How might EME central banks respond to the influence of global monetary factors?

Blaise Gadanecz, Ken Miyajima and Jörg Urban[1]

Abstract

Easy monetary conditions in advanced economies have played an important role in determining domestic monetary conditions in emerging market economies (EMEs), notably through the exchange rate and domestic bond yields. How can EME central banks best react to such external influences? Using a small, highly stylised and non-structural monetary policy model, we show that setting the policy interest rate in response to movements in the exchange rate and the yield on domestic long-term bonds – in addition to focusing on more traditional domestic variables such as the output gap and the inflation gap – can make monetary policy more effective. But there are important caveats and trade-offs, notably with respect to uncertainty about the structure of the economy and opposing effects of exchange rates and bond yields on domestic monetary conditions.

Keywords: Emerging market economies, monetary policy, exchange rate, bond yields

JEL classification: E43, E52, E58, F31, F36, F42

[1] Bank for International Settlements.

Prepared with assistance from Tracy Chan, Sonja Fritz, Emese Kuruc and Lillie Lam. Comments from Claudio Borio, Andrew Filardo, Madhusudan Mohanty, Kostas Tsatsaronis, Philip Turner, James Yetman and BIS seminar and meeting participants are gratefully acknowledged.

1. Introduction

Easy monetary conditions in advanced economies (AEs) have played an important role in determining domestic monetary conditions in emerging market economies (EMEs). How can central banks best react to such external influences and what are the potential trade-offs? This paper focuses on two variables that influence macroeconomic and financial stability policy choices in addition to the traditional macroeconomic variables included in stylised policy rules (ie the output gap and the deviation of inflation from the target, the "inflation gap"):

- **The exchange rate**: Currency appreciation normally reduces aggregate demand. In addition, currency overvaluation creates financial stability risks. Gourinchas and Obstfeld (2011), for instance, argue that overvalued exchange rates during cyclical booms increase the risk of subsequent financial crises. Because of its implications for macroeconomic and financial stability, the exchange rate creates policy trade-offs.
- **The yields on long-term domestic bonds**: As EME domestic bond markets have grown and foreign participation has risen, domestic yields have become more closely linked to yields in the main financial centres. Low or even negative term premia in the dollar market tend to lower yields on EME bonds, thus loosening domestic monetary conditions. In such circumstances, monetary policy may have become less effective as raising policy rates does not necessarily increase interest rates at the long end.

To address such issues, EME policymakers during the past decade have resorted to a wider range of monetary and non-monetary policy tools. Foreign exchange market intervention has been used frequently. Central banks have also used a wide range of non-monetary policy tools such as macroprudential and capital flow management measures. Reserve requirements have also been important in some countries.

One key question is whether EME central banks need to place more weight on the exchange rate and domestic bond yields in the conduct of monetary policy. For the purposes of this paper, monetary policy effectiveness is measured by macroeconomic stability: a reduction in the volatility of the output gap and the inflation gap. We use a small, highly stylised and non-structural monetary policy model to address this question. We argue that setting the policy interest rate in response to movements in two key asset prices, the exchange rate and the yield on domestic long-term bonds, in addition to more traditional domestic variables such as the output gap and the inflation gap, can make monetary policy more effective. But policymakers need to be mindful of trade-offs. For instance, when the relationships among the key macroeconomic variables are not certain, monetary policy may become less effective if the central bank sets the policy interest rate in response to the exchange rate and the domestic bond yield.

A related question pertains to the role of non-monetary policy measures in this policy setting. Expanding interest rate-setting rules may not be sufficient to address the challenges posed by easy global monetary conditions and volatile capital flows. Probably for this reason, EME central banks have increasingly been relying on a range of non-monetary policy measures. But we do not yet fully understand how effective such measures are and how best to combine them with monetary policy.

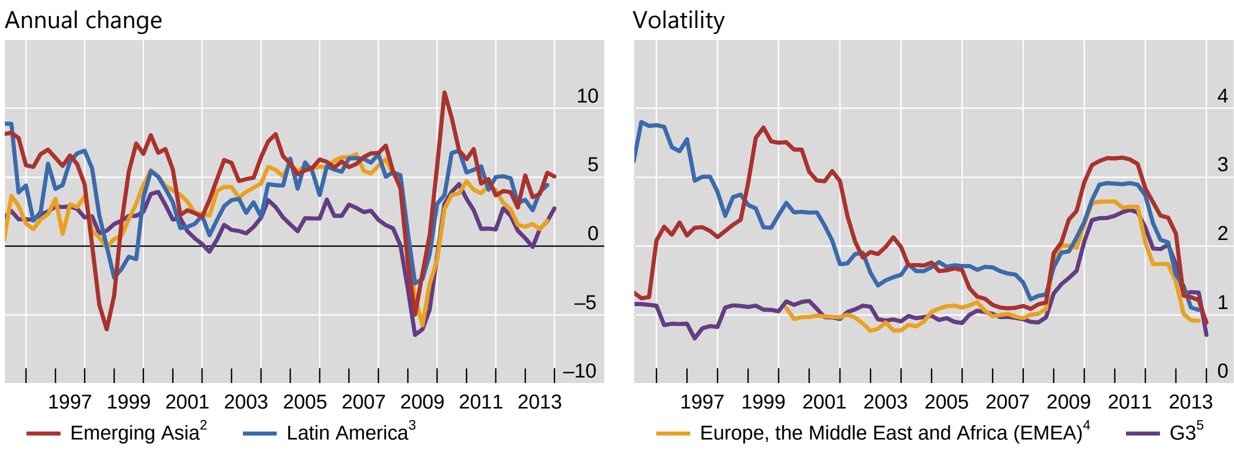
The rest of the paper is structured as follows. Section 2 presents some stylised facts about the macroeconomic performance of EMEs and possible risks. Section 3 discusses the role of the exchange rate and domestic long-term bond yields in EMEs. Section 4 discusses possible monetary policy responses to their movements. Section 5 discusses the role of non-monetary policy measures. Section 6 concludes.

2. Performance of output and inflation

Output growth and inflation are the most common variables that are used to assess monetary policy performance. A moderate level of inflation, as well as low output and inflation volatility, can generally be considered as good proxies for the objective functions of many central banks in EMEs and AEs alike. Of course, the ideal measures would rather be the deviation of actual output from its potential level, and that of actual inflation from the target. But those measures are not straightforward to estimate for certain EMEs.

Global output performance[1]

In per cent | Graph 1



[1] Measured by real GDP. Volatility represents the three-year moving standard deviation of quarterly percentage point changes of year-on-year growth rate. Average for G3; median otherwise. [2] China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] Brazil, Chile, Colombia, Mexico and Peru. [4] Czech Republic, Hungary, Israel, Poland, Russia, South Africa and Turkey. [5] Germany, Japan and the United States.

Sources: Datastream; national data; authors' calculations.

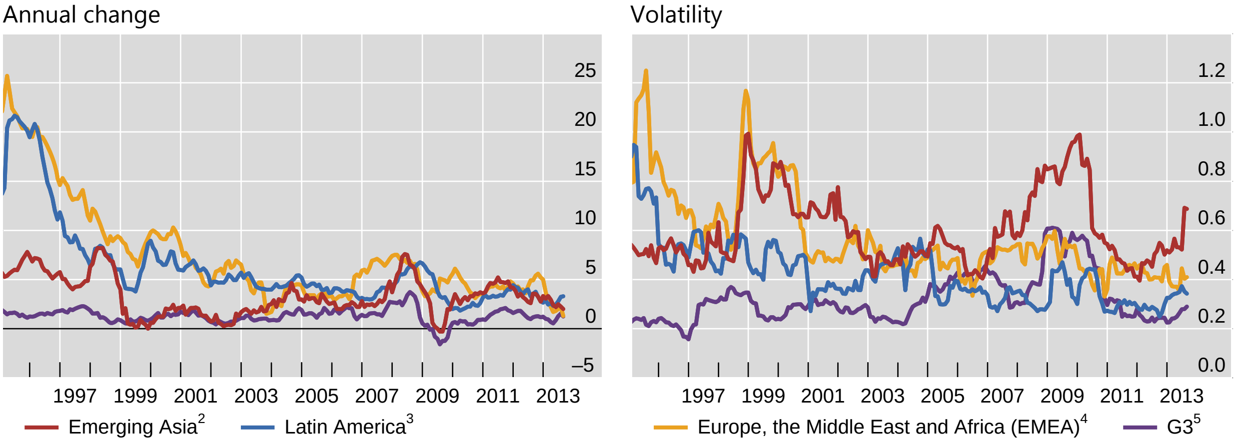
Starting with the performance of output, the left-hand panel of Graph 1 suggests that output growth has been correlated between EMEs and AEs since the 1990s. The correlation has become more pronounced since the early 2000s, especially during the financial crisis in 2008–09. Tighter trade and financial linkages[2] probably explain some of this. Common shocks, such as greater uncertainty and shifts in global investor sentiment, may also play a role.

