvement of standards and practices has been instrumental in achieving the objectives set for reserve management at the Bank of Mexico (ie liquidity, capital preservation and return enhancement).

Keywords: International reserve management, FX intervention mechanisms, portfolio allocation.

JEL classification: E58, F31, G11.

[1] Deputy Governor at the Bank of Mexico.

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The Bank of Mexico's international reserves have increased significantly, although with fluctuations, in recent decades. The current stock, of around USD 179 billion, represents a tenfold increase from early 1997. At the same time, the level of reserves has remained roughly constant over the last three years. This is explained by a combination of factors.

Given the uncertainty regarding the optimal level of reserves, a tendency to err on the side of caution is desirable. In fact, evidence in the economic literature shows that large stocks of international reserves enhance an economy's resilience to external shocks, including through the diminished probability or cost of potential sudden stops of capital inflows.

Decisions by Mexico's Foreign Exchange (FX) Commission[2] regarding the level of the stock of international reserves, take into account a range of tests and metrics. However, in view of their varying nature and at times diverging results, these are used only as a reference and never as an explicit goal. In fact, no single metric is uniquely relied upon to gauge international reserves adequacy, thus rendering the FX Commission's judgment crucial in this task.

Reserve accumulation in Mexico has originated from two sources.

On the one hand, as per the Bank of Mexico's Law, all non-financial entities of the Federal Public Administration are required to operate with foreign currencies following the rules and policies set forth by the central bank, as well as to sell them directly to the latter under prevailing market conditions. Naturally, the motivation for such a requirement rests on those institutions' potentially large trade surpluses or deficits. Due to this regulatory framework, international reserves were sourced, for many years, to a significant extent from Pemex, the national oil company. The Federal Government has been another important driver of the international reserves stock.

On the other hand, when the level of reserves has been deemed insufficient, the FX Commission has resorted to a rules-based approach to buy US dollars from the market, in the form of preannounced auction mechanisms with relevant terms and conditions (such as timing and size) made public in advance. Specifically, these have consisted in the sale of US dollar put options to the market through monthly auctions during the periods August 1996–June 2001 and February 2010–November 2011. These instruments give financial institutions the right to sell US dollars to the central bank over the course of the following month, conditional on two requirements. First, the option's strike price is the FIX exchange rate determined by the Bank of Mexico on the business day prior to the exercise. [3] Second, the option can be executed only when the exchange rate of exercise has appreciated with respect to its 20-day moving average.

Of course, the benefits of holding an ample stock of international reserves come at a cost. In order to avoid potential pressures that could weaken monetary policy,

[2] The FX Commission, the body responsible of Mexican foreign exchange policy, includes three members of the Ministry of Finance (the Minister and two Deputy Ministers) and three from the Bank of Mexico (the Governor and two Deputy Governors). The Minister of Finance chairs the Commission and has the casting vote. In his or her absence, the Governor of the central bank takes on these roles.

[3] The FIX exchange rate is determined by the Bank of Mexico as an average of quotes in the wholesale foreign exchange market for operations payable in 48 hours. The central bank reports the FIX from 12:00PM onward each banking day. It is published in the Official Gazette (Diario Oficial de la Federación) one banking business day after its determination date, and it is used to settle liabilities denominated in US dollars payable in Mexico on the day after its publication in the Official Gazette.

the Bank of Mexico has sterilised the added liquidity injected into the economy, as foreign currency is purchased with domestic currency, by issuing interest-bearing liabilities. The cost of accumulating international reserves arises from the fact that the return on investing international reserves is typically lower than the interest paid on said central bank liabilities.

In view of the above-mentioned trade-off, the FX Commission has at times decided to reduce the pace of accumulation when international reserves have reached levels at which the benefits of future expected accumulation have started to be surpassed by their financial costs (ie the cost of carry). For instance, from May 2003 through July 2008, following a period of rapid reserve accumulation owing mainly to large US dollar sales from Pemex to the central bank, the FX Commission introduced a mechanism through which the Bank of Mexico sold, via preannounced daily auctions over the course of a given quarter, half the net amount accumulated during the previous quarter.[4]

Notwithstanding the merits of holding adequate levels of international reserves, as underscored by the experience of recent years, it is worthwhile to consider additional measures. In Mexico's case, these include an IMF Flexible Credit Line (FCL), which since 2009 has enhanced the economic position of the country in the event of external shocks, at a financial cost lower than that of holding international reserves. Currently at around USD 74 billion, this FCL yields, among other benefits, potential additional resources in foreign currency to face any contingency in the foreign exchange market, an endorsement by the IMF of Mexico's economic policies, and another mechanism of discipline for the authorities.

In addition, Mexico has negotiated several regional arrangements. For instance, under the North American Framework Agreement (NAFA), and with the purpose of promoting orderly currency exchange markets, the Bank of Mexico has a bilateral currency swap line with the US Federal Reserve and a parallel agreement with the US Department of the Treasury. The former, amounting to USD 3 billion, has been renewed annually since it was established in 1994, with Mexico drawing upon the line for the last time in 1995. In the case of the latter, the resources available were tripled in 2018 to USD 9 billion. Further to these, reciprocal currency arrangements (swap lines) for an amount of up to USD 30 billion were temporarily established between the Bank of Mexico and the Federal Reserve at the height of the global financial crisis (from 29 October 2008 to 1 February 2010), to help provide US dollar funding to financial institutions in Mexico.

It is important to note that neither the FCL nor the other arrangements are to be seen as a substitute for international reserves, but rather as a complement to them.

The second issue under consideration in this note relates to intervention in the foreign exchange market.[5] The Mexican economy operates under a flexible exchange rate regime. In this context, market forces determine the equilibrium real rate, the exchange rate plays a key role as a shock absorber, and the value of the currency is

[4] Nearly a year after the introduction of this mechanism, the "previous quarter" reference was changed to a moving average of the previous four quarters to smooth out the seasonality inherent in international reserve accumulation and thus avoid large fluctuations in amounts sold.

[5] For a detailed account of Mexico's experience with FX intervention under the current free-floating exchange rate regime, see R Cano, D Gallardo and J Acosta, "Mexico: free-floating exchange regime", in M Chamon, D Hofman, N Magud and A Werner (eds), *Foreign exchange intervention in inflation targeters in Latin America*, International Monetary Fund, 2019, Chapter 11.

supported mainly by economic fundamentals. At the same time, mechanisms for intervention in the foreign exchange market have been used to manage the level of international reserves, as already described, or to foster orderly market operating conditions.

In line with those related to the management of the level of international reserves, Mexico's FX Commission has relied mainly on preannounced, rules-based tools for interventions to smooth volatility or to provide liquidity to the market. These include the daily US dollar auctions (both with and without a minimum bid price) held on a number of occasions in the past,[6] as well as the previously mentioned USD-denominated credit lines offered to banks (also allocated through auctions), which they could on-lend to corporates.[7] Although the vast majority of Mexico's experience in this regard has taken place in the spot market, interventions through derivatives have also been carried out. In fact, the FX Commission recently introduced auctions of non-deliverable forwards (NDFs) which, by being settled in MXN, protect the stock of international reserves. In place since February 2017, the size of this programme is USD 20 billion, of which only USD 5.5 billion has been auctioned and subsequently rolled over.

Although the FX Commission has typically resorted to rules-based and preannounced operations like the ones described above to intervene in the FX market, extraordinary measures to provide it with liquidity and restore its smooth functioning have also been harnessed, although only in exceptional circumstances. These include the USD auctions of October 2008, as well as four episodes[8] of discretionary outright sales of US dollars, the last of which (in January 2017) was conducted, for the first time, with institutions located outside the country, thereby attesting to the Bank of Mexico's capabilities to intervene at any time, through several mechanisms (including both electronic and more traditional platforms), and not only via domestic counterparties.

Mexico's experience with interventions has been positive, not only as a result of the expertise gained through their execution, but also in terms of their effectiveness in containing surges of volatility in the FX market. On the one hand, when the Bank of Mexico has sought to accumulate international reserves or to reduce the pace of accumulation through purchases or sales of US dollars, respectively, the interventions have served their intended purpose. On the other hand, when the aim of interventions has been to provide liquidity to the market to ensure adequate operating conditions, the evidence suggests that, in most cases, they have reduced extremely high volatility and bid-ask spreads (a proxy for illiquidity). However, caution should be used when arriving at conclusions derived from analyses of the effectiveness of interventions, as this is not a straightforward question. For example, even if volatility does not diminish after an intervention, it is not necessarily the case that the intervention was ineffective.

[6] Auctions *with* a minimum bid price were used during February 1997–June 2001, October 2008–April 2010, November 2011–April 2013, and December 2014–February 2016, while corresponding mechanisms *without* a minimum bid price were in place during March 2009–September 2009 and March 2015–November 2015.

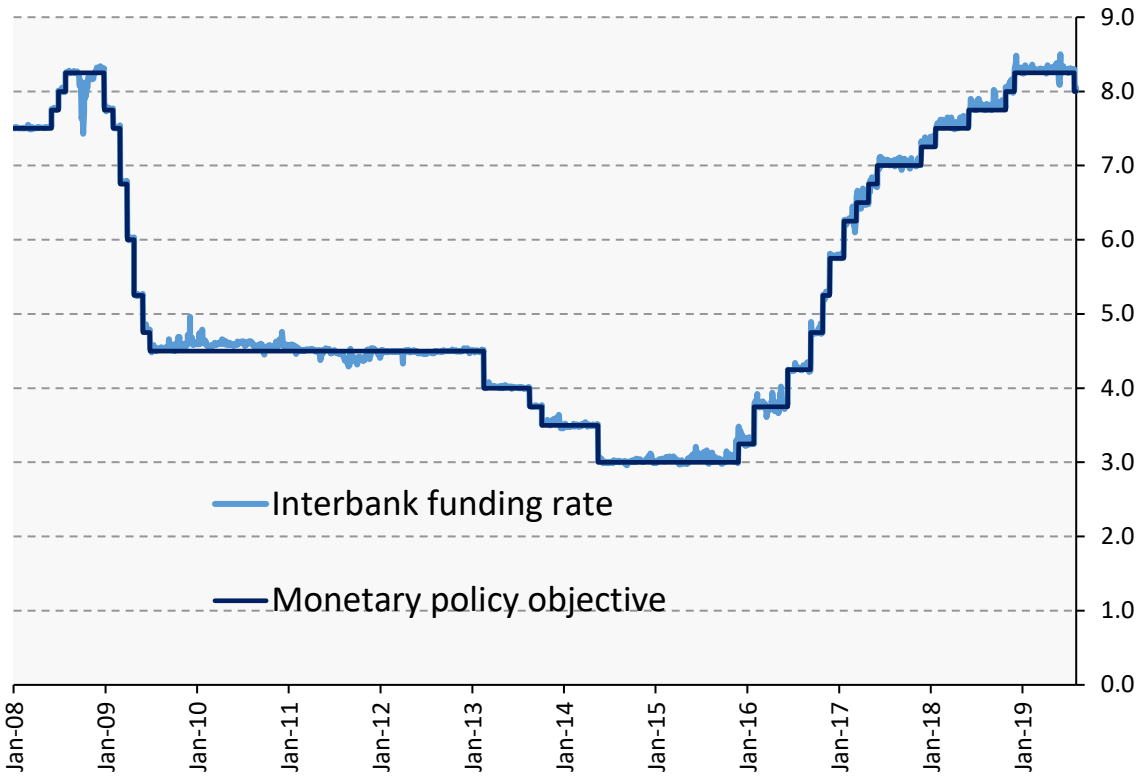
[7] This mechanism was resorted to in April 2009, when USD 3.2 billion were allocated via auction. It is noteworthy that international reserves were not used, as the resources came from the above-noted swap line established with the Federal Reserve.

[8] September 1998, February 2009, February 2016 and January 2017.

The problem is that, in practice, central banks have no counterfactual scenario against which to compare the outcome of a given intervention.

Since the impact of FX interventions on liquidity has been sterilised by the Bank of Mexico, they have had no implications for the implementation of monetary policy. This is evidenced, for instance, by the fact that the interbank funding rate has been very close to the central bank's target since its adoption in 2008 (Graph 1).

Interbank funding rate and monetary policy objective (%) Graph 1



Source: Bank of Mexico.

It is important to stress that the actions described above have been taken *without* setting a target for the exchange rate. As a result, FX interventions have been implemented in a way fully consistent with the free-floating exchange rate regime.

Regarding the Bank of Mexico's standards and practices in reserves management, the Bank has three main objectives: liquidity, capital preservation and return enhancement. The balance among these aims is determined, to a significant extent, by the interplay between the international environment and the Mexican economy, ongoing perspectives on financial markets, and the central bank's needs. Liquidity stands out as the most important of these objectives, and it is taken into account in any context to determine the composition of the reserve's portfolio, while the relative focus on capital preservation vis-à-vis return enhancement – usually conflicting objectives – may change depending on the economic and financial context.

For example, between 2000 and 2012, Mexico's international reserves grew rapidly, from USD 31 billion to USD 164 billion. Naturally, given the amount of accumulated reserves and the low levels of international interest rates, the cost of

carry was significant. In this context, the Bank of Mexico focused its strategic asset allocation on enhancing the return of the portfolio to mitigate carry costs. This was achieved by including new asset classes and currencies that allowed the central bank to increase the expected return of the international reserves portfolio without significantly increasing market risk, thereby harvesting the benefits of diversification.

In contrast, starting in 2013, the looming normalisation of the Federal Reserve's monetary policy stance was expected to result in an appreciation of the US dollar and an increase in interest rates, which could pose a significant risk to the returns of the international reserves portfolio, and give rise to capital losses. In addition, the price of gold could drop due to the higher opportunity cost of holding the precious metal, while reserve accumulation had come to a halt given lower oil prices and, as previously described, the need to use the Bank of Mexico's reserves on several occasions to provide liquidity to the FX market and restore its adequate functioning. As a result, the Bank shifted the balance of objectives towards capital preservation, which was achieved by identifying the main risk factors of its portfolio, and adding forward-looking measures to its optimisation models. All in all, the efforts made were successful in mitigating capital losses, and the measures taken allowed the Bank of Mexico to successfully diminish the volatility of returns on the reserves portfolio.

Currently, in view of the uncertainty surrounding the path for US monetary policy going forward and other factors, the focus of the Bank of Mexico's asset allocation strategy is still to preserve capital while maintaining a more balanced portfolio that should be less affected by different economic and financial outcomes.

Within this context, the Bank of Mexico significantly adjusted its strategic asset allocation methodology. Firstly, changes in financial markets dynamics after the global financial crisis made apparent that the usage of historical data had to be revamped. Thus, the models of the central bank were adapted to use the information embedded in market prices as their primary source. This provided a forward-looking element to the methodology, and allowed for a more intuitive and sound estimation of the expected distribution of returns, while minimising subjective elements within the decision-making process. Secondly, the inputs used in the portfolio's optimisation were enhanced by enabling them to match empirical facts, such as the non-normality of asset returns, in view of the evidence suggesting that their actual distributions tend to be "fatter" at the tails than would be predicted under the previously held assumption of a normal distribution. Lastly, the Bank of Mexico redefined the risk metric of the portfolio altogether. From using volatility, and thereby the typical mean-variance approach (Markowitz), towards optimising the portfolio using a risk metric that focuses on the left-hand side of the distribution of returns, such as the conditional value-at-risk, thus explicitly matching the objective function of the portfolio with the objective of capital preservation.

In tandem with these and other practices adopted internally, the Bank of Mexico's framework for reserves management has been further enhanced in recent years through the incorporation of non-benchmarked mandates, awarded to external managers. These provide direct diversification benefits derived from uncorrelated investment strategies which, on the basis of absolute returns but within the boundaries of eligible asset classes, construct portfolios that can be deemed unusual for a central bank. In addition, this type of mandates allow part of the reserve's portfolio to adjust rapidly to changing market conditions, while the external managers' capability to implement investment strategies having a low correlation with other portfolios' positions effectively expands the investment efficiency frontier.

Lastly, our staff's increased exposure to novel approaches and methodologies as part of this process has been of great value, not least due to the resulting learning and insights.

Some important challenges remain. Among these, a most significant one relates to the general public's understanding and perception about the broader contours of the issues at hand, including the rationale behind the FX Commission's directives, as well as their implementation by the Bank of Mexico. Particularly, in spite of the assessed adequacy of the current level of international reserves as per a variety of objective metrics, there is a risk that public opinion could deem them excessive and/or invested sub-optimally from a social standpoint. Should views like these become entrenched, the central bank could face pressures to generate higher returns or distribute the reserves to meet other objectives. In such a situation, a direct and clear communication strategy is important, to better explain the purpose, scope and usage of international reserves, especially their role in the financial and economic stability of the country. In this regard, further to the mandated disclosures derived from Mexico's transparency law, the Bank of Mexico has been working on different projects to provide more clarity to the public, including efforts to increase awareness and understanding of international reserves management practices.

International reserves and forex intervention in Peru

By Renzo Rossini, Adrian Armas, Paul Castillo and Zenon Quispe[1]

Abstract

This paper reviews the Peruvian experience in using FX intervention and reserve requirements for macroprudential purposes, with the aim of limiting the financial risks associated with dollarisation. Peru is a successful market-driven case of de-dollarisation, which reflects both macroeconomic stability and prudential policies. Since the adoption of inflation targeting in 2002, core inflation has been on average 2.1%. During the same period, financial dollarisation has declined steadily, from levels close to 80% to less than 30%. Besides delivering low and stable inflation, the current monetary policy framework has also contributed to providing an effective response to the global financial crisis, by limiting its spillover effects on the domestic financial system.

Keywords: monetary policy, central banking, FX intervention, dollarisation.

JEL classification: E52, E58, F31.

[1] Central Reserve Bank of Peru. Corresponding author: renzo.rossini@bcrp.gob.pe

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1. Monetary policy framework

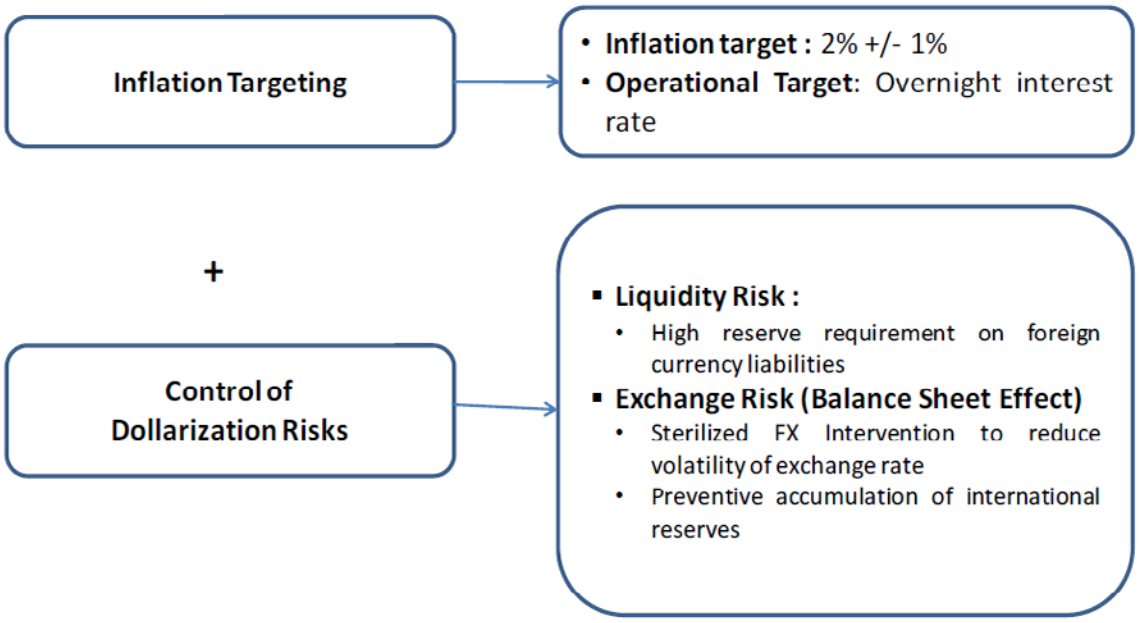
Monetary policy in Peru follows an inflation targeting scheme adapted to take into account the risks associated with financial dollarisation. This framework includes sterilised FX intervention to reduce the volatility of the exchange rate, preventive accumulation of international reserves and high reserve requirements on foreign currency liabilities to mitigate liquidity risk.

In parallel with the deepening of the FX derivatives market, the central bank has expanded its toolkit of FX intervention instruments. In addition to FX intervention through transactions in the spot market, the central bank introduced in 2002 the use of central bank securities indexed to the exchange rate and created in 2014 a currency swap. This set of indirect intervention instruments provides the banking system with an FX hedge, reducing pressures in the forward market, and consequently on the spot market.

Additionally, the central bank started a de-dollarisation program in 2013, based on additional reserve requirements to promote a reduction in credit dollarisation. As a result, dollarisation of credit to the private sector has dropped from 44% in December 2014 to 28% in November 2018.

This policy framework has been effective in maintaining inflation low and stable, within the target band, while at the same time keeping the financial system sound and reducing financial vulnerabilities. This note highlights the main characteristics of this policy scheme and describes the main measures taken, in particular from 2013 onwards.

The inflation targeting plus dollarisation risk control framework in Peru — Graph 1



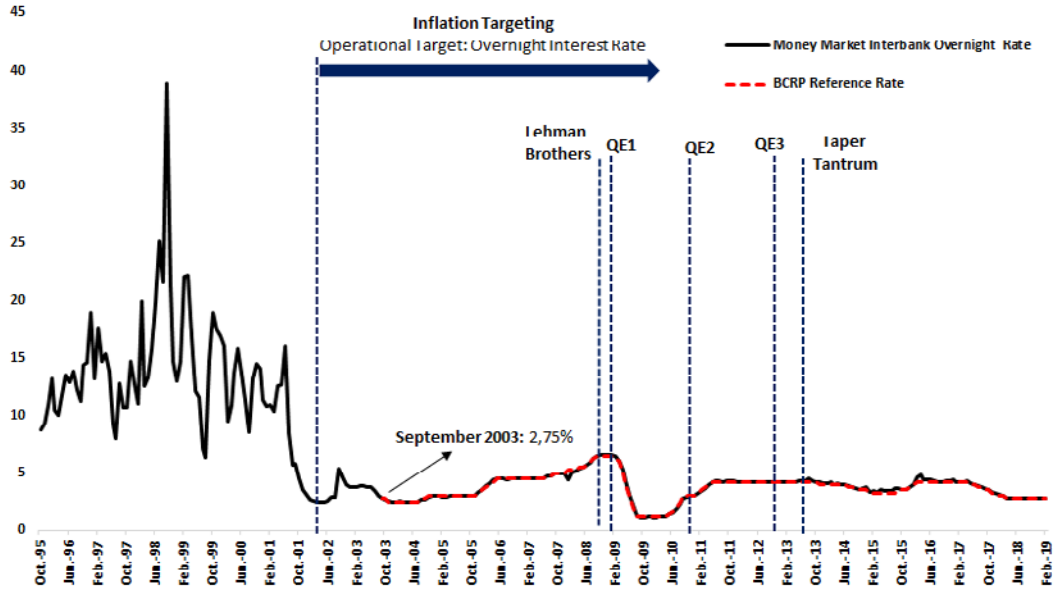
The operational target of monetary policy is the short-term interest rate. This operational target is used by the BCRP, just as it is by any other IT central bank, to deliver the stance of monetary policy to the market. During periods of high inflation

or output gap levels, the central bank tends to increase its policy interest rate to fight inflationary pressures; conversely, when inflation is below the central bank target and the output gap is negative, the central bank tends to cut its policy rate.

However, in the case of a financially dollarised economy, interest rate setting also has to take into account how dollarisation affects the transmission mechanism of monetary policy. The BCRP addresses this issue by using an inflation forecasting model (MPT) that explicitly takes into account the impact of dollarisation on credit market conditions and on the dynamics of exchange rate and inflation (Winkelried (2013)). In this model, dollarisation reduces the impact of monetary policy over inflation and the output gap, since a large depreciation not only generates a typically positive impact on exports but also triggers a negative impact on the financial position of firms with currency mismatches. So, with dollarisation, the typically expansionary effect of the exchange rate channel of monetary policy after a policy easing is muted. Also, the MPT takes into account the impact of both reserve ratio changes and exchange rate market interventions on the dynamics of interest rates and the exchange rate.

Even though this share has been declining in recent years, it is still an important source of financial vulnerability with respect to credit risks associated with abrupt movements in the exchange rate and risks associated with the availability of adequate levels of international liquidity. First, currency depreciation can increase the amount of non-performing loans and potentially induce a financial crisis. Second, banks dependence on foreign currency liabilities can put pressure on international reserves when central bank liquidity support is needed. These two vulnerabilities have been identified by the central bank as the main reasons for intervening in the foreign exchange market and for using higher reserve ratios on foreign currency liabilities.

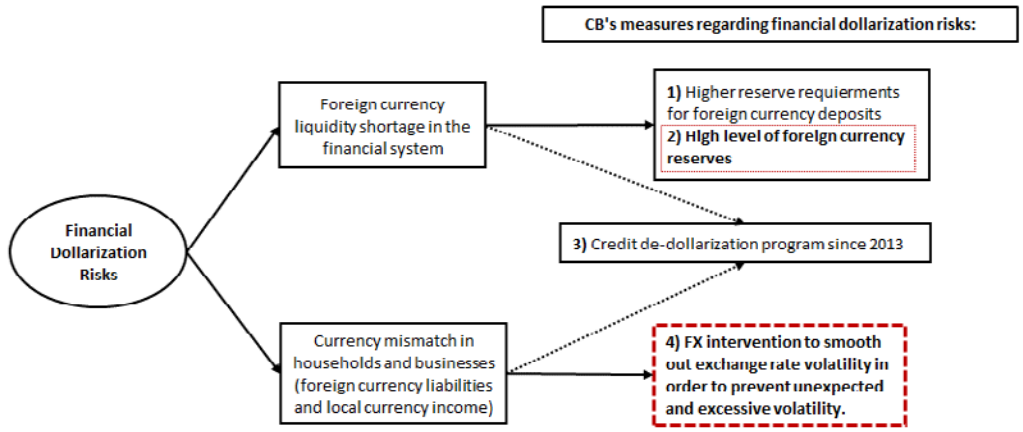
Peru: Interbank Overnight Rate and Central Bank Reference Rate — Graph 2



2. Forex intervention: motivation, strategic and tactics

As noted in the previous section, FX intervention is a complementary tool, in the context of an inflation targeting regime, for preserving macro-financial stability in a partial dollarised economy. Financial dollarisation generates two potential problems: (i) a liquidity shortage in foreign currency, and (ii) a currency mismatch risk. The existence of these financial vulnerabilities called for action by the central bank (see Graph 3).

