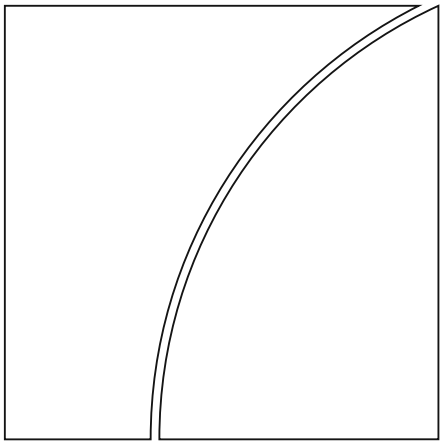

BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers

No 445

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by Blaise Gadanecz, Aaron Mehrotra and M S Mohanty

Monetary and Economic Department

March 2014

JEL classification: E51, E52, E58, F31

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ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

ISBN 978-92-9131-212-2 (print)
ISBN 978-92-9131-213-9 (online)

Foreign exchange intervention and the banking system balance sheet in emerging market economies

Blaise Gadanecz, Aaron Mehrotra and M S Mohanty[1]

Abstract

Large-scale forex intervention in emerging market economies (EMEs) aimed at resisting currency appreciation has major implications for the composition of banking system balance sheets. The domestic monetary consequences depend on the nature of central bank liabilities that are the counterpart of forex reserves. Even if the immediate change in bank reserves due to FX intervention is offset by the sale of securities, bank lending may still be stimulated, running counter to the aims of the monetary authority. In this paper, we empirically investigate the impact of banks' holdings of liquid government securities, generated by such intervention, on bank credit in a panel of EMEs. We find that, for well capitalised banking systems, holdings of government and central bank paper over time lead to an expansion in their credit to the private sector. This result is confirmed at both country and bank level. The balance sheet effects of large-scale FX intervention therefore require close attention.

JEL classification: E51, E52, E58, F31

Keywords: bank lending; sterilised intervention; foreign exchange reserves; central bank securities; emerging market economies

[1] All views are those of the authors and do not necessarily reflect those of the BIS. The authors would like to thank Juliusz Jabłecki, Frank Packer, Philip Turner, James Yetman and Fabrizio Zampolli for helpful comments, and Tracy Chan and Emese Kuruc for research assistance.

Contents

1. Introduction

Over the past decade or so, intervention in the foreign exchange market by emerging market economies (EMEs) has been associated with large changes in their banking systems' balance sheets. As a simple indicator, the aggregate FX reserves of EMEs rose from 16% of GDP in 1997 to 37% of GDP in 2013. Given that banks are the main counterparty in central bank transactions, it is not surprising that their balance sheets have also grown rapidly. Yet the balance sheet effects of FX intervention have received only limited attention in academic and policy discussion.

In the simple textbook versions that were once widely used, the key issue was whether the central bank financed FX reserve accumulation by expanding bank reserves. If it did so, then this was viewed as a change in the monetary policy stance and it would result in downward pressure on the interbank rate. By contrast, if the central bank was able to issue alternative liabilities, bank reserves and the monetary base would not change. The intervention was then said to be "sterilised".[2]

In practice, however, the central bank's policy choices are much wider than the classical base money/other liabilities dichotomy. This paper explores those policy choices that are of particular relevance for the stance of monetary policy. The main question explored is: how has large-scale FX intervention of the type undertaken by many EMEs during the past decade affected commercial banks' balance sheets? In particular, has this had implications for the lending behaviour of banks, and thus for domestic monetary and financial conditions more broadly?

The different liabilities issued by the central bank will have different implications for commercial bank balance sheets. To illustrate, Table 1 presents a highly stylised banking system balance sheet. The central bank can finance its foreign currency purchases wholly or in part by issuing currency. When intervention is small, or when net positions tend to reverse quickly, financing them will probably pose little difficulty, as demand for currency will be increasing in a rapidly growing economy. However, this means of financing is insufficient when foreign currency assets become very large and far exceed the public's currency holdings. The central bank will then face a financing gap, which equals the difference between FX reserves and currency in circulation.[3]

Following the scheme laid out in Table 1, one way of financing FX accumulation without increasing bank reserves would be to increase non-monetary liabilities. For instance, the government could be asked to increase its deposits at the central bank by aiming for fiscal surpluses. Government deposits could also be transferred from the commercial banks to the central bank. Alternatively, the government could decide to inject additional equity into the central bank. Increasing government