[2] Financial linkages may induce growth divergence between EMEs and AEs in normal times by allowing capital to move where it is most productive. However, these linkages may increase spillovers (via investor sentiment) in crisis times. See Kalemli-Özcan et al (2013).

The right-hand panel of Graph 1 shows that the volatility of output growth has fallen significantly in the decade prior to the 2008 crisis. This likely owes in part to the increased credibility of monetary policy frameworks thanks to a stronger focus on price stability.[3] EMEs and AEs experienced a simultaneous spike in output growth volatility after the 2008 financial crisis, but volatility has fallen since 2011. Some EMEs succeeded in implementing countercyclical monetary and fiscal policies.[4]

Global inflation performance[1]

In per cent | Graph 2



[1] Average for G3; median otherwise. Volatility represents the three-year moving standard deviation of quarterly percentage point changes of year-on-year growth of CPI. [2] China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] Brazil, Chile, Colombia, Mexico and Peru. [4] Czech Republic, Hungary, Israel, Poland, Russia, South Africa and Turkey. [5] Germany, Japan and the United States.

Sources: Bloomberg; authors' calculations.

Graph 2 shows that inflation (left-hand panel) and its volatility (right-hand panel) had fallen in EMEs to levels comparable with those observed in AEs through the middle of the 2000s. This is, again, due partly to greater focus on price stability in some EMEs. Since the early 2000s, inflation volatility has remained low in AEs, but has surged in EMEs, coinciding with the increased volatility of capital flows. It has been particularly high in Asia, probably as more heavily managed exchange rates have increased the pass-through of global nominal shocks into domestic monetary and financial conditions.

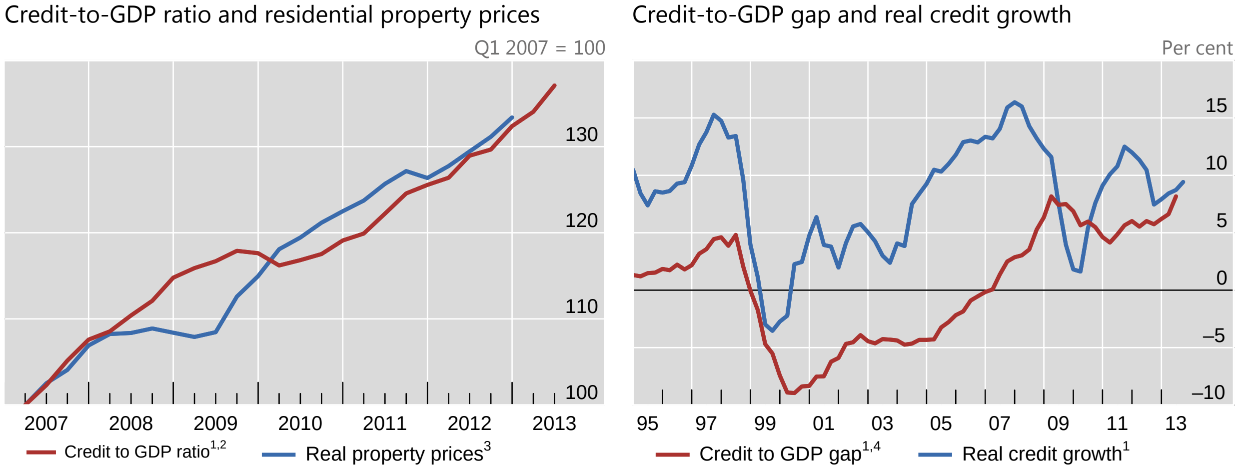
While inflation and its volatility have generally fallen, inflation risk may be on the rise in some EMEs. Policy rates and long-term bond yields in EMEs have shown a high degree of co-movement with those of AEs, as the output and inflation performance of the two groups of countries has been converging. As shown in the first two panels of Table A1 of the Appendix, in most EMEs both short- and long-term real interest rates have declined from 2007 and have since remained low.

[3] Whether the formal adoption of inflation targeting can be credited with this result may depend on the region. See Filardo and Genberg (2010) and Mehrotra and Yetman (forthcoming).

[4] Takáts (2012) argues that, for several reasons, EMEs are now better able to implement countercyclical measures than before. In addition to the adoption of inflation targeting, fiscal conditions and balance sheet structures have improved and exchange rates have become more flexible.

Taken at face value, this could point to stronger inflation pressures at some point in the future.

Private sector credit and residential property prices Graph 3



[1] Simple average of Argentina, Brazil, Chile, China, Hong Kong SAR, Colombia, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand and Turkey. Saudi Arabia is excluded before Q1 2009. Bank credit for Chile, Colombia, Peru and the Philippines; total credit otherwise. [2] The index is based on the difference between quarter-on-quarter changes in nominal credit to the private sector and quarter-on-quarter changes in the four-quarter moving sum of nominal GDP. [3] Seasonally adjusted, quarterly averages; definitions may differ across economies. Simple averages of Brazil, China, Hong Kong SAR, Colombia, Indonesia, Korea, Malaysia, Mexico, Peru, Singapore, South Africa and Thailand; Thailand is excluded before Q2 2008. [4] The credit-to-GDP gap is the deviation of the credit-to-GDP ratio from a one-sided long-term trend. The smoothing parameter λ is 400,000.

Sources: IMF, *International Financial Statistics*; Datastream; national data; BIS calculations.

In addition, financial stability risks may have risen.[5] The ratio of credit to GDP has been shown to be useful as an indicator of the stage of the financial cycle, notably by Borio and Lowe (2002, 2004) and more recently by Shin (2013). The left-hand panel of Graph 3 shows that the average credit-to-GDP ratio (red line) and real residential property prices (blue line) have risen rapidly since 2007. The right-hand panel shows that the credit-to-GDP gap (red line) in EMEs as a whole has reached its highest level in more than a decade. However, real credit growth (blue line) has remained below its previous highs. The third panel of Table A1 shows that in many EMEs real credit growth in 2013 was 5–15 percentage points below its 2007 level.

3. Exchange rates and domestic long-term bond yields in the conduct of monetary policy

Monetary policy in EMEs seems to have been effective so far, but signs are emerging that financial stability risks, and possibly also inflation risks, may be building up. This owes partly to the strong influence of international monetary and financial factors on the exchange rate and domestic long-term yields. Against this

[5] For a recent discussion of central banks' monetary and financial stability objectives, see Borio (2014).

backdrop, we next review the implications of these two key factors for monetary policy and financial stability.

Exchange rates

EME central banks have faced policy challenges arising from both exchange rate appreciation and depreciation in the past two decades. During the decade preceding the 2008 crisis, and since 2009, interest rate and growth differentials have resulted in substantial capital inflows and exchange rate appreciation pressures.[6] By contrast, large capital outflows during May–September 2013 and early 2014 were accompanied by sharp exchange rate depreciations. Overall, in most EMEs nominal effective exchange rates depreciated significantly and were volatile between 2007 and 2013.[7] However, as shown in the fourth panel of Table A1, real effective exchange rates strengthened, with the exceptions of Argentina, India, Korea and South Africa.

