International monetary policy transmission

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Abstract

In this paper we investigate how monetary policy in advanced economies affects financial conditions in emerging market economies (EMEs). We find evidence for the working of several international transmission channels. In particular, advanced economy monetary policy, as proxied by US monetary conditions, seems to drive EME policy rates beyond what domestic factors would suggest. Furthermore, US long-term interest rates also affect EME long-term interest rates significantly. Finally, our results suggest that while the impact of US monetary policy has weakened, the co-movement of long-term rates became stronger after the financial crisis in 2008.

Keywords: Monetary policy, international spillovers, Taylor rule

JEL classification: E52, E58, F33

[1] Bank for International Settlements.

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1. Introduction

Emerging economy financial markets tumbled in January after the Federal Reserve announced its intention to cut the volume of the bond purchase programme. Even though US monetary policy remained quite accommodative following the announcement, the move signalled tighter future policies. In Alexandre Tombini's words, the prospect of tighter US policy acted as a "vacuum cleaner" and capital started to flow out of emerging market economies (EMEs). The event echoed what had happened after the first "tapering" announcement last May: the prospect of US monetary tightening sent EME financial markets tumbling.

These developments confirm that advanced economy monetary policy has large and significant effects on EMEs. EME capital markets have increasingly become open over time. This has led to large gross capital flows and the build-up of large international balance sheets (BIS, 2011). However, these international positions have not only helped to allocate capital efficiently: they have also provided the means for sudden shifts in international risk appetite to translate into macroeconomic volatility, especially after 2008. And monetary policy in advanced economies, particularly in the United States, seems to drive this risk-taking as shown in Borio and Zhu (2012) and Bruno and Shin (2013). Evidence is accumulating on the workings of such monetary spillovers: Aysan et al (2013) found monetary spillovers for Turkey and many other EMEs, Barroso et al (2013) for Brazil and Chua et al (2013) for Malaysia, for instance. However, many uncertainties remain: we do not know precisely how and through which channels international monetary transmission works.

To shed further light on this question, this paper explores how international monetary transmission works in EMEs participating in the Meeting of Deputy Governors in Basel.[2] We set out to investigate the influence of international monetary policy through five areas: (i) short-term policy rates, (ii) long-term interest rates, (iii) exchange rates, (iv) international bank lending and (v) market risk-taking. Importantly, when measuring the EME policy rate responses we think about the transmission from advanced economy monetary policy, ie including unconventional tools, to the policy rate of EMEs. This means that the short-term policy rate responses can work even after advanced economies' policy rates have reached the zero lower bound.

In our empirical analysis, we focus on the policy rate and long-term interest rates, because they are most likely to capture the shift in transmission implied by the shift from policy rates to unconventional monetary policies in advanced economies after the 2008 crisis. Using regression analysis based on estimated Taylor equations and bond pricing, we find consistent evidence that short- and long-term interest rates transmit US monetary conditions to most EMEs.

Furthermore, we find evidence that policy rate responses became less important after 2008, while long-term interest rates became more important – as one might expect given the shift from conventional to unconventional policies. These results are also consistent with the central bank responses to our

[2] Algeria, Argentina, Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand, Turkey and the United Arab Emirates.

questionnaire reviewed in the accompanying paper by Mohanty (2014). Finally, we estimate a monthly VAR model and study the impulse responses of cross-border portfolio flows to EMEs following changes in the US long-term interest rate.

When we talk of spillovers, we mean that at least one of the following variables is affected as discussed in Caruana (2013): (i) quantities, (ii) prices and/or (iii) endogenous policy responses. Quantity effects include changes in gross capital flows such as portfolio investment and cross-border bank lending. However, asset prices can change without necessarily requiring a change in quantities. Finally, EME central banks may adjust their policy settings in response to advanced economy monetary conditions to limit quantity and price movements.

The rest of the paper is organised as follows. Section 2 discusses the policy rate responses. Section 3 investigates the long-term interest rate. Section 4 discusses the issues relating to exchange rates, international bank lending and portfolio flows. Section 5 concludes.

2. Response of EME policy rates to US monetary policy

EME central banks might react to the stance of US monetary policy when setting their policy interest rates. In fixed exchange rate regimes with free capital mobility, such as Hong Kong SAR, Saudi Arabia and the United Arab Emirates, the link between advanced and EME policy rates is largely direct and automatic. In China, notwithstanding capital controls and progressive liberalisation of the exchange rate regime over the past decade, the renminbi short-term interest rate has not deviated much from the US policy rate.

The impact of advanced economy monetary policies on EME policy rates is not automatic in floating exchange rate regimes. Many EMEs have formally adopted inflation targeting regimes over the past two decades. Under strict inflation targeting the exchange rate is allowed, in principle, to move freely. This would, in turn, help to insulate monetary policy from external effects, as implied by the Trilemma theory.[3] However, according to the IMF only Chile, the Czech Republic, Israel, Mexico and Poland are classified among the inflation targeting economies of the meeting as operating under fully free floating exchange rates. Thus, the resulting resistance to large exchange rate movements, a kind of "fear of floating" from Calvo and Reinhart (2002), could still link EME monetary policy to advanced economies beyond, for instance, what inflation targeting policy responses would imply.

Furthermore, even full exchange rate flexibility might be insufficient to insulate emerging economies from advanced economy monetary policy. Rey (2013) argues, for instance, that without capital controls EME monetary policies are necessarily linked to advanced economy monetary policies: there is no Trilemma, only the dilemma between free capital movements and independent monetary policy.

In the following, we investigate empirically how monetary policy in advanced economies, in particular in the United States, affects policy rate setting in EMEs.

[3] The Trilemma, or impossible trinity, originates from the work of Fleming (1962) and Mundell (1963) and states that countries can have two of the following three: free capital movement, fixed exchange rates and independent monetary policy.