[2] Note, however, that "sterilised intervention" has different connotations depending on the monetary regime in question. In the classical sense, it implies neutralising the impact of the FX intervention on base money (see, for instance, Jurgensen Report (1983) and Frankel (1997)). In the modern sense, sterilised intervention may simply mean adjusting the day-to-day supply of bank reserves to demand so that the short-term interest rate is maintained on or around the chosen policy path (see Borio and Disyatat (2009)). Yet another view is that sterilised intervention is a misnomer in the sense that central banks respond automatically to all changes in bank reserves irrespective of the sources of the shock.

[3] See Mohanty and Turner (2006) on the concept of the central bank financing gap.

deposits at the central bank has the first-order effect of reducing commercial bank deposits. Not only can such financing mitigate the expansionary effect of capital inflows, it will also obviate the need for the central bank to issue interest bearing liabilities and expose its balance sheet to potential losses.[4]

A stylised banking system balance sheet

Table 1

Central bank		Commercial banks	
Assets	Liabilities	Assets	Liabilities
Foreign assets	Monetary liabilities	Reserves with the CB	Deposits
Domestic assets	Currency	Loans	Private clients
	Bank reserves		Government
	Central bank securities		Market borrowing
	Non-monetary liabilities	Investment	
	Government deposits	Sovereign securities	
	Other liabilities	Domestic private bonds	
	Equity	Foreign currency assets	Equity

Source: Authors.

Part of the central bank's financing gap could also be met by increasing the required reserve ratio on banks. Depending on how required reserves are remunerated, however, this might weaken the banking system's profitability considerably. Some of the intervention could also take place off balance sheet, in the form of FX swaps, which can insulate domestic monetary variables – albeit temporarily – from FX intervention.

However, the larger and longer-lasting an intervention becomes, the more likely it is to be financed by central bank issuance of securities. While it is true that this is a non-distortive way of financing intervention, it is not a zero sum game for monetary policy. The monetary impact depends on several factors, including the maturity of the new debt. When FX intervention is financed by selling long-term government bonds to the domestic *non-bank* sector, the portfolio adjustment leads to a decline in the holding of short-term assets, including bank deposits. Private sector balance sheets become less liquid. That said, bondholders may be unwilling to absorb additional issuance without higher interest rates, creating capital losses on government bond holdings and lowering aggregate demand.[5]

[4] However, whether or not this method can be pursued depends on the government's fiscal position and its ability to run an active countercyclical fiscal policy. In Singapore, government deposits have traditionally accounted for a large part of central bank liabilities, greatly relieving the financing pressures on the Monetary Authority of Singapore (MAS) stemming from exchange rate-centred monetary policy operations. In 2010, government deposits constituted over 40% of MAS's total liabilities.

[5] This is consistent with the predictions of the portfolio balance theory developed by Tobin (1963), Modigliani and Sutch (1967) and Friedman (1978). During the 1970s and 1980s, the portfolio balance theory formed the core of the open economy monetary models developed by Kouri and Porter (1974), Branson (1977), Isard (1978) and Henderson (1982). However, the importance of these models started to fade during the 1990s under the growing influence of the mainstream New Keynesian literature.

Those effects will be smaller if the central bank sells short-term securities, which are shown in Table 1 as a separate liability. Although in the conventional definition of money central bank securities are considered as non-monetary liabilities, they may not be completely neutral from the viewpoint of monetary policy, for several reasons.

First, short-term government and central bank securities can be a close substitute for bank reserves. For instance, in the 1960s, the Radcliffe Committee argued that open market operations in bonds, not bills, should be the main weapon of monetary policy.[6] Later, Tobin (1963) provided a formal framework to study the monetary effects of short-term government debt. In his view, banks consider short-term government bonds as close substitutes for excess reserves because they are subject to little capital loss and can be easily sold to finance new lending.[7] More generally, to the extent that short-term securities yield transaction services and reduce liquidity constraints, they may play a special role in aggregate demand developments.[8]

Second, investors' ability to increase leverage may depend on their holdings of liquid government and central bank securities. Borio and Zhu (2008), for instance, differentiate between "funding liquidity" (ability to cash in asset values) and "market liquidity" (ability to trade an asset at short notice). Short-term government/central bank securities fulfil both functions very well. In particular, given their high collateral values, a high stock of short-term sovereign securities may facilitate increased risk-taking in the financial system, leading to higher credit growth.