As implied by the "impossible trinity" concept (ie the impossibility of reconciling free capital flows with both fixed exchange rates and an independent monetary policy), an independent monetary policy requires either flexible exchange rates or capital flow management measures. Conditional on the move towards fewer restrictions on capital flows, an independent monetary policy thus requires sufficiently flexible exchange rates (IMF (2005)).[8] Depending on the circumstances,[9] a flexible exchange rate can help central banks in responding to external monetary shocks, particularly when capital flows are attracted to EMEs by interest rate differentials.

In practice, however, central banks do respond to exchange rate movements due to concerns about macroeconomic and financial stability in the short run, or medium-term resource allocation considerations (Mihaljek (2011)). In the short term, currency depreciation can increase inflation if the exchange rate pass-through into domestic prices is large. Exchange rate volatility can affect asset prices and private sector balance sheets, leading to "fear of floating" (eg Calvo and Reinhart (2002)). Output volatility can also increase with exchange rate volatility, particularly if domestic financial markets are underdeveloped and risk-hedging is difficult. In the medium term, a strong exchange rate can reduce external competitiveness and tilt resources towards the non-tradables sector.

6 See CGFS (2009) for a discussion of capital flows and emerging markets, including the macroeconomic context of capital flows, their composition, policy responses and the implications for financial markets, banks and financial intermediation.

7 Notable exceptions are China and commodity exporters such as Chile and Peru.

8 For instance, Masson et al (1997) argue that the co-existence of an inflation objective and other policy goals such as an exchange rate target can create tensions for monetary policy. Taylor (2013) advocates that the policy rate should not be moved in reaction to the exchange rate. Such a move could have an adverse effect on the economy when the perceived deviation of the exchange rate from an equilibrium level reflects productivity changes. If exchange rate volatility represents random movements along the path of mean reversion, attempts to smooth them out would only increase interest rate volatility.

9 Gadanecz and Mehrotra (2013) report an intriguing result: the relationship between real exchange rate volatility and output volatility in a group of EMEs appears to be U-shaped. Up to a point, real exchange rate flexibility (proxied by its volatility) can help absorb shocks and limit output volatility, but very volatile real exchange rates are associated with high output volatility.

The question, then, is whether EME central banks respond appropriately to exchange rate movements to ensure price stability (together with financial and hence macroeconomic stability) or whether they respond too much or too little. One view is that EME central banks respond too much to exchange rates, not least owing to concerns about external competitiveness.

Long-term domestic bond yields

The long-term interest rate is important for the real economy for several reasons. Since the government is typically a large-scale net debtor in the bond markets, movements in the long-term interest rate have significant wealth effects for the private sector. A risk-free yield curve serves as a benchmark for the pricing of key long-term financial contracts such as mortgages. Banks are less willing to engage in maturity transformation if term spreads are too volatile, which can adversely affect the supply of long-term financing. Finally, financial stability risks can arise from the valuation effects of long-term interest rates on domestic balance sheets.

In traditional macroeconomic models for a closed economy, the monetary authority manages only the short-term interest rate, which then determines the yield curve in the economy. The path of expected future policy rates fully determines long-term rates. In these models, the assumption of a fixed, or non-existent, term premium is key (Turner (2013)).

However, when the term premium depends on policies and shocks, long-term interest rates can move differently to the path of expected future short-term interest rates. This argument is strengthened in an open economy because long-term interest rates are more highly correlated across countries than short-term interest rates. The greater integration of EMEs into global financial markets has strengthened this link (Turner (2013)). Turner (2014) argues that EMEs' domestic monetary conditions have been looser in the past two years than what the policy rates would imply, because domestic long-term bond yields have fallen substantially along with those in AEs.[10] In such cases, there could be reasons for the monetary authority to seek to influence the level and volatility of long-term interest rates. This may become more important when private borrowing rates (particularly mortgage rates) are linked to long-term government yields rather than short-term interest rates. Influencing the long-term bond yield has, indeed, been one aim of AE monetary authorities' asset purchases during the financial crisis.

Chadha, Turner and Zampolli (2013) provide two explanations as to why the monetary stance may not be fully transmitted along the yield curve. First, according to the so-called preferred habitat theory, originally developed by Modigliani and Sutch (1966), and recently revisited by Vayanos and Vila (2009) in the context of the financial crisis, certain investors are concerned about specific maturities.[11] Second, market participants are not always able to perform arbitrage between different

[10] During 2005–12, EME domestic long yields were influenced more by US 10-year yields than by domestic policy rates (all measures in first difference). As much as one half of changes in US 10-year yields were seemingly passed through to changes in domestic long yields in EMEs. In Korea, Oh (2013) notes that long-term yields were declining since 2009 because of large capital inflows, despite the central bank raising the policy rate several times since 2010.

[11] For instance, pension funds care mainly about the performance of long-term securities.

maturities along the entire yield curve. Especially at times of market stress, expectations become unanchored, banks face liquidity or capital constraints, and the substitutability between short- and long-term securities declines.

The transmission of the policy rate to long-term yields may be even weaker in EMEs, where bond markets are less developed, further reducing substitutability across maturities (Committee on the Global Financial System (2007)).[12] The term premium may be significantly volatile in small bond markets which lack depth (Filardo et al (2012)).

4. Monetary policy responses

One way for EME central banks to address concerns about exchange rates and long-term rates is to take them into account when setting policy. An obvious example is that of augmented Taylor-type rules (Mohanty and Klau (2004), Stone et al (2009), Aizenman et al (2011), Filardo et al (2011), Garcia et al (2011), Ostry et al (2012)). EME central banks can also set the policy rate in reaction to movements in domestic long-term bond yields.

Many central banks consider that foreign factors such as AE policy rates or foreign bond yields are important determinants of domestic macroeconomic and financial stability. Consequently, many of these central banks have formally or informally incorporated the major foreign factors into their monetary policy decisions, which they believe has often increased the policy's effectiveness.

Our model suggests that augmenting Taylor rules with exchange rates and domestic bond yields can improve economic performance. In the Appendix to this paper, we present a small-scale, admittedly non-structural, monetary policy model in which a stylised central bank accounts for the developments in the exchange rate and long-term domestic bond yields in its rate-setting rules, in addition to focusing on the more traditional factors such as the output gap and the inflation gap. We find that economic performance can be higher (ie the variability in the output gap, the inflation gap and the policy rate can be lower) when the Taylor-type rules are augmented to include the exchange rate and domestic long-term bond yields.

However, there are some important caveats. Such performance gains from augmenting Taylor-type rules could be smaller when the pass-through of an exchange rate appreciation (a proxy for capital inflows) into long yields is stronger. In such an economy, a policy rate rise aimed at lowering aggregate demand could, instead, stimulate it, as the capital flows attracted by higher policy rates compress long yields. In such a situation, a policy rate rise (and the ensuing exchange rate

[12] Despite considerable progress in developing them, the report by CGFS notes the following main signs of underdevelopment of local currency bond markets in EMEs: illiquidity, lack of foreign investor presence, predominance of banks among investors and of the public sector among issuers. As noted by Filardo et al (2011), given relatively underdeveloped EME bond markets and a shortage of high-quality EME assets, the term premium is likely to be more sensitive to changes in demand for various debt maturities than to anticipations of future monetary policy actions. Admittedly, then, long-term bond yields may play a smaller role in the transmission mechanism in EMEs to the extent that bond maturities tend to be short, a large share of financial contracts are indexed to short-term rates and in some cases, and dollarisation is high.

appreciation) tightens monetary conditions, while lower long yields ease them, potentially creating asymmetric effects on the tradables and non-tradables sectors.

There are at least two issues that EME central banks should consider when augmenting their Taylor rules. First, reliance on a more complex Taylor rule would create greater uncertainty about the performance gains. The linkage of the exchange rate and the domestic long-term interest rate with other macroeconomic variables is probably less well understood than the links behind the classic Taylor rule. Such a relationship may be less stable over time in dynamically evolving EMEs. Our small monetary policy model illustrates a well known general result: faced with uncertainty about the structure of the macroeconomy, a stylised EME central bank may be better off relying on a more parsimonious Taylor rule.

Second, augmenting their Taylor rules alone would not be enough for EME central banks to fully address challenges created by large and volatile capital flows. For instance, capital inflows would lead to currency appreciation, which is contractionary, but also reduce domestic bond yields, which is expansionary. A policy rate reaction aimed at stabilising aggregate demand could be overly tight for the tradables sector while overly easy for the non-tradables sector, facilitating resource allocation towards the non-tradables sector.