Co-movement of EME policy rates: principal component analysis

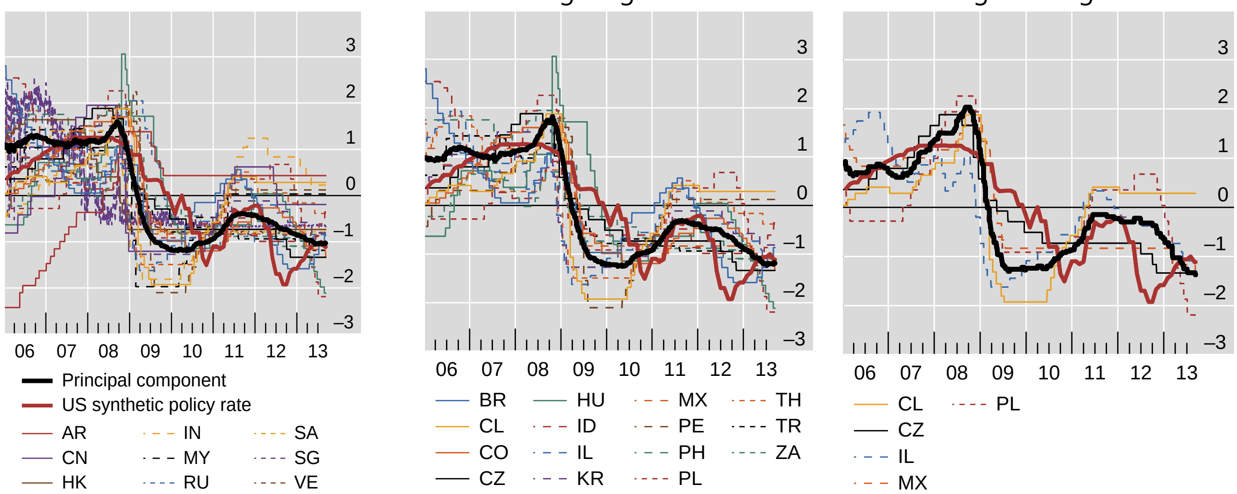
Principal component analysis provides straightforward evidence on the co-movement in EME policy rates (Graph 1). When considering all EMEs together (left-hand panel), one can see that in spite of the sizeable heterogeneity there is a strong co-movement of policy rates in EMEs: the first principal component explains around 60% of the total variation in rates.[4]

Furthermore, the first principal component of EME policy rates (thick black line on Graph 1) seems to follow a similar, though not fully identical path to that of the "shadow" US monetary policy rate (thick red line). In order to account for the impact of unconventional monetary policies, we measure the stance of US monetary policy by using the estimates from Lombardi and Zhu (2013). This estimate accounts for the impact of unconventional policies once the policy interest rate has reached the zero lower bound. Naturally, it can be negative.

Principal components for emerging economies: policy rates

Normalised variables (zero mean and unit standard deviation) — Graph 1

All EMEs[1] | Inflation targeting economies[2] | Free floating exchange rates[3]



AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; 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; VE = Venezuela; ZA = South Africa.

[1] The first principal component accounts for 61% of total variations of time series for the 24 countries under consideration. [2] The first principal component accounts for 66% of total variations of time series for the 15 countries under consideration. [3] The first principal component accounts for 70% of total variations of time series for the five countries under consideration.

Sources: Bloomberg; Datastream; BIS calculations.

[4] The strength of the co-movement is difficult to compare with that of advanced economies. Though the first principal component would explain a larger share of total variation for advanced economies, the advanced economy figure is artificially inflated because there are fewer advanced economies with independent monetary policy and many of those reached the zero lower bound for some time.

Surprisingly, the correlation between US and EME policy rates is stronger for inflation targeting regimes than for all EMEs taken together (Graph 1, centre panel). Taken at face value, and without controlling for other factors, this suggests that inflation targeting might not be sufficient in itself to insulate the domestic monetary policy decision from external influence. Furthermore, the correlation is just as strong in the case of those economies which the IMF considers as having a fully free floating exchange rate (right-hand panel). Though other factors, such as co-movements in EME and US business cycles, might also be responsible for this result, the strong correlations in EME policy rates certainly suggest the possibility that advanced economy monetary policy drives this common factor.

Regression analysis

The strong co-movement calls for a closer investigation of key drivers of policy rates: how far does the co-movement reflect external monetary factors (such as US monetary policy) as opposed to domestic factors (such as the business cycle or inflation)? In order to achieve this identification, we investigate the impact of advanced economy monetary policy in two steps.

In the first step, we estimate a domestic Taylor equation for each EME:

$$r_{t,EME} = c + \alpha\pi_{t,EME} + \beta y_{t,EME} \tag{1}$$

where r denotes the monetary policy rate of the EME in question, π the inflation rate and y the output gap; t is the quarterly time index. In the regression analysis, we focus on the post-2000 period when most EMEs' monetary policy turned countercyclical as shown in Takáts (2012). The country sample covers 20 out of 24 economies participating in the meeting as data were not available for four countries.[5]

We then augment the Taylor equation with the US policy rate and separately also with the US shadow policy rate from Lombardi and Zhu (2013):

$$r_{t,EME} = c + \alpha\pi_{t,EME} + \beta y_{t,EME} + \gamma r_{t,US} \tag{2}$$

The results show that US monetary policy has a statistically and economically significant impact on EME policy rates (Table 1). The first and second columns show, respectively, the estimated impact of the US federal funds and shadow rates during the period 2000–13 and the third column shows the results for the US shadow rate for 2008–13. While there are important nuances and small differences, the basic message is clear: US monetary policy has a significant impact, both statistically and economically, on EME policy rate setting. Thus, the results suggest that more accommodative advanced economy monetary policies led to more accommodative EME policies than would have been warranted by Taylor rules consistently with the estimates of Hofmann and Bogdanova (2012).

Further analysis shows that economic crises originating from EMEs do lead to larger coefficient estimates as policy rates appear to be more sensitive to sudden changes in economic and financial conditions. In our sample period, Brazil and

[5] In the case of Singapore, we used the interbank overnight rate implied by its monetary policy centred on the management of the trade-weighted exchange rate.

Turkey experienced crises and the size of the coefficient estimates partly reflect this. However, re-estimating the coefficients for the post-2003 period still yields economically and statistically significant results. Our results are also robust to a number of changes in the specification as detailed in the Appendix. Adding exchange rates, lagging independent variables or adding the lagged dependent variable do not materially affect the main thrust of the findings.