Finally, some authors have argued that banks may adjust the composition of their assets in relation to a desired long-term ratio of investment to lending (Vargas et al (2013)). The banks' demand for securities evolves depending on how near or far they are from their desired portfolio equilibrium. According to this view, excessive holdings of government bonds are costly to banks as they come at the expense of forgone lending. As a result, banks may reduce their lending rate to reach the desired investment-to-loan ratio. If so, a persistent and significant rise in banks' holdings of liquid securities is likely to contain information about future lending growth.

Keeping these arguments in mind, we analyse in this paper what effects large-scale sterilised FX intervention to resist exchange rate appreciation has on banks' balance sheets. We start by reviewing the size and the composition of banking system balance sheets in EMEs. In the core part of the paper, we empirically investigate the relationship between banks' holdings of liquid securities and their lending.

In studying the monetary effects of FX intervention, we consider two hypotheses. The first is that bonds and bank credit may be substitutable in borrowers' and banks' portfolios, in which case securities holdings may crowd out

[6] In the late 1980s, the UK Treasury explicitly excluded short-term Treasury bills from counting under its full funding rule for fiscal deficits; see Turner (2011) for a review.

[7] The size of the impact depends on the sensitivity of banks' holdings of securities to the level of the interest rate. When interest rates are low, short-term securities become more substitutable with bank reserves (see Zampolli (2012)).

[8] See Kumhof (2004) for a discussion of the aggregate demand impact of short-term government debt.

lending to the private sector (eg Bernanke and Blinder (1988), Kuttner and Lown (1998)).[9] Alternatively, the substitutability of liquid securities with excess reserves, or the use of short-term government securities as a liquidity buffer, will lead commercial banks to increase lending (eg Kashyap and Stein (1997, 2000)). Our empirical analysis provides a test of these two competing hypotheses. At the same time, we highlight the importance of the banks' capital position in affecting the relationship between securities holdings and lending.

Using country-level data in a panel setup, we find that bank holdings of government and central bank paper over time lead to an expansion in credit to the private sector. The effect is strongest in economies with a well capitalised banking system. The estimates with country-level data suggest that when well capitalised banks' holdings of government and central bank securities, as a ratio of their credit stock, rise by 1 percentage point, their lending growth increases by 0.2 percentage points two years later. This result is economically and statistically significant. Even though it is not the primary factor determining bank lending, this channel accounts for about 16% of the total variance in credit growth during 2001–11. Narrowing down our definition of liquid assets to comprise only short-term government and central bank securities and base money leads to stronger effects. The variance of credit growth explained by liquid assets more than doubles to 37%. Additional estimates using a large data set with bank-level data from BankScope largely confirm these findings.

The rest of the paper is structured as follows. Section 2 presents a brief review of the size of FX intervention in the past decade and the related changes in balance sheets. Section 3 discusses the empirical framework for evaluating the link between commercial banks' holdings of liquid securities and their lending to the private sector. Section 4 presents the results of the country-level and the bank-level panel models. Section 5 concludes and highlights the major policy implications of our results.

2. FX accumulation and banking system balance sheets

How has the size of EME central bank balance sheets evolved in practice? The blue line in Graph 1 shows the aggregate stock of foreign exchange reserves in EMEs as a percentage of GDP since 1990. In the absence of actual FX intervention data, we assume that FX reserves are a close proxy for such intervention. Valuation changes induced by exchange rate movements can lead to day-to-day fluctuations in FX reserves. Such valuation changes should not affect the path of FX accumulation over a longer horizon – unless, of course, the exchange rate itself has a trend.[10]