Another possible monetary policy response is foreign exchange intervention. The extent of foreign exchange market intervention varies substantially across EME central banks. Before the 2008–09 financial crisis, and more recently, large capital inflows prompted many EME central banks to resist currency appreciation by selling their domestic currencies. During the 2008–09 financial crisis, and more recent bouts of EME asset sell-offs, a number of EMEs intervened to resist the depreciation of their currencies and to provide liquidity to their domestic financial systems.[13]

Ostry et al (2012)) argue that foreign exchange intervention can be optimal even under an inflation targeting regime. The monetary authority should use the policy interest rate primarily for inflation targeting. When volatile capital flows create a large and temporary deviation of the exchange rate from its medium-term value, foreign exchange intervention can be used to influence the exchange rate. By using two distinct instruments to address two separate concerns, the central bank can avoid confusing the public and is able to safeguard its credibility. To the extent that capital inflows are driven by self-fulfilling expectations of exchange rate appreciation, foreign exchange intervention could also reduce carry trade incentives.

That said, depending on circumstances, foreign exchange intervention may not be that effective in influencing the exchange rate, and can be very costly. Its success in EMEs has been, at best, mixed. It appears that such interventions have been more successful in curbing exchange rate volatility than in influencing the level of the exchange rate.[14] In addition, intervention entails fiscal costs if the interest rate on domestic liabilities exceeds that earned on foreign assets.

13 For an overview of recent intervention motives and tactics by EME central banks, see Mohanty (2013).

14 Indeed, Miyajima and Montoro (2013) find that foreign exchange intervention can in some cases increase exchange rate volatility.

5. Non-monetary policy responses

Monetary policy responses may not be able to fully resolve the dilemmas resulting from globalisation. This has led the monetary authorities of EMEs to also rely on non-monetary policy tools. In this section, we discuss the effectiveness of these policies, focusing first on macroprudential policies, then on debt management measures and finally on capital flow management measures.

Macroprudential measures

What is the role of macroprudential tools in relation to the traditional policy interest rate? One view is that macroprudential tools might completely substitute for interest rates in stabilising the economy, because the transmission channels are similar[15] (Cecchetti and Kohler (2012)). The opposite view is that macroprudential tools cannot replace policy rate adjustments (Stein (2013)), because interest rates are the universal price of leverage which apply to all agents in the economy and present virtually no scope for regulatory arbitrage.

In general, it is probably best to consider macroprudential and monetary policies as complementary, for at least two reasons. First, the interest rate alone may be too blunt a tool to address financial stability risks, which often have a sectoral dimension. Targeted macroprudential measures can therefore help, especially if the transmission of policy rate changes to interest rates of different maturities and different parts of the economy is weak. Second, and more generally, financial booms are simply too powerful to be addressed with one type of policy. And treating macroprudential and monetary policies as complementary can make it easier to jointly pursue the objectives of price stability, output stability and financial stability (Caruana (2010), Borio (2012), Shin (2013)).

The right policy mix between monetary and macroprudential tools depends on the type of imbalances and shocks.[16] Some macroprudential tools can be used to remedy financial imbalances that are domestic in nature. Countercyclical capital buffers, limits on debt service and loan-to-value ratios, and other balance sheet policies would fall into this category. Other instruments can reduce vulnerabilities arising from the influence of global factors on EMEs monetary conditions, by specifically targeting currency mismatches, or types of funding that are particularly susceptible to global liquidity conditions. Bruno and Shin (2013) argue that in Korea macroprudential measures targeted at non-core deposits have reduced the sensitivity of capital inflows to global factors, relative to a group of comparator countries.

However, the literature provides mixed evidence on the effectiveness of macroprudential policies across a broader set of EMEs. Habermeier et al (2011) find that macroprudential measures introduced in 13 EMEs succeeded in mitigating the impact of capital inflows in some cases, reduced credit growth in others, but failed

15 Changes in policy rates or in capital requirements both alter banks' cost of doing business.

16 That puts a premium on an appropriate set of indicators to guide the deployment and release of macroprudential measures.

to restrain asset price inflation.[17] Such measures also do little to remedy maturity and currency mismatches on the liability side of balance sheets. Kuttner and Shim (2013) find that certain types of targeted credit and tax policies can affect the housing market, and could potentially be used as tools to promote financial and macroeconomic stability. However, not all policies are able to achieve this outcome. In particular, policies designed to affect either the supply of or the demand for credit have no discernible impact on house prices, and the authors also caution that their findings are sensitive to the choice of econometric approach.

A large number of central banks have deployed a range of macroprudential measures and consider these measures to have been effective. Loan-to-value and debt service to household income ratios have been used most.

Debt management policies

Long-term interest rates have been an important intermediate target for AE central banks using unconventional monetary policy measures (notably the US Federal Reserve, the Bank of England and the Bank of Japan) as policy rates had hit the zero lower bound in several instances. There is considerable evidence by now (eg Gagnon et al (2011), Baumeister and Benati (2013)) suggesting that unconventional monetary policy measures have had an impact on long-term yields. In addition, Chadha, Turner and Zampolli (2013) find that changes in the private sector's holdings of public debt can significantly influence the term premia on domestic sovereign bond yields even outside crisis times.

Central bank balance sheet policies to influence long yields have not been common in EMEs during the financial crisis, but there have been exceptions. The experience of India is a case in point. After the announcement in May 2013 that the Fed might start "tapering", the rupee started to depreciate sharply, prompting the Reserve Bank of India to raise the policy rates. An unintended consequence was a rise in long yields; the central bank responded by conducting open market purchases of long-term government securities while simultaneously auctioning cash management bills to keep money market conditions tight.

Under normal circumstances, in most EMEs, both governments and central banks are active in sovereign bond markets (Filardo et al (2012)). Governments issue debt of various maturities to finance fiscal deficits. Central banks issue their own securities to finance the acquisition of assets (particularly foreign exchange reserves). These actions influence the size and the maturity structure of public debt held by the private sector. Given the imperfect substitutability of assets along the maturity spectrum, this also has an impact on the shape of the yield curve.

That said, the objectives of debt management, such as reducing the cost of government debt, may conflict with those of monetary policy, notably when the central bank is seeking to stimulate aggregate demand (Borio and Disyatat (2009)). This highlights the importance of coordination[18] to ensure that the actions of the

[17] The objectives of capital flow management noted by the authors include stemming currency appreciation, reducing the volume of capital inflows, changing their composition, providing greater room for monetary policy manoeuver, slowing credit growth and dampening asset price inflation.

[18] Such coordination can, for instance, be realised through increased transparency or a central debt management office located inside the central bank (Filardo et al (2012)).

debt manager and the central bank should not influence the long end of the yield curve in opposite directions.

Capital flow management measures

Recently, some observers have argued that monetary policy can remain independent only if the capital account is managed. The influence of global factors on EMEs' domestic financial conditions, including domestic bond yields, de facto limits their monetary policy autonomy, regardless of the flexibility of the exchange rate regime in place. Rey (2013) posits that monetary policy in AEs has a powerful influence on the global financial cycle (proxied by the VIX) and thus the leverage of global banks.[19] Given the difficulties of coordinating monetary policy and regulatory frameworks across countries, governments may need to manage capital flows in addition to macroprudential policies to ensure both monetary and financial stability (CGFS (2012), IMF (2013), Agénor and Pereira da Silva (2014)).

Others are more concerned about the effectiveness of capital flow management measures. Even if such measures may provide short-term insulation from international monetary influence, they tend to lose effectiveness over time. In their review of the experiences of 13 EMEs in the 2000s, Habermeier et al (2011) find ambiguous support at best for the effectiveness of capital flow management. While these measures were occasionally effective in reducing capital inflows, the effect was usually short-lived and not sufficient to reduce currency appreciation pressures. Moreover, capital flow management entails costs and cannot replace macroeconomic policies (Fratzscher (2012)). Capital flow management measures can be counterproductive if they delay necessary policy adjustments (Caruana (2011)). And some control measures can reduce speculative capital inflows, but impair access to external finance.