Estimated EME policy rate response to US monetary policy — Table 1

	US policy rate	US shadow rate	
	Q1 2000–Q3 2013		Q1 2008–Q3 2013
Brazil	1.08***	0.66***	0.35***
Chile	0.03	0.02	–0.10
China	0.07***	0.04**	0.03
Colombia	0.36***	0.16**	0.06
Czech Republic	0.48***	0.39***	0.21***
Hungary	0.07	0.30***	0.34***
India	0.38***	0.24***	0.05
Indonesia	0.50***	0.48***	0.17***
Israel	0.95***	0.41***	–0.15***
Korea	0.32***	0.19***	0.08
Malaysia	0.02	0.01	–0.03**
Mexico	0.78***	0.26***	0.22***
Peru	0.51***	0.19***	–0.09**
Philippines	0.89***	0.44***	0.05***
Poland	0.75***	0.50***	0.03
Russia	0.53**	–0.14	0.10
Singapore	0.49***	0.14***	0.05***
South Africa	0.73***	0.59***	0.36***
Thailand	0.16***	0.05	–0.02
Turkey	3.33***	1.52***	0.86***

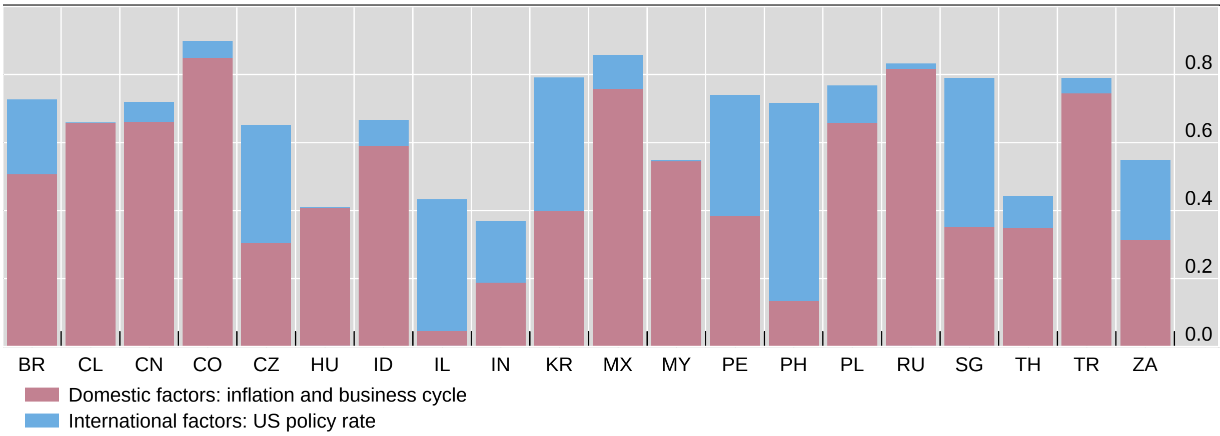
γ coefficient estimates for equation (2): *** denotes results significant at the 1% level, ** at the 5% level and * at the 10% level.

Source: Authors' calculations.

The results are also consistent with the questionnaire responses: the number of countries that report a response to advanced economy monetary policy falls after 2008. While for the full 2000–13 period the shadow policy rate coefficient is significantly positive at the 5% level for 16 economies, it is only significantly positive at the same level for nine economies during 2008–13. Furthermore, for three countries (Israel, Malaysia and Peru) the US shadow rate becomes negatively significant. While these negative effects are interesting they do not seem to be economically significant.

Furthermore, our regression framework describes the evolution of EME policy rates well. Graph 2 shows that the estimated policy rule explains between 40 and 90% of the variance of EME policy (red and blue bars together). Domestic factors (red bars) explain a large share of the total variation in most EMEs: over 60% in Chile, China, Colombia, Mexico, Poland, Russia and Turkey. However, the US policy rate (blue bars) also explains a substantial part: between 20 and 40% in Brazil, the Czech Republic, Israel, Peru, the Philippines, Singapore and South Africa.

Factors explaining EME monetary policy[1] Graph 2



BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; HU = Hungary; ID = Indonesia; IL = Israel; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU = Russia; SG = Singapore; TH = Thailand; TR = Turkey; ZA = South Africa.

[1] Red bars: R-squared from estimating equation (1). Red and blue bars: R-squared from estimating equation (2) with the US policy rate. Blue bars: partial R-squared for US monetary policy.

Source: Authors' calculations.

These significant regression results do not necessarily imply a loss of monetary policy independence in EMEs. In principle, EME central banks can choose their short-term policy rates. The question is *why* they seem to follow US monetary policy, an issue which is discussed in the accompanying paper by Gadanecz, Miyajima and Urban (2014). While this might happen due to monetary spillovers, there are other explanations too. For instance, US monetary policy might co-move with some common factors, such as the prospects for the global business cycle and risk sentiment, which affect EMEs and advanced economies alike. Furthermore, the significant results, even if true for EMEs as a group, do not apply to all EMEs. For example, in Chile and Malaysia we found consistent evidence that US monetary policy is not significant for domestic policy rate setting.

In sum, our results indicate that EME policy rates co-move together with the US rate. Furthermore, the impact of US monetary policy seems to have declined after 2008. These results are also consistent with central bank questionnaire responses.