Financial dollarization risks and central bank policy tools — Graph 3

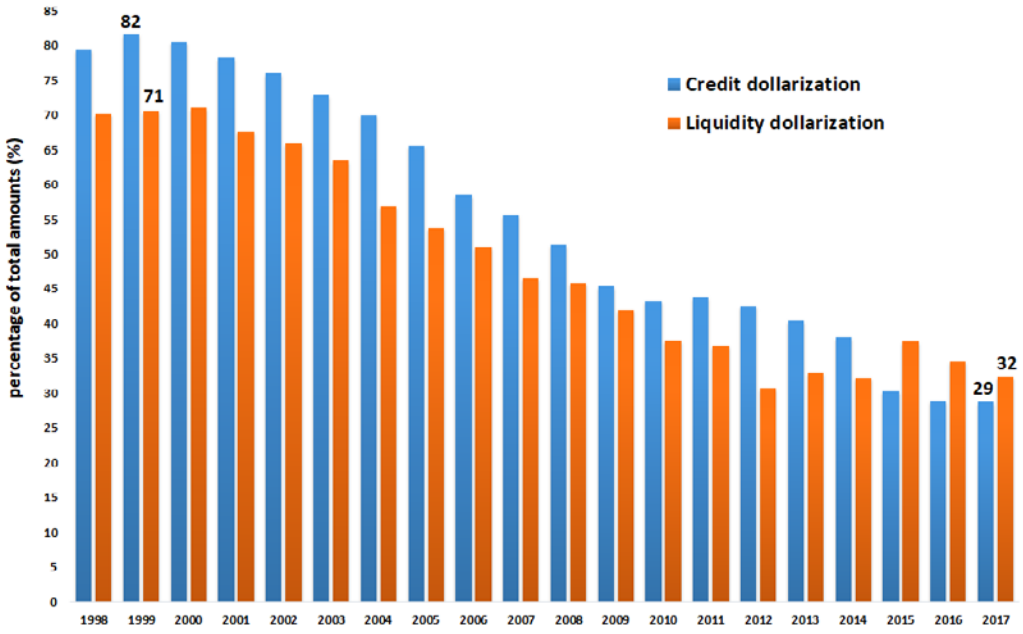


FX intervention is used to manage the current state of dollarisation risk in the Peruvian economy, while the credit de-dollarisation programme is used to address the causes now and in the future. As the persistent path of de-dollarisation in the Peruvian economy continues, enhanced by the dollarisation programme since 2013, FX intervention may be less required. However, this process will take time.

Financial dollarisation is one of the key driving forces behind the contractionary effects of exchange rate depreciations. In short, the contractionary effects are due to currency mismatches in the balance sheets of non-tradable firms and households. On occasion, these contractionary effects can be larger than the usual textbook expenditure-switching effects of depreciations, which are expansionary. Mostly, periods of sharp and large depreciation may imply overall contractions due to large-scale balance sheet effects.

The key rationale for FX intervention is to prevent financial vulnerabilities stemming from the dollarisation of the financial system. The financial stability literature points to the exchange rate as a key asset price that could trigger a financial crisis. On this basis, intervention aims to (i) accumulate reserves with a precautionary motive, and (ii) avoid excess exchange rate volatility that would trigger negative financial and real effects in the economy.

Credit* and liquidity** dollarisation of the financial system Graph 4



* Share of foreign currency credit in the total amount of credit.

** Share of foreign currency liquidity (mainly deposits) in the total amount of liquidity.

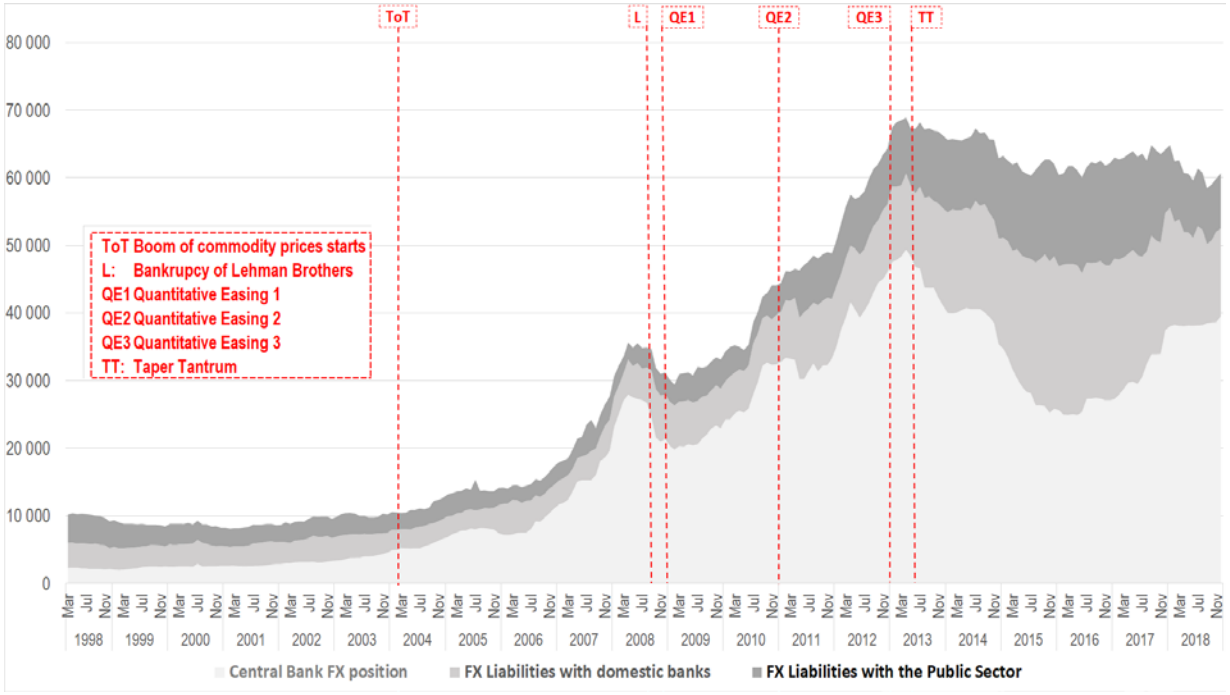
2.1 Reserve accumulation

International reserves are drawn from three sources: (i) the central bank's own FX position that can be affected by interventions in the foreign exchange market and the return on investing the reserves; (ii) FX liabilities with local banks related to reserve requirements; and (iii) FX deposits of the Treasury at the central bank.

In Graph 5, it is shown that the accumulation of international reserves is related to the central bank's FX interventions during periods featuring external shocks to the current and capital accounts of the balance of payments.

The central bank accumulates reserves to provide international liquidity in order to successfully address sudden stops in periods of heightened volatility in the international financial markets. Ample international reserves overcome a problem that financially dollarised economies face, namely, the lack of a US dollar-based lender of last resort. Furthermore, an adequate level of reserves gives credibility to the FX intervention and the central bank's monetary policy.

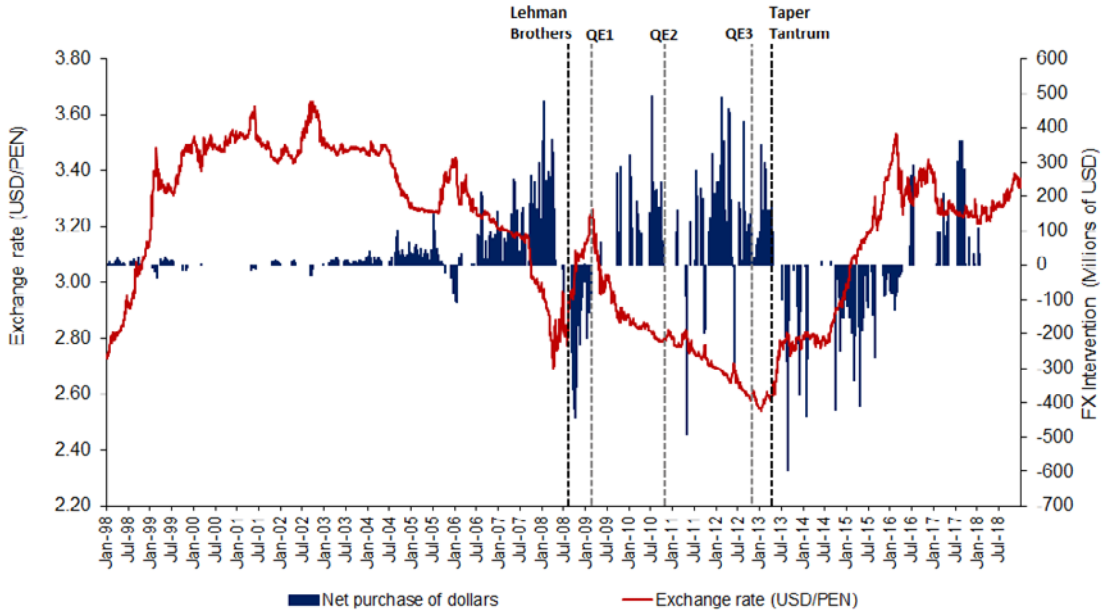
Sources of international reserves (USD millions) Graph 5



2.2 Reducing exchange rate volatility

The CRBP's aim in reducing exchange rate volatility is to mitigate any sharp and unexpected exchange rate depreciation, which would exacerbate the damaging effects of currency mismatches on the economy. Thus, to avoid low-risk but potentially damaging outcomes arising from balance sheet effects, the central bank uses sterilised forex interventions in order to reduce exchange rate volatility. On the other hand, the CRBP does not target any particular exchange rate, since the exchange rate should ultimately reflect local and international macroeconomic fundamentals.

Exchange rate and FX intervention Graph 6



FX intervention

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Spot														
Number of days	188	109	143	102	32	86	54	164	104	44	98	50	55	4
Volume* (millions USD)	3 560	4 654	10 306	14 712	2 405	8 963	5 929	14 531	10 415	4 248	8 064	3 394	5 246	184
Average (millions USD)	19	43	72	144	75	104	110	89	100	97	82	68	95	46
Forward														
Number of days	15	7	1	20	27	5	23	7	52	96	203	119	26	27
Net balance** (end of period, millions USD)	- 350			-1 421		160			-1 113	-6 468	-10 029	- 385	- 132	- 502

* Volume of total intervention (buy plus sell intervention)
** Negative/positive indicates net sale/buy stock position

2.3 FX intervention strategy

Traditionally, foreign exchange intervention has been performed mostly through transactions in the spot market. However, since 2002, the central bank has introduced a set of indirect intervention instruments in response to the ever-growing scale of the forward and derivative foreign exchange markets.

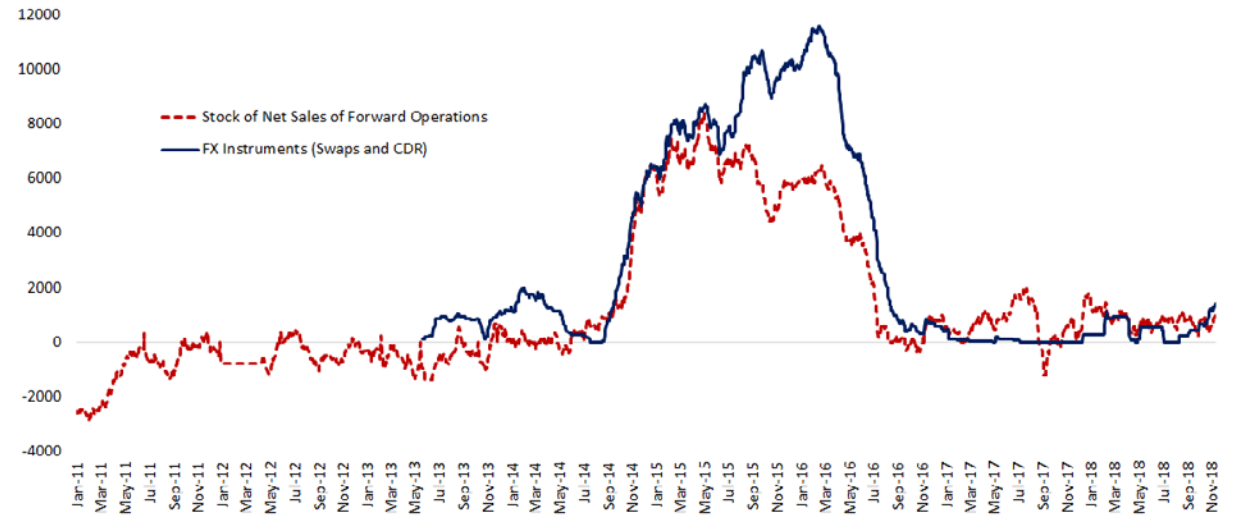
The period from 2013 onward, has been characterised as mainly negative for EMEs because of the Fed's tightening, falling commodity prices and trade tensions. This international macroeconomic context put pressure on their exchange rates and increased volatility in EME financial assets.

In addition, the local FX market saw a greater volume of forex derivative transactions, mainly forwards. In response, the central bank increased the use of a central bank security indexed to the exchange rate, (CDR, available since 2002) and created a currency swap (2014). These indirect instruments offer an FX hedge to the banking system, reducing pressures in the forward market and hence diminishing their effect on the spot market.

The main advantage of these instruments is that the CRBP can intervene in the FX market without using its reserves, when the pressure in the exchange rate comes from the derivatives market due to hedging or speculative motives and not from a real demand for foreign currency. The central bank currency swap does not affect liquidity in local currency since it is settled at the end of the contract on a net basis. Given that this instrument does not affect liquidity in local currency, no sterilisation or injection of liquidity is required.

FX forward net sales position of commercial banks and net issuance of CRBP's FX instruments (millions of US dollars)

Graph 7

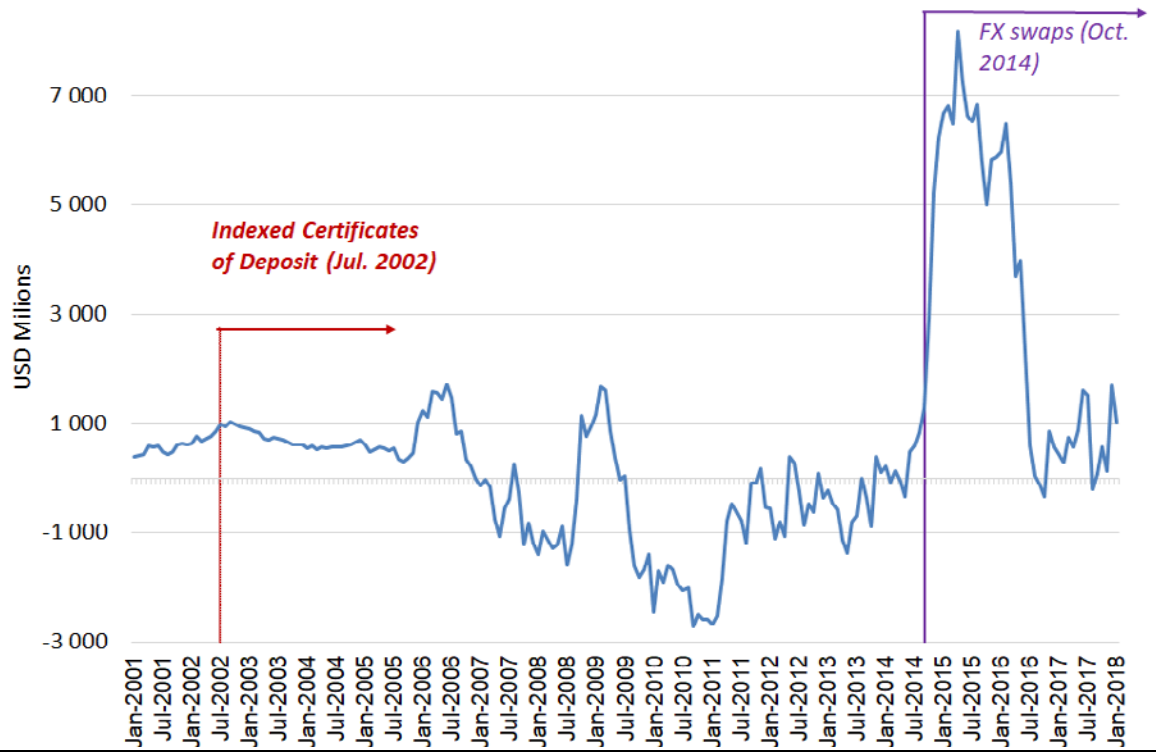


Graph 8 shows when these direct instruments were used, together with the net sale positions in the forward market. These outstanding net positions indicate if there are appreciation or depreciation pressures in the market. In July 2002, the central bank introduced indexed certificates of deposit. This instrument is like any certificate of deposit issued by a central bank, the difference being that payment in soles is indexed to the change in the exchange rate between the day of issuance and the day of maturity.

In October 2014, the central bank introduced a currency swap to reduce exchange rate volatility during depreciation and appreciation episodes. Like cross-currency swaps, these are agreements between the central bank and any agent to exchange interest payments and principals on loans denominated in both soles and US dollars.

Forex forward net sales position of commercial banks and adoption of alternative FXI instruments

Graph 8



FX intervention by type of instrument (millions of USD)

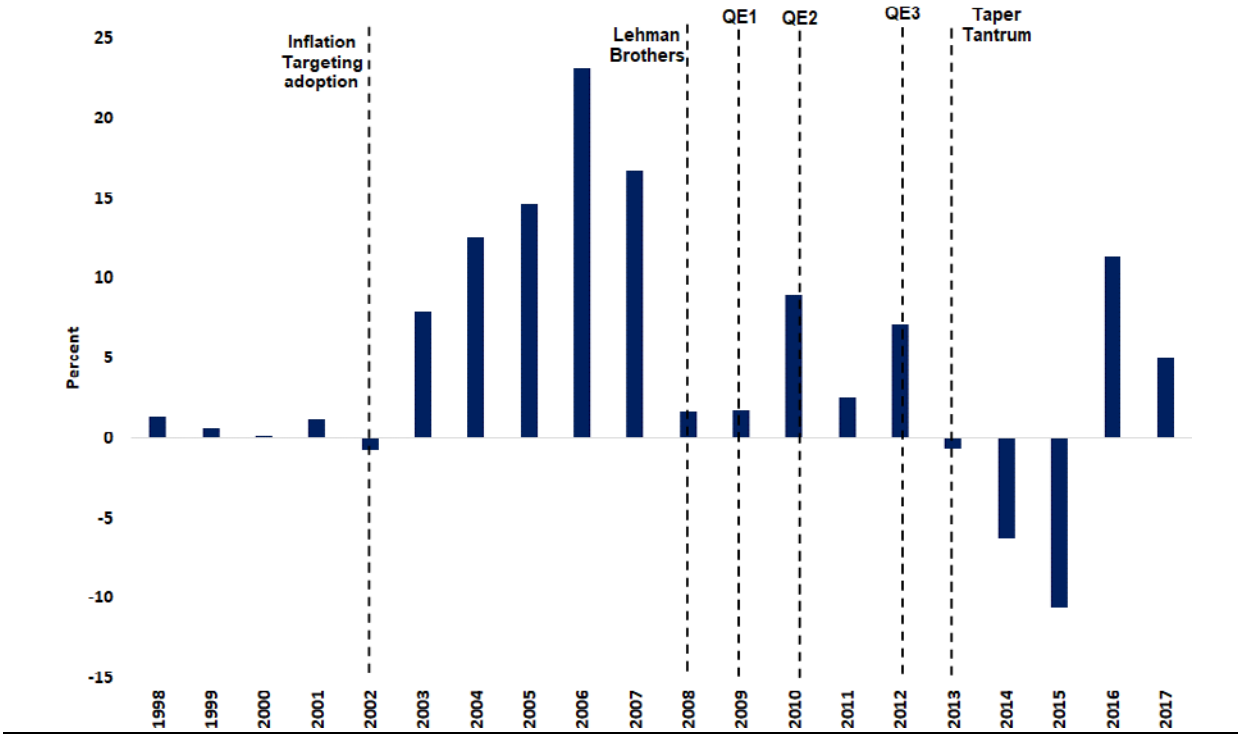
Table 1

	Net purchase of dollars*	Stock of derivatives and indexed securities			
		CDR	CDLD	Currency Swaps	Total Stock of Instruments
2014	-4 208	882	0	5 586	6 468
2015	-8 064	2 123	0	7 906	10 029
2016	786	236	0	149	385
2017	5 246	256	124	0	380
2018	184	0	0	502	502

* Negative/positive sign indicates net sale/purchase of dollars.

The scale of spot interventions as a share of market size is depicted in Graph 9. As can be seen, periods under stress feature sizeable spot foreign exchange intervention on the buying or selling sides. On the buying side, central bank purchases amounted to close to 25% in 2006, and selling amounted to about 13% of total spot market turnover between June 2008 and February 2009. During 2016, another selling episode, intervention reached 11% of turnover.

Net yearly purchases in FX spot market (as a ratio of interbank FX turnover) Graph 9



2.4 The empirical evidence for the effectiveness of intervention

The effectiveness of Peruvian forex interventions has been documented in several papers. All papers have used high-frequency data easily available from the central bank website, except for papers that use intra-day data such as those of Flores (2003), Lahura and Vega (2013) and Fuentes et al (2014). The central bank website also publishes the daily exchange rates,[2] a feature that has also been used for example in Mundaca (2011) and Tashu (2014). All papers that have tackled the issue of volatility have found that the interventions have been effective in reducing excess volatility.

One important reason why interventions have been effective is the amount of daily interventions relative to the size of the forex market (average local daily spot interbank transactions are around US$ 450–550 million). Were the forex market larger, the central bank would find it very difficult to have any impact on the exchange rate.

The level of financial integration and size of the FX market may explain the effectiveness of FX intervention in reducing exchange rate volatility. Graph 10 shows that the turnover in over-the-counter forex markets in Peru is still low, even compared with other that of countries in the Latin American region. In addition, Graph 9 shows that the size of spot forex intervention has reached, at some point, up to 20% of spot market turnover.

[2] The publication is made after the forex market closes.

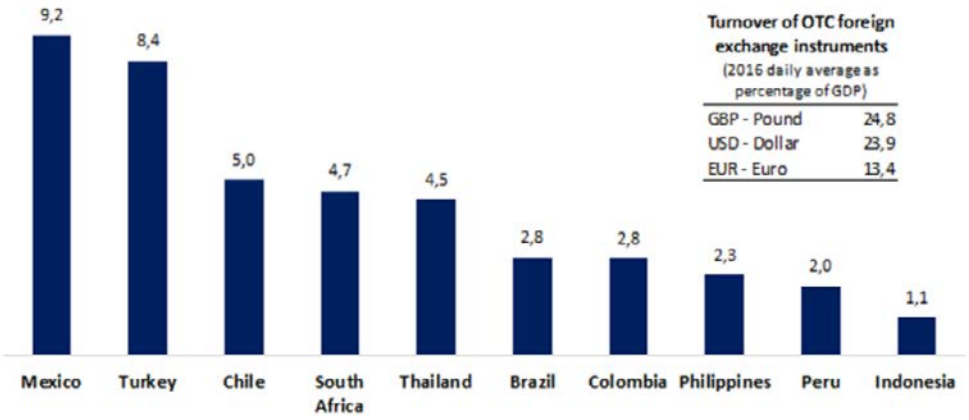
Literature about the effectiveness of forex intervention in Peru

Table 2

	Level	Expected depreciation	Volatility	Asymmetric	Data
Arena and Tuesta (1999)	yes		Yes		Daily, 1994–98
Flores (2003)			Yes	Purchases >> Sales	Intra-daily January 1999–June 2001
Shiva (2003)			Yes		Daily, Jan. 1997–Jan. 2004
Rossini, Quispe and Gondo (2008)			Yes	No	Daily, Jan. 2004-Dec. 2007
Humala and Rodríguez (2010)			Yes		*Intraday 1994 to 2007*
Mundaca (2011)	yes		Yes		2004–09
Lahura and Vega (2013)	yes			Sales >> purchases	Intraday, 5 Jan. 2009 to 27 Apr. 2011
Fuentes et al (2013)	yes		mild		Intraday, 5 Jan. 2009 to 27 Apr. 2011
Rossini, Quispe and Serrano (2014)		yes			
Tashu (2014)	yes		Yes	Sales >> purchases	Intraday, Jan. 2010–Dec. 2013
Durán-Vanegas (2016)			Yes		Daily, 2003–15

Turnover of OTC foreign exchange instruments (2016)

Graph 10



Source: BIS Triennial Survey.

Another important point that adds to the effectiveness of Peruvian forex intervention is the central bank's long experience (more than 25 years) of conducting operations in the spot market. Both the forex market and central bank procedures have evolved and adapted together. In the process, the central bank has gained a reputation of being an effective agent due to its strong balance sheet, high level of reserves, and its status as an informed market participant.

To conduct forex intervention with all available market information is key. This comprises knowing the microstructure of the market in terms of the main flows

coming from other market participants such as non-residents, pension funds, banks and mining companies.

2.5 Peruvian sol volatility vis-à-vis that of other regional currencies

To put the Peruvian sol volatility in context, the parameters beta are estimated to measure the volatility of a currency (Peruvian sol) or a group of currencies (other Latam-five currencies) in comparison with the overall volatility of the FX market.