Some central banks have used controls on capital inflows and outflows in recent years. Those measures were deployed, for instance, because of monetary policy and financial stability considerations. It appears that the measures had some intended effect, at least in the short term.

6. Conclusion

The influence of foreign monetary factors has posed challenges for monetary policy and financial stability in EMEs. Globalisation has increased the need to revisit policy frameworks, especially interest rate policy. Many central banks have paid particular attention to external factors in their monetary policy management.

A very stylised modelling exercise illustrates the general point that EME central banks can increase the effectiveness of their monetary policy by taking into account the exchange rate and domestic bond yields in their interest decision rules, besides output and inflation. Even so, there are trade-offs arising from the uncertainty about the way in which the exchange rate and long-term domestic yields interact with

[19] Bruno and Shin (2013) develop a model in which expected EM currency appreciation leads to an increase in the leverage of global banks (a driver of capital flows to EMEs) and vice versa.

each other and with other macroeconomic variables. And even in the absence of such uncertainty, interest rate policy alone may not be able to address challenges from large and volatile capital flows. It is therefore not surprising that many EME central banks have increasingly relied on non-monetary policy tools, such as capital flow management measures and macroprudential instruments with a view to gaining better control over the economy.

Appendix

Monetary conditions in emerging market economies

Table A1

	Real policy rate[1]		Real domestic five-year gov't bond yield[2]		Real credit year-on-year growth[3]		Real effective exchange rate[4]	
	2007	2013	2007	2013	2007	2013[5]	2007	2013
Emerging Asia[6]	**2.0**	**0.2**	**1.9**	**0.6**	**11.8**	**11.1**	**100.0**	**104.0**
China	2.7	3.4	–1.3	1.0	16.0	14.7	89.0	115.9
Hong Kong SAR	3.7	–3.8	2.2	–2.6	14.5	11.4	105.3	104.6
India	2.9	1.4	2.9	1.9	16.6	9.6	99.4	89.3
Indonesia	2.2	0.5	3.3	–0.6	15.6	17.6	94.2	93.7
Korea	2.5	1.2	2.8	1.7	10.1	3.1	129.2	104.5
Malaysia	1.5	0.9	1.5	1.3	4.5	7.1	98.3	100.1
Philippines	2.3	0.6	2.9	2.9	7.3	13.6	94.8	109.6
Singapore	–0.8	–2.3	0.5	–1.6	18.8	13.1	91.8	113.1
Thailand	1.0	0.1	1.9	1.2	2.7	9.4	97.5	105.3
Latin America[6]	**1.6**	**–3.6**	**4.3**	**2.6**	**25.9**	**13.5**	**97.5**	**104.1**
Argentina	–0.6	–1.1	…	…	30.0	15.9	113.6	90.5
Brazil	7.6	3.8	7.9	4.3	20.9	9.3	83.7	90.4
Chile	1.6	2.4	1.5	3.0	16.2	8.9	97.8	102.7
Colombia	4.0	1.2	4.5	3.6	18.6	12.1	87.8	99.4
Mexico	3.5	–0.3	3.7	0.9	18.8	5.0	108.5	102.1
Peru	3.2	1.2	4.1	1.1	30.9	14.6	91.0	105.6
Venezuela	–7.8	–32.3	…	…	46.2	28.8	100.3	137.9
Europe, the Middle East and Africa (EMEA)[6]	**2.6**	**–0.6**	**1.7**	**1.0**	**18.7**	**7.9**	**95.3**	**97.4**
Algeria	…	…	…	…	11.6	14.6	99.1	101.9
Czech Republic	0.6	–1.4	0.9	–0.3	12.3	2.3	90.6	96.1
Hungary	–0.5	1.3	–1.0	3.5	10.8	1.3	102.5	95.9
Israel	3.7	–0.5	…	…	…	…	87.6	102.5
Poland	2.6	1.3	3.0	2.3	21.4	2.7	102.9	96.1
Russia	1.0	–1.3	–2.9	–0.3	40.3	11.1	93.6	107.1
Saudi Arabia	1.4	–1.5	…	…	22.1	11.2	89.5	105.2
South Africa	4.9	–0.8	2.2	0.8	14.7	3.1	91.8	82.5
Turkey	7.0	–3.0	8.0	0.2	16.3	20.5	95.9	90.6
United Arab Emirates	…	0.1	…	…	…	4.0	99.3	96.4
Memo								
Germany	1.7	–1.3	1.8	–0.9	–0.5	–0.2	105.5	97.8
Japan	0.4	–0.3	1.2	–0.1	0.6	1.0	82.6	79.8
United States	1.4	–1.2	1.6	–0.3	6.7	2.6	105.1	97.7

[1] End of period. [2] Period average. [3] Bank credit for Chile, Colombia, Peru, the Philippines, the United Arab Emirates and Venezuela; total credit otherwise. [4] 2010=100; period average. [5] As of Q2 2013 for Algeria and the United Arab Emirates; as of Q4 2013 for China; as of Q3 2013 otherwise. [6] Simple average of the region.

Sources: IMF, *International Financial Statistics*; Bloomberg; national data; BIS.

Augmenting EME Taylor rules with exchange rates and domestic bond yields

What might EME monetary policymakers do to dampen the influence of international monetary and financial factors? To help shed some light on the trade-offs, we consider a small-scale monetary policy model. The model comprises a macroeconomic block of equations calibrated to EME data and a monetary policy block with a Taylor-type policy rule. We explore the potential benefits of including the exchange rate and the domestic bond yield in the monetary policy reaction function.

The macroeconomic block

The macroeconomic block includes four equations which are meant to capture the macroeconomic dynamics of output, inflation, the exchange rate and the long-term bond yield. The structure of the model is consistent with a standard IS-PC model commonly used in the literature (eg Batini and Haldane (1999) and Rudebusch and Svensson (1999)). Given the purpose of our paper, we introduce domestic benchmark bond yields instead of bond prices.[20] Our macroeconomy is characterised by four variables: the output gap, inflation, the exchange rate and the domestic bond yield.

- **Output equation:** The output gap is assumed to be a function of its own lag, the real exchange rate, the real bond yield and the real policy rate:

$$y_t = \alpha_{11} y_{t-1} + \alpha_{13}(e_{t-1} - \pi_{t-1}) + \alpha_{14}(b_{t-1} - \pi_{t-1}) + \alpha_{15}(i_{t-1} - \pi_{t-1}) + \varepsilon_{y,t} \qquad (1)$$

where y is the output gap, π is inflation, e is the year-on-year change in the nominal effective exchange rate (where a positive value represents depreciation), b is the nominal domestic bond yield, i is the nominal policy rate and ε is an i.i.d. random error.

- **Inflation equation:** The inflation rate is a function of the (lagged) output gap, inflation and the nominal exchange rate:

$$\pi_t = \alpha_{21} y_{t-1} + \alpha_{22} \pi_{t-1} + \alpha_{23} e_{t-1} + \varepsilon_{\pi,t} \qquad (2)$$

- **Nominal exchange rate equation:** The exchange rate is a function of the lagged exchange rate and policy rate:

$$e_t = \alpha_{33} e_{t-1} + \alpha_{35} i_{t-1} + \varepsilon_{e,t} \qquad (3)$$

20 We adapt the approach of Filardo (2000) for asset prices, which in our case is the long-term bond yield.

This specification captures the notion that exchange rate dynamics are difficult to predict using macroeconomic variables such as output and inflation developments. It also represents our assumption that the exchange rate responds to signals created by policy rate actions about the future change in bond yields.[21]

- **Nominal domestic bond yield equation:** The domestic bond yield is allowed to vary with lags of most of the above variables:

$$b_t = \alpha_{41} y_{t-1} + \alpha_{43} e_{t-1} + \alpha_{44} b_{t-1} + \alpha_{45} i_{t-1} + \varepsilon_{b,t} \tag{4}$$

Table A5 presents empirical estimates of the parameter values of the model using a panel regression with fixed effects on a set of 14 major EMEs for the period 2000–07.[22] The size of the coefficients and the signs are mostly economically plausible.