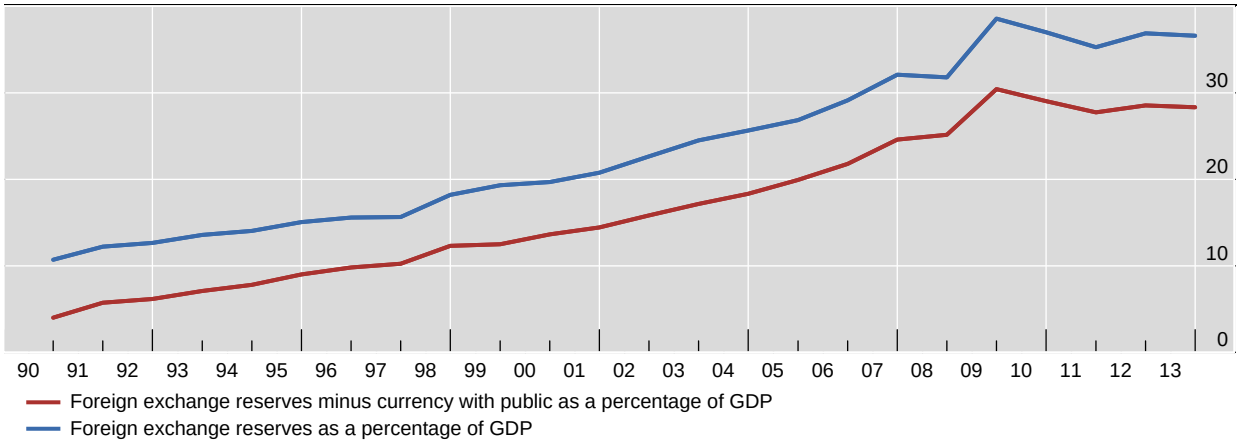
[9] See also Cook and Yetman (2012)), who find a negative impact from reserve accumulation on loan growth in Asia. The authors suggest that this could arise as banks purchase sterilisation instruments instead of providing credit.

[10] Adler and Tovar (2011) compare actual intervention data with changes in foreign exchange reserves for five emerging economies. They show that, in terms of a daily frequency, the two can differ significantly, but there is already a marked increase in the correlation between the two series when a weekly frequency is considered.

Graph 1 highlights two major developments. First, the blue line shows that the size of EME central banks' FX assets has expanded in an unprecedented way compared with the previous decades. During the 1990s, the aggregate FX reserves of EMEs were fairly modest, at around 10–20% of GDP, even though this period coincided with a major episode of capital inflows in 1990–93. Over the next decade, however, these reserves grew rapidly, reflecting EMEs' resistance to currency appreciation pressures stemming not only from their large current account surpluses but also from sizeable capital inflows into many economies. The jump in FX reserves during 2009, which coincided with the introduction of unconventional monetary policies by advanced economies, is particularly striking. EMEs accumulated FX reserves close to 7% of their GDP in that year. Over the past three years, there has been some stabilisation of FX reserves, as capital inflows ebbed and currency pressures reversed in many EMEs, particularly following the May 2013 "tapering" announcement by the Federal Reserve.

Foreign exchange reserves and central bank financing requirements[1]

As a percentage of GDP — Graph 1



[1] Simple average of Algeria, Argentina, Brazil, Chile, China, Colombia, the Czech Republic (from 1995), Hong Kong SAR, Hungary, India, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia (from 1993), Saudi Arabia, Singapore, Thailand, Turkey, South Africa. 2013 GDP provisional.

Sources: IMF, *International Financial Statistics*; IMF, *World Economic Outlook*.

The second development is highlighted by the red line in Graph 1. It shows the same picture from the liability perspective, but with one important difference. The stock of public currency holdings is deducted from the FX reserves to arrive at a measure of the central banks' *ex ante* financing gap, as discussed in the Introduction. At 28% of GDP in 2013, EME central banks' financing gaps are three times larger now than they were in the beginning of the 1990s.