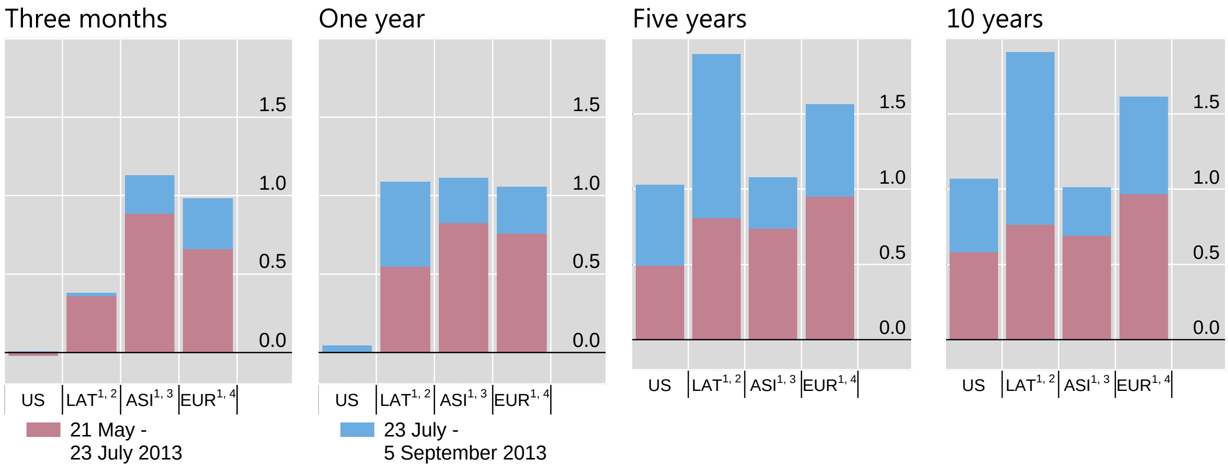
3. The long-term interest rate

The long-term interest rate in advanced economies can influence financial conditions in EMEs through portfolio investment decisions. The freer capital markets are and the greater the substitutability between long-term bonds of advanced economies and those of EMEs, the stronger is the expected impact of advanced economy rates on EME yields as, for instance, suggested by Turner (2014). However, capital flows are not strictly necessary for this spillover: yields can and do adjust through price effects with little or no capital flows. This spillover is in sharp contrast with the short-term rate, where international factors might convince central banks to adjust their rates, but the choice is ultimately theirs.

The close co-movements of global long-term yields after the Federal Reserve's "tapering" announcement last summer demonstrated how rapidly changes in US bond yields can be transmitted to other countries (Graph 3). Yields started to rise after the announcement (red bars), and continued to rise until early September (blue bars) – that is, until the Federal Reserve clarified its policy response. The current turmoil provides similar anecdotal evidence on the impact of US long-term rates. And more systemic evidence is also accumulating; for instance, Moore et al (2013) show how US large-scale asset purchases have compressed EME long-term yields.

Yield curve evolution after the "tapering" announcement

Change, in percentage points — Graph 3



US = United States; LAT = Latin America; ASI = Asia; EUR = Emerging Europe.

[1] Change in weighted average based on 2005 GDP and PPP exchange rates of the economies listed. [2] Brazil, Chile, Colombia, Mexico and Peru. [3] China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Singapore and Thailand. [4] The Czech Republic, Hungary, Poland, Russia and Turkey.

Source: Bloomberg.

A principal component analysis confirms the co-movement of long-term yields. The first principal component explains around 55% of the total variation across EMEs, which is higher than the corresponding figure for advanced economies. Furthermore, the first principal component of the EME bond yield co-moves very closely with the US long-term rate. This co-movement suggests that common factors could drive EME long-term yields.

Regression analysis

To shed further light on the issue we estimate a regression model incorporating both the domestic policy rate and US long-term yields following Turner (2014). Formally, we estimate the regression model below:

$$r_{t,EME}^{long} = c + \alpha r_{t,EME}^{policy} + \lambda r_{t,US}^{long} \qquad (3)$$

where r^{long} denotes the five-year interest rates in EMEs and in the US, respectively, r^{policy} denotes the EME policy rate, , and t denotes monthly frequency. We use fully modified OLS to account for the cointegrating relationship. As before, we use series dating back to 2000. However, to expand our sample size to 19 EMEs we allowed eight economies which have series starting later than 2000, but not later than 2004.

The results show that US long-term rates have a statistically and economically significant impact on EME long-term rates (Table 2). The first column shows the coefficient estimates for 2000–13: eight out of the 19 estimates are significantly positive at the 5% level and only two are significantly negative at that level. The coefficients are also economically significant: on average a 10 basis point change in the US long-term rate is associated with around a 2 to 7 basis point change in EME long rates. The second column shows the impact for 2008–13. Interestingly, in spite of the smaller sample size, the estimates tend to be larger and are significant for more countries: 14 out of 19 estimated coefficients are significantly positive at the 5% level and only one is significantly negative at that level. These results are again consistent with the questionnaire responses.

Estimated EME long-term rate response to the US long-term rate — Table 2

	M1 2000–M9 2013[1]	M1 2008–M9 2013
Brazil	0.11	1.45***
Chile	0.09**	0.09
China	–0.03	0.05
Colombia	0.30	1.40***
Czech Republic	0.05	0.84***
Hong Kong SAR	1.28***	0.88***
Hungary	–0.27***	–0.11
India	–0.11	–0.08
Indonesia	0.50	0.98***
Israel	0.19	0.66***
Korea	0.66***	1.02***
Malaysia	0.52***	1.03***
Mexico	0.22***	0.26***
Philippines	–0.19	0.94***
Poland	0.12	0.77***
Russia	–0.78***	–0.84***
Singapore	0.67***	0.58***
South Africa	0.37***	1.10***
Thailand	0.32***	0.35***

γ coefficient estimates for equation (3):*** denotes a coefficient significant at the 1% level, ** at the 5% level and * at the 10% level.

[1] India and Mexico, M4 2000-; Israel, M4 2001-; Chile, Q4 2002-; Colombia and Indonesia, M1 2003-; Brazil and China, M1 2004-.

Source: Authors' calculations.

The coefficient estimates are also robust to changes in the specification as discussed in detail in the Appendix. Removing the lagged dependent variable or adding additional controls does not change the main thrust of the results: US long-term rates drive EME long-term rates.

In sum, our results show that US long-term yields significantly drive long-term yields in EMEs. Furthermore, similarly to how central banks perceived the evolution of this impact in their questionnaire responses, our results suggest that the influence of US long-term rates became stronger after 2008.

4. Exchange rates, bank lending and portfolio flows

In the previous two sections we explored the influence of two variables – advanced economies' short-term and long-term interest rates – on the corresponding variables in EMEs. In this section, we broaden the analysis to consider spillovers operating through the exchange rate, international bank lending and portfolio flows.

These variables are interdependent, as Alper et al (2013) argued. Bruno and Shin (2013) showed that US monetary policy drives private sector risk-taking. In turn this risk-taking, measured for instance by the VIX index, drives exchange rates, bank lending and portfolio flows – and thereby transmits monetary policy internationally. First, to stimulate the discussion on these interactions, we briefly describe the mechanisms at work.