The monetary policy block

The central bank chooses the parameters of its policy rule to optimally respond to the economic dynamics summarised in equations (1)–(4). We assume for pedagogical purposes a standard central bank loss function used in the literature. The economic losses, L, are assumed to be well represented by the variance of the output gap, the deviation of inflation from the target and changes in the policy rate. We set the preference parameters of the central bank to be equal to 1.0 for the variance of the output gap and the inflation gap and 0.2 for the variance of the change in the policy rate.

In other words, the central bank solves the following minimisation problem:

$$\min L = \underset{\beta}{\operatorname{argmin}} \; \{1 * var(y_t) + 1 * var(\pi_t - \pi^*) + 0.2 * var(i_t - i_{t-1})\} \tag{5}$$

subject to equations (1)–(4) above, where var stands for variance, π^* for the targeted year-on-year inflation rate, and β is the vector of Taylor-type policy rule coefficients defined below for each specification of the rule.

We consider three Taylor-type rules. The first, R1, is a conventional Taylor-type rule that includes the reaction to both the output gap and the inflation gap; the others include the exchange rate smoothing and the bond yield.[23]

[21] The exchange rate equation is motivated by Ball (1999) and Eichengreen (2002). We also experimented with versions where bond yields, rather than the policy rate, enter this equation on the right hand side. However, we decided to use the policy rate, as this representation best captures our assumption that the exchange rate responds to the signal created by policy rate actions. Indeed, if we used bond yields in the exchange rate equation, the effect of policy rate moves on the exchange rate would be transmitted only indirectly through bond yields.

[22] Brazil, Chile, Czech Republic, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Philippines, Poland, South Africa, Thailand and Turkey. Parameter values estimated for three regions (Asia; Latin America; Eastern Europe, Middle East and Africa) are broadly similar.

- **Rule 1 (R1):** The central bank reacts only to the lagged output gap and the lagged inflation gap:

$$i_t = \beta_{11} y_{t-1} + \beta_{12}(\pi_{t-1} - \pi^*) \quad (6)$$

- **Rule 2 (R2):** The central bank also takes into account exchange rate smoothing with one lag, which is the quarter-on-quarter difference in e:

$$i_t = \beta_{21} y_{t-1} + \beta_{22}(\pi_{t-1} - \pi^*) + \beta_{23} \Delta e_{t-1} \quad (7)$$

- **Rule 3 (R3):** The central bank also reacts to the lagged yield on long-term domestic government bonds:

$$i_t = \beta_{31} y_{t-1} + \beta_{32}(\pi_{t-1} - \pi^*) + \beta_{33} \Delta e_{t-1} + \beta_{34} b_{t-1} \quad (8)$$

Baseline results

Given the macroeconomy and monetary policy blocks and the parameters in Table A5, we solve the model using numerical methods, ie we simulate the macroeconomy summarised in equations (1)–(4) and search for the parameters of the Taylor-type rules that minimise the loss function (5).[24]

The simulation results highlight two key policy findings. First, by including the exchange rate and the domestic bond yield in the Taylor-type rules, the hypothetical monetary authority can improve macroeconomic performance. The last column of Table A2 shows that the loss associated with variability in the output gap,

[23] Our model assumes that when the central bank augments its reaction function, the parameters of the underlying economy remain unchanged. In practice, this is an empirical issue, as the change in policy may alter the behaviour of private agents. Our result should be interpreted with this Lucas critique in mind.

[24] In the model, the output gap, inflation, the exchange rate and the domestic bond yield move in accordance with the four macroeconomic relationships described in equations (1)–(4). In addition, each of the four variables is subjected to a shock in each period. We draw normally distributed i.i.d. random shocks with (i) a mean of zero, and (ii) a standard deviation that allows us to match the second moment of the simulated macroeconomy with that of the actual macroeconomic data. For modelling purposes, π^*, the targeted level of inflation is set to zero as the model is formulated in terms of deviations from the steady state. Specifically, we generate i.i.d. shocks $\varepsilon_{y,t}$, $\varepsilon_{\pi,t}$, $\varepsilon_{e,t}$, $\varepsilon_{b,t}$ for 5,000 periods to compute time series for the output gap, inflation, the exchange rate movement, the bond yield as well as the policy rate. Depending on the specific Taylor rule, at most four unknown β_i coefficients need to be determined, so as to minimise the loss function L specified in equation (5). We start at β_i=0 and parse its neighbourhood (defined by a certain predefined grid size) to search for the minimum of L until the desired level of precision is achieved. We repeat this exercise 1,000 times. We subsequently jump to the point which corresponds to that minimum, and parse again in that neighbourhood to search for a new minimum. If we do not find a minimum, we refine our grid and start again from the previous point. Our results are robust to a more general Monte Carlo setup comprising 100,000 iterations where the search array is not dependent on the starting values.

the inflation gap and the policy rate is lower with the augmented Taylor-type rules R2 and R3. When the rule is expanded from R1 with exchange rate smoothing to R2, the loss declines by 18%, and the decline is statistically significant at the 95% level.[25] When R2 is expanded with the domestic bond yield to R3, the loss declines by another 10%, although the difference in loss is only significant at the 90% level.

Second, given the calibration of the model, it is interesting to note that Taylor-type rule coefficients in Table A2 are consistent with those in the empirical literature for EMEs (eg Mohanty and Klau (2004), Filardo et al (2011)). In particular, the optimised rule coefficients on the output gap are between 0.7 and 1.4, and those on the inflation gap range from 1.0 to 4.0. The coefficients on the exchange rate are positive in rules R2 and R3, which indicates that the central bank would tighten policy as the nominal exchange depreciates; the coefficient on the domestic bond yield is negative, which indicates the central bank would lower policy interest rates when the domestic bond yield rises. It is also interesting to note that, when the hypothetical central bank directly includes exchange rate smoothing and the domestic bond yield in its policy rate setting, the coefficients on the inflation gap rise. In other words, the central bank reacts more vigorously to inflation outcomes when also reacting directly to these other variables.

Central bank reaction and loss: baseline economy

Table A2

	Central bank reaction				Loss
	y_t	$\pi_t - \pi^*$	Δe_t	b_t	
R1	1.42 [1.28, 1.56]	0.97 [0.88, 1.05]			3.08 [2.87, 3.30]
R2	1.28 [1.15, 1.41]	1.50 [1.39, 1.61]	0.31 [0.30, 0.33]		2.54 [2.37, 2.70]
R3	0.70 [0.61, 0.78]	4.05 [3.84, 4.25]	0.30 [0.29, 0.32]	–1.67 [–1.81, –1.54]	2.28 [2.14, 2.41]

95% confidence intervals around the point estimates in square brackets. *y* is the output gap, π *and* π^* are realised and targeted year-on-year inflation, Δe is the quarter-on-quarter difference in the year-on-year percent change of the exchange rate, *b* is the government bond yield. The loss is calculated as $1 * var(y_t) + 1 * var(\pi_t - \pi^*) + 0.2 * var(i_t - i_{t-1})$, where var stands for variance and *i* for the policy rate.

Source: Authors' calculations.

Increasing the pass-through of the exchange rate into bond yields

In this section, we illustrate the limitations of interest rate policy by showing that monetary policy actions alone cannot fully resolve certain policy dilemmas. To do this, we continue focusing on the dilemma faced by many EME central banks when higher domestic interest rates attract larger capital inflows, reduce domestic bond yields and undo some of the impact of a policy rate hike.

To illustrate the point, we consider, in addition to the baseline economy, an alternative economy where, in the bond yield equation (equation (4)) the coefficient

25 (2.54–3.08)/3.08*100 = –17.5%.

α_{43} on exchange rate movements (which proxies capital flows) is raised from the baseline value of 0.1 to the alternative value of 0.3.

$$b_t = \alpha_{41} y_{t-1} + \boldsymbol{\alpha_{43}} e_{t-1} + \alpha_{44} b_{t-1} + \alpha_{45} i_{t-1} + \varepsilon_{b,t} \quad (4)$$

In Table A3, we report the Taylor rule coefficients and the central bank loss for the alternative economy. The right column shows that expanding the Taylor rule form R1 to R2 (paying attention to the exchange rate in addition to the output gap and inflation) still brings a significant welfare gain of 14%, even though it is smaller than the 18% gain obtained in the baseline economy. However, the additional gain from expanding the Taylor rule from R2 to R3 (incorporating the bond yield) is very small and statistically insignificant. In the baseline economy, the gain amounts to is 10%, but is only significant at the 90% level.