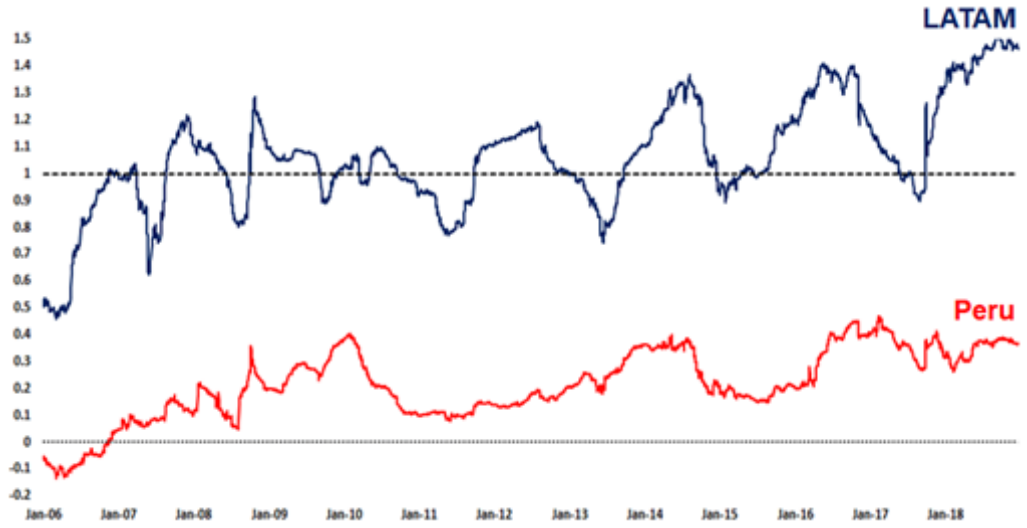
$$\text{The expression for beta is: } \boldsymbol{\beta} = \frac{\boldsymbol{Cov\,(i,M)}}{\boldsymbol{Var(M)}}$$

Where "$\boldsymbol{i}$" is the daily return of a currency (Peruvian sol) or group of currencies (Latam); while "$\boldsymbol{M}$", is the daily return of the whole FX market.[3]

The beta coefficients estimated are interpreted as:

- If $\boldsymbol{\beta} > \mathbf{1}$; volatility higher than volatility of the whole FX market.
- If $\mathbf{0} < \boldsymbol{\beta} < \mathbf{1}$; volatility lower than volatility of the whole FX market

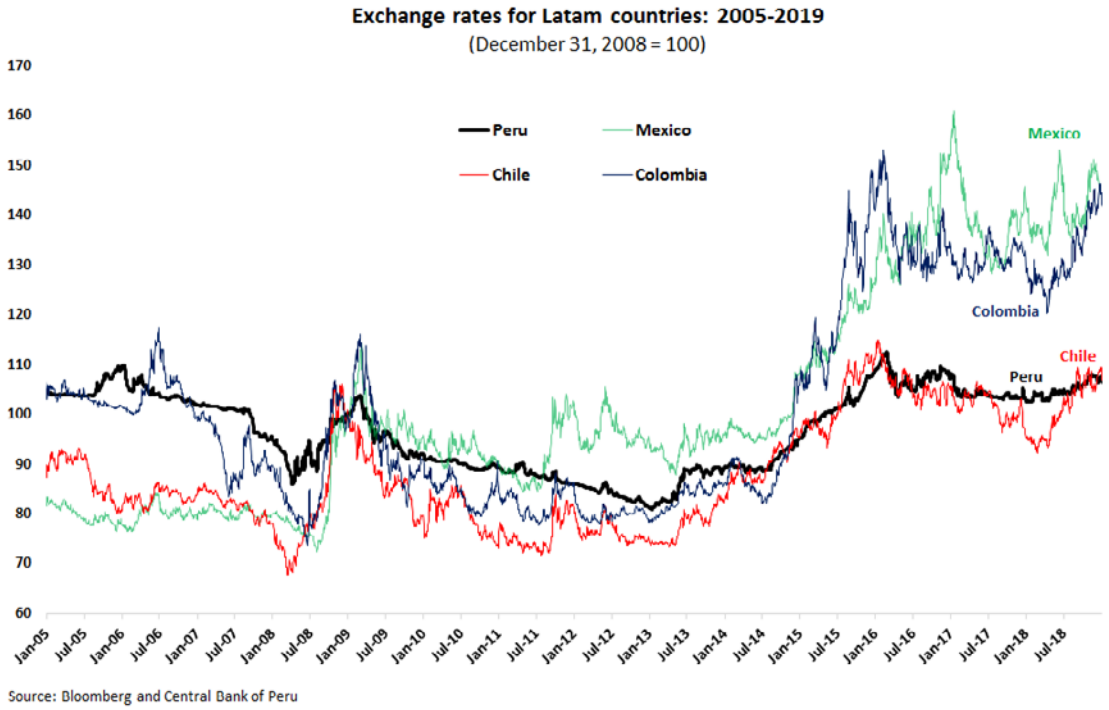
Estimated betas* in the FX market: Latin America and Peru — Graph 11



* Estimated in moving early periods.

The volatility of Latin American currencies fluctuates at around 1 (the average beta for these currencies is 1.1) which implies that, on average, those currencies have a volatility similar to that of the whole FX market. However, the Peruvian sol volatility is always lower.

[3] For the whole forex market, an equally weighted index was created using 26 currencies from developed and emerging economies, all against the US dollar. In the case of the Latam index, the currencies of Mexico, Brazil, Chile and Colombia only were used.



Source: Bloomberg and Central Bank of Peru

Coefficient of Variation

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Chile	4,6	1,7	2,8	13,9	6,6	4,4	4,1	2,6	4,1	3,9	5,7	3,0	2,5	5,2
Colombia	1,3	4,2	5,3	10,7	9,5	3,4	3,4	1,9	3,0	6,6	10,8	4,8	1,8	4,8
Mexico	2,0	3,8	1,9	17,5	7,8	3,6	11,4	5,5	4,3	5,6	8,5	8,4	9,7	6,0
Peru	1,8	2,1	3,0	4,9	4,8	1,0	1,6	1,8	4,0	2,3	3,3	1,9	1,0	1,4

3. Reserve requirements as a macroprudential instrument

3.1 Dampening the credit cycle

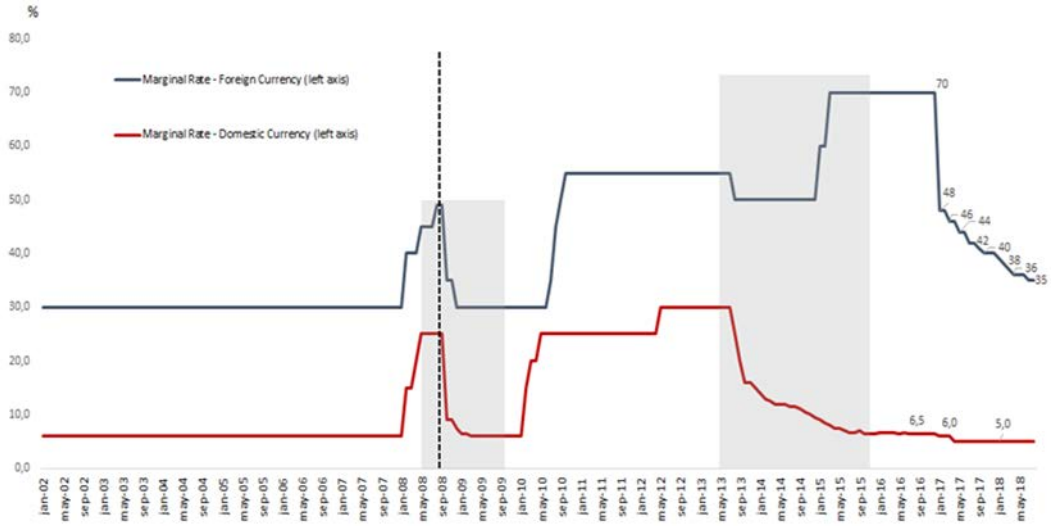
Reserve requirements (RRs) are used as an active monetary control tool to moderate the impact of capital flows over domestic credit conditions denominated in both domestic and foreign currency. The BCRP has also set high RRs on foreign currency liabilities as a prudential tool vis-à-vis liquidity and foreign currency credit risk. These additional policy tools have relaxed the trade-offs that the BCRP faces when implementing standard monetary policy within an inflation targeting regime that also takes into account financial stability considerations. The ready use of RRs in the Peruvian monetary policy framework has allowed the BCRP to induce the necessary quantitative tightening (QT) required to counter the domestic spillover effects of the quantitative easing (QE) policies in developed countries.

Since 2008, RRs have been changed frequently to complement policy rate changes. The main reason was the unprecedented monetary expansion in developed economies, and the implementation of QE. Emerging economy central banks have had to deal with the spillover effects of these ultra-easy policies, as manifested in capital inflows and low international interest rates.

Reserve requirements rate in domestic and foreign currency: 2002–18

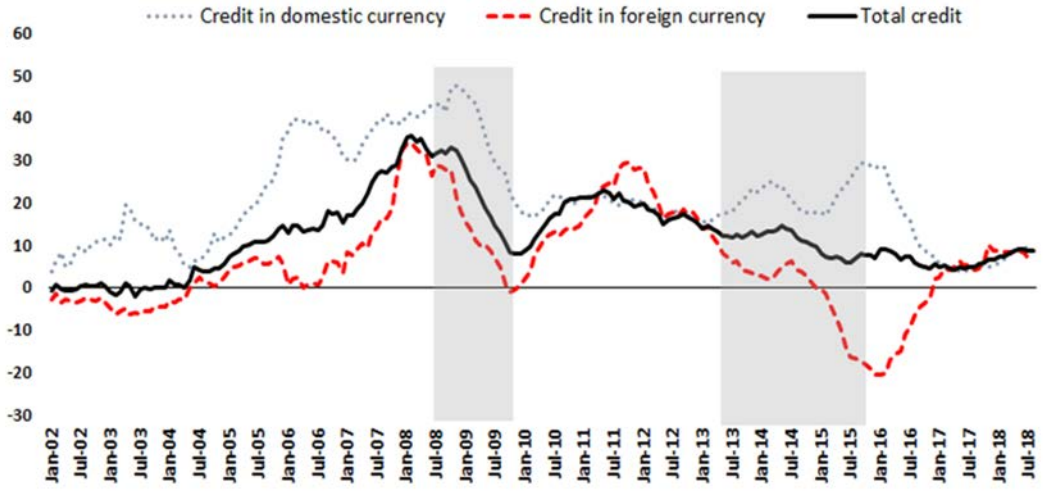
As % of total deposits

Graph 13



Credit growth (yoy change)

Graph 14



Starting in 2008, changes in the marginal and the average RR rates have been used cyclically. RRs have been raised in response to capital inflow episodes, such as those of Q1 2008 and since the second half of 2010, following the announcement of QE2. This RR tightening had the aim of limiting the impact of capital inflows on credit, particularly credit denominated in foreign currency. This also increased the BCRP's capacity to inject foreign currency liquidity in the case of a sudden capital flight.

An active use of reserve requirements can limit the impact of the global credit cycle on domestic credit, increasing the BCRP's scope for implementing countercyclical monetary policy even during periods of high financial market volatility. In Peru, the cyclical use of reserve requirements have helped to reduce the financial risks associated with credit cycles.

4. De-dollarisation programme 2013–16[4]

In 2013, the BCRP implemented additional reserve requirements to induce a more rapid reduction in credit dollarisation. Financial institutions with dollar-denominated-loan growth rates above certain thresholds set by the BCRP were subject to these requirements. Reducing financial vulnerabilities in a timely manner is crucial to maintaining financial stability and effectively implementing monetary policy, particularly under the current external conditions of high volatility in financial markets. In dollarised economies, the need to limit the effects of foreign currency liquidity shocks and unexpected large exchange rate movements on liquidity conditions and credit spreads is crucial for the stability of the financial system.

As a permanent feature, the BCRP has set higher reserve requirements for deposits in foreign currency than for those in domestic currency. This difference increases the cost of financial intermediation in foreign currency, thus reducing the incentives for dollarisation.

In December 2014, the BCRP set additional reserve requirements in foreign currency to speed up the reduction in credit dollarisation. Banks were given until June 2015 to reduce their stock of total credit in foreign currency (excluding foreign trade operations as well as operations with terms longer than four years and amounts over US$ 10 million) to at most 95% of their September 2013 levels. Otherwise, banks would face additional requirements on their total liabilities in foreign currency proportional to the gap between their current stock and the desired balance. A similar set of rules applied for car and mortgage loans denominated in foreign currency. In this case, by June 2015 banks had to reduce their stock for this type of credit to at most 90% of the balance as of February 2013.

In order to support the de-dollarisation programme, the BCRP launched two new liquidity facilities:

- Repos for credit substitution

  In this operation, banks purchase dollars from the BCRP and simultaneously perform a currency repo using these same dollars as collateral, these constituting a restricted deposit at the BCRP. As a result, bank customers obtain loans in soles, while the banks maintain the same amount of assets in dollars. The repo for credit substitution provides banks with a dollar-denominated asset (the restricted deposit in US dollars that serves as collateral for the repo) and a sol-denominated liability (the repo itself). These cancel the effect of credit substitution on banks' dollar exposure, by increasing their assets in soles and reducing dollar assets.

- Repos for credit expansion

  Through this instrument, banks can use part of their reserve requirements in foreign currency (up to an amount equivalent to 10% of their total liabilities subject to these requirements, extended to 20% in December 2015) to conduct currency repos with the BCRP, obtaining long-term funding in domestic currency.

  After the implementation of this programme, aggregate dollarisation levels for bank lending dropped from 44 to 32% from December 2014 to December 2015

[4] This section is based on Castillo et al (2016).

(Table 3). The reduction of dollarisation was widespread across different credit market segments.

Ratio of dollarisation of credit to the private sector — Table 3

	Percentage		
	Dec. 10	**Dec. 14**	**Dec. 15**
Credit to firms	**55.9**	**48.5**	**38.7**
Corporation and large firms	69.4	59.9	46.4
Medium firms	67.4	59.3	47.5
Small firms	19.3	11.5	8.5
Household Credit	**26.5**	**20.0**	**15.9**
Consumer loans	10.8	9.5	7.8
Car loans	64	68.9	44.9
Credit cars	7.2	6.6	6.4
Rest	8.4	5.9	5.8
Mortgage loans	52.2	33.9	26.8
Total	**46.1**	**38.3**	**30.5**

5. Concluding remarks

Peru's monetary policy framework, which has aimed since 2002 at inflation targeting combined with control of the dollarisation risks, has been successful in keeping the headline inflation rate and its expectations anchored to the target range of 1–3%. To achieve this target, the BCRP sets the interbank overnight reference rate to be consistent with the inflation forecast. Moreover, it provides enough liquidity to the banking system to ensure that the effective interbank rate is in line with the reference rate. The control of risks is achieved by the setting of reserve requirements to monitor the credit cycle (with higher reserve requirements for foreign currency than for the domestic one) and by using sterilised foreign exchange interventions to mitigate exchange rate volatility. Both measures take account of the economy's partial dollarisation, a feature that potentially exposes the financial system to external shocks. Such shocks can affect inflation expectations (eg the exchange rate pass-through and the balance sheet effect), thus potentially hindering the achievement of the inflation target. In particular, since 2013, the BCRP has been working on the implementation of different measures to effectively de-dollarise the financial system, by reducing the share of foreign currency-denominated credits below 30%. The latter policy has been crucial, since it has created room to undertake an independent monetary policy, and to reduce the frequency of foreign exchange interventions (which are now more associated with swaps), given that the financial system is now more resilient to external shocks.

The future agenda focuses mainly on the additional policy actions that could be taken in order to better anchor inflation expectations and reduce their persistence. This is in line with the monetary policy communication, and the use of different instruments to reduce uncertainty in the financial system.

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Reserves management and FX intervention

By Maria Ramona Santiago[1]

Abstract

In line with this year's topic for the Annual Meeting of the Emerging Market Deputy Governors, the Bangko Sentral ng Pilipinas shared its views and insights on three interrelated issues: (1) drivers of reserve accumulation from a policy perspective; (2) strategies, tactics and motivations of FX intervention; and (3) FX reserve management practices.

Specific to the first issue, reserves are held for four main reasons, according to the IMF: transaction, insurance, precautionary and investment. In the case of the Philippines, one of the reasons why the BSP accumulates reserves is to maintain the international stability and convertibility of the Philippine peso (Section 65 of Republic Act 7653). During periods of exchange market pressure or when the local currency is under attack, the BSP normally provides liquidity to the market settled via spot or non-deliverable forwards (NDFs). However, the build-up of reserves comes at a price, which includes sterilisation costs, actual or potential exchange rate valuation losses, the opportunity cost of foregone consumption or investment, and the costs arising from the maturity mismatches between reserves and sovereign liabilities. It is, therefore, a challenge for the authorities to manage reserves carefully in order to balance the costs incurred with the benefits.

The BSP's participation in the foreign exchange market is limited to smoothing out volatility, or tempering sharp fluctuations in the exchange rate. When such movements are excessive, the BSP enters the market mainly to maintain order and stability. When warranted, the BSP also stands ready to provide liquidity and ensure that legitimate demands for foreign currency are satisfied. It is important to underscore that the overall strategy of the BSP is to allow the exchange rate to be market-determined.

On reserve management, the BSP tranches its reserves so that investment management can be aligned with the various objectives of reserve management, ie ensuring the availability of sufficient foreign exchange liquidity for day-to-day operations; generating income over the medium to long term and diversifying while maintaining acceptable risk exposures. Since the financial crisis, there has been an increased effort to further strengthen the risk management framework, which includes intensifying market surveillance, promoting investment compliance monitoring and conducting periodic stress testing and scenario analysis on the reserves portfolio.

Keywords: Bangko Sentral ng Pilipinas, motives for holding reserves, FX intervention, tranching of reserves.

JEL classification: E58, F31.

[1] Senior Assistant Governor, Bangko Sentral ng Pilipinas.

1. Overview

The purpose of this meeting on reserves management and FX intervention is to take a broad perspective in discussing three interrelated issues:

- Drivers of reserve accumulation from a policy perspective;
- Strategies, tactics and motivations of FX intervention; and
- FX reserve management practices.

The aim is to compare the experiences of central banks from major EMEs and explore policy options.

2. Drivers of reserve accumulation from a policy perspective

What have been the determinants of reserve levels in the past decade? To what extent have FX reserves been accumulated for precautionary reasons and as a by-product of other policies (eg maintaining competitiveness, limiting exchange rate overshooting, maintaining financial stability, supporting market liquidity)? Has there been peer pressure to increase reserves? What are the costs of reserve holdings? To what extent have low returns on reserves influenced their accumulation?

Countries accumulate reserves primarily for the following reasons:

- *Transactions motive*. Adequate reserves would promote international stability and convertibility of the local currency, and satisfy any foreseeable demand for FX (servicing central bank liabilities and national government demands for foreign currency).
- *Precautionary motive*. Adequate reserves would satisfy foreign exchange requirements in the case of insufficient domestic foreign exchange supply and difficulty in obtaining external finance for crisis mitigation purposes (war chest against future crises); that is, reserves reduce the cost of a crisis, once it has occurred – ex post.[2]
- *Prevention motive*. Having adequate reserves reduces the probability of occurrence of a crisis because adequate reserves underpin investor confidence in the country's ability to meet its external obligations.
- *Intervention motive*. Economies hold foreign exchange reserves as a tool for influencing exchange rates. Foreign exchange market intervention is driven mainly by the following macroeconomic objectives: to control inflation or maintain internal balance; to maintain external balance and prevent resource misallocation; and to prevent or deal with disorderly markets or crises.[3]

For the Philippines, one of the reasons why the BSP accumulates reserves is to maintain the international stability and convertibility of the Philippine peso (Section 65 of RA 7653). During periods of exchange market pressure or when the local currency is under attack, the BSP normally provides liquidity to the market settled via spot or NDFs.

[2] IMF, "Issues in reserve adequacy and management", Policy Paper, 2001.

[3] R Moreno, "Motives for intervention", in *Foreign exchange market intervention in emerging markets: motives, techniques and implications*, BIS Papers, no 24, pp 4–18.

Meanwhile, the increase of reserves seen in the past decade can be traced to strong inflows from the net foreign exchange operations of the BSP, investment income from abroad, as well as revaluation gains on the BSP's gold holdings. In particular, reserve accumulation was unprecedentedly high for the period 2009–11. Strong structural inflows of foreign exchange from overseas via Filipino remittances, business process outsourcing and tourism receipts, and foreign direct investments have been significant contributors to the country's external payments position. Moreover, it was not a coincidence that the fastest pace of reserve accumulation in Philippine history happened during this period. Unconventional monetary policies in the United States resulted in inflows that could have driven an excessive appreciation of the peso. It was anticipated that normalisation of US monetary policy would later result in large outflows that would cause a large depreciation of the peso, unanchoring inflationary expectations away from the BSP's inflation target. In other words, when the BSP borrowed heavily to buy dollars, the expectation was that some of the accumulated reserves would be sold as US monetary policy began to normalise.

The build-up of reserves also involves sterilisation costs, which are subject to diminishing returns (emerging markets gain little additional benefit for building reserves in excess of the sum of short-term debt and current account deficit) and have the potential to be harmful to both the domestic (foregone consumption and investments) and global economies (imbalances between surplus and deficit countries). The costs attributed to reserves building include sterilisation costs, actual or potential exchange rate valuation losses, the opportunity cost of foregone consumption or investment, and the costs arising from the maturity mismatches between reserves and sovereign liabilities. It is, therefore, a challenge for authorities to manage reserves carefully in order to balance the costs incurred with the benefits.

As the level of reserves is also a by-product of intervention, it has an inherent cost which is approximately represented by the domestic policy rate. To address the cost of holding reserves (negative carry), reserves are tranched by objectives, and the Bank seeks to maximise the returns of each tranche subject to the risk tolerance set by the Board.

2.1 How does the cost-benefit trade-off for reserves depend on structural features of the economy (eg exposure to terms of trade shocks, degree of dollarisation)?

There are two ways in which reserves can help to mitigate the impact of a balance of payments (BOP) crisis on domestic welfare. First, the reserves can be used to mitigate the fall in domestic output. Second, the reserves can be used to buffer the impact of the BOP shocks on domestic absorption. The authorities can reduce the output cost of a crisis by using international reserves through various channels. Foreign exchange interventions can mitigate the depreciation of the domestic currency, and thus the disruption induced by currency mismatches in balance sheets. Reserves help the monetary authorities to provide liquidity to the domestic financial markets, the banking sector and even exporters; this is especially valuable if there is significant dollarisation of bank deposits and other domestic liabilities.

Currently, the Bank tranches its reserves where the currency composition and size of fund per tranche take into consideration the fundamental requirements including, among other factors, the terms of trade, external debt and even the exchange rate policies of the country. Given this structure, the Bank ensures that reserves are used according to the objectives and risk constraints set for each tranche.

2.2 What is the best way to assess reserve adequacy? Are the best measures country-specific? Is it better to consider several measures simultaneously?

According to the report of the IMF's Independent Evaluation Office (IEO), no single indicator or model can capture the complex set of factors that determine the adequacy of reserves in an individual country, and, therefore, reserve adequacy indicators should be applied flexibly and take into account the multiple trade-offs involved in decisions on reserve accumulation and reserve adequacy. The IEO report noted that IMF reserve adequacy assessments and advice in the context of bilateral surveillance seemed often to have been pro forma, highlighting traditional indicators and hardly incorporating country-specific circumstances. However, tailoring the reserve assessment too specifically to any particular member would undermine its usefulness for cross-country comparison.

Reserve adequacy assessments should be attuned to the different types of economy. Reserves play different roles in advanced, emerging, and low-income countries. In EMEs, they are associated with lower risks of a currency crisis, although the marginal benefits decline at high levels. In advanced economies, reserve buffers are associated with a lower risk of banking crises and market dysfunction. In low-income countries, reserves are associated with the ability to smooth domestic absorption to current account shocks. These differences largely reflect these economies' varying exposures to and tolerance of external risks. Countries' tolerance depends on their market depth and the robustness of market liquidity, as well as their economic flexibility. The depth of market liquidity could limit the impact of external pressures, while economic flexibility makes adjustment to external shocks easier.

Assessing the adequacy of reserves for precautionary purposes provides a useful starting point for the discussion on reserve issues. While there is no universally accepted framework for discussing reserve adequacy for precautionary purposes, several metrics have been widely used for reserve adequacy assessments. The advantage of these metrics is that they are simple guides to the strength (or vulnerability) of a country's reserves position relative to particular risk factors and can be applied uniformly across economies. However, some metrics may be more appropriate than others depending on a country's circumstances. In this regard, metrics can provide a practical starting point beyond which analysis of country specific risk factors could complement the discussion.

There may not be a best way to assess reserve adequacy, as the definition of best in the context of reserve adequacy may vary. Assessing adequacy by considering numerous measures may be prudent, but at the end of the day, the adequate level of reserves that we determine will always be theoretical and never truly tested, and perhaps we should not let it be tested. What does adequacy even mean? Does it mean the economy can zero out its reserves when a big shock occurs, and everything should be all right as reserves were "adequate?" What happens to confidence and the economy as the "adequate" level of reserves slowly diminish? What happens afterwards? All these seem to suggest that more than what is perceived as adequate will always be better, unless the central bank holds the view that the cost of holding reserves is too high compared with the investment income. The investment income from reserves is only one of the many benefits of having reserves. It would be good to know if other countries are adjusting their reserve holdings to be in line with what they perceive as an adequate level of reserves.

John Nugee and Gary Smith[4] have noted that one of the most difficult issues for policymakers has been to define the optimum size for the national foreign exchange reserves. This is comparable to the challenge commercial banks face in determining the correct proportion of the balance sheet that should be held as reserves against creditors. In both cases, the dilemma is that to hold too much can be expensive but to hold too little can be disastrous. In relation to this, the IMF has attempted to bring rigour to the topic with the publication of a methodology called "Assessing Reserve Adequacy (ARA)" and associated calculations for their member countries. The authors noted that it can be misleading to assume that the complex topic of whether a given level of reserves is sufficient can be boiled down to single figure. They argue that the IMF itself wrote in October 2017 that assessing the appropriate level of reserves to hold is challenging – not just because of the multiple roles played by reserves, but also because of the complexity of quantifying external risks and vulnerabilities, and the opportunity costs each country faces. It highlighted that ARA suffers from several drawbacks – first, the output statement is capable of two interpretations and can lead to false assumptions of security; and second, the ARA methodology has the benefit of being neutral and consistent across countries, although this comes at the cost of over-simplicity and rigidity. The weights in the calculation may be the most appropriate average weights, but their rigidity is a weakness. Although the calculation is designed to reflect multiple potential channels of market pressures, all EMEs are not equally vulnerable to the four indicators: imports, money supply, short-term external debt and other external liabilities, in the same proportions. The main concern was that the weights in the equation were static. Furthermore, the authors highlighted a better approach to ARA is to follow the style of rating agencies and offer a qualitative assessment, albeit backed by quantitative analysis. They noted that there are seven factors that probably weigh on a country's reserves adequacy and vulnerability to market pressure:

- Political stability
- Government finances
- Banking system depth and stability
- Current account balance
- Exchange rate history
- Credit rating
- Size of reserves

The authors also emphasised that by avoiding "over-precision", such a method would capture more of the influences on the complex question of reserves adequacy and better reflect differences among countries.