Exchange rates

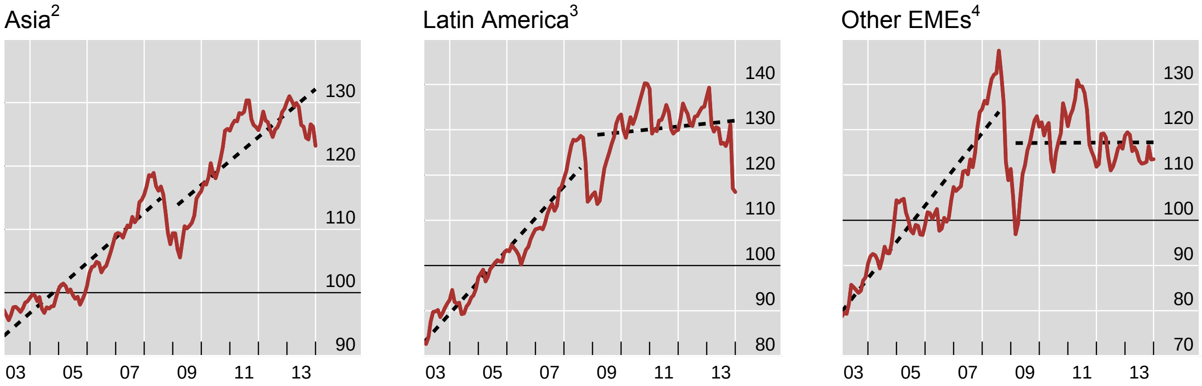
Easier monetary policy in the United States leads to portfolio adjustments and generally an appreciation in EME exchange rates. This currency appreciation in turn reduces demand for domestic goods and hurts trade competitiveness. In addition, Borio and Lowe (2002) and more recently Gourinchas and Obstfeld (2012) show evidence that overvalued exchange rates contribute to the build-up of financial stability risks. Rapid depreciations then lead to stresses on financial stability, especially in heavily dollarised or euroised economies.

A currency appreciation, which may have a qualitatively similar impact on aggregate output to an increase in policy rates, affects the tradable sector disproportionately. Given that the effects of interest rate changes are more broadly felt, EMEs might have difficulties in offsetting the impact of exchange rate appreciation. Not surprisingly given these concerns, EMEs are often perceived as resisting exchange rate appreciation.

However, in spite of these concerns EME currencies did appreciate substantially in real terms in all regions prior to the 2008 financial crisis (Graph 4). Though during the global financial crisis EMEs' currencies weakened significantly, emerging Asian currencies resumed their real appreciation trend after the crisis (left-hand panel). By contrast, real exchange rate appreciation has virtually stopped in Latin America (centre panel) and in other EME regions in the post-crisis period (right-hand panel).

EME exchange rates also move together, pointing to a common driving factor. The first principal component explains around 50% of the total variation.

Real exchange rates in emerging markets[1] Graph 4



Dashed black lines represent trends for the periods January 2003 to July 2008 and February 2009 to December 2013, respectively.

[1] Real exchange rate vis-à-vis the US dollar, deflated by CPI. Simple average of real exchange rate indices (2005 = 100) of the region. An increase denotes an appreciation. [2] China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [4] The Czech Republic, Hungary, Poland, Russia, South Africa and Turkey.

Source: National data.

International bank lending

Monetary policy decisions in advanced economies affect global liquidity and hence the ability of both banks and other corporations to fund real and financial assets. This ability, however, does not depend directly on the level of monetary policy, but on how the conditions set by monetary policy are translated into the financing costs of market participants. We focus first on the role of international banks, and discuss the role of other corporations in the transmission of global shocks to EMEs separately later.

International banks have traditionally played a large role in transmitting global financial conditions, including the impact of advanced economy monetary policy, to EMEs as shown, for instance, by Cetorelli and Goldberg (2012). The relevance of advanced economy factors in cross-border bank lending has also been confirmed by studies using the BIS international banking statistics, for instance Takáts (2010) and Avdjiev et al (2012).

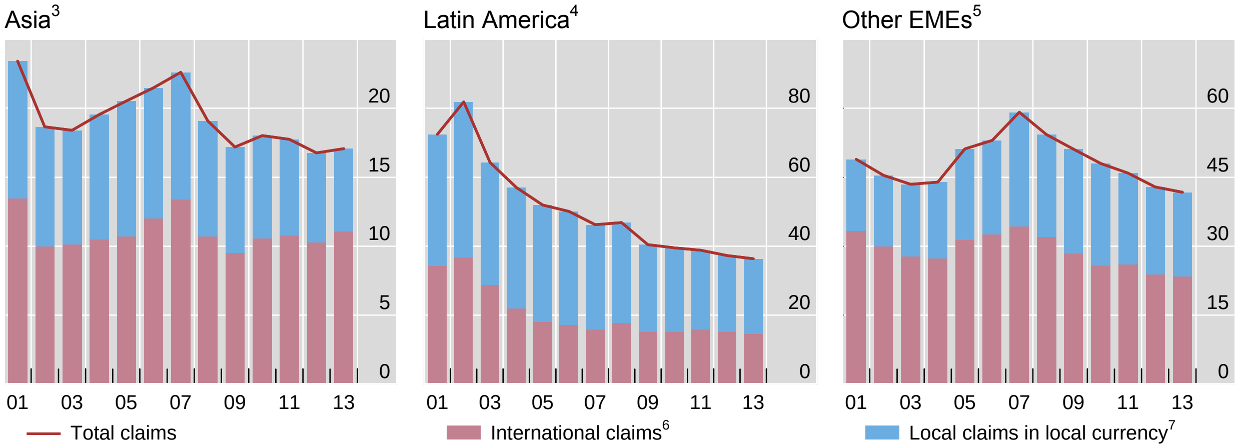
However, in spite of impressive growth figures when expressed in US dollars, international bank lending has tended to lose importance or to stagnate in comparison to domestic financing in most EME regions over the past decade (Graph 5). The main reason is the fast development of EME financial markets and local financial institutions. The BIS banking statistics, which include the local operations of international banks, illustrate this. In Latin America the share of international banks in financing the domestic economy was falling even before the financial crisis (red line on centre panel). In emerging Asia (left-hand panel) and in other EMEs (right-hand panel) the financial crisis eroded all the gains international banks had made before 2008.