These results are not surprising, given that the policy dilemma referred to above is more pronounced in the alternative economy. That is, in the presence of capital inflows, concern about further exchange rate appreciation would call for an easier monetary stance. However, as capital inflows compress domestic long-term bond yields and ease domestic monetary conditions, incorporating the domestic bond yield in monetary policy decisions call for a tighter (or less easy) monetary stance.

Central bank reaction and loss: alternative economy

Table A3

	Central bank reaction				Loss
	y_t	$\pi_t - \pi^*$	Δe_t	b_t	
R1	1.12 [1.00, 1.24]	0.91 [0.82, 0.99]			2.80 [2.60, 3.01]
R2	1.10 [0.99, 1.22]	1.28 [1.18, 1.39]	0.27 [0.26, 0.29]		2.40 [2.25, 2.56]
R3	1.13 [1.02, 1.24]	0.86 [0.47, 1.24]	0.27 [0.26, 0.29]	0.13 [0.02, 0.24]	2.40 [2.24, 2.57]

95% confidence intervals around the point estimates in square brackets. *y* is the output gap, *π and π** are realised and targeted year-on-year inflation, Δ*e* is the quarter-on-quarter difference in the year-on-year percent change of the exchange rate, *b* is the government bond yield. The loss is calculated as $1 * var(y_t) + 1 * var(\pi_t - \pi^*) + 0.2 * var(i_t - i_{t-1})$, where var stands for variance and *i* for the policy rate.

Source: Authors' calculations.

Considering parameter uncertainty

The baseline results assumed that the central bank knows with certainty the parameters in the macroeconomy captured in equations (1)–(4). In practice, these relationships are not precisely known, especially in dynamically evolving EMEs. In this section, we look at how parameter uncertainty can affect the conclusions drawn from the baseline results. We find that parameter uncertainty alters the policy trade-offs that central banks face and, in the case we address, perhaps argues for greater reliance on more parsimonious Taylor-type policy rules.[26]

We consider the following scenario: the coefficient on lagged exchange rate movements in the bond yield equation, α_{43}, takes on the value of 0.1. However, the central bank believes that it may have taken on a higher value, namely 0.3.[27] The potential for a larger coefficient could be interpreted as reflecting the inherent limitations in precisely estimating parameters that may be undergoing structural change. In the case of EMEs, for example, greater financial globalisation has meant larger capital inflow volatility, and the central bank may believe that these flows now play a bigger role in compressing domestic long-term bond yields than in the past.

This exercise differs from that discussed in the previous section where we compared two economies, in which the value of the pass-through from changes in the exchange rate to bond yields was known with certainty. In this exercise, uncertainty has been introduced about this value.

So, how can we assess the potential cost arising from this type of parameter uncertainty? In the context of our model, it would be to compare the losses associated with the Taylor-type rules R1, R2 and R3 using the following two scenarios:

- Baseline scenario: the central bank uses the "true" parameter α_{43} = 0.1 to optimise its Taylor rules and the loss is calculated using the same parameter value of 0.1.
- Downside scenario: the central bank optimises its Taylor rules assuming α_{43} = 0.3 but the loss is calculated using α_{43} = 0.1 (the true value).

Central bank losses evaluated using α_{43} = 0.1

Table A4

	Baseline scenario	Downside scenario	Difference
R1	3.08 [2.87, 3.30]	3.11 [2.87, 3.35]	0.03
R2	2.54 [2.37, 2.70]	2.57 [2.39, 2.74]	0.03
R3	2.28 [2.14, 2.41]	2.68 [2.48, 2.87]	0.40

95% confidence intervals around the point estimates in square brackets. Under both scenarios, the loss is calculated using α_{43} = 0.1, but the Taylor rules are optimised using α_{43} = 0.1 under the baseline scenario and α_{43} = 0.3 under the downside scenario.

Source: Authors' calculations.

26 This result is consistent with the conclusion drawn by Taylor (1999) that heavily augmented Taylor-type rules lack robustness, when compared to simpler ones, where there is uncertainty about the exact specification of the model of the economy.

27 The choice of the magnitude of the coefficient difference is guided by the fact that one side of the 95% confidence interval in our regressions used to set up the parameters in equations (1)–(4) was in the range of 0.1–0.2. Hence, the value of 0.3 would be seen as a surprise to a central bank relying on econometric methods alone to assess the relationship between exchange rate movements and domestic bond yields.

Several key messages come out of Table A4, in which the comparison is reported. First, for a given rule, the losses can be higher when the central bank makes a wrong assumption. This is especially the case for R3, the most complex rule, where the potential additional loss of 0.4 is large and statistically significant. Under the more parsimonious rules R1 and R2, the potential loss arising from parameter uncertainty is not significantly different from zero. Second, and most important, parameter uncertainty can alter the ranking of the preferred Taylor-type rules. Under parameter uncertainty, the point estimates of the losses associated with R3 (2.68) are greater than those associated with R2 (2.57) even though the confidence intervals overlap.

This result underscores the fact that parameter uncertainty is an important consideration to take into account in choosing from competing policy options. Parameter uncertainty alters the policy trade-offs that central banks face and, in the case we address, can argue for greater reliance on more parsimonious Taylor-type policy rules. Of course, the nature of parameter uncertainty in reality is more complex than in this particular example.

Baseline parameter calibration

Table A5

Equation	Variable	Parameters	Model	Regression[6]	Literature				Note
					Filardo (2000)	Rudebush & Svensson (1999)	Batini & Haldane (1999)	Ball (1999)	
y_t	y_{t-1}	α_{11}	0.60	0.58 ***	0.60	0.91 [1]	0.80	0.80	Following regression result. Similar to values in the literature.
	$e_{t-1} - \pi_{t-1}$	α_{13}	0.05	0.03 *			0.20	0.20	Following regression result. Lower than values in the literature.
	$b_{t-1} - \pi_{t-1}$	α_{14}	–0.10	–0.11 **	–0.20[4]				Following regression result. Similar to values in the literature.
	$i_{t-1} - \pi_{t-1}$	α_{15}	–0.20	0.20 ***	–0.20	–0.10	–0.50	–0.60	Similar to values in the literature. Regression result suggests opposite sign.
π_t	y_{t-1}	α_{21}	0.15	0.06	0.15	0.14		0.40	Taken from values in the literature.
	π_{t-1}	α_{22}	0.75	0.74 ***	1.00	1.00 [2]			Following regression result. Lower than values in the literature.
	e_{t-1}	α_{23}	0.10	0.06 *				0.20 [5]	Following regression result. Similar to values in the literature.
e_t	e_{t-1}	α_{33}	0.85	0.71 ***			1.00		Somewhat higher than regression result to match second moment in the data.
	i_{t-1}	α_{35}	–0.50	–0.50			1.00 [3]	–2.00 [5]	Lower than values in the literature.
b_t	y_{t-1}	α_{41}	0.10	0.03					Following regression result despite being insignificant.
	e_{t-1}	α_{43}	0.10	0.04					Following regression result despite being insignificant.
	b_{t-1}	α_{44}	0.70	0.54 ***					Somewhat higher than regression result to generate sufficiently high second moment
	i_{t-1}	α_{45}	0.20	0.15					Following regression result despite being insignificant.

[1] Sum of two lags [2] Sum of four lags [3] Differential to foreign interest rate; UIP [4] Original coefficient is +0.20 on real asset price inflation [5] Real exchange rate [6] 14 EMEs for 2000–07; BR, CL, CZ, HU, ID, IL, IN, MX, MY, PH, PL, TH, TR, ZA. The nominal and real policy rate and bond yields have been de-trended using a Hodrick-Prescott filter with a smoothing parameter of 1,600 for panel regression with fixed effects and robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Sources: IMF, *International Financial Statistics*; Bloomberg; Global Financial Data; JP Morgan, national data; authors' calculations.