That said, the Bank still looks into the traditional metrics of reserve adequacy, and continuously finds way to further enhance its internally developed measurement of the optimal level of reserves specific to the Philippine's case. These approaches, whether standalone or used collectively have provided important information in terms of gauging the country's resiliency against external shocks or vulnerability.

[4] J Nugee and G Smith, "The changing importance of foreign exchange reserves", Official Monetary and Financial Institutions Forum, September 2018.

2.3 What are the alternatives to reserve accumulation? To what extent can macroprudential tools or capital flow measures help? How have changes in the global financial safety net and regional arrangements influenced the optimal level of reserves?

The alternative to continued reserve accumulation, in several cases to levels far beyond any reasonable measure of adequacy, is economic policy aimed at significantly reduced global imbalances and a potentially large IMF, able to provide financing on a large scale when needed. Whether or not policies are agreed that reduce the demand for reserves, the creation of reserves will be discussed in the period ahead as large reserve holders have become concerned about the predominant role of the US dollar as a reserve currency and the supply of reserve currencies in general.

Swap lines can substitute for reserves since they serve the same basic purpose – they provide international liquidity that can be called upon in case of an unexpected shortage. Yet there are clear limits to the substitutability of swaps and reserves. The credibility of reserves in the eyes of financial markets is ultimately determined by the credibility of the central bank holding the reserves while the credibility of swap lines is determined by the credibility of the central bank providing the liquidity support.

Reserves matter because they are a key determinant of a country's ability to avoid economic and financial crisis. This is true of all countries, but especially of EMEs open to volatile international capital flows. The availability of capital flows to offset current account shocks should reduce the amount of reserves a country needs. However, access to private capital is often uncertain and inflows are subject to rapid reversals, as seen all too often in recent years. It was also seen in recent crises that countries that had ample reserves did better, by and large, in withstanding contagion than those with smaller reserves.

Empirical evidence shows that countries with exchange rate regimes that lie between the two extremes of a pure float and a completely fixed exchange rate have become more exposed to exchange rate pressures, particularly in the presence of increased capital mobility. Thus, an adequate level of external reserves is an important factor in support of a fixed exchange rate arrangement.

Moreover, the Asian financial crisis in the late 1990s taught the region's countries several lessons, which called for further strengthening of regional cooperation efforts, particularly in the area of short-term liquidity support. In 2008, in order to ensure regional market stability, the ASEAN+3 countries agreed to accelerate the establishment of an advance framework for regional liquidity support arrangement in the form of the Chiang-Mai Initiative Multilateralization (CMIM). The CMIM is a pooled fund within the Asian region that aims to address balance of payments and short-term liquidity difficulties in the region, and to supplement the existing financial arrangements by providing financial support through currency swap transactions among CMIM participants.

The CMIM has proven to be a commendable initiative in the aftermath of the Asian financial crisis. It provided the region with its own liquidity arrangement that can be called upon when the need arises. However, the size of the swaps is still limited compared with the foreign exchange reserves held by the ASEAN+3 countries. In addition, the swaps are bilateral in nature, and linked to an IMF programme.

In addition, the BSP has existing swap lines with other central banks to help mitigate the impact of a BOP crisis. Apart from these, the BSP may also consider

tapping the flexible credit line facility of the IMF, which assures qualified countries large and immediate access to IMF resources with no ongoing conditions.

2.4 Have there been any unintended consequences of reserve accumulation? Does reserve accumulation support or weaken monetary policy or financial stability objectives? For instance, has reserve accumulation helped to "lean against" capital inflows or has it reinforced them by being perceived as a form of insurance? Do these implications vary with the time horizon?

Foreign exchange reserves exhibit both advantages and disadvantages compared with other forms of asset holdings. The chief disadvantage is that they pay a relatively low rate of return because they consist almost entirely of very safe sovereign debt. On the other hand, foreign exchange reserves are very liquid and the government has direct control over them, allowing them to be used at its discretion, in case of sudden need, such as in response to a natural disaster or a domestic financial crisis. These characteristics allow the authorities to use the foreign exchange reserves to defend the domestic currency against speculative attack or to recapitalise the domestic banking system in the case of a financial crisis.

Results from a paper by Andreas Steiner[5] suggest that the Global Financial Crisis is an example of a crisis that was a by-product of EME central banks' appetite for reserves. By this account, the reserve-accumulating EMEs impose a negative externality on the advanced economies because their behaviour increases the probability of a global crisis. While past experience indicates that central banks were usually able to sterilise the expansionary impact of foreign exchange purchases on base money, interventions have been larger and more prolonged in recent years. When specific features of today's reserve-accumulating EMs, such as their underdeveloped financial systems, are taken into account, some risks and costs may materialise as a result of the process of accumulation. The most significant ones include inflationary pressure, overinvestment, asset bubbles, complications in the management of monetary policy, segmentation of the public debt market, potentially sizeable capital losses on monetary authorities' balance sheets, sterilisation costs, and misallocation of domestic bank lending. At the same time, the risks and costs may vary significantly from country to country and, over time, within each country. Hence, the balance of incentives and disincentives to accumulate reserves may also change. Looking forward, if net disincentives were to materialise in a number of countries, accumulation would probably decrease overall but it might also become further concentrated in a smaller group of economies.

As reserves have grown, there may be a view that reserves are already sufficient. On the impact of reserves on capital flows, it may be more positive (inward flows) than negative (capital flight). While, recently, reserves have declined amid outflows, the outflows are related to the nation's capital requirements and the Federal Reserve's normalisation rather than to testing the resolve of the central bank.

[5] A Steiner, "Reserve accumulation and financial crises: From individual protection to systemic risk," *European Economic Review*, vol 70(C), 2014, pp 126–44.

3. FX interventions: motivations, strategies and tactics

3.1 How important are different motivations for intervening in FX markets (eg smoothing out volatility, acting as a circuit breaker, provide liquidity, leaning against capital flows, containing excessive credit growth)?

The BSP's participation in the foreign exchange market is limited to smoothing out volatility, or tempering sharp fluctuations in the exchange rate. When movements are excessive, the BSP enters the market mainly to maintain order and stability. When warranted, the BSP also stands ready to provide liquidity and ensure that legitimate demands for foreign currency are satisfied.

Other factors, such as capital flows, form part of the BSP's assessment on whether or not to intervene in the market, but these may not be the major motivations. Economic reasons (eg credit growth) are not considered in the central bank's day-to-day decisions on whether to intervene, but are looked at in the BSP's monitoring of markets.

3.2 What factors, including objectives or circumstances (eg nature of the shocks, appreciation or depreciation pressures), influence the choice of (i) instruments and markets; (ii) timing, market conditions and size; (iii) counterparty choice or platform; (iv) rules vs discretion; and (v) the degree of transparency (ex-ante and ex post)?

In deciding whether to intervene in the market, the BSP takes into account various factors which affect the volatility of the PHP. Among others, the BSP looks at regional movements, market expectations, expected and actual dollar inflows/outflows, and local players' trading behaviour, among others. These affect the timing and size of intervention.

On the choice of instrument, market, counterparty and platform, the BSP's interventions are conducted mainly via purchases and sales in the USD/PHP spot market. There have also been occasions when moral suasion was used to discourage speculative spot market transactions.

On whether transactions are based on rules or discretion, it is mostly discretionary. There is no specific list of factors, circumstances or rules that dictate intervention, as the BSP considers intervention as a balancing act.

On the degree of transparency, statistics on intervention are considered to be confidential and are not released to the public before or after the operations.

3.3 To what extent are interventions influenced by the operation of other public sector entities (eg sovereign wealth funds, commodity stabilisation funds)?

The BSP's interventions are independent from the actions of other public sector entities.

3.4 To what extent have the modalities of intervention changed? If so, why?

Since the BSP's intervention activities are not conducted on a regular basis, this question may not be directly applicable to the BSP.

It can be noted, however, that given the bouts of global market volatility this year that have weighed on EME currencies, including the Philippine peso, the BSP has been present in the market to temper sharp fluctuations in the exchange rate.

While the thrust remains geared towards managing the volatility of the USD/PHP rate (without targeting any specific level), the day-to-day tactical strategies or styles have differed to some extent compared with previous years.

3.5 How effective have interventions been? Why? How do the tactics used affect effectiveness? Does it matter whether the exchange rate is appreciating or depreciating? What are the main economic mechanisms through which intervention operates?

We believe the BSP's presence in the spot market has been one of its most effective tools in managing USD/PHP volatility. In the year to date (as of end-October), the USD/PHP volatility has been the lowest among comparable regional currencies (PHP 2.08%, THB 2.26%, IDR 3.93%, MYR 2.41%, KRW 2.41%, TWD 2.20%, INR 4.69%). In 2017, the peso was the second least volatile currency (IDR 0.74%, PHP 1.19%, TWD 1.64%, INR 1.93%, KRW 2.17%, THB 2.66%, MYR 2.70%).

Nonetheless, the BSP's participation in the foreign exchange market is limited to tempering sharp fluctuations, or smoothing volatility, in the exchange rate. It is important to underscore that the overall strategy of the BSP is still to let the market determine the exchange rate.

3.6 To what extent has FX intervention hampered or supported the day-to-day implementation of monetary policy (eg sterilisation operations, control of the interest rate)? How does this depend on the context (eg normal times vs crises)?

FX intervention has generally complemented the BSP's day-to-day implementation of monetary policy. In particular, our forecasts/expectations on FX intervention figures form part of our local currency liquidity forecasting and are factored into our Term Deposit Facility (TDF)[6] offerings. For instance, if we are projecting sizeable dollar sales for a given week or month, we may reduce the volume of our TDF offerings, as we would already be siphoning off pesos through our dollar sales. Consequently, if we are projecting dollar purchases, we may increase the volume of our TDF offering, as we would be injecting peso liquidity through our dollar purchases. These hold true in both normal times and crises.

There have been occasions, nonetheless, when the BSP implemented seemingly opposite FX and monetary policies, although these were implemented to address certain risk factors such as slowing economic growth or increasing peso volatility. During the global financial crisis in 2008, for instance, the BSP sold dollars to temper the sharp depreciation in the local currency. The dollar sales resulted in a siphoning of peso liquidity away from the system. At the same time, in the wake of slowing

[6] The TDF is a liquidity absorption facility used by the BSP for liquidity management. Counterparties are asked to submit bids (volume and rate) for term placements with the BSP. The BSP offers three tenors—seven days, 14 days and 28 days—in its term deposit auction.

global and local economic activity following the crisis, the BSP started cutting its policy rate,[7] which eased peso liquidity.

Recently, some market players also reportedly received mixed signals from the BSP early in the year (February to May) after it hiked its policy rate[8] (tightened peso liquidity) but cut the reserve requirement (RR) ratio[9] (released peso liquidity). At the same time, due to depreciation pressure on the local currency this year, the BSP has been a net seller of dollars (siphoning off peso liquidity). This RR cut was an operational adjustment, as the BSP's RR is the highest in the region and may require adjustments to help reduce intermediation cost.

4. Reserves management

4.1 Which overall motivations guide the composition of reserves portfolios? How can the various motivations best be balanced? How does the strategic asset allocation reflect that balance? Is there any link between the portfolio composition and intervention strategies?

The Bank tranches its reserves so that the currency composition and size of fund per tranche take into account fundamental requirements including, among others, the terms of trade, external debt as well as the exchange rate policies of the country. The management of each tranche is guided by specific objectives, which broadly reflect the risk tolerance of the Monetary Board. As such, we ensure that we allocate a portion for intervention and liquidity needs, investments and long-term fund for yield enhancement and reserves diversification.

4.2 What have been the most important shifts in the composition of reserves over the past decade (eg expansion into new asset classes, shifts in currency composition)? Along which dimensions, such as market, liquidity, or credit risk, has risk-taking changed? In prompting these shifts, what has been the role of changes in mandates/laws, in risk preferences, in the macro-financial environment, and in other factors? Has the search for yield been a significant consideration?

In past years, the significant changes in the composition of the reserves that were implemented include the following:

- Exclusion of EUR-denominated assets from the strategic investment tranche's benchmark after the euro markets went into negative interest rate territory;

[7] On 18 Dec 2008, the BSP cut its policy rate by 50 basis points to 5.5% from 6.0%.

[8] On 10 May 2018, the BSP hiked its policy rate by 25 basis points to 3.25% from 3.00%. The BSP further hiked its policy rate by 25 basis points on 20 June 2018 (to 3.50% from 3.25%), 50 basis points on 9 Aug 2018 (4.00% from 3.50%) and another 50 basis points on 27 Sep 2018 (4.50% from 4.00%).

[9] On 15 February 2018, the BSP announced that it would cut the RR by 100 basis points, from 20% to 19%, effective 2 March. On 25 May 2018, the BSP announced another cut in RR by 100 basis points from 19% to 18%, effective 1 June.

- Modification of the investment tranche's benchmark to include the up-to-one-year sector which also led to the shortening of the duration of the strategic portfolio;
- Creation of the hold-to-maturity portfolios in anticipation of a rising interest rate environment;
- Creation of the long-term tranche, which led to the expansion of the investment universe to include new asset classes such as inflation-linked bonds, Asian local currencies and US dollar-denominated government bonds and Chinese government bonds. This long-term tranche, with a risk profile higher than that of other tranches, was established in order to bridge the gap between the cost of holding reserves and reserves income. That said, investments remain in very high-quality government bond issues.
- On the credit risk front, the lowering of the minimum credit rating threshold, still within the investment grade space, for all counterparties in money market, foreign exchange and gold transactions, was adopted as a spate of ratings downgrades was seen in 2008–12 resulting from the financial crisis in the United States and Europe.

Importantly, the BSP shifted the composition of its reserves in response to financial market developments and to further diversify its investments, with a focus not merely on returns but on better risk management.

4.3 Have there been important changes in risk management, remuneration, or the degree of outsourcing? If so, why? Can governance arrangements, including remuneration policies, help to limit procyclical investment behaviour, in particular when selling into a stressed market?

Since the financial crisis, there has been an increased effort in further strengthening the risk management framework, which includes among others, the intensifying market surveillance, promotion of investment compliance monitoring and the conduct of periodic stress and scenario analysis on the reserves portfolio. Furthermore, the Bank's move towards adopting more market-based risk measures such as value-at-risk and tracking error will help improve the way the internal fund managers view risk-taking in the portfolio.

The BSP has been outsourcing a portion of its reserves to external fund managers since the late 1990s. Outsourcing was considered mainly as a way of tapping the specialised skills of external fund managers for the new asset classes that the Bank was considering for its investments. Currently, most of the long-term tranche is outsourced to external fund managers.

On the issue of remuneration, although there was a bank-wide job evaluation that led to higher entry level positions, the level of remuneration for internal portfolio managers is still limited in terms of providing incentives consistent with favourable results.

4.4 Have there been important changes to disclosures (eg their granularity and frequency) over the past decade? If so, why, and what have been the trade-offs? What effect have they had?

Reserve management disclosures are at a minimum. At present, disclosures of information on the reserve management operations are limited to the Investment

Management Committee and the Monetary Board. After the Bank's recent reorganisation, the Treasury Department, now known as the Financial Market Operations Sub-Sector, also reports to the Deputy Governor of the Monetary and Economics Sector.

Reserve management-specific activities are not disclosed to the public – only the results of the actions are published (ie the GIR level, which in part is determined by the intervention actions/policy and the actions of portfolio managers).

4.5 How far are reserve management practices constrained by political economy considerations (eg impact of losses on the central bank's reputation, equity or profit distribution)? What arrangements or practices can help manage these risks (eg communication vis-à-vis the Treasury or the general public; involvement of loss-sharing arrangements)?

As mandated by our existing Charter (Republic Act No 7653 of 1993), the central bank has to remit 75% of its net income to the national government.[10] Currently, the BSP is working on an amendment of the Charter that puts forward a recommendation to increase the capitalisation of the Bank from the national government and the flexibility to establish a reserve fund, whenever it has income or a surplus, to mitigate future risks such as the impact of FX and price fluctuations, and to address other contingencies inherent in carrying out the Bank's mandated functions as the central monetary authority.[11]

[10] Under the Republic Act No. 7656 – The Government Owned and Controlled Corporations (GOCC) Dividend Law of 2016, the minimum dividend rate may be raised to more than 50% in cases of excess cash or windfall of revenues, provided that the viability and purposes for which the GOCC has been established are not impaired.

[11] It may be noted that under the current BSP Charter, the Bank is allowed to make adequate allowance for or establish adequate reserves for bad and doubtful accounts.

Reserves accumulation and diversification: the case of Poland

By Beata Berłowska, Bogusława Bezzubik and Magdalena Żaczek[1]

Abstract

The note provides an overview of foreign exchange reserves trends in Poland. At the end of October 2018, FX reserves reached the equivalent of USD 105.3 billion, placing Poland among the 20 largest reserves holders worldwide. Given the systematic inflow of EU funds and a crisis-driven fall in yields in major advanced economies, a consistent theme of reserves management by the Narodowy Bank Polski (NBP) over the past decade has been diversification into the so called non-traditional currencies. Along with the excursion into less traditional reserve currencies, the NBP has diversified its range of investable instruments. At present, in addition to sovereign bonds, which offer high liquidity and the lowest credit risk, the NBP invests in supranational bonds, bonds issued by local governments or agencies and corporate bonds. In 2018, the NBP made a strategic decision to expand its gold reserves by 25%. As a result, the share of gold in official reserve assets went up from 3.8% at the end of June 2018 to 4.5% in October 2018.

Keywords: National Bank of Poland, FX reserve management, FX reserve accumulation, FX reserve diversification, investment strategy, gold reserves.

JEL classification: E58, G11, G15, G32.

[1] Narodowy Bank Polski (National Bank of Poland, NBP)

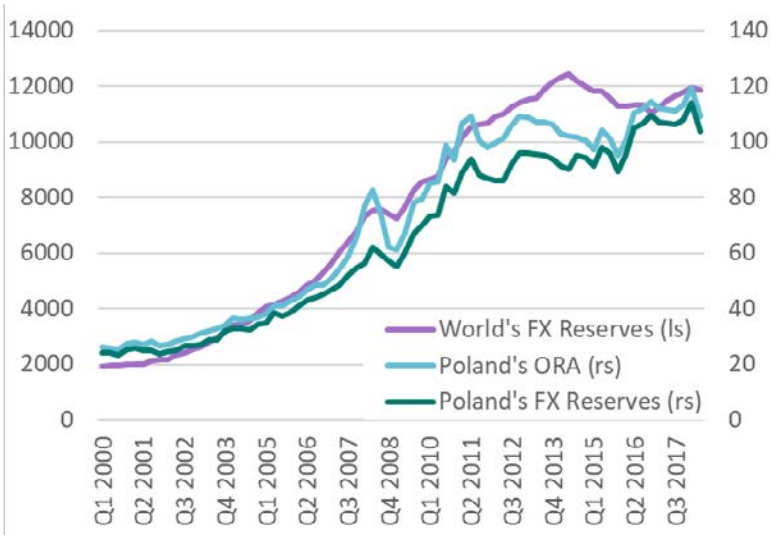
This note provides an overview of foreign exchange reserves trends in Poland, starting from their accumulation in recent years, through governance issues and management strategy. It presents a historical outline of changes in the currency structure of the NBP's FX reserves in the context of drivers and limits of diversification as well as the effects of diversification. It also describes the NBP's investment spectrum and the role of gold. The note closes with a brief discussion of the main directions for the development of the NBP's investment strategy in the coming years.

1. Overview of reserve management and accumulation

1.1 Reserves accumulation trends

The scale of FX reserves accumulation by the NBP has been broadly in line with global trends over the past two decades. At the end of October 2018, FX reserves – ie assets denominated in foreign currencies, mainly in the form of securities, deposits as well as repo/reverse repo transactions – reached the equivalent of USD 105.3 billion (19.1% of GDP as of Q2 2018), securing Poland's position among the 20 largest reserves holders worldwide. At the same time, official reserve assets (ORA)[2] – which, in addition to FX reserves, also comprise gold and SDR holdings, among others, and are used to assess reserve adequacy – accounted for USD 111.4 billion, increasing in USD terms roughly fourfold from USD 27.5 billion in 2000 and almost doubling over the past decade.

World's and Poland's FX reserves and Poland's ORA (in USD bn) since 2000 Graph 1

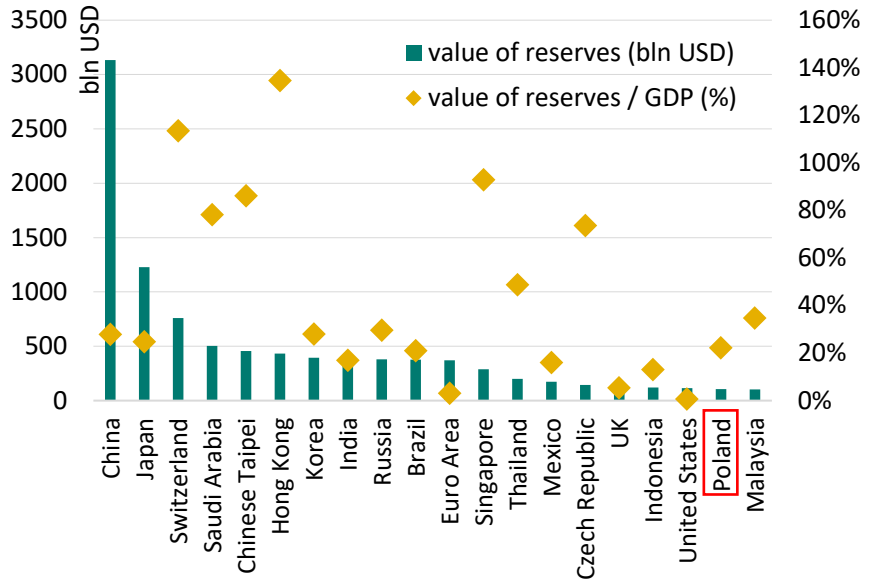


Sources: IMF, NBP.

[2] Official reserve assets include FX reserves (assets in foreign currencies, mainly in the form of securities, deposits and currencies, and other assets, such as reverse repo transactions), gold reserves, Special Drawing Rights (SDRs) and the reserve position in the International Monetary Fund.

However, while the scale of reserves accumulation in Poland largely mirrored global patterns, the primary sources or drivers were rather unlike those in most EMEs. In particular, **the successive growth in the value of official reserve assets over the past decade has resulted not from overt intervention, but mainly from the positive balance of external flows, driven largely by the inflow of funds from the European Union.**[3]

Largest holders of FX reserves (in USD bn) at the end of Q2 2018 Graph 2



Source: IMF.

Other important drivers included the changing scale of investments in reverse repo transactions carried out together with repos,[4] fluctuations in foreign exchange rates (valuation effect) and the return on investments.

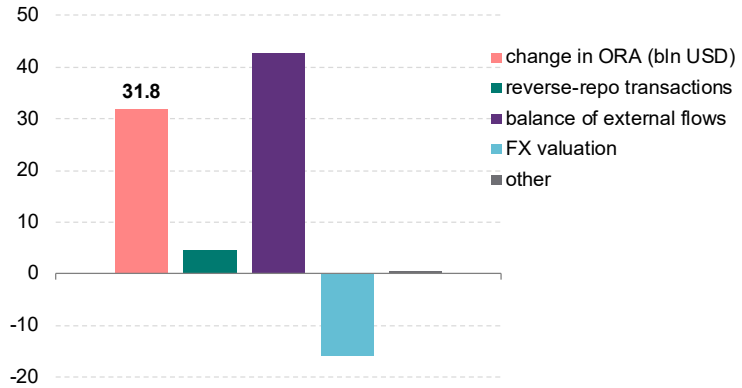
And indeed, a considerable inflow of EU funds in 2009–12 helps to explain why those years saw the fastest rate of reserves accumulation (on average 15.4% per year). In subsequent years, the pace of accumulation has slowed, with FX valuation effects and repo/reverse repo being the main drivers of portfolio size in USD terms.

In recent years, **the level of official reserve assets as well as foreign exchange reserves has been broadly adequate according to standard reserves adequacy indicators**, including the IMF's ARA metric and the optimisation model.

[3] According to the Ministry of Finance the net value of inflows from the EU since 2004 in September 2018 stood at EUR 103.1 billion (USD 119.9 billion). A significant part of these inflows has been converted into PLN by the NBP, increasing the NBP's foreign currency resources.

[4] In a repo transaction, the NBP agrees to lend a security in exchange for cash. The amount of cash received is recorded as a short-term liability of the NBP. When the NBP enters into this kind of transaction both the assets (official reserves) and the short-term liabilities (included also in external debt statistics) increase. When the transaction matures both official reserve assets and short-term liabilities decrease.

Main factors driving the change in the level of ORA from 2010 (USD bn) Graph 3



Source: NBP.

1.2 Institutional context for managing reserves: priorities and decision-making

Pursuant to the Act on Narodowy Bank Polski, the central bank holds and manages FX reserves, as well as taking measures to ensure the safety of Poland's foreign exchange operations in terms of payment liquidity. Our experience is **that, in the context of a floating exchange rate – such as in Poland – the role of FX reserves is primarily to enhance the country's financial credibility**, thereby reducing the cost of financing in the global markets and the volatility of the zloty exchange rate, as well as mitigating the risk of a sudden outflow of capital. Incidentally, FX reserves may be used to support the stability of financial markets or the banking sector in the event of significant disturbances in their functioning. Indeed, while **official intervention has been rather infrequent and targeted solely on curtailing excessive volatility of the zloty** (since 2010, the NBP has intervened six times, most recently in 2013), the NBP has in fact used reserves before to fulfil its mandate of ensuring financial stability. **In particular, as part of a broader set of measures implemented in 2008–09 – termed the Confidence Package – the NBP acted as a lender of last resort for domestic banks which could not access FX funding to close their on- and off-balance sheet open FX positions.**[5] While the demand for FX swaps offered by the NBP peaked at only about PLN 1 billion – ie much lower than potential needs, the rest being provided mostly by foreign parent companies – the experience did underscore how useful a liquid reserves portfolio can be, even in an economy with a fully floating exchange rate regime.

While managing FX reserves, the NBP aims primarily to ensure the safety and liquidity of invested funds, and – with these priorities satisfied – to maximise return, in given market circumstances. All resources are managed internally within an integrated investment strategy – ie without tranching – as laid out in the investment guidelines approved by the Management Board. The guidelines

[5] The open FX positions were due to the prevalence, at the time, of mortgages denominated in foreign currencies, mainly Swiss francs. As a consequence of harsh experience during the crisis as well as new supervisory measures, lending in foreign currencies has virtually stopped, with the legacy portfolio shrinking gradually.

comprise a set of principles, regulations and procedures which provide a framework for the whole investment process; in particular defining the decision-making process, the eligible asset classes, as well as the rules of financial risk management, including principles for establishing credit limits and the criteria for the selection of counterparties. Thus, although the Board does not specify its risk appetite directly in the form of a numerical risk budget, the approved investment guidelines nonetheless provide an implicit check on the degree of financial risk-taking consistent with the Board's preferences.