There is also substantial geographical heterogeneity: international banks finance a larger share of the domestic credit in Latin America and other regions than they do in emerging Asia. These differences naturally affect how much international bank lending can affect these regions.

BIS reporting banks' lending to emerging market economies[1]

As a percentage of domestic credit[2]

Graph 5



[1] Emerging market positions of BIS reporting banks. Data are not adjusted for exchange rate movements. For 2013, as of Q2. [2] Bank credit to the private and public sector. [3] China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [4] Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [5] Algeria, the Czech Republic, Hungary, Israel, Poland, Russia, Saudi Arabia, South Africa, Turkey and the United Arab Emirates. [6] International claims comprise consolidated cross-border claims in all currencies and local claims in foreign currencies. [7] Local claims in local currency comprise local currency claims of reporting banks' foreign offices with local residents.

Sources: IMF, *International Financial Statistics*; national data; BIS consolidated banking statistics on an immediate borrower basis.

Furthermore, one needs to consider not only the size of international banks, but also their funding and lending model. International claims, ie cross-border claims and local claims in foreign currency, are more likely to transmit foreign monetary impulses (red bars on Graph 5), whereas locally funded local currency-denominated claims (blue bars) are more sensitive to local monetary policies. Thus, looking forward, emerging Asia, where international claims became more important relative to local-in-local claims (left-hand panel), is likely to be more affected than total claims of international banks would suggest. And the historically high share of locally funded local currency claims in Latin America (centre panel) may suggest that foreign monetary policy might affect the regions less than the size of international banks would otherwise suggest. However, these local-in-local claims might not necessarily insulate EMEs from international bank lending: international banks may be less responsive to host country monetary policy than domestic banks, as Wu et al (2009) argue. In addition to international banks, domestic banks in EMEs also often lend in foreign currencies, which transmits further international shocks. He and McCauley (2013) document, for instance, the growing share of foreign currency loans in China.

Notwithstanding this heterogeneity, cross-border bank lending to EMEs has also co-moved strongly across countries over the past decade. The first principal component explains around 60% of the total variation. This is remarkably high compared to advanced economies, where the first principal component is able to account for less than 50%. This strong co-movement again suggests that common drivers are at work.

Portfolio flows

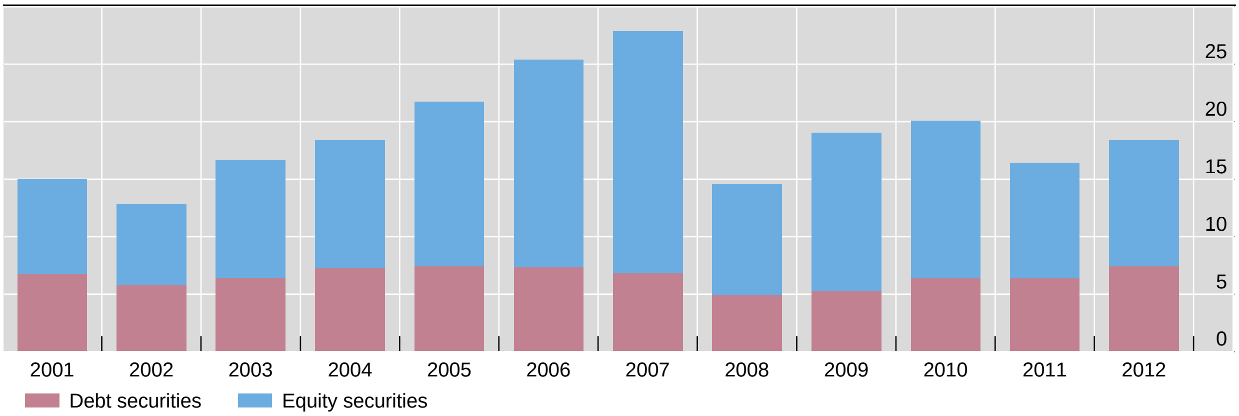
In recent years capital flows to EMEs and issuance of securities by EME corporations in international debt markets have taken an increasingly important role. Consequently, changes in investor sentiment and risk-taking, in part influenced by monetary policy in the jurisdictions of the main international currencies, represent another major avenue through which advanced economy monetary conditions can affect EMEs. The effect can manifest itself as changes in quantities (for instance, in gross capital flows) or prices. One example is the well-known risk-on/risk-off behaviour of international investors.

The value of portfolio investment in EMEs grew much faster than domestic credit in EMEs before the financial crisis in 2008 (Graph 6). Though capital outflows and falling valuations reduced these portfolios substantially in 2008, they recovered by more than US$ 2 trillion in the following five years. The recovery was particularly strong for debt securities (red bars), which reached around the same levels compared to domestic credit as before the financial crisis.

While some of these gross flows reflect the improved fundamentals and growth prospects of EMEs, a significant part is influenced by unconventional monetary conditions in advanced economies. There are thus concerns that the unwinding of easy monetary policy in advanced economies could lead to large reversals of these inflows from EMEs.

Portfolio investment in EMEs[1]

As a percentage of domestic credit[2] — Graph 6



[1] Derived portfolio investment liabilities. Emerging market economies: Algeria, Argentina, Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand, Turkey, the United Arab Emirates and Venezuela. [2] Bank credit to the private and public sector.

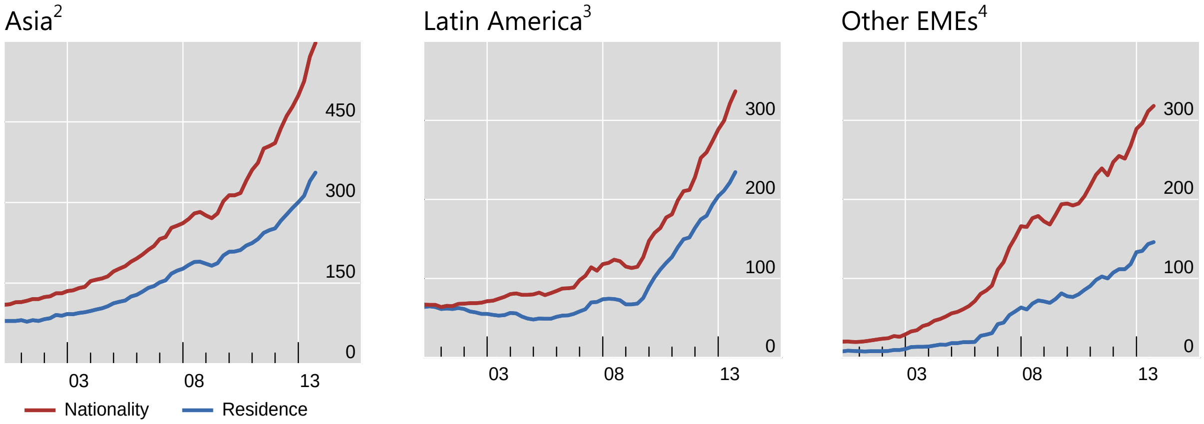
Sources: IMF, Coordinated Portfolio Investment Survey, International Financial Statistics; national data.