References

Agénor, P-R and L Pereira de Silva (2014): *Inflation targeting and financial stability: a perspective from the developing world*, monograph published by the Inter-American Development Bank and CEMLA.

Aizenman, J, M Hutchison and I Noy (2011): "Inflation targeting and real exchange rates in emerging markets", *World Development*, vol 39, no 5, pp 712–24.

Ball, L (1999): "Monetary policy rules for open economies", in J Taylor (ed), *Monetary policy rules,* Chicago University Press, pp 127–56.

Batini, N and A Haldane (1999): "Forward-looking rules for monetary policy", *Monetary Policy Rules*, National Bureau of Economic Research, pp 157–202.

Baumeister, C and L Benati (2013): "Unconventional monetary policy and the great recession: estimating the macroeconomic effects of a spread compression at the zero lower bound", *International Journal of Central Banking*, vol 9, no 2, pp 165–212.

Borio, C (2012): "The financial cycle and macroeconomics: what have we learnt?", *BIS Working Papers,* no 395, December. Forthcoming in the *Journal of Banking and Finance*.

——— (2014): "Monetary policy and financial stability: what role in prevention and recovery?", *BIS Working Papers*, no 440, January.

Borio, C and P Disyatat (2009): "Unconventional monetary policies: an appraisal", *BIS Working Papers*, no 292, November.

Borio, C and P Lowe (2002): "Asset prices, financial and monetary stability: exploring the nexus", *BIS Working Papers*, no 114, July.

——— (2004): "Securing sustainable price stability: should credit come back from the wilderness?", *BIS Working Papers*, no 157, July.

Bruno, V and H-S Shin (2013): "Capital flows and the risk-taking channel of monetary policy", mimeo.

Caruana, J (2010): "Monetary policy in a world with macroprudential policy", speech delivered at the SAARCFINANCE Governors' Symposium 2011, Kerala, 11 June.

——— (2011): "Capital flows to the emerging market economies: a perspective on policy challenges", speech delivered at the 46th SEACEN Governors' Conference, Colombo, Sri Lanka, 24–26 February.

Cecchetti, S and M Kohler (2012): "When capital adequacy and interest rate policy are substitutes (and when they are not)", *BIS Working Papers*, no 379, May.

Chadha, J, P Turner and F Zampolli (2013): "The ties that bind: monetary policy and government debt management", *Oxford Review of Economic Policy*, vol 29, no 3, pp 548–81.

Committee on the Global Financial System (2007): "Financial stability and local currency bond markets", *CGFS Papers*, no 28, June.

——— (2009): "Capital flows and emerging market economies", *CGFS Papers*, no 33, January.

——— (2012): "Operationalising the selection and application of macroprudential instruments", *CGFS Papers*, no 48, December.

Eichengreen, B (2002): "Can emerging markets float? Should they inflation target?", *Central Bank of Brazil Working Paper Series,* no 36.

Filardo, A (2000): "Monetary policy and asset prices", *Federal Reserve Bank of Kansas City Economic Review,* Third Quarter.

Filardo, A and H Genberg (2010): "Targeting inflation in Asia and the Pacific: lessons from the recent past", *BIS Papers*, no 52, July.

Filardo A, G Ma and D Mihaljek (2011): "Exchange rates and monetary policy frameworks in EMEs", *BIS Papers*, no 57.

Filardo, A, M Mohanty and R Moreno (2012): "Central bank and government debt management: issues for monetary policy", *BIS Working Papers*, no 67, October.

Fratzscher, M (2012): "Capital controls and foreign exchange policy", *ECB Working Papers*, no 1415, February.

Gadanecz, B and A Mehrotra (2013): "The exchange rate, real economy and financial markets", *BIS Papers*, no 73, October.

Gagnon, J, M Raskin, J Remache and B Sack (2011): "The financial market effects of the Federal Reserve's large-scale asset purchases", *International Journal of Central Banking*, vol 7, no 1, pp 3–43.

Garcia, C, J Restrepo and S Roger (2011): "How much should inflation targeters care about the exchange rate?", *Journal of International Money and Finance* 30(7): 1590–1617.

Gourinchas, P and M Obstfeld (2011): "Stories of the twentieth century for the twenty-first", *NBER Working Paper*, no 17252.

Habermeier, K, A Kokenyne and C Baba (2011): "The effectiveness of capital controls and prudential policies in managing large inflows", *IMF Staff Discussion Note*, no 11/14, August.

International Monetary Fund (2005): "Inflation targeting in emerging market economies", *World Economic Outlook*, Chapter 4, October.

——— (2013): "Guidance for the liberalization and management of capital flows", April.

Kalemli-Özcan, Ş, E Papaioannou and F Perri (2013): "Global banks and crisis transmission", *Journal of International Economics*, vol 89, no 2, pp 495–510.

Kuttner, K and I Shim (2013): "Can non-interest rate policies stabilise housing markets? Evidence from a panel of 57 economies", *BIS Working Papers*, no 433, November.

Mehrotra, A and J Yetman (forthcoming): "How anchored are inflation expectations in Asia? Evidence from surveys of professional forecasters", *BIS Papers*.

Mihaljek, D (2011): "How have external factors affected monetary policy in the EMEs?", *BIS Papers*, no 57, October.

Miyajima, K and C Montoro (2013): "Impact of foreign exchange interventions on exchange rate expectations", *BIS Working Papers*, no 73, October.

Modigliani, F and R Sutch (1966): "Innovations in interest rate policy", *American Economic Review*, 56(1/2), pp 178–97.

Mohanty, M (2013): "Market volatility and foreign exchange intervention in EMEs: what has changed? – An overview", *BIS Papers*, no 73, October.

Mohanty, M and M Klau (2004): "Monetary policy rules in emerging market economies", in R Langhammer and L Vinhas de Souza (eds), *Monetary policy and macroeconomic stabilization in Latin America*, Springer, pp 205–45.

Oh, G (2012): "Public debt and monetary policy in Korea", *BIS Papers*, no 67, October.

Ostry, J, A Ghosh and M Chamon (2012): "Two targets, two instruments: monetary and exchange rate policies in emerging market economies", *IMF Staff Discussion Note*, no 12/01, February.

Rey, H (2013): "Dilemma not trilemma: the global financial cycle and monetary policy independence", mimeo.

Rudebusch, G and L Svensson (1999): "Policy rules for inflation targeting", in J Taylor (ed), *Monetary policy rules*, Chicago University Press, pp 203–62.

Shin, H-S (2013): "Adapting macroprudential approaches to emerging and developing economies", in *Dealing with the challenges of macrofinancial linkages in emerging markets*, World Bank Studies, October.

——— (2013): "Procyclicality and the search for early warning indicators", *IMF Working Paper*, no 13/258.

Stein, J (2013): "Overheating in credit markets: origins, measurement and policy responses", remarks at the Research Symposium "Restoring household financial stability after the great recession: why household balance sheets matter", sponsored by the Federal Reserve Bank of St Louis, 7 February.

Stone, M, S Roger, S Shimizu, A Nordstrom, T Kisinbay and J Restrepo (2009): "The role of the exchange rate in inflation targeting emerging economies", *IMF Occasional Paper*, no 267.

Takáts, E (2012): "Countercyclical policies in emerging markets", *BIS Quarterly Review*, June.

Taylor, J B (1999): "The robustness and efficiency of monetary policy rules as guidelines for interest rate setting by the European central banking", *Journal of Monetary Economics*, vol 43, pp 655–79.

Taylor, J B (2013): "International monetary coordination and the great deviation" *Journal of Policy Modelling*, vol 35, no 3, pp 463–72.

Turner, P (2013): "Benign neglect of the long-term interest rate", *BIS Working Papers*, no 403, February.

——— (2014): "The global long-term interest rate, financial risks and policy choices in EMEs", *BIS Working Papers*, no 441.

Vayanos, D and J Vila (2009): "A preferred-habitat model of the term structure of interest rates", *NBER Working Paper*, no 15487.

Wynne, M and G Solomon (2007): "Obstacles to measuring global output gaps", *Economic Letter, Federal Reserve Bank of Dallas*, March, vol 2, no 3.