From an operational point of view, reserves are managed within a three-layer process, comprising strategic, tactical and portfolio management perspectives. The first step of the process is the approval by the Management Board of the strategic asset allocation (SAA) – or strategic benchmark – which sets the key parameters of the long-term investment strategy in accordance with the Board's risk-return preferences. The SAA framework is normally reviewed annually to ensure that a wide range of up-to-date macroeconomic and financial forecasts can be used in the underlying optimisation exercise. On a general level, the review provides key strategic parameters, in particular the currency structure and modified duration with their corresponding ranges for deviations which determine the scope of active management for tactical asset allocation and active portfolio management. Against this background, the FX Investment Committee is responsible for the tactical asset allocation (TAA), which tries to take advantage of medium-term market developments unforeseen in the strategic benchmark, with a view to outperforming the SAA. Finally, portfolio managers take active decisions on a day-to-day basis, striving to outperform the tactical benchmark.

Such a framework allows for adjustments of strategic asset allocation to medium- and short-term market fluctuations. This aims not only at enhancing returns but also at reducing downside risk and supporting capital preservation. An obvious precondition and, indeed, the major challenge for such an approach, is the ability of portfolio managers to anticipate market developments, define regimes, identify shifts in cycles at an early stage with either qualitative (macroeconomic leading indicators, sovereign risk analysis, early warning signals) or quantitative signals (technical analysis, momentum, volatility patterns). They should not be tempted to stick to the strategic benchmark during periods of increased market volatility, when protection against downside risk is most desired.

Decision-making process — Graph 4

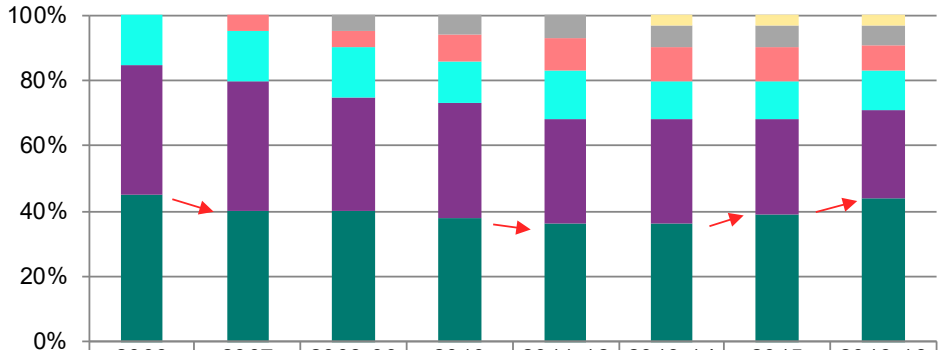
Source: NBP.

2. A look at the currency composition of the NBP's FX reserves portfolio

2.1 SAA in historical perspective

Given the systematic inflow of EU funds and the crisis-driven fall in yields in major advanced economies, a consistent theme of the NBP's reserve management over the past decade has been diversification into the so-called non-traditional currencies, subject to the credit, market and liquidity risk constraints discussed above. Specifically, starting from a portfolio featuring only USD (45%), EUR (40%) and GBP (15%) in 2006, the NBP has gradually added exposures to the Australian and New Zealand dollars (8% and 3% allocation, respectively) as well as the Norwegian krone (6%; Graph 5). Temporary positions – albeit on a much smaller scale – have also been taken in the Brazilian real and Mexican peso.

SAA currency composition of NBP's FX reserves — Graph 5



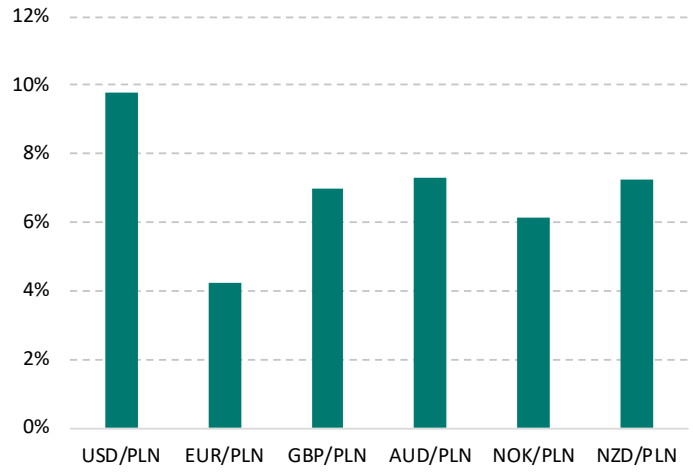
	2006	2007	2008-09	2010	2011-12	2013-14	2015	2016-18
NZD						3%	3%	3%
NOK			5%	6%	7%	7%	7%	6%
AUD		5%	5%	8%	10%	10%	10%	8%
GBP	15%	15%	15%	13%	15%	12%	12%	12%
EUR	40%	40%	35%	35%	32%	32%	29%	27%
USD	45%	40%	40%	38%	36%	36%	39%	44%

Source: NBP.

In line with global trends, the US dollar and the euro continue to play a dominant role in the NBP's foreign reserves portfolio, given the liquidity and investment opportunities offered by the US and German government bond markets. These are also perceived as the least credit-risky investments. Significant exposure in these markets ensures that the priorities of the central bank's FX reserves management – maximum security of the invested funds and adequate liquidity – are maintained. This assures efficient performance of central bank's responsibilities. That said, the allocation to the euro has declined over the past decade (from 40% in 2006 to 27% in 2016–18), to levels generally lower than observed in most regional peers. Still, the NBP maintains a non-trivial allocation towards the euro – in fact, the second largest in the portfolio – which is considered the main potential intervention vehicle, given

its dominant share in the FX spot market of the Polish zloty.[6] In addition, the euro has the lowest volatility against the zloty (both historical and implied) among the currencies in the reserve portfolio, which helps to improve the reserves' risk profile.

Volatility of reserve currencies against PLN in 2018 Graph 6



Source: NBP.

While direct comparisons may be difficult, the combined share of the USD and EUR in the NBP's portfolio at 71% is significantly lower than in the global reserves portfolio (83% at the end of the 2nd quarter of 2018), which indicates a relatively high degree of currency diversification of the NBP's FX reserves. Against this benchmark, we review below the main considerations driving currency diversification and comment briefly on the factors limiting it in future.

2.2 Drivers and limits of diversification: the NBP vs other emerging markets

The NBP's emphasis on maintaining a diversified currency structure is dictated by the desire to reduce market risk (especially FX volatility) and increase return in the long term.

The choice of currency structure underlying the strategic asset allocation is supported by macroeconomic forecasts (in both the base case as well as the stress-test scenario), optimisation and simulation analyses, as well as dynamic sovereign risk analyses based on selected macroeconomic factors – specific for each economy, but also assuring comparability – that make it possible to monitor the development of economic activity, fiscal conditions, international position, real estate and labour market conditions, as well as the soundness of the financial system. The size and liquidity of the market as well as investment opportunities in a given currency are also taken into account.

[6] Data from the Bank of England indicate that, in 2017, the share of EUR/PLN operations in the turnover on the London spot market of the Polish zloty was around 77%. On the domestic spot market of the Polish zloty, EUR/PLN transactions accounted for around 73% of the turnover.

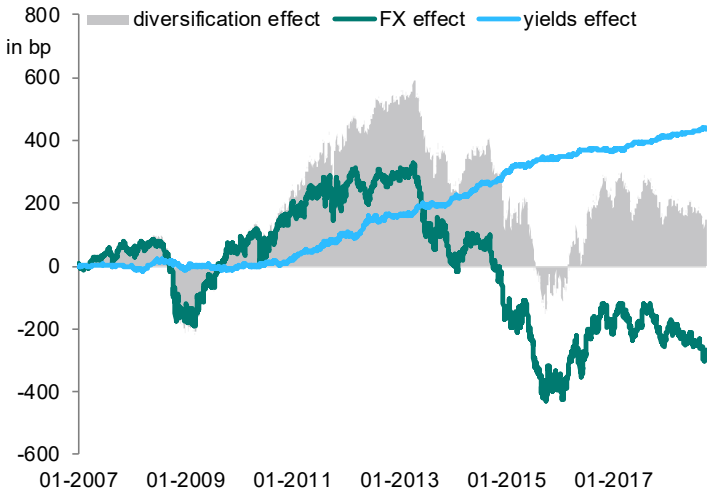
A significant level of foreign reserves and a free-floating exchange rate regime allows the NBP to run a slightly different investment strategy than some central banks in the region, where allocation is constrained by other criteria such as the currency structure of the central bank/government's or banking/financial sector's liabilities, the foreign exchange regime, or the geographical structure of imports.

Further diversification is constrained by the accepted risk level, the lack of asset classes and markets with sufficient depth, the lack of counterparties and the shortcomings of IT systems.

2.3 Benefits of FX diversification: how well has diversification served us?

One way to assess the NBP's overall experience with reserves diversification is to ask how well it has fared in delivering superior risk-return outcomes, as benchmarked against the original "undiversified" USD-EUR-GBP portfolio. Over the long run, currency diversification has contributed to a higher rate of return due to the stable positive impact of differences in the level of yields on individual markets, with a variable impact of changes in exchange rates (as shown in Graph 7).

Impact of diversification of currency structure on rate of return since 2007 Graph 7



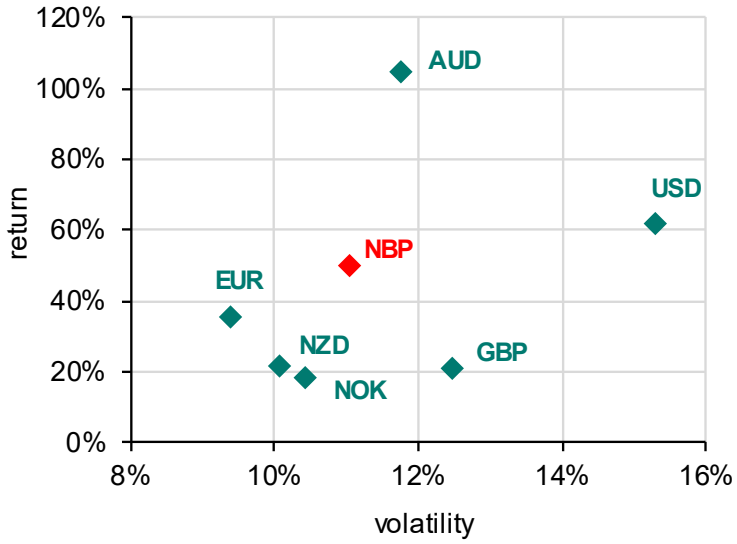
Source: NBP.

As a result of high bond yields combined with their significant decline since the beginning of 2007, the Australian dollar made the greatest contribution to the increase of the return. A smaller contribution came from the New Zealand dollar, which was added to the portfolio in 2013. Another positive effect of diversification was the reduction of the volatility of the rate of return.

A higher rate of return and the lower volatility of the diversified SAA currency structure translated into higher investment efficiency than before the start of the diversification process.

The positive impact of currency diversification is shown in Graph 8. Throughout the 2007–18 period, the euro, NZD and NOK portfolios have reduced risk of the total reserves whereas investments in USD and AUD contributed to the higher return.

Risk/return relation (in PLN) of FX portfolios and reserves (2007–18*) Graph 8



* The starting point for calculating NZD cumulative return and volatility is 2013 whereas for NOK it is 2008. For other currencies it is 2007.

Source: NBP.

3. Changes in the NBP's investment universe

3.1 Asset composition changes over the past decade

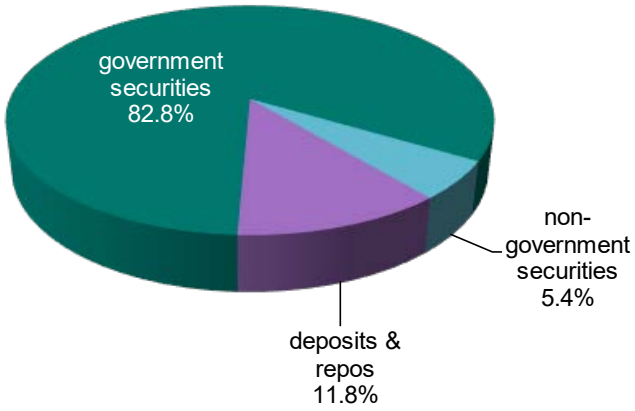
Along with its excursion into less traditional reserve currencies, the NBP has diversified the range of investable instruments, subject to the general investment guidelines and risk preferences set out by the Board. Naturally, the majority of FX reserves is still invested in sovereign bonds, which offer high liquidity and the lowest credit risk. In addition, the NBP also purchases supranational bonds, bonds issued by local governments or agencies, and corporate bonds. Most recently, inflation-linked bonds have been considered within active portfolio management. Some limited use of interest rate derivatives is also allowed, primarily for modified duration management.

Within predefined limits, traders are also allowed to make uncollateralised interbank deposits (with maturity of up to three months) and engage in securities lending or repo/reverse repo transactions. The contribution of each instrument to overall performance is generally not easy to disentangle and differs by market and currency but, thanks to the implemented Performance Attribution model, a detailed excess return decomposition is possible.

Within the diversification process, the NBP has set up a corporate bond portfolio in USD in June 2012. Corporate bonds have since become quite popular instruments among central banks. According to a recent BIS survey,[7] in 2018 some 51 central banks held corporate bonds issued by financial or non-financial corporations.

[7] Central Bank Reserve Management Practices 2018.

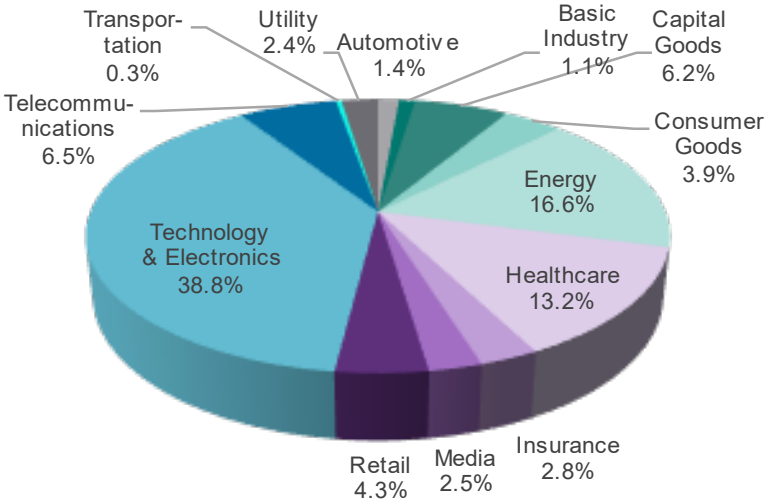
Share of investment instruments in the NBP foreign currency reserves excluding gold (as end-October 2018) Graph 9



Source: NBP.

Since the portfolio was built in-house, with the aim of gaining practical market expertise and know-how, the initial value of the corporate portfolio was set to a relatively low level of USD 500 million (0.6% of FX reserves), comprising bonds from a few strong, highly capitalised sectors. But, to avoid excessive concentration, investments in the financial sector were excluded, since the NBP already retained some exposure there through interbank deposits. As a practical matter, and in view of the somewhat lower market liquidity in the corporate bond space relative to sovereigns, the investment process was initially passive in nature and entailed close cooperation between the risk and portfolio management functions to select the appropriate portfolio characteristics.

Sector composition of the customised corporate bond index Graph 10

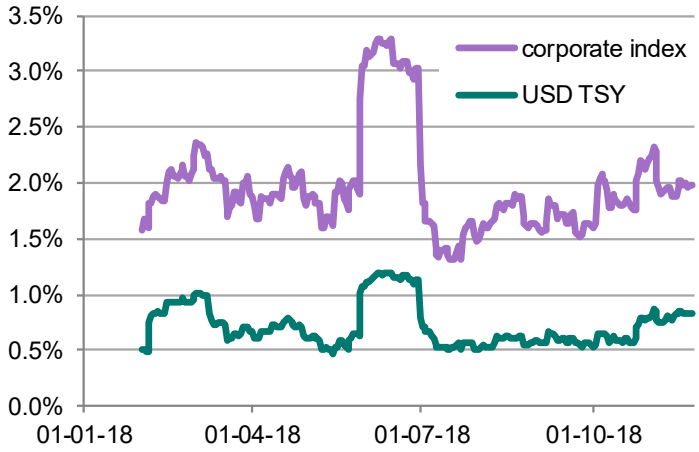


Source: NBP.

Over time, corporate bonds rose in prominence within the NBP's reserve management framework and, since the beginning of 2018, they have been included

as part of the USD investment portfolio with the share of 2%, covered by the three-layer decision-making process (SAA, TAA, APM). This decision was coupled with the introduction of a broad, diversified USD corporate bond index, appropriately customised to the NBP's risk profile (Graph 11). Reflecting the corporate bond market characteristics, the modified duration of the index exceeds that of the USD benchmark, translating into the former's somewhat higher volatility.

30-day rolling volatility of USD corporate bond index and USD benchmark in 2018 Graph 11



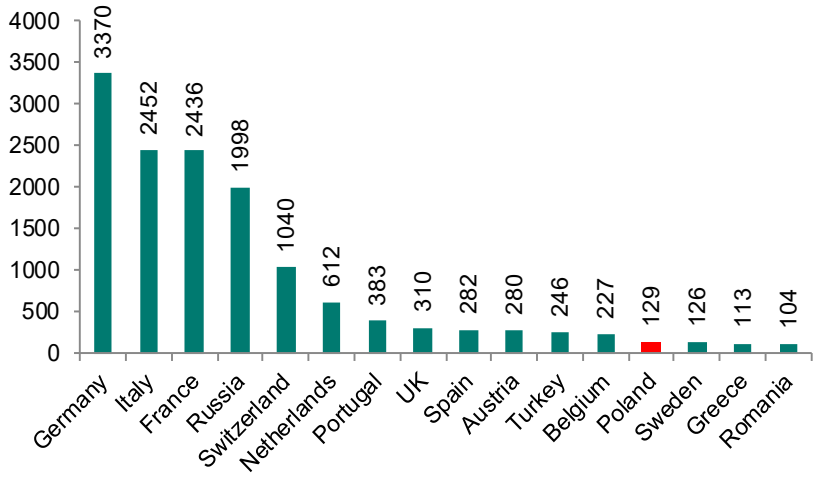
Source: NBP.

3.2 Gold as a strategic hedge

A somewhat distinct, yet by no means less important, part of the official reserves portfolio is made up by the NBP's gold holdings, which are perceived as an ultimate strategic hedge. Gold offers some unique investment features such as a virtual absence of credit risk, a historically strong performance during periods of high inflation, diversification benefits, scarcity and physical durability. These factors go a long way towards explaining why gold is seen as a safe haven asset in times of financial and political stress.

With these considerations in mind, the NBP made a strategic decision in 2018 to expand its gold reserves by 25%. The decision was supported by the fact that the NBP's gold holdings were lower than implied by the overall size of its reserves portfolio when benchmarked against those of other countries. The process of buying gold was finalised in October 2018, leading to an increase in the gold reserves to about 129 tons. As a result, the share of gold in official reserve assets went up from 3.8% at the end of June 2018 to 4.5% in October 2018. Currently, the NBP ranks 25th among central banks in the world and 13th in Europe in terms of gold holdings in tons (it ranked as 33rd and 16th before the purchase). Gold reserves are not included in the three-step investment process (SAA/TAA/APM). Decisions concerning the gold portfolio's size and investment strategy are taken by the Management Board. The NBP's gold is invested in deposits at central and commercial banks.

The biggest holders of gold in Europe (in tons) Graph 12



Source: IMF.

4. Conclusion: lessons learned and challenges for the future

As far as the future currency structure of the NBP's FX reserves is concerned, maintaining the dominant share of major reserve currencies (USD and EUR) seems to be reasonable as this should ensure the security and liquidity of the FX reserves. However, currency diversification should remain a key element of the NBP's investment strategy, aimed at reducing FX risk and maximising return over the long term. That said, the prospects of increasing the return on FX reserves through further diversification within the currently used asset classes would seem to be limited, given the NBP's preferences with respect to risk and liquidity. We may, therefore, be reaching a stage where further improvements in the risk-return profile of the reserves portfolio are likely to be achieved by gaining exposure to new asset classes, such as major equity markets or the EME space. Whether and how far we ultimately should go in that direction will be subject to further analysis.

FX intervention and FX reserves management

Central Bank of the Russian Federation

Abstract

Russia introduced its inflation targeting regime in 2015. Subsequently, fiscal policy was changed with a view to reducing the economy's dependence on natural resource prices; these changes are known as "the fiscal rule". At the same time, a financial stability policy and its instruments were developed. These changes in the monetary, fiscal and financial stability policies are the main factors that have influenced FX reserves accumulation and adequacy, intervention policy and reserves management in recent years.

Keywords: inflation targeting, fiscal rule, exchange rate, FX reserves.

JEL classification: E52, E58, E62, E63.

Russia introduced its inflation targeting regime in 2015. Subsequently, fiscal policy was changed with a view to reducing the economy's dependence on natural resource prices; these changes are known as "the fiscal rule". At the same time, a financial stability policy and its instruments were developed. These changes in the monetary, fiscal and financial stability policies are the main factors that have influenced FX reserves accumulation and adequacy, intervention policy and reserves management in recent years.

1. Monetary policy

Following the adoption of an inflation targeting regime, the inflation target has been set at a CPI rate of 4% and central bank monetary operations now focus on short-term rouble interest rates. The rouble exchange rate is free-floating. Hence there is effectively no FX intervention policy within the monetary policy rules.. Monetary policy operations as a result do not lead to the significant accumulation of FX reserves and do not require large amount of FX reserves to be available at any moment.

2. Fiscal rule

The fiscal rule aims to limit the extent to which the regular budget expenditure depends on volatile tax revenues from natural resources. While natural resource prices are high, the extra budget surplus is saved in the form of foreign currency-denominated assets. Once natural resource prices fall below predefined levels, the budget may include some of the previously accumulated savings.

Russian taxes are almost entirely paid in domestic currency, as are budget expenditures. The fiscal rule requires that, while natural resource prices are high, the Federal Treasury uses surplus revenue to purchase foreign currency and sells it once prices fall. This approach allows flows of foreign currency sold by taxpayers to be matched with the Federal Treasury's purchases of foreign currency while natural resource prices are high. When these prices fall, the Federal Treasury becomes the seller of the previously accumulated foreign currency.

These FX purchase and sale operations are carried out not by the central bank but by the Federal Treasury. The value of FX operations under the fiscal rule is restricted, being limited to either the rouble amount of accumulated extra tax revenues or the amount of the foreign currency purchased earlier.

These restrictions mean that these FX operations under the fiscal rule cannot be considered as setting or managing the rouble exchange rate policy. The rouble exchange rate continues to be free-floating, and the Federal Treasury is a large FX market participant that cannot and does not aim at a particular rouble exchange rate.

All purchases and sales of foreign currency are sterilised via the central bank's monetary policy operations. The Central Bank of the Russian Federation administers the FX purchase and sale operations under the fiscal rule and may stop them if it determines that they are a threat to the financial stability. The foreign currency accumulated by the Federal Treasury's purchases under the fiscal rule has the effect of increasing Russia's FX reserves. However, sales of this foreign currency are limited

by the overall amount and schedule of budget spending. From an FX reserves management perspective, any spending (portfolio outflow) of foreign currency under the fiscal rule is relatively predictable in terms of amounts flowing out during the next few months.

3. Financial stability

This relatively new type of financial policy has two sets of implications for financial stability: (i) issues that are commonly experienced worldwide; and (ii) country-specific issues. The commonly experienced financial stability issues arose mainly during and after the 2007–09 global financial crisis. Among these, free-floating exchange rates proved to be a generally better shock-absorbing policy than FX intervention-based policy. The trivial conclusion is that, during the crisis, more FX reserves were better than less. Further, excess debt creation in an economy should be more closely monitored and addressed in good time etc.

The country-specific financial stability implications for Russia arise mostly from the industrial structure of the economy, its emerging market economy characteristics, and the sanctions regime that restricts the access of Russian corporations and government to the global capital market.

Russia's financial stability policy assumes the possibility of FX intervention, including outright sale of foreign currency and foreign currency lending (FX swaps, FX repo and FX lending). Outright foreign currency sales are decided on an ad hoc basis; the timing and amounts are not precisely predictable, and any intervention would require sterilisation via monetary policy operations.

The central bank provides FX lending through overnight swaps available daily on standby terms. Other types of FX lending (repo and loans) may be quickly activated if needed. But the unpredictability as to the timing and amount of any intervention creates a challenge for FX reserves management and, as a result, a strong FX liquidity preference is applied when the FX reserves asset allocation is decided.

4. FX reserves management

The above-mentioned foreign currency transactions, within the frameworks of the fiscal rule, as well as the financial stability and monetary policies, define the investment objectives and constraints for the central bank's FX reserves management. Asset allocation decisions (on currencies, asset classes etc) reflect to the extent possible the estimated amounts, currencies and timing of potential reserves usage.

The effects of changes in the monetary, fiscal and financial stability policies on FX reserves accumulation and adequacy, policy and management are summarised in the table below.

Monetary, Fiscal, Financial Stability Policies and FX Reserves

Table 1

	FX reserves accumulation and adequacy	FX intervention policy	FX reserves management
Monetary policy (introduction of inflation targeting)	Less important for monetary policy	Not required for monetary policy	Monetary policy demands less from FX reserves management
Fiscal policy (introduction of the fiscal rule)	Performed according to the fiscal rule	Performed according to the fiscal rule	The fiscal rule is relatively predictable for FX reserves management
Financial stability (common and country-specific circumstances)	More important for financial stability	Required for financial stability, mostly on ad hoc basis	For FX reserves management, financial stability is less predictable

Reserves management

by Ayman Alsayari[1]

Abstract

This note discusses FX reserves management as practised by emerging market economies and, more specifically, by Saudi Arabia. It shares the Saudi Arabian Monetary Authority's experience on reserve adequacy, investment objectives, philosophy and process, portfolio tranching, risk management and performance measurement. It also includes some discussion of active and passive investment strategies, investment committee governance and institutional values.

Keywords: reserves management, reserve adequacy, investment philosophy, investment process, portfolio tranching, performance measurement, risk management.