The international issuance of debt securities of EME non-bank corporations has increased rapidly since 2008 (Graph 7). Consequently, even those economies where external debt is considered low could be vulnerable to global monetary shocks, because corporations might issue securities via affiliates in offshore centres. This offshore issuance is captured by the difference between corporate international debt issuance by borrower nationality (red line) and by residence (blue line). The gap has increased rapidly to around US$ 250 billion for emerging Asia (left-hand panel), US$ 100 billion for Latin America (centre panel) and around US$ 150 billion for other emerging economies (right-hand panel).

International debt securities by residence and nationality[1]

Amount outstanding, in billions of US dollars

Graph 7



[1] International debt securities issued by non-banks (non-financial and financial corporations excluding central banks, private banks and public banks), in all maturities. [2] Aggregate of China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] Aggregate of Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [4] Aggregate of Algeria, the Czech Republic, Hungary, Israel, Poland, Russia, Saudi Arabia, South Africa, Turkey and the United Arab Emirates.

Sources: BIS securities statistics by nationality; BIS securities statistics by residence.

The strong co-movement in portfolio inflows to EMEs suggests the existence of common factors. The first principal component of cumulative capital inflows explains more than 92% of movements in individual EME capital inflows. This is much higher than the corresponding value of 66% for advanced economies.

Panel VAR analysis of portfolio inflows, exchange rates and reserves

In the rest of this section we carry out a more general econometric exercise that brings together some of the factors discussed so far. In particular, we explore the international transmission of changes in US sovereign yields through an unrestricted panel VAR model, which considers the interconnectedness of long-term interest rates, cross-border portfolio flows and exchange rates.

The estimation is based on monthly observations over 2005–13 for 13 EMEs for which information was readily available.[6] All of these countries have flexible exchange rates. The United States was used to represent advanced economies. The panel VAR includes the following variables: (i) 10-year US sovereign yields (representing global monetary conditions), (ii) the difference between 10-year US and EME government bond yields, (iii) cross-border portfolio flows to EMEs (proxied

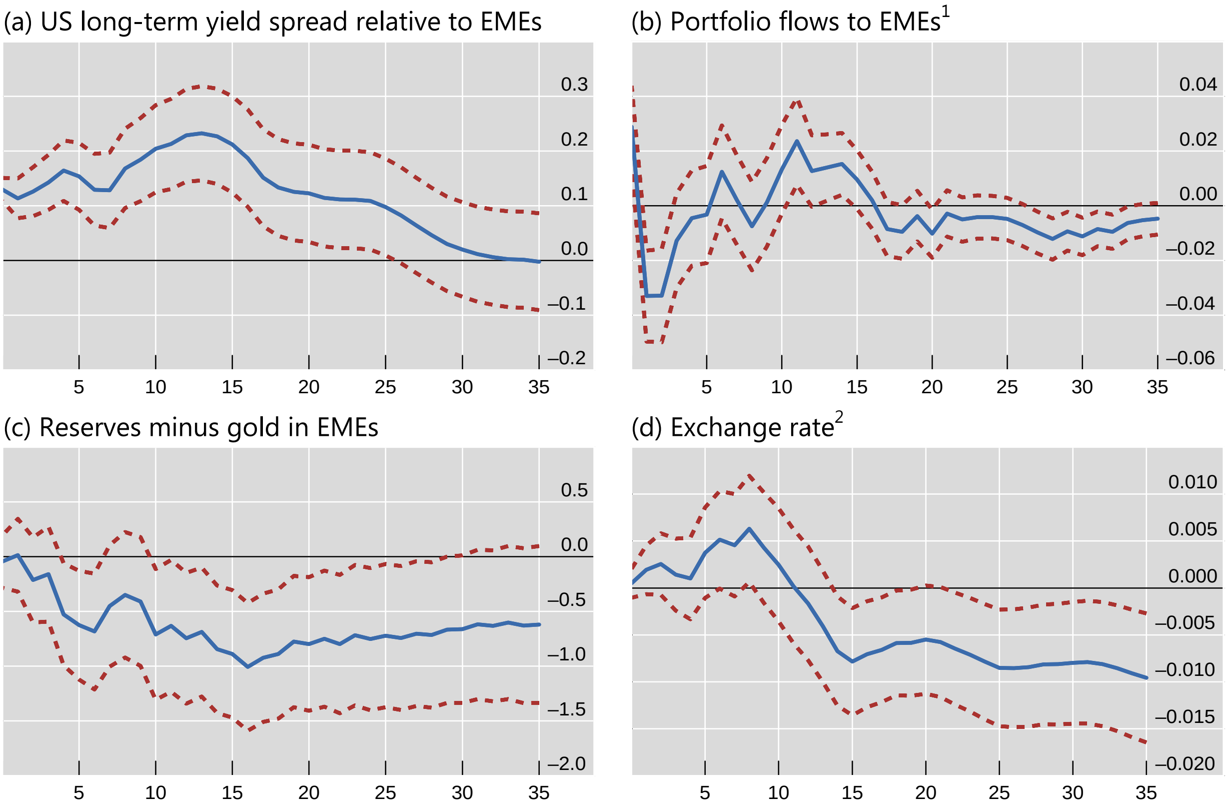
[6] The EMEs considered in the estimation were chosen on the basis of data availability for the 10-year sovereign yields: Brazil, Chile, Colombia, the Czech Republic, India, Indonesia, Israel, Korea, Mexico, Peru, the Philippines, Poland and Singapore.

by flows to dedicated EME mutual funds reported by EPFR) and (iv) nominal exchange rates of EMEs vis-à-vis the US dollar.[7]

Given space limitations, we report only the (generalised) impulse responses of long-term interest rate spreads, portfolio flows and exchange rates to a change in 10-year US sovereign yields. As Graph 8 shows, an increase in these yields results in a mild increase in the spread of US yields relative to EMEs' long-term yields. Therefore, despite the fact that long-term yields in both the United States and EMEs tend to co-move closely, the spread widens (panel (a)).

Impulse response function to a one standard deviation shock to US long-term yields

Response of each variable | Graph 8



[1] As measured by EPFR. [2] Domestic currency per US dollar.

Source: Authors' calculations.

The contractionary impact of a rise in US long-term yields on portfolio capital flows to EMEs appears to be relatively short-lived (panel (b)), despite the fact that the effect on long-term yield differentials is somewhat persistent. The gross flows decline sharply following the change but then return to previous levels in a fairly short time period.

[7] The panel VAR excludes fixed effects and analysis focuses on generalised impulse responses. Therefore, the shocks are not orthogonal and one cannot attach to them any structural interpretation.

An interesting outcome of the analysis is the response of international reserve assets (excluding gold) to the increase in US long-term yields (panel (c)). Not only do international reserves contract on impact but the effect also seems to show some persistence. One possible interpretation is that central banks in EMEs have relied on FX intervention as a shock absorber in response to developments in international financial markets.

However, our analysis does not indicate a clear-cut response of exchange rates to US long-term yields, perhaps as a result of the different ways in which EMEs have reacted to changes in US yields. In particular, our results indicate that higher US long-term yields have induced a statistically negligible depreciation pressure on exchange rates (panel (d)), which is followed by a significant appreciation. Clearly, this may also reflect several factors driving exchange rates (eg FX intervention or capital account measures).

5. Conclusion

In this note, we discuss a number of channels through which monetary policy in advanced economies can affect EMEs and we find evidence of tight linkages. In addition, consistent with the questionnaire responses from central banks, we find that EME policy rates reacted less to advanced economy monetary policy after the 2008 crisis, while their long-term interest rates have reacted more to changes in long-term rates in advanced economies. Our VAR analysis also suggests that changes in US long-term interest rates are associated with significant effects on portfolio flows to EMEs and international reserves.

However, many uncertainties remain about how exactly international monetary transmission works. The potential channels certainly need more discussion and research. The discussion at the meeting has identified two other potential channels. The first one is the commodity price channel. Several central banks have argued that advanced economy monetary policy has a direct impact on commodity prices, and therefore on macroeconomic conditions in EMEs. The precise channel, through which this might occur – investment in commodity related financial assets, commodity futures, remains uncertain. The second is the market psychology channel. The discussion revealed that market psychology can play an independent role in the transmission of advanced economy monetary policy to EMEs. This can manifest through rapid shifts in market sentiment, from excessive optimism to excessive pessimism, in response to actual or perceived changes in advanced economy monetary policy stance. Finally, the spillover effects are likely to depend on country-specific factors which have not been adequately studied.

Appendix

Robustness of the analysis of policy responses

In order to confirm robustness of our findings we repeated the analysis in four additional specifications. The main thrust remained unchanged: US monetary policy does matter for EME policy rate setting, but the impact weakens after 2008.

Equation (A.1) uses lagged independent variables to address endogeneity concerns. Equation (A.2) adds the exchange rate. In spite of the importance of the exchange rate in non-linear specification and higher-frequency data, it often turned out to be insignificant. At quarterly frequency the exchange rate is highly endogenous: we might not observe exchange rate movements precisely because of the EME policy reaction. Equation (A.3) adds the lagged dependent variable to address autocorrelation in policy rates. However, the relationship with the US policy rate remains strong. Finally, equation (A.4) combines lagged policy rates and exchange rates.

$$r_{t,EME} = c + \alpha\pi_{t-1,EME} + \beta y_{t-1,EME} + \gamma r_{t,US} \quad \text{A.1}$$

$$r_{t,EME} = c + \alpha\pi_{t,EME} + \beta y_{t,EME} + \gamma r_{t,US} + \theta\Delta REER_{t,EME} \quad \text{A.2}$$

$$r_{t,EME} = c + \varphi r_{t-1,EME} + \alpha\pi_{t,EME} + \beta y_{t,EME} + \gamma r_{t,US} \quad \text{A.3}$$

$$r_{t,EME} = c + \varphi r_{t-1,EME} + \alpha\pi_{t,EME} + \beta y_{t,EME} + \gamma r_{t,US} + \theta\Delta REER_{t,EME} \quad \text{A.4}$$

Finally, we also re-estimated the baseline regression for central and eastern European economies (the Czech Republic, Hungary and Poland) for the euro rate instead of the US dollar rate. Again, the results remained robust.

Robustness of the influence of long-term interest rates

We repeated the analysis in three additional specifications. The main thrust remained unchanged: US monetary policy does matter for EME policy rate setting and the impact is stronger after 2008.

$$r^{long}_{t,EME} = c + \varphi r^{long}_{t-1,EME} + \alpha r^{policy}_{t,EME} + \lambda r^{long}_{t,US} \quad \text{A.5}$$

$$r^{long}_{t,EME} = c + \alpha r^{policy}_{t,EME} + \beta\pi_{t,EME} + \gamma E_t\pi_{t+long,EME} + \phi d_{t,EME} + \lambda r^{long}_{t,US} \quad \text{A.6}$$

$$r^{long}_{t,EME} = c + \varphi r^{long}_{t-1,EME} + \alpha r^{policy}_{t,EME} + \beta\pi_{t,EME} + \gamma E_t\pi_{t+long,EME} + \phi d_{t,EME} + \lambda r^{long}_{t,US} \quad \text{A.7}$$

Equation (A.5) repeats the analysis with the lagged dependent variable. Using quarterly data equation (A.6) controls for inflation, long-term inflation expectations and budget deficit following Miyajima et al (2012) and Montoro et al (2012). Finally, equation (A.7) adds the lagged dependent variable to equation (A.6). In addition, we also repeated the analysis with the 10-year bond yield. Though data was available for fewer countries, the main thrust of the results did not change.

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