JEL classification: E58, E59, G10, G11, G20.

[1] Deputy Governor for Investment, Saudi Arabian Monetary Authority.

1. Introduction

Historically, central banks have held reserves to maintain the convertibility of the domestic currency at a fixed rate of exchange (originally, of course, the reserves were gold under the gold standard system). That system evolved into one of adjustable pegged exchange rates (the Bretton Woods system) and then into more flexible exchange rate arrangements.

Reserves management policies and practices differ at central banks, depending upon their level of sophistication and the country-specific circumstances. The FX reserves of developed economies have not been as high as those of emerging market economies (EMEs), given their established access to international markets and an advanced institutional structure.

In the 1970s and 1980s, EME central banks found themselves with growing dollar reserves (often a consequence of high commodity prices). The initial strategy was to assume that this was a transient phase of economic development, and they took an overwhelmingly conservative approach with a short-duration US dollar bond programme to meet the overriding objectives of liquidity and capital preservation. As equity and bond markets in developed economies became more liquid (and it became clear that large FX reserves were here to stay), progressive central banks adjusted their risk appetite and started investing in risk assets (such as equities and credit products, followed in recent years by EME assets). The emphasis shifted from merely focusing on liquidity to include risk-adjusted return. The choice of well known benchmarks for relative portfolio performance reflected institutions' desired level of risk.

Broadly speaking, central banks take a portfolio tranching approach by dividing the portfolio into:

- a liquidity portfolio (with an emphasis on investing in high-quality liquid assets for immediate deployment); and
- an investment portfolio (with a focus on return, and greater scope for diversification).

As it became apparent that typical active managers could not consistently beat their index, the investment universe tilted towards passive products, leading to a surge of ETFs, with rising interest in (smart) beta strategies.

A marked distinction between developed economy and EME central banks is that the latter tend to hold a much higher level of FX reserves relative to GDP. There are a number of reasons for this:

- the major developed economies (European Union, Japan, United Kingdom, United States) have "clean" floating exchange rates with no or rare FX intervention;
- their currencies have global credibility as the core holdings of institutional investors;
- central banks in developed economies have swap and credit lines that are either not available to EME central banks or are too onerous in terms of operational cost; and
- EMEs lack these factors and need reserves to meet the FX needs of the government, the private sector and (often large and unpredictable) capital

outflows, which may be part of a crisis that has nothing to do with them (eg the global financial crisis arose in the United States but led to withdrawals of capital from EMEs).

This tendency to hold large FX reserves gained momentum following the Asian financial crisis in 1997–98, as emerging market central banks accumulated FX reserves as an insurance against any eventualities.

2. FX reserves management – SAMA's experience

The Saudi Arabian Monetary Authority (SAMA), the central bank of Saudi Arabia, has been managing FX reserves since its inception in 1952, and on a large scale since the 1970s. SAMA's reserves management has evolved over time as it accumulated reserves and gained expertise. This section seeks to address reserve adequacy, investment objectives, philosophy and process, portfolio tranching, risk management and performance measurement.

2.1 Reserve adequacy

The IMF formula for assessing reserve adequacy considers the major potential risks for an economy from a shock to the balance of payments, but its shortcoming is that it is applied equally to EMEs which may have very heterogeneous capital outflows. In practice, each country's reserve adequacy target depends on specific circumstances. These include:

- the exchange rate regime – more reserves are needed to support a peg than a floating currency;
- the structure of the economy – a monoline commodity exporter is more vulnerable to economic shocks than a diversified economy and needs more FX reserves;
- the linkage between government spending and foreign exchange outflow – where government spending mostly depends on export revenues rather than domestic taxes, there is a close relationship between the two. This is because the injection of demand into the economy from government spending leads to higher imports;
- external indebtedness – external debt requires servicing and repayment out of foreign exchange; and
- foreign investment – foreign holders of local currency assets will want to be able to sell their holdings and exchange the local currency into their base currency.

Reserves are an essential external liquidity buffer. There are broad reserve adequacy guidelines, based on empirical studies and reserves management practices, but there is no ideal formula for all economies, and the right level of reserves can vary for a single economy over time. This is because the level of reserves needed is based on the demand for FX by the government and private sectors, and also on protecting against external shocks of varying sorts.

Although there is no ideal formula, it has been clear since the Asian crisis some twenty years ago that "runs" on FX reserves are more likely to happen if it is perceived

that FX reserves are not adequate. In other words, there is a virtuous circle where high FX reserves reduce the likelihood of a crisis (in technical terms for a pegged exchange rate regime, where there is a "credible peg"). This is also due partly to the fact that, when the authorities have adequate FX reserves, they do not have to resort to hiking interest rates to protect the currency, which may be politically unpopular.

Applying these general points to Saudi Arabia, it needs first to be stated that, for SAMA, reserve accumulation is not a policy choice. Unlike at most other central banks, SAMA's FX reserve accumulation is involuntary, as it is linked to oil revenue, which is a function of Saudi Arabia's output level and the price of oil. While we have discretion over our output level, the oil price exhibits no duration dependency; in other words, it is an unpredictable random walk. The historical policy challenge for Saudi Arabia has been to accumulate sufficient reserves when the oil price is strong so that they can be drawn down when the oil price is weak, without threatening the credibility of the riyal-dollar peg in place at SAR 3.7500 since 1986.

SAMA's reserve adequacy metric takes into account the following factors:

- 100% mandatory currency backing, standard import cover, foreigners' remittances, a certain percent of broad money M3 (against a potential bank run), short-term debt cover (against a contingency of balance sheet crisis) and government debt servicing. External borrowing to buttress FX reserves has its uses, but it is not a permanent asset because it needs to be repaid.

Historically, there has been a strong correlation between government spending and foreign exchange outflow for two reasons:

- FX earnings come overwhelmingly from oil produced in the state sector, and when they are disbursed through government spending, this stimulates demand in the economy; and
- the country's heavy reliance on imports of goods and services.

SAMA has developed its own internal models to validate reserve adequacy and assess reserve requirements. These models take into consideration global practices and incorporate some specific macroeconomic factors relevant to Saudi Arabia and are regularly backtested to ensure their soundness.

To summarise: reserve adequacy is a blend of both quantitative and qualitative factors. It also requires a subjective judgment to be applied on historical linkages and the volatility of capital flows. Saudi Arabia's FX earnings tend to be volatile, which calls for holding a good precautionary cushion of FX reserves. Even if swap/credit lines were available, they differ from reserves in that they do not constitute an asset and their availability in times of stress is not certain. Any compromise on reserve adequacy could impair institutional credibility with higher than desired cost implications for the economy.

2.2 Investment philosophy and process

SAMA has three investment objectives: to preserve capital, maintain liquidity and achieve an investment return compatible with its risk appetite. The philosophy is to have a globally diversified portfolio via top-down asset allocation, which is critical to generating returns. There is no one standardised solution for allocating assets. It is a process of progression and fine-tuning. Strategic asset allocation (SAA) adheres to a base policy mix. SAMA reviews its Investment Policy Statement (IPS), which includes

SAA and operating guidelines, annually. Tactical asset allocation (TAA) seeks to capitalise on investment opportunities from a higher frequency of revision.

SAMA's investment process is built around relative weightings against the strategic benchmark. Operational benchmarks are chosen based on SAMA's risk tolerance. Manager selection focuses on their competence and alpha-generating capability in active mandates. Most managers follow the bottom-up process. Thus, the investment process blends both top-down and bottom-up approaches.

2.3 Portfolio tranching

FX reserves are split into two portfolios to optimise a blend of high-quality liquid instruments for reserves management, and risk assets for risk-adjusted returns. Asset allocation remains SAMA's prerogative.

- The **Reserve Portfolio (RP)** includes money market instruments and high-quality government bonds.
- The **Investment Portfolio (IP)** includes growth assets, hedge assets and real assets. IP uses asset roles rather than asset classes to create a non-correlating asset mix to stabilise returns.
- **Currency composition** is a function of asset allocation. SAMA does not engage in currency overlay strategies.

The larger the amount set aside for RP, the smaller the IP and the lower the investment returns over time. This means that SAMA expects investment returns to rise as FX reserves increase, and to drop when reserves decline.

2.4 Performance measurement and risk management

Performance and Risk Management (PRM) is a middle office function dealing with performance measurement, risk monitoring and the level of compliance relative to guidelines. SAMA uses standard as well as customised benchmarks for relative performance measurement.

SAMA has adopted the asset owners' recommendations of Global Investment Performance Standards (GIPS) in measuring portfolio performance. GIPS provide a set of standardised industry-wide principles that guide investment firms in calculating and presenting investment results.

Following the global financial crisis, risk management and compliance have assumed greater significance. SAMA's risk management parameters take into account currency positions, credit criteria, counterparty and operational risks among others.

Performance data are not formally released, but the size of reserves is reported publicly every month in line with IMF guidelines.

2.5 Active vs passive mandates

SAMA maintains a blend of active and passive strategies to capture beta as well as alpha. Active strategies seek to exploit market anomalies (focus on optimising alpha) while passive strategies focus on low-cost market tracking. Active and passive strategies are well suited to inefficient and mature markets respectively. Passive

strategies seek to capture market beta, which is a growing trend in the industry in mature markets for reasons of cost-effectiveness and exposure to broad beta. The risk of active management is in hiring closet indexers and that of passive management is sectoral allocation risk in a crisis (for example, post-crisis, the financial sector took a beating due to a massive correction).

2.6 Investment committee roles and responsibilities

The Governor heads SAMA's Investment Committee (IC), which comprises senior executives and internal investment professionals. The IC meets on a quarterly basis to discuss the Investment Deputyship presentation including tactical investment recommendations based on FX flows, asset position, global themes/market trends, the investment matrix, portfolio actions, and portfolio performance. The IC goes by a best practice framework, which focuses on institutional coherence (commitment to clarity and investment objectives) and disciplined decision-making (informed and accountable choices). Upon the Governor's approval of the investment programme, its execution is the responsibility of the Investment Deputyship.

The Investment Deputyship recommends investment guidelines, objectives and performance benchmarks for approval by the Governor acting as chair of the IC.

2.7 Investment deputyship values

The deputyship operates from a single location in the central bank. It emphasises staff integrity, teamwork, a culture of openness, information-sharing, mutual dependency and collective purpose. It strongly believes that the combination of experienced hands and fresh minds invigorates the thinking process for better performance. In doing so, the deputyship has adopted best practices in corporate governance, with clear job descriptions and responsibilities as well as segregation of front, middle and back office operations.

3. Conclusion

Reserves management is a dynamic process. Asset allocation is critical for generating return. Experience shows that investment process pays off in the long run. There is no ideal formula for reserve adequacy, which is a blend of both quantitative and qualitative assessment. Prudent ranges of reserve buffers depend on the underlying characteristics of the economy. For a pegged exchange rate regime, it is best to seek a "credible peg" status. The required precautionary element in reserve adequacy may have some insurance cost but this is worth incurring against any unknown event. Any compromise on reserve adequacy could impair institutional credibility with higher than desired cost implications for the economy (such as higher inflation and elevated interest rates leading to slower growth).

Reserve management and motivations for FX interventions

Monetary Authority of Singapore

Abstract

Unlike most central banks which target interest rates, Singapore runs an exchange rate-centred monetary policy framework, in which the Singapore Dollar Nominal Effective Exchange Rate (S$NEER) is the intermediate target of monetary policy. The S$NEER fluctuates within a policy band that is calibrated to ensure medium-term price stability. The Monetary Authority of Singapore (MAS) undertakes foreign exchange intervention operations to ensure that the S$NEER stays within the policy band. In the process of monetary policy implementation, the central bank accumulates or expends official foreign reserves, leading to changes in the size of its balance sheet. As with other central banks, the MAS' main objective of holding reserves is to meet balance of payment needs, which underpin the effective implementation of monetary policy.

JEL Classification: E52, E58, E61, G32

Keywords: exchange rate, NEER, FX intervention, reserve management, Singapore

1. Introduction

Unlike most central banks that target interest rates, the Monetary Authority of Singapore (MAS) uses the nominal exchange rate as the intermediate target of monetary policy. This is because in a small and open economy such as Singapore, where gross exports and imports of goods and services are more than 300 percent of GDP and almost 40 cents of every dollar spent domestically is on imports, the exchange rate has a much stronger influence on inflation than the interest rates.

The operating framework of such a monetary policy rate policy is centred on managing the Singapore dollar against a basket of currencies along a typically appreciating path or crawl within a policy band. This framework is often referred to as the basket, band and crawl (BBC) system. In effect, the intermediate target of monetary policy is the Singapore Dollar Nominal Effective Exchange Rate (S$NEER), which is a trade-weighted basket of currencies as it has a stable and predictable relationship with inflation.

The MAS focusses on the S$NEER rather than a bilateral exchange rate between the Singapore dollar and any particular foreign currency, as the trade-weighted exchange rate better reflects Singapore's diverse trading patterns. From a monetary policy implementation perspective, the S$NEER also tends to be more stable than bilateral exchange rates, as it is not unduly affected by idiosyncratic factors in any one particular economy.

1.1 Implementation of Singapore's monetary policy

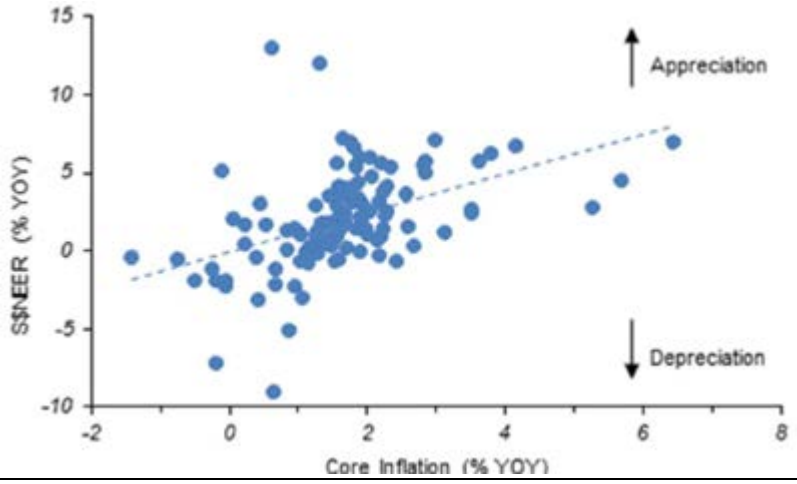
Monetary policy implementation in Singapore means ensuring that the S$NEER, which is the MAS' intermediate target of monetary policy, is kept within the boundaries of the policy band and remains aligned with domestic price stability. The primary tool to do so is intervention operations in the spot foreign exchange (FX) market, involving the sale or purchase of US dollars against Singapore dollars as this is by far the most liquid Singapore dollar currency pair traded.

In the process of monetary policy implementation, the MAS accumulates or expends official foreign reserves (OFRs) leading to changes in the size of the balance sheet. For example, the selling of US dollars to strengthen the S$NEER will have the effect of reducing OFRs on the asset side of the MAS' balance sheet, which is matched by a reduction in banks' cash balances with the MAS on the liabilities side. Such intervention operations are thus akin to interest rate-targeting central banks' monetary policy operations. Instead of using money market operations (via purchase or sale of domestic assets) to achieve a targeted policy rate, the MAS uses FX intervention operations to ensure that the S$NEER stays within the policy band and is aligned with domestic price stability.

The chart below, which plots the year-on-year change in the S$NEER against the MAS Core Inflation, shows that the S$NEER has generally fluctuated in line with underlying economic conditions. This tight relationship has been due both to the appropriateness of the MAS' monetary policy settings as well as the implementation of monetary policy through FX intervention operations. Typically, when forces acting on the S$NEER are orderly and largely self-equilibrating, the MAS allows the market to determine the level of the S$NEER within the policy band. The MAS also generally does not need to conduct significant FX intervention to implement the monetary

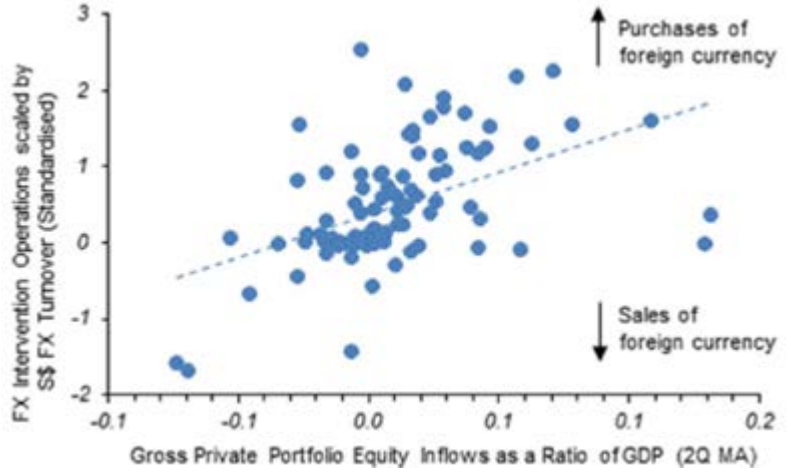
policy stance after the policy announcement. This reflects the MAS' credibility in formulating monetary policy that is congruent with the prevailing outlook for the economy and the objective of maintaining medium-term price stability.

Year-on-year change in the S$NEER against core inflation Graph 1



Nevertheless, FX intervention operations are sometimes necessary to lean against exchange market pressure, which may drive the S$NEER away from a level consistent with domestic price stability. For example, given Singapore's role as a global financial centre, the Singapore dollar is sometimes subjected to significant gross capital flows, driven by external factors such as global liquidity, risk aversion and regional contagion. These domestic and external factors cause exchange rate pressures that are often unrelated to Singapore's domestic inflation trends.

Intervention operations against gross private equity portfolio inflows Graph 2



The chart above plots a standardised measure of MAS intervention operations against gross private equity portfolio inflows as a percentage of nominal GDP. It shows that MAS' FX intervention operations "lean against the wind" and thereby help ensure that the S$NEER is in line with underlying economic conditions. The MAS sells Singapore dollars and buys US dollars when there is a surge in capital inflows, moderating the excessive appreciation pressure; and buys Singapore dollars and sells

US dollars when foreign capital flows out, tempering the undue weakening of the exchange rate.

In late 2006 and 2007, for example, Singapore experienced a sharp increase in gross capital inflows, or a 'surge' episode. This was followed by a sharp capital outflow, or 'stop' episode, during the peak of the Global Financial Crisis in 2008–09. The MAS undertook FX intervention operations to lean against the wind during this entire period, even as the S$NEER was allowed to appreciate over 2006–07 when inflation was rising, and then ease when inflation fell in 2009.

1.2 Reserve management

As with other central banks, the MAS' main objective of holding FX reserves is to meet balance of payments needs. This is particularly important given Singapore's exchange rate-centred monetary policy framework, where reserves are essentially used to back the effective implementation of monetary policy. Holding a sufficient buffer of reserves sends a strong signal that the MAS can and will defend any attacks on the Singapore dollar, thus deterring potential speculators and maintaining confidence in our regime. FX reserves are also needed to meet the MAS' various commitments with other central banks, such as currency swap arrangements.

Reserve adequacy measures and metrics provide a starting point for assessing the balance of costs and benefits in holding reserves. However, these should not be applied mechanically to assess reserve adequacy needs without considering the unique circumstances facing each country. For example, the cost-benefit model in Jeanne and Ranciere (2006)[1] for assessing reserve adequacy in a small open economy may be further adapted by adjusting model parameters according to country-specific circumstances. For instance, in Singapore's case, it would be inappropriate to assess the adequacy of reserves simply on the coverage of short-term external debt, which is invariably very high given our role as an international financial centre. Instead, this can be supplemented by bottom-up analysis of the specific components of debt and broad money, based on assumptions made on the probability of deleveraging or flight of such capital to calibrate the size of sudden stop or capital flight in the cost-benefit model.

The MAS invests OFRs prudently in a well-diversified portfolio of cash, bonds and equities, ensuring sufficient liquidity to support the conduct of monetary policy and keeping within risk tolerance levels, while seeking to achieve good long-term returns. About three quarters of OFRs are denominated in the G4 currencies ie USD, EUR, JPY and GBP. Within the G4 currencies, the USD forms the bulk.

The MAS' strategic allocation is approved by the MAS Board and reviewed on a regular basis to ensure that the investment objectives continue to be met. The OFR portfolio is managed both internally and through external fund managers. The Risk Committee, chaired by an independent Board Director, assists the Board in providing oversight and guidance over the management of risks assumed by the MAS.

The MAS monitors the investment risks of the OFR closely. Risk controls and limits are established to manage financial risks, including market, credit and liquidity risks. The MAS conducts regular stress tests to assess if the portfolio can weather the

[1] Jeanne, O, and Ranciere, R (2006), "The Optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications", *IMF Working Paper WP/06/229*

impact of potential tail risk events over the medium term, and considers appropriate responses when needed. The risk management framework is reviewed on a regular basis to ensure it remains adequate and appropriate in addressing the investment risks of the OFR portfolio.

Information on the MAS' OFRs is publicly disclosed on a monthly basis, including on- and off-balance sheet items in accordance with the International Monetary Fund's Data Template on International Reserves and Foreign Currency Liquidity of the Special Data Dissemination Standards (SDDS), which the MAS has subscribed to since its establishment in 1996. This aims to provide a comprehensive account of foreign currency asset and drains on such resources arising from various foreign currency liabilities and commitments. Further information on the MAS' OFRs is reported in the financial statements in the MAS' Annual Reports. Foreign reserves assets are accounted for on a lower of cost and market valuation basis in the MAS' financial statements.

Reserves management and FX intervention

South African Reserve Bank

Abstract

Emerging market economies (EMEs) have increased their reserves holdings primarily for self-insurance. The South African Reserve Bank (SARB) has accumulated its foreign exchange (FX) reserves for the same reason, recognising the need to reduce external vulnerability. Both debt issuance and the growth in the monetary base have been used to fund reserve accumulation, and therefore the cost (of holding reserves) comes through the cost of foreign debt issuance and the opportunity cost of forgone monetary accommodation to banks. As a benefit of FX reserve accumulation, reserves as a means of self-insurance can bolster investor confidence, particularly during a crisis, while the level of reserves often plays an important role in broader sovereign credit rating assessments. More recently, and in South Africa's case, other macro factors such as GDP growth and fiscal debt metrics have tended to be ratings-sensitive.

Most EMEs have remained active in the FX markets for various reasons, ranging from attempts to limit exchange rate volatility and/or influencing the level of the exchange rate, to accumulating foreign reserves. This note delves into the evolution of the SARB's FX intervention objectives, strategies and tactics, as South Africa has become more integrated with the global financial markets. It also highlights the impact of FX intervention on official reserves and the rand exchange rate. Currently, the SARB's intervention in the FX market is aimed at gradually building up the official reserves without unduly influencing the rand exchange rate in either direction.

The SARB's FX reserves management has matured over time, resulting in the introduction of new asset classes and currencies. There has been a growing focus on the cost of holding reserves as the size of the FX reserves has grown, and the note describes the use of tranches in the foreign exchange reserves portfolio to adequately address both the liability hedging requirements and return motivations. The note concludes by briefly touching on the SARB's securities lending and external fund management programmes.

Keywords: South African Reserve Bank, foreign exchange reserves, official reserves, foreign currency reserves, reserves management, foreign exchange intervention, reserves accumulation, reserves adequacy, reserves tranching, strategic asset allocation.

JEL classification: E44, E59, E65, F31, G11, G15, N27.

1. Introduction

This note addresses some aspects of reserves management and foreign exchange (FX) intervention that are of particular relevance to the South African Reserve Bank (SARB). In the first section, we focus on the measures and principles that guide the SARB in accumulating and determining the adequacy of FX reserves. The second section addresses the role of FX intervention strategies at the SARB and the final section concludes with a discussion on the management of the FX reserves and the strategic asset allocation (SAA).

2. Drivers of reserve accumulation from a policy perspective

As in the crisis periods of the late 1990s and 2000s, EMEs have built up their foreign exchange (FX) reserves mainly in order to self-insure against future crises. This motivation stemmed from an element of frustration with the International Monetary Fund (IMF) and a feeling that financial resources were provided to EMEs on very stringent terms, which in some instances may have slowed their economic recovery.

As South Africa has a floating exchange rate regime, creating capacity to intervene in the FX market has not been a significant driver for accumulating FX reserves. The key motive behind the SARB's accumulation of FX reserves has been largely for self-insurance purposes, recognising the need to reduce external vulnerability. South Africa's current level of gross reserves of approximately US$ 50 billion, although above the estimated adequacy level, has not yet reached a level that is deemed as sufficient. Reserve adequacy refers to the amount in liquid assets that the country needs to hold to cover known and likely trade and debt obligations over a one-year period[1] – it can thus be viewed as the minimum required reserve holding. The optimal level of reserves is determined using various factors and an amount that is deemed most appropriate for purposes of maintaining macroeconomic stability. This includes the provision for unanticipated obligations or the risk of a sudden stop, and also takes into account the cost of holding reserves. The difference between adequate and optimal reserves can thus be viewed as a safety buffer. The SARB also frequently reviews the level of reserves held by other EMEs, although this does not result in any mechanistic trigger to increase FX reserves. In recent years, the level of reserves deemed as optimal for South Africa has tended to increase, due mainly to a significant increase in gross domestic debt and higher non-resident holdings of that debt.

In terms of the cost of holding FX reserves, the direct financial cost typically comes through the interest paid on sterilisation instruments transacted at domestic market interest rates, which are well in excess of the return earned on the reserve

[1] Forward-looking projections are also utilised in order to try and capture the changing short-term obligations in each calendar year. Furthermore, the time period or horizon over which the adequacy level is determined is dependent on the particular measure or model employed. For instance, the more traditional import cover rule assumes it might take three months for normalisation, and thus a country would need to cover that amount of imports. The models being employed by the SARB (in collaboration with National Treasury) are based on the size of shortfalls experienced by a country during a sudden stop. Time therefore is generally implied rather than being explicitly modelled.

assets. Should the monetary base be used to fund foreign exchange reserve accumulation, the shortage in the money market would not grow as expected, and therefore the cost would be the forgone interest earned on accommodation to banks transacted at the policy rate. Alternatively, reserves are funded through the issuance of foreign debt and the cost is then a combination of the term premium associated with issuing longer-dated liabilities and the country credit spread. South Africa has used both foreign debt issuance and the growth in the monetary base to fund accumulation, and therefore the cost comes through the cost of foreign debt issuance and the opportunity cost of forgone accommodation to banks. Moreover, in the past, FX reserves accumulation has been funded using SARB debentures[2] and government rand deposits.

Turning the focus to the benefit of FX reserve accumulation, reserves as a means of self-insurance can add to investor confidence, especially during a crisis. The level of reserves also often plays an important role in credit rating assessments. However, in the case of South Africa, more recently other macro factors such as GDP growth and fiscal debt metrics have tended to be more prominent issues for ratings outcomes. There is also the argument that higher reserves may help to reduce volatility in the FX rate. In fact, many country vulnerability assessments include reserve adequacy ratios, with the exchange rate commonly believed to be vulnerable to volatility and depreciation tendencies during times of stress. However, in practice, it is not always apparent that higher reserve holdings will contribute to lower FX volatility during such periods.

Measures to assess reserve adequacy are a greatly debated topic, particularly as regards the relevance of any specific measure to the country involved, and also whether certain measures should be augmented with others.

In assessing South Africa's optimal level of reserves, four measures are used in order to inform a range representing an optimal level, these include: the adjusted Guidotti rule, the Jeanne-Rancière model, the IMF's formula for reserve adequacy, sometimes referred to as IMF assessment of reserves adequacy (ARA), and the Southern African Development Community (SADC) macroeconomic convergence criteria.

When assessing the optimal level of reserves for South Africa, it is particularly useful to look at the various and significantly different inputs considered by each measure. For example, the Guidotti formula takes into account the level of non-resident holdings of domestic government bonds. This is structurally important from a South African perspective, as close to 40% of South African government debt is held by non-residents. In addition, the Jeanne-Rancière formula uses the input of the probability of a sudden stop, which is another structurally important variable to consider, given South Africa's heavy reliance on capital flows. In 2014, the IMF published a paper on estimating the optimal level of reserves. It noted that market maturity and flexibility affect this optimal level, but did not sufficiently take into consideration the relative maturity of South African markets. In measuring the optimal level of reserves for South Africa, the IMF's ARA formula is included in the set of reserves adequacy formulae used, although the IMF has suggested additional work

[2] SARB debentures are short-term debt instruments, issued by the SARB, with maturities of up to 56 days.

on understanding the impact of indicators such as short–term bank FX funding, trading liquidity and pricing behaviour.

From a regional perspective, and in line with the memorandum of understanding between the SADC countries on macroeconomic convergence, the SADC convergence criteria are also used to assess reserves adequacy, being that international reserves should not be less than six months' worth of import cover.

3. FX interventions: motivations, strategies and tactics

Many central banks intervene in the FX markets in response to undesirable exchange rate movements, or when their currencies experience extreme bouts of volatility. Their aims are to ensure the orderly functioning of markets; to influence the exchange rate if they believe that it is misaligned or dislocated from the underlying fundamentals; or to limit exchange rate volatility, and also to accumulate FX reserves.

The SARB's participation in the FX market has evolved over time as South Africa has become more integrated with global financial markets, but also in line with economic developments in the country, including the adoption of an explicit inflation targeting framework. South Africa has highly developed and liquid FX markets, which facilitate continuous price discovery and a smooth execution of FX transactions. Sophisticated and mature domestic financial markets allow market participants, including the SARB, to seamlessly transact in domestic FX markets using various derivative instruments. These instruments include, among others, outright forwards, FX swaps, forward-forwards, currency futures and currency options, currency swaps and basis trading. As at the end of October 2018, the net average daily turnover in the rand foreign exchange market amounted to approximately US$ 8.5 billion.

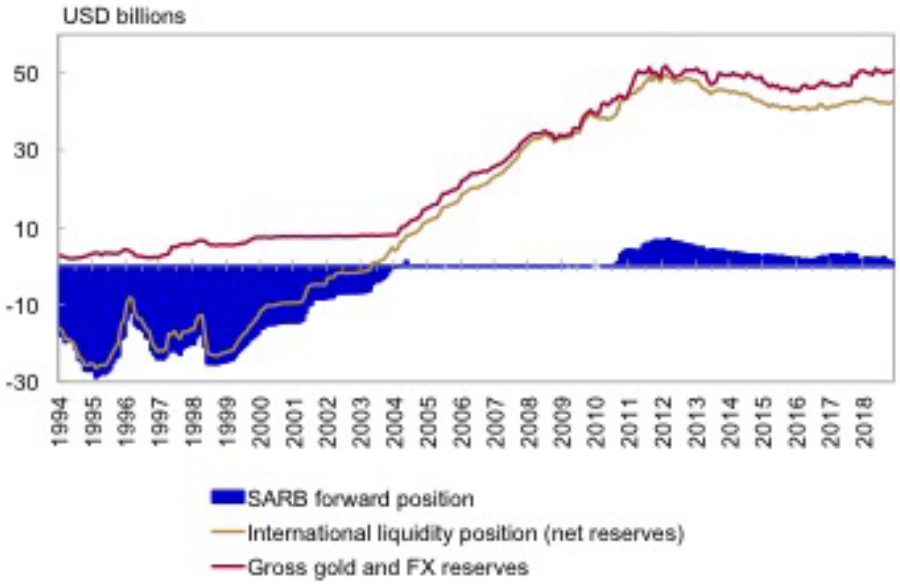
Until 1998, the SARB's interventions in the FX market were aimed at limiting the depreciation of the rand or reversing the observed trend – the so called "leaning against the wind" policy. This entailed conducting spot sales of FX reserves with authorised dealers in the market. During this period, due to the relatively low level of official FX reserves, the SARB also conducted FX swaps in order to sterilise the rand and the related liquidity impact and also to safeguard the gross reserves position.

This intervention strategy to counter the depreciation of the rand resulted in an oversold forward book of US$ 28.8 billion as at the end of February 1995, and consequently, for the same period, the SARB had a negative net open foreign currency position (NOFP) of US$ 26.5 billion. This position effectively gave speculators reason to sell the rand, as this was then deemed a one-way bet given the huge forward dollar commitments of the country. Following unsuccessful FX interventions to support the depreciating rand exchange rate, and after almost depleting its foreign exchange reserves during the EME financial crisis in 1998, the SARB decided to reduce the NOFP to zero and also abandoned all FX interventions aimed at influencing the exchange rate. The SARB then shifted its focus to gradually rebuilding its international reserves without seeking to influence the exchange rate in either direction. After eliminating the NOFP in 2003, the SARB started accumulating reserves by buying foreign exchange on a spot basis when conditions were deemed favourable, while taking care not to influence the rand exchange rate towards any particular level or range. The combination of spot FX purchases and FX swaps conducted by the SARB

to match the oversold forward maturities ultimately led to the squaring-off of the forward book in February 2004.

Since then, the SARB has been successful in rebuilding its international reserves, resulting in an international liquidity position and official gross reserves of US$ 43 billion and US$ 51 billion, respectively, as at the end of November 2018. Graph 1 below shows the evolution of reserves accumulation during the period 1994 to end November 2018, which also includes the SARB's activity in the international syndicated loan market in the early 2000s, to augment gross reserves.

Official gross and foreign exchange reserves plus forward position Graph 1



Source: SARB (November 2018).

As indicated earlier, in recent years the SARB's foreign exchange operations have been directed towards gradually building up the official FX reserves, also for the purpose of managing domestic liquidity for monetary policy implementation purposes. However, the SARB does not target a specific level or range for the rand exchange rate. This is consistent with the SARB's inflation targeting framework and flexible exchange rate.

South Africa's monetary policy is aimed at achieving price stability, while the nominal exchange rate is allowed to adjust to balance the external accounts. This does not mean that the SARB is indifferent to the challenges posed by the volatility and abrupt adjustments of the exchange rate. It is generally deemed appropriate for central banks operating within a flexible exchange rate system to intervene in FX markets to maintain orderly market conditions in support of financial stability.

Current FX accumulation strategies generally consist of a combination of methods such as purchasing or taking in the proceeds of government's foreign bond issues as a deposit (the latter only boosting gross reserves, but not net reserves) and purchasing FX from authorised dealers in the open market, when conditions allow, ie without unduly influencing the exchange rate or adding to volatility in the market. In certain exceptional circumstances, in order to facilitate the execution of transactions that are exceptionally large relative to the size of the local FX market, the SARB directly

purchases a portion of foreign direct investment inflows (FDI) or mergers and acquisitions-related flows.

Disclosures in relation to FX reserves have remained fairly consistent over the past decade. The SARB releases a monthly report to the public via its website indicating the level of official gross gold and foreign exchange reserves as well as the international liquidity position. This report is published monthly within five business days of the month-end and contains a brief explanation of the main changes. In addition, the SARB also publishes information about reserves management activities in its annual reports. Finally, in 2016, the SARB began publishing the Official Gold and Foreign Exchange Reserves Management Investment Policy (IP) on its website. The IP defines the approach and framework governing the management of reserves and its publication is an effort by the SARB to promote and improve transparency around the management of FX reserves.

4. Reserves management

As previously discussed, FX reserves accumulation at the SARB is primarily driven by precautionary considerations. As such, the currency composition of FX reserves is guided by relevant external liquidity considerations such as the foreign currency denomination of government debt and the currency composition of South Africa's imports. However, as reserves have grown, the holding costs have become an important consideration along with the question whether the FX reserves can generate sufficient returns to cover this cost. In terms of the SARB Act, gains and losses on gold and FX holdings due to foreign currency translations (into rand) are for the account of the South African government.

To balance the liability hedging and return motivations, the gross reserves are separated into two tranches, a liquidity and investment tranche. Furthermore, the liquidity tranche is segregated into a working capital subtranche that provides liquidity for short-term liabilities and cash management needs, and a buffer subtranche that provides for any external financial shocks that may require their immediate use. Additionally, the gold and SDR holdings are individual subtranches within the liquidity tranche. The investment tranche, however, is guided by the need to mitigate the cost of holding reserves and its composition is determined on a risk-return basis in order to generate returns within the Bank's risk parameters. The overriding objectives of capital preservation and liquidity are important to both the liquidity and investment tranches.

The size of these tranches is based on the Jean-Ranciére model as a measure of reserve adequacy, although the two tranches are considered separately within the strategic asset allocation (SAA). The buffer subtranche is optimised, based on the determined currency composition, to reduce the probability of negative returns to below 1%. The optimisation of the investment tranche, however, is guided by the risk-return objectives of the SARB and the need to recoup the cost of holding reserves. This can be achieved by either managing duration, and/or adding other higher-yielding asset classes to the SAA.

A number of changes have been made to the SAA over the past decade. In 2013, given the growth in mainly FX reserves, it became important to focus on improving the overall return on FX reserves, yet to also retain a balance between accumulation

and the cost of holding FX reserves. Within this context, yield became an important consideration, however, given the objectives of capital preservation and liquidity, explicit yield-enhancing activities were confined to the investment tranche. Furthermore, as an alternative to increasing risk-taking within traditional reserve currencies and securities, these activities were focused on increasing the number of asset classes and including currencies with higher-yielding assets.

As a result, the SARB then expanded its investment universe for internal portfolio managers to include China, South Korea, Japan, Sweden and Australia. Furthermore, new asset classes were introduced, namely; US agency mortgage-backed securities (MBS), US dollar supranational bonds, euro covered bonds, and the use of bond futures to enhance the efficiency of internal portfolios.

The new asset classes required enhancements to risk analytics. As a result, the SARB began a process of systems renewal, which included an end-to-end solution supporting reserves management and treasury operations as well as third-party payments.

In developing the latest SAA, implemented in 2017, the SARB was faced with the prospect of normalising policy rates in advanced economies, specifically in the United States. This resulted in a number of changes to the SAA developed in 2013, the most important of which was a significant reduction in overall portfolio duration and the introduction of a new asset class, namely US Treasury Inflation Protection Securities or TIPS. Other changes included, limiting exposures to certain currencies, including non-core reserve currencies as the prospects for more traditional reserve currency economies improved. The SARB also increased its portion of the reserves invested in the onshore Chinese bond market. This reflects the country's level of trade with China, as well as the risk-adjusted returns that were expected from the bond investments at the time of developing the SAA.

Another important change related to the outsourcing of the SARB's securities lending programme. As part of good governance, the SARB performed a comprehensive review of its securities lending programme which, since its introduction in 2005, had made use of a custodian to conduct securities lending on the Bank's behalf. The main purpose of the review exercise was to ascertain whether or not the SARB's current securities lending model best fitted the risk-reward optimisation objective of the programme by way of a peer comparison, while at the same time evaluating and comparing other important aspects of the service offerings such as risk processes, collateral management, indemnifications, utilisation ratios, revenue-sharing and track records. The project was concluded in 2016 with the appointment of a third-party securities lending agent. Hence, the securities lending programme changed from a custody lending to a third-party lending model.

The SARB has maintained an external fund management (EFM) programme since 1999. The EFM programme adds additional diversification to the management of FX reserves, allows for a transfer of skills, greater risk-taking given broader guidelines, and acts as a benchmark for the internal portfolio managers. The programme typically focuses on actively managed portfolios, specifically within specialist asset classes such as US TIPS and US MBS.

Reserves management and FX intervention in Thailand

Bank of Thailand

Abstract

In recent years, the economic and financial environments have continued to confront emerging market economies, including Thailand, with challenges in conducting monetary and exchange rate policy. The unwinding of unconventional monetary policy, escalating trade tensions and disruption from new technology have complicated policy design and implementation. As a result, the policy framework needs to be continuously assessed in order to validate its effectiveness while avoiding unintended consequences. This paper explains the objectives of Thailand's FX intervention policy along with the benefits and costs to the economy. It also discusses the effectiveness of FX intervention, as well as alternatives. In addition, the paper describes various aspects of the reserves management framework, such as governance and portfolio structure, which have shifted in recent years in the interests of financial stability and improved returns within the risk guidelines. Public communications regarding FX intervention and reserves management, which is the means to maintaining central bank's independence and credibility, are also addressed.

Keywords: Bank of Thailand, FX intervention, sterilisation, reserves management.

JEL classification: E58, O24.

1. Determinants of Thailand's reserves level

Under its flexible exchange rate regime, the Bank of Thailand (BOT) has maintained an intervention framework focusing on moderating excessive exchange rate volatility, discouraging sharp capital flows, and curbing excessive currency speculations. These, in turn, contribute to the main objective of maintaining long-term economic growth, as well as price and financial stability. From a policy perspective, there is no predetermined level of FX reserves, and the change in Thailand's reserves level is generally a by-product of other policies.

1.1 Benefits, costs and consequences

In the past decade, during which major central banks conducted ultra-loose monetary policy, Thailand, like many other Asian countries, occasionally experienced massive capital inflows that caused the currency to move in one direction with excessive volatility. Even in the recent years of policy unwinding, the gradual pace of QE normalisation was, at times, seen to support EMs and could lead to excessive speculation in some EM currencies. FX interventions that curbed such movements were deemed warranted, as they helped avoid adverse impacts on the adjustment of the real economy. As a by-product of this policy, Thailand's net FX reserves have increased from USD 118 billion in 2008 (40% of GDP) to USD 234 billion in 2018 (52% of GDP).[1]

A high level of FX reserves and a persistent current account surplus have put Thailand's external position on a solid footing. In the period of high uncertainties caused by monetary policy normalisation in major economies, FX reserves have helped support monetary policy and financial stability objectives by providing a cushion for potential capital outflows and safeguarding confidence. Thus, the BOT can maintain monetary autonomy, conducting monetary policy according to the needs of the domestic economy.

Despite such benefits, the BOT recognises that FX interventions also come with costs that must be weighed carefully against the benefits. The accumulation of reserves can expose the BOT's financial position to two main risks. First, it could incur losses from negative carry when returns on foreign reserves are lower than the costs of sterilisation. Second, the currency mismatch between assets and liabilities of the BOT could lead to either gains or losses depending on exchange rate movements, thus adding volatility to the central bank's capital. Given these risks to the balance sheet, appropriate communication with the public is necessary to ensure the central bank's credibility.

Financial risks aside, other consequences must also be considered. Sizeable reserves accumulation and the resulting sterilisation may create distortions in certain pockets of the domestic financial market, especially where the BOT's presence is large compared with that of private participants. Another side effect is that the country may be perceived as an "EME safe haven" due to the high level of reserves. As a result, it could be exposed to additional short-term capital flows during risk-off episodes, creating further pressure for rapid exchange rate appreciations.

[1] Net reserves as of October 2018 and GDP is a three-year average.

More importantly, excessive FX interventions might cause local players to be too reliant on the central bank's actions in the market, and become unable to develop their own capacity to manage currency risks. As such, they might lack resilience when hit by volatility. Furthermore, persistent intervention could also lead to misallocation of resources and complacency among businesses, which may delay the structural adjustments needed to enhance productivity and long-term growth potential.

Recognising the benefits of FX reserves as a cushion for external volatility and as a means of anchoring confidence, the BOT is also mindful of the costs and consequences associated with reserve accumulation when determining its foreign exchange policy.

1.2 Reserves adequacy assessment

The BOT considers several approaches to reserves adequacy assessment concurrently. First, the BOT uses traditional metrics, eg the reserves to short-term external debt ratio, the reserves to three-months-of-imports ratio, and the reserves to 20% of broad money ratio. Second, the BOT applies the IMF's Assessing Reserve Adequacy for Emerging Markets (ARA EM) metric with weights adjusted for the case of a "managed float" exchange rate regime. The BOT pays heed to the ARA EM metric on the basis that it takes into account a comprehensive list of factors, including exports, short-term external debt, broad money and other liabilities. For a forward-looking assessment, the BOT projects the traditional metrics and the ARA EM metrics over the medium term. Third, the BOT employs scenario analysis to assess reserves adequacy. The scenarios are based on historical episodes in Thailand and other Asian countries during the Global Financial Crisis, as well as other extreme cases of capital outflows that may potentially occur in the future.

According to the assessment for Q3 2018, Thailand's gross reserves of USD 204.5 billion remained adequate. This level amounted to 3.1 times short-term external debt, 1.7 times 20% of broad money, and could support 8.8 months of imports. The level of gross reserves was 162% of the IMF's ARA EM metric, above the 100–150% band recommended by the Fund. Moreover, this level could accommodate capital outflows in all scenario cases analysed.

2. BOT FX intervention

2.1 Motivations, strategies and tactics

The Monetary Policy Committee (MPC) is responsible for the policy that allows the exchange rate to adjust flexibly as a shock absorber to the extent that it remains in line with fundamentals, and does not lead to further imbalances.

The BOT normally uses both verbal and actual interventions to curtail excessive and persistent volatility, discourage speculation and deter sharp capital flows. The two-sided intervention would allow more time for economic agents to smoothly adjust to volatility and avoid disruption to the real economy. However, the action is not intended to either resist changes in the exchange rates that are in line with economic fundamentals, or gain competitiveness from an undervalued currency.

Generally, the timing of an intervention is based on exchange rate developments and market conditions. A set of indicators such as price movements, volatility, market participants' activities and liquidity conditions are taken into consideration. For price movements, the BOT considers not only the USD/THB spot rate, but also the nominal effective exchange rate (NEER), the real effective exchange rate (REER), and the relative movements against regional currencies. The BOT also monitors the behaviour of key market players to ensure that currency movements would not trigger a panic or excessive speculative flows, which could create further imbalances.

The interventions are conducted mainly via outright spot USD/THB transactions on both onshore and offshore interbank markets. The BOT employs designated agent banks to maintain anonymity in the market.

The BOT has never announced any actual FX operations ex ante or ex post, as doing so might create destabilising effects and limit the effectiveness of the intervention, especially given the relatively small size of the Thai FX market. However, the amount of net reserves is published on the BOT's website on a weekly basis with a one-week lag.

2.2 Effectiveness of FX interventions

FX interventions may influence exchange rates via various channels, such as the signalling (or expectation) and the order-flow (or microstructure) channels. The basis of the signalling channel is that a track record of the central bank's activities can influence market expectations about future interventions and exchange rates. In the case of Thailand, despite the fact that interventions are not announced, market participants occasionally infer the BOT's actions from price behaviour. Such inferences could play a part in forming expectations about future interventions.

In terms of the order flow channel, preliminary results from the BOT's study from 2017[2] on the effects of FX intervention on market microstructure show that the BOT's purchases or sales of US dollars can influence market behaviour by encouraging order flows, especially from residents, from the same side as the BOT over a short period (the so-called coordination channel). However, such interventions are not found to deter order flows from the opposite side (the dampening channel).

Regarding verbal intervention, the central bank's credibility is key to ensuring its effectiveness. It is also crucial that such interventions are delivered at the right time with the appropriate message. Most of BOT's past verbal interventions yielded their intended results, although, at times, the effects were short-lived.

2.3 Alternatives to FX interventions

During periods of massive capital inflows, the BOT generally allows the exchange rate to adjust flexibly as a shock absorber, before resorting to FX intervention or other alternative tools. Rather than imposing the CFM-type tools as the first alternative, the BOT focuses on tackling capital flow imbalances that could cause excessive one-way volatility. To this end, the BOT has liberalised regulations and eased restrictions on

[2] A further study based on J Koosakul and I Shim, "The beneficial aspect of FX volatility for market liquidity", *BIS Working Papers*, no 629, April 2017.

capital flows to create an environment that fosters more balanced flows. Examples of liberalisations that have been completed are as follows.

- For residents:
    - In 2010 and 2013, respectively, the limits for Thai companies and Thai individuals' outward direct investment were completely removed.
    - In 2013, the BOT removed the outward portfolio investment limit for institutional investors and retail investors (through local intermediaries), and expanded the types of permitted securities to cover instruments such as foreign currency-denominated bonds.
    - In 2016, the BOT allowed qualified investors (QI) with specified amounts of financial assets to invest directly in securities abroad but only within a certain limit. The qualification and investment limits for qualified investors were further relaxed in 2018.
- For non-residents (NR):
    - In 2015, the BOT relaxed the limit on domestic financial institution lending THB to non-residents without underlying from THB 300 million to THB 600 million per non-resident group for one financial institution.

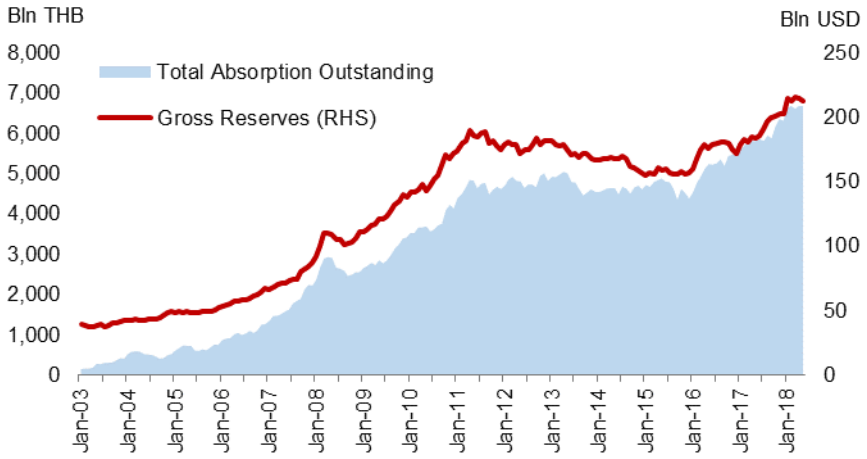
In addition, the BOT also pursues policies that encourage local market participants to manage FX risk more efficiently and thus become more resilient to exchange rate fluctuations. This should help lessen the need for exchange rate management going forward.

- The BOT collaborates with commercial banks in promoting the use of FX hedging products, by arranging seminars and providing materials to raise the corporate sector's awareness of such products, especially among small and medium-sized enterprises (SMEs).
- The BOT supports initiatives in Thailand's FX options projects to promote the use of FX options and provide incentives for SMEs to manage their FX exposure.
- The BOT collaborates with commercial banks in publishing forward points for SMEs on the BOT's official website. These indicative hedging costs could help improve pricing transparency and competition, as well as enhance SMEs' negotiating power.
- The BOT publishes indicative interest rates and fees for foreign currency deposit accounts (FCDs) on the BOT's official website. These indicative rates help the corporate sector to conveniently compare interest rates on FCDs offered by different commercial banks.

2.4 Sterilisation

Under the current inflation targeting regime, in which the policy interest rate is an operational target, excess THB liquidity created by the purchase of USD needs to be fully sterilised to ensure that the prevailing money market rates are in line with the Monetary Policy Committee's (MPC) policy interest rate. In the past few years, the obligation has increased (Graph 1) due to higher capital inflows.

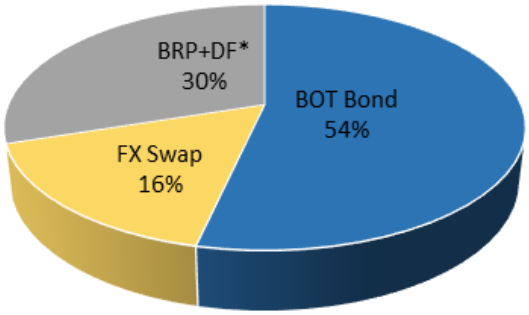
Total absorption instruments outstanding Graph 1



Source: Bank of Thailand (as of October 2018).

The BOT employs several instruments to sterilise excess liquidity. The main ones are the issuance of BOT bills and bonds, bilateral repurchase operations, and FX swaps (Graph 2). The proportion allocated to each instrument is determined by its effectiveness in transmitting monetary policy, the potential impact on individual markets and the effect on financial market development.

Proportion of total instruments outstanding Graph 2



*DF = Deposit Facility.

Source: Bank of Thailand (as of October 2018).

The bilateral repurchase operation (BRP) between the BOT and primary dealers is the most flexible tool for daily liquidity management, with varying tenors of up to one month. The rates conducted via bilateral repo are most closely anchored to the policy rate. The high volume of bilateral repo transactions has been a major factor contributing to the active private repo market.

FX swaps are used when market conditions permit, as fluctuations in USD liquidity could cause the FX swap rates movement to be more volatile than that of other short-term rates. The BOT plays a major role in the FX swap market, absorbing THB while injecting USD in up to one-year tenors. Some episodes of temporary

tightness in USD funding could make FX swaps the less costly instrument to absorb liquidity.

The BOT's bills and bonds, which represent the largest share of absorption tools, are used to absorb liquidity of 14-day to three-year maturities (Table 1). The BOT and the Ministry of Finance (MOF) have agreed to take up separate segments of the sovereign yield curve, with the BOT issuing bonds in tenors of up to three years, and the MOF issuing government bonds in tenors of longer than three years. Coordination between the two authorities has helped foster bond market development by providing a regular supply of bonds along the entire curve.

BOT bond issuance plan in 2019 Table 1

Type of bond	Issue size per auction (millions of baht)	Outstanding per Issue (millions of baht)	Number of issues per year
1. Discount bond			
Cash management bills	10,000–50,000	10,000–50,000	As appropriate
one-month	10,000–30,000	10,000–30,000	As appropriate
three- and six-month	20,000–60,000	20,000–60,000	50–52
one-year	20,000–60,000	20,000–72,000	10
2. Fixed coupon bond			
two-year	15,000–40,000	45,000–144,000	4
three-year	15,000–45,000	45,000–162,000	2
3. Floating-rate bond			
three-year	8,000–25,000	48,000–180,000	1

2.5 Communications

The BOT's operations and financial results are reported and discussed in the meetings of the Bank of Thailand Board and the Bank of Thailand Audit Committee (AC), which are held regularly. At present, there are no risk transfer arrangements between the BOT and the MOF. The BOT thus bears all financial risks and costs related to its operations.

To ensure the BOT's independence and credibility, sufficient and appropriate public communications are needed. Details of the BOT's operations (except for FX interventions) are published daily on its official website, and summaries of financial status are published weekly. Direct communications regarding the effect of FX policy and market operations are also addressed to key influencers – eg researchers, private analysts and members of the press – who will in turn make their own communications to the general public. Furthermore, regular communications through the official channels and social media, in the forms of official data, articles, analysis, research papers, executive interviews and educational materials, help enhance knowledge and understanding among the general public of various issues, eg the objectives of intervention policy and the consequences of the policy for the BOT's balance sheet etc.

3. Reserves management

International reserves are crucial in maintaining investors' confidence in the country, facilitating international trade and investment, and withstanding shocks arising from capital flight or lack of liquidity in the foreign exchange market. Reserves management under the BOT is therefore based on the principle of prudence, financial soundness, and liquidity. While the intention is to generate returns within the investment and risk guidelines, they are not the BOT's primary objective. As such, foreign currency reserves management operations are carefully conducted to support monetary and foreign exchange policy, and to safeguard financial stability.

In 2016, the BOT introduced changes to various aspects of the reserves management framework, such as a governance structure, portfolio structure and management, new asset classes, and performance measurement. The revised framework of the BOT's reserve management is described below.

3.1 Governance structure

The BOT has continuously underscored the importance of a rigorous risk management mechanism through the designated Risk Management Committee, Financial Risk Management Sub-Committee, Reserve Investment Committee, and Investment Sub-Committee. The redefined governance structure, with the creation of the Reserve Investment Committee, promotes a well-defined organisation and reduces conflict of interest between units in charge of reserve investment and risk management, leading to an improved standard of check and balance in reserve management process (Graph 3).

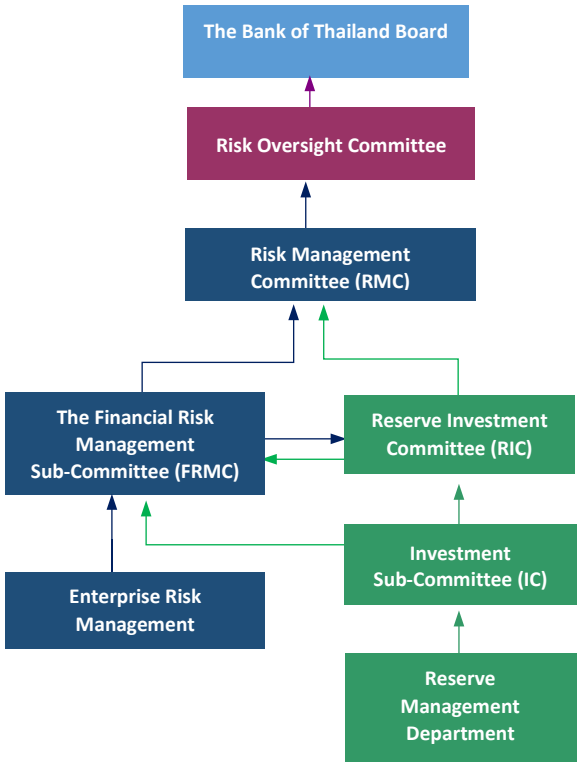
1. The Risk Management Committee (RMC), chaired by the Governor, determines the overall risk management policy and framework for the BOT, which defines an acceptable level of risk-taking and ensures adequate risk management processes. Furthermore, the RMC considers proposals related to financial risk management as submitted by the relevant subcommittees.

2. The Financial Risk Management Sub-Committee (FRMC) examines and filters proposals related to risk management policy and framework before submission to RMC. For checks-and-balances purposes, the FRMC is chaired by the Deputy Governor of Corporate Support Services. Topics under deliberation may involve risk management practices, foreign currency reserve management policies, investment benchmarks, and the scope and tools involved within investment processes. FRMC is also tasked with monitoring and evaluating performances of investment strategies and risk management outcomes related to foreign currency reserve management operations and selecting permissible counterparties.

3. The Reserve Investment Committee (RIC), established in 2016 and chaired by the Deputy Governor of Monetary Stability, is responsible for taking a bank-wide view of strategic asset allocation (SAA). The committee draws upon resources from the whole organisation, as it comprises senior executives from various departments within the BOT, including the Financial Markets Department, Reserve Management Department, Monetary Policy Group and Research Institute.

4. The Investment Sub-Committee (IC), chaired by the Assistant Governor of Financial Markets Operations Group, formulates investment strategies in relation to the country's foreign currency reserves within the boundaries of the RMC-approved risk management policy and framework. In carrying out its task, the IC monitors the world's major economies and factors relevant to foreign currency reserve management operations, proposes SAA strategy preference, and evaluates potential entries into new asset classes, geographical markets, or instruments before submission to the RMC for approval.

BOT's governance structure for reserves management Graph 3



3.2 Portfolio structure and management

The foreign reserves of the Bank of Thailand are divided into the following two main portfolios.

1. Liquidity portfolio for the purpose of meeting the short-term liquidity needs of monetary and exchange rate policies. This portfolio contains highly liquid asset classes, such as deposits and short-term securities in US dollars.
2. Long-term investment portfolio for capital preservation and returns from both interest payments and capital gains. The portfolio also serves as a balance of payment buffer in crisis times, and to maintain long-term international purchasing power. As such, the tranche has a strategic exposure to countries with sound economic fundamentals as well as long-term competitiveness and potential.

Apart from the funds managed at the head office in Bangkok, the BOT manages a portion of reserve assets through its representative offices in New York and London, outsourcing another portion to external fund managers. The benefits of outsourcing investment in more sophisticated asset classes are not only to generate above-average returns by taking advantage of external managers' investment skills and geographical locations, but also to acquire insights into high-quality investment ideas, research and industry best practices for both investments and operations. The ultimate goal is to upgrade the internal capability so that all types of asset class are eventually managed within the BOT.

3.3 Asset classes

The expansion into new asset classes is pursued in order to increase overall portfolio diversification, rather than to seek enhanced yields. The BOT continues to expand into new asset classes while maintaining the risk level of the overall portfolio and without compromising the key objectives of reserves management. This is made possible by taking a total portfolio approach, such as targeting capital preservation at the portfolio level instead of at the asset level, or not focusing only on short-term fixed income when considering the liquidity of the overall portfolio.

The BOT has recently diversified investment risk in the long-term investment portfolios by expanding the range of countries and asset classes. The universe of investable assets has been broadened from purely defensive assets such as sovereign bonds to riskier assets, namely foreign currencies (including CNY), inflation-linked bonds, covered bonds, agency mortgage-backed securities and high-rated corporate bonds. The major development in the composition of reserves is the inclusion of equities in 2016, which included as eligible assets exchange-traded funds or foreign equity securities, in an effort to manage overall portfolio risk.

3.4 Disclosure

The BOT discloses neither the performance of its reserves under management, nor the detailed composition of reserve portfolios. However, the data on the outstanding and forward obligations of the international reserves, from 1999 to the present, are disclosed weekly on the BOT's official website with a one-week lag. The data are published in both US dollar and Thai baht terms. The composition of the international reserves is also presented broadly in terms of foreign currency reserves, gold, Special Drawing Rights, and the reserve position at the IMF. In addition, the BOT reports the end-of-period quarterly data on the currency composition of official foreign exchange reserves (COFER) to the IMF.

Reserves management and FX interventions

Central Bank of the Republic of Turkey

Abstract

Policy normalisation in the major advanced economies affects emerging market economies (EMEs) through many channels, posing major challenges for their central banks. EMEs have adopted a policy toolkit including monetary, fiscal, exchange rate and macroprudential policies. Given many EMEs' high external debt, the effective use of macroprudential measures and FX reserves is of great importance to contain financial fragilities in a challenging external environment. At the same time, central banks are taking a more active role in the FX markets. In particular, EME central banks are tending to use financial derivatives heavily as FX intervention tools. Therefore, it is crucial to establish whether these lead to a more efficient reserve management strategy and whether they are consistent with the broader policy framework. In this regard, this note first outlines post-crisis reserves management trends and central bank intervention strategies. It then surveys how the Central Bank of the Republic of Turkey uses its set of FX instruments, and their effects on the reserves and market liquidity.

Keywords: monetary policy, FX intervention, exchange rate volatility, macroprudential measures, financial stability.

JEL classification: F31, E52, E58.

1. Post-crisis trends in international reserves management

Following the global financial crisis, capital inflows stimulated by the unconventional monetary policies of the major advanced countries have put upward pressure on the currencies of emerging market economies (EMEs). Central banks have repeatedly expressed concerns about the spillovers of these policies into expanded capital flows and exchange rate volatility. Large and widening currency mismatches in EMEs have increased the importance of policies aimed at containing exchange rate volatility.

Meanwhile, EME central banks have adjusted their FX toolkit sets, including macroprudential measures, capital controls and FX interventions, to cope with the effects of large capital flows. The instruments and methods used in FX interventions have been redesigned in parallel with the structural changes in FX markets. In many cases, FX interventions have been complemented by the use of other instruments to manage capital flows, including reserve requirements as well as capital controls. Promoting financial stability has become an increasingly important motive for FX interventions, which can be designed to complement the monetary policy stance.

Starting with the 1997 Asian crisis, a trend towards the accumulation of reserves was observed. During the 2007–09 global financial crisis, however, the reserves of EMEs decreased slightly. Post-crisis expansionary monetary policies in the advanced economies accelerated capital inflows into the EMEs, allowing them to continue building their reserves. EMEs' FX reserves rose from $4 trillion in 2004 to almost $8 trillion as of end-2016. Central banks accumulate FX reserves to mitigate possible shocks to the economy, to make external debt payments, to support monetary and exchange rate policies and to provide FX liquidity to the financial system. Central banks with floating exchange rate regimes can intervene to counter excessive exchange rate volatility and prevent unsound price formation. Within this framework, central banks accumulate reserves to create a buffer against possible shocks, increase their credibility, reduce risk premiums and enhance the effectiveness of monetary policy.

If reserves are insufficient, the cost of possible shocks to the economy tends to increase and the risk perceptions of domestic currency assets to deteriorate. In this regard, there is a balance to be sought between the level of reserves and their opportunity cost. Countries make cost-benefit analyses when determining the optimal level of reserves as the cost of holding reserves may differ for each country. The reserves create a buffer against potential risks and fluctuations in FX, and therefore the cost of holding reserves can be viewed as an insurance premium. But, given the cost of holding reserves, central banks have come up with more efficient ways of using reserves when doing interventions, which is covered in the next section.

2. Central bank FX interventions

Central banks intervene in FX markets for various reasons and with a variety of techniques, depending on whether they aim to control inflation, maintain competitiveness, support financial stability or build up FX reserves against potential speculative attacks. These aims should also be seen in the context of their appropriateness for monetary and financial stability goals. Although macroeconomic

and financial stability objectives, which are the main drivers of interventions, have not changed fundamentally, the main reasons for FX interventions by EMEs are capital flows, exchange rate volatilities and reserves accumulation.

Recent developments in the global economy, particularly capital flows, have influenced the supply and demand for FX and, therefore, the approach to FX interventions. When the exchange rate is volatile in both directions there is an incentive for the corporate sector or domestic/ international investors to hedge their exchange rate risk, increasing demand for foreign currency. According to the IMF's Global Financial Stability Report, EME corporates have increased their indebtedness. Additionally, the share of foreign currency in corporate debt has increased substantially, increasing the sensitivity of firms to changes in the exchange rate. This exposure raises demand for FX hedging, depending also on factors such as the composition of firms' balance sheets, and the nature of their business operations. Similarly, foreign investors also hedge the FX risk arising from their portfolios of EME domestic currency bonds.

Additionally, capital flows tend to be increasingly dependent on the risk perception of international investors and global liquidity conditions, leading to sudden and sharp fluctuations in exchange rates. Credit supply to EMEs may also be affected by the depreciation of the local currency against other currencies. This may result in the tightening of domestic financial conditions. Adequate FX reserve buffers can mitigate the effects of fluctuations stemming from risk aversion in international markets. In this regard, central banks may intervene with a view to maintaining efficient market functioning. Another recent development is that some EME central banks, including those of Brazil, Colombia, Mexico and Turkey, have increasingly used FX derivatives or other instruments to hedge against FX risk and to influence FX market liquidity while economising on the use of their FX reserves. The next section briefly summarises the CBRT's FX toolkit.

3. CBRT foreign exchange instruments

The CBRT has recently expanded its toolkit (see Table 1), in much the same way as other EMEs have, and has embarked on a reserves management policy that allows it to economise on its use of FX reserves. In this way, the CBRT seeks to provide FX liquidity with a view to ensuring the smooth functioning of the FX market, compensating for interruptions in the availability of external private financing and preventing disorderly exchange rate movements.

3.1 Turkish lira-settled forward FX auctions

Forward FX sale auctions settled in Turkish lira (TRY) started at the end of 2017. The framework is quite similar to the one implemented in Mexico. The main aim of this instrument is to enhance the currency risk management of both the financial and real sectors. Although the direct counterparties for this instrument are eligible banks, it benefits corporates indirectly. In these auctions the CBRT has a short FX position while the auction-winning banks have a long FX position. Banks can transfer the forward FX long positions purchased from the CBRT to the corporate sector through the local OTC markets or sell them in foreign markets. In this respect, the instrument

The CBRT's FX instrument set

Table 1

Instrument	Mechanism	Provide FX hedge	Support FX market liquidity	Economise on use of FX reserves
TRY-settled forward FX sale auctions	CBRT sells forward FX through auctions and pays/receives TRY depending on the exchange rate at maturity date.	Yes, TRY payment/ receipt offsetting FX valuation loss/gain	Yes, support management of FX liquidity	Yes, no FX payment
TRY-settled forward FX sale transactions at the BIST Derivatives Market	CBRT sells forward FX contracts and pays/receives TRY related to changes in exchange rate throughout holding period	Yes, TRY payment/ receipt offsetting FX valuation loss/gain	Yes, support management of FX liquidity	Yes, no FX payment
FX deposits against TRY deposits auctions	CBRT sells FX and purchases TRY at the auction date	Yes, against market risk	Yes, supplies FX liquidity	Yes, only temporary supply of FX
FX deposit facility	Banks can borrow FX from the CBRT and also borrow from and lend to each other	Yes, against market risk	Yes, supplies FX liquidity	Yes, only temporary supply of FX.
Collateral FX deposit facility	CBRT accepts FX deposits at TRY providing operations	Indirectly yes, against market risk	Yes, economise on excess FX liquidity as a collateral	Yes, temporary increase in FX reserves
TRY currency swap market	CBRT buys FX and sells TRY at the spot leg of the transaction	Yes, against market risk	Yes, support both TRY and FX liquidity management	Yes, temporary increase in FX reserves
Rediscount credits	CBRT extends credits in TRY, repayments are in FX	No	No	Yes, permanent increase in FX reserves
Repayments of rediscount credits in TRY	CBRT extends credits in TRY, repayments in TRY, instead of FX	Yes, repayments in TRY from fixed exchange rate	Yes, supplies liquidity when demand for FX increases	No
FX sales to energy-importing state-owned companies	CBRT sells FX to energy importing state owned companies	Yes	Yes, supplies liquidity when demand for FX increases	No
FX reserve requirements	Banks maintain FX to fulfil their FX required reserves	No	Yes, balances FX market liquidity	Yes, temporary increase in FX reserves
Reserve option mechanism	Banks can maintain FX and gold accounts to fulfil their TRY required reserves	No	Yes, balances FX market liquidity	Yes, temporary increase in FX reserves

Source: CBRT.

contributes to the hedging toolkit at times of heightened FX volatility in domestic financial markets.

If the spot exchange rate on the maturity date is higher than the forward exchange rate set on the contract date, the CBRT pays the difference between the spot and forward exchange rate in TRY. If the spot exchange rate on the settlement date is lower than the forward exchange rate set on the contract date, the CBRT receives the difference between these two rates in TRY from the corresponding bank. In neither case are payments on settlement dates made in FX.

Auctions are held via the traditional auction method. Although auctions are conducted at various maturities, such as one, three or six months, an auction with a

maturity other than these may be held if deemed necessary. Member banks of the CBRT FX Markets present their bids at these auctions. The banks submit the amount of FX and forward exchange rate bids and must keep collateral at the CBRT until the contract expires. The winners are the banks with the highest forward exchange rate bids. The CBRT may also roll over the maturing contracts if it deems appropriate. The quarterly timetable and auction amounts are pre-announced on the CBRT website such that there is no surprise effect, in contrast to the auctions carried out by the Bank of Mexico.

In these auctions, the prices are determined by supply-demand conditions, so that the auction prices are in line with those in the market. The auctions help to deepen the forward FX market.

TRY-settled forward FX sale auctions have no direct impact on the CBRT's FX reserves. If the CBRT becomes the payer on the settlement date, the payment is made in TRY, so that the CBRT's FX reserves are not drawn upon.

3.2 TRY-settled forward FX transactions in the derivatives market at Borsa Istanbul Stock Exchange (BIST)

In addition to the traditional TRY-settled forward FX sale auctions, the CBRT also conducts the same transactions at the BIST Derivatives Market (VIOP), which likewise contributes to the efficient functioning of the domestic FX markets. The main aim of these transactions is to support the corporate sector's exchange rate risk management. By making transactions in this market, the CBRT takes advantage of this market's longer operating hours and wider access to different market participants. To date, the main counterparties have been foreign corporates, as well as domestic retailers and corporates.

3.3 FX deposits against TRY deposits auctions

The market for FX deposits against TRY deposits is used to enhance the flexibility and instrument diversity of TRY and FX liquidity management within the current monetary and exchange rate policy framework. In this way, the CBRT provides FX deposits to banks in exchange for TRY deposits, with a set auction and bank limit. In these auctions, banks send their FX deposit demand, and the CBRT determines the interest rate to be paid on TRY and USD deposits. Via these auctions, the CBRT offers an alternative to the offshore swap market. Since the interest rates on both legs are determined by the CBRT, the facility serves as a benchmark for the offshore swap market. The daily auctions have a one-week maturity, with the interest rate determined and announced by the CBRT. The banks are obliged to keep additional collateral at the CBRT until maturity. The CBRT publishes the auction amounts, the amount of total bids and the FX deposits granted on a daily basis.

3.4 FX deposit facility

Banks can borrow FX liquidity from the FX Deposit Market within the CBRT at a predetermined interest rate. In this context, CBRT provides EUR and USD liquidity to the banks that are members of the CBRT's FX and Banknotes Market, within their limits. In this market, banks are also able to borrow from and lend to each other

through the intermediation of the CBRT and the rules laid down by the CBRT. FX deposit transactions are carried out under the CBRT's guarantee and between banks that are temporarily in need of FX liquidity and banks that have excess FX liquidity. Currently, banks are able to borrow FX deposits from the CBRT on one-week and one-month maturities. Deposit rates are set according to FX market liquidity conditions.

3.5 Collateral FX deposit facility

The collateral FX deposits facility allows banks to place FX deposits as collateral for open market operations and standing facilities. The flexibility of this facility lets banks conduct short-term FX swap transactions through the CBRT. In addition, the collateral FX deposit facility also decreases banks' off-balance sheet FX positions, as it has the effect of reducing the currency mismatch between banks' assets and their liabilities. In practice, it serves as an alternative to currency swap transactions. It also prevents the currency swap rate from diverging too far from the BIST repo rate, as observed in periods of heightened hedging costs during periods of financial stress.

3.6 TRY currency swap market

The primary objective of the CBRT's TRY currency swap market, is to enhance flexibility and instrument diversity in banks' TRY and FX liquidity management. The market started operating in November 2018. The transactions in this market only temporarily increase the CBRT's reserves, without having any long-term effect.

Since transactions are conducted within pre-determined limits, they should not be considered as a substitute for the offshore swap market. However, the benefits of shifting these currently OTC transactions onto an organised exchange are obvious from the viewpoint of increased transparency, operational risk, cost reduction, central clearing, monitoring, reporting and reducing systemic risk.

Turkey's FX swap market is important for the banking sector. Swaps are heavily used by banks to convert FX assets into TRY assets without taking on FX risk. Recently, the Banking Regulation and Supervision Agency restricted the total notional principal amount of Turkish banks' currency swap and swap-like transactions with foreign counterparties so that domestic banks can pay TRY and receive FX to a maximum of 25% of the respective bank's regulatory capital. This threshold also limited the access of foreign counterparties to TRY liquidity. The main objective was to support financial stability and to reduce the exchange rate volatility. After the regulation was put in place, volatility in FX markets indeed fell and the depreciation of the TRY lost momentum.

3.7 Rediscount credits

Firms are permitted to obtain rediscount credits from the CBRT through intermediary banks with a maximum maturity of 240 days or 360 days for exports of high-tech industrial products, exports to new markets and FX-earning services, by presenting FX bills for rediscount.

Rediscount credits are extended to firms through intermediary banks in the TRY equivalent of the foreign currency amount specified in the discounted bill, as calculated with the exchange rate effective on the day that the credit is extended. As

the repayments of these credits are made in FX, they help boost the CBRT's FX reserves on the maturity dates. Rediscount credits are extended with maturities of predominantly eight months or, to a lesser extent, of four months or shorter. Their contribution to reserves varies according to these maturities. The bill discounting framework is similar in many respects to those of other countries.

If deemed necessary, to support financial stability, the CBRT gives banks the option to repay the rediscount credits in TRY at a fixed below-market exchange rate. In this case, the demand for FX from exporters diminishes, since they do not have to make the repayment of their rediscount credits in foreign currency. Thanks to the reduced uncertainty on their foreign currency exposure, this option helps exporters manage their debt more effectively.

3.8 FX sales to energy-importing state-owned enterprises

The FX needs of energy-importing state-owned enterprises are met directly, in whole or in part, by the CBRT and the Ministry of Treasury and Finance. Details of FX sales to these enterprises are published on the CBRT website.

3.9 FX reserve requirements

According to the Communiqué on Reserve Requirements, banks are obliged to maintain FX required reserves at the CBRT for their foreign currency liabilities. FX required reserves are remunerated on a similar basis to domestic currency required reserves.

3.10 Reserve Option Mechanism (ROM)

Within the framework of its post-crisis policy mix, the CBRT has started to use reserve requirements. In the first stage, reserve requirement ratios were gradually increased, then the remuneration of required reserves was discontinued, reserve requirement ratios were differentiated across maturities, and the range of liabilities subject to reserve requirements was widened. In August 2011, as risk appetite became more volatile due to global developments, reserve requirement ratios were reduced in order to lower the banking system's demand for liquidity. At this time, the Reserve Option Mechanism was introduced to dampen the impact of volatile capital flows on macroeconomic and financial stability, strengthen the CBRT's gross FX reserves and give banks more flexibility in their liquidity management.

The ROM allows banks to hold a certain fraction of their TRY reserve requirements in FX (USD and/or euro) and standard gold. It lets banks manage their FX assets in line with their TRY liquidity needs. Banks can also voluntarily accumulate foreign currency reserves at the CBRT. Increased capital inflows due to abundant foreign resources result in a higher utilisation of the ROM facility and hence increased withdrawal of FX liquidity via the mechanism. In this case, the amount of TRY liquidity to be sterilised will be less than what would have been the case if the CBRT had bought the same amount of FX.

List of Participants

Central Banks

Central Bank of Argentina	**Gustavo Cañonero** First Deputy Governor
Central Bank of Brazil	**Carlos Viana de Carvalho** Deputy Governor, Economic Policy
Central Bank of Chile	**Joaquín Vial** Deputy Governor
People's Bank of China and State Administration of Foreign Exchange	**Xin Zhang** Adviser, People's Bank of China, and Deputy Administrator, SAFE
	Zheng Wang (B) Deputy Director-General, SAFE Investment Center
Central Bank of Colombia	**Hernando Vargas Herrera** Technical Deputy Governor
Czech National Bank	**Marek Mora** Deputy Governor
Hong Kong Monetary Authority	**Lillian Cheung** Executive Director, Research
Magyar Nemzeti Bank	**Márton Nagy** Deputy Governor
Bank Indonesia	**Dody Budi Waluyo** Deputy Governor
	Rudy Brando Hutabarat (B) Director, Reserve Management Department
Bank of Israel	**Nadine Baudot Trajtenberg** Deputy Governor
Bank of Korea	**Seungheon Lee** Director General, International Department
Central Bank of Malaysia	**Norzila Abdul Aziz** Assistant Governor
	Cheng Hoon Beh (B) Deputy Director, Investment Operations & Financial Markets
Bank of Mexico	**Javier Guzmán Calafell** Deputy Governor

Central Reserve Bank of Peru	**Renzo Rossini Miñán** General Manager
Bangko Sentral ng Pilipinas	**Maria Ramona Santiago** Senior Assistant Governor
National Bank of Poland	**Piotr Wiesiołek** First Deputy President
Central Bank of the Russian Federation	**Alexander Kashturov** Director, Market Operations Department
Saudi Arabian Monetary Authority	**Ayman Alsayari** Deputy Governor, Investment
Monetary Authority of Singapore	**Sing Chiong Leong** Assistant Managing Director
South African Reserve Bank	**Daniel Mminele** Deputy Governor
Bank of Thailand	**Vachira Arromdee** Assistant Governor
Central Bank of the Republic of Turkey	**Emrah Şener** Deputy Governor

Bank for International Settlements

Claudio Borio
Head of Monetary and Economic Department

Hyun Song Shin
Economic Adviser and Head of Research

Mathias Drehmann
Head of Emerging Markets

Michael Chui
Principal Economist

Yavuz Arslan
Senior Economist

Jochen Schanz
Senior Economist

Nikhil Patel
Economist

Paolo Cavallino
Economist

Carlos Cantu
Economist

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