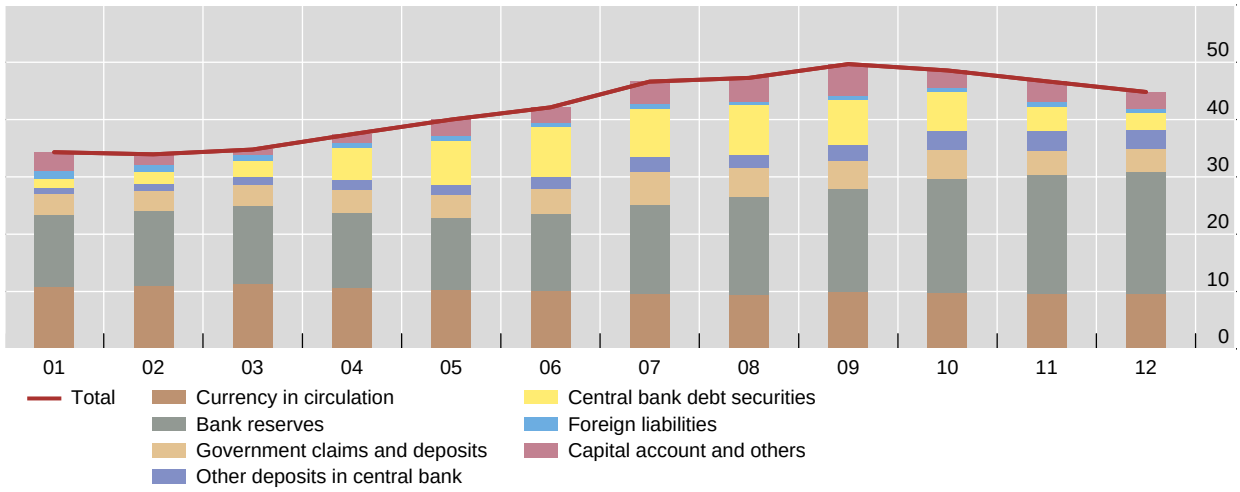
As an example of how large-scale interventions were sterilised in practice, Graph 2 shows the composition of central bank liabilities in emerging Asia, where FX reserves have risen rapidly. Unsurprisingly, given the scale of intervention, the balance sheets of Asian central banks have expanded sharply over the past decade. It is interesting to observe that the ratio of currency to output has been quite stable in Asia, suggesting that currency demand is rising at least in step with the growth in output. To the extent that the expansion of currency demand was met by FX accumulation, it has helped to reduce the financing gap of the central bank. Moreover, commercial bank reserves at the central bank filled a large part of the

financing gap. Hikes in reserve requirement ratios have contributed to reserve holdings, particularly in China. Government claims and deposits constitute a sizeable part of central bank liabilities.

Central bank liabilities in emerging Asia[1]

As a percentage of GDP

Graph 2



[1] Weighted average of China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand based on 2005 GDP and PPP exchange rates.

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; BIS calculations.

Issuance of securities by Asian central banks remained very modest at the beginning of the 2000s but rose rapidly in the next decade to constitute about 8% of GDP by 2009. With the slowdown in reserve accumulation since 2011, the share of outstanding central bank securities in emerging Asia has fallen considerably of late.[11] In particular, the share in Korea fell from over 20% to 14% of GDP during 2005–12, and in China it dropped from close to 15% to 3% of GDP during 2008–12.

We should note two stylised facts about sterilisation securities. The first concerns their maturity. Table 2 shows the maturity distribution of central bank and government securities for a number of EMEs, including those from Latin America, and central and eastern Europe. It is clear from the table that the average maturity of securities issued by EME central banks tends to be quite short. In 2011, for instance, close to 85% of central bank securities had remaining maturities of less than a year. Only less than 5% of securities had a maturity of three years or more. In stark contrast, over 60% of government securities had remaining maturities exceeding three years. The average maturity of government securities has generally increased over the past decade.

[11] The stock of government securities has also increased sharply in many countries. A large part of that increase reflects the governments' own financing requirement.

Average maturity of government and central bank securities at end of year Table 2

	Government securities (percentage of total outstanding)				Central bank securities (percentage of total outstanding)			
	Less than 1 year	Between 1 and 3 years	Above 3 years	Average remaining maturity in years	Less than 1 year	Between 1 and 3 years	Above 3 years	Average remaining maturity in years
2000	32.6	25.9	41.5	3.8	86	9.1	4.9	0.8
2005	18.6	21.2	60.2	5.7	78.1	11.2	10.9	1.1
2010	17.4	22.8	59.8	6.2	86.4	10.3	3.3	0.6
2011	16.4	22.8	60.8	6.2	84.8	10.5	4.6	0.8

Sources: BIS central bank questionnaire, February 2013; BIS calculations.

A second stylised fact relates to the holdings of sterilisation securities. Table 3, adopted from Mohanty and Berger (2013), shows commercial banks' holdings of government and central bank securities in various regions at different points in time since 2000. The data are sourced from responses to a central bank survey conducted in 2013.

Holders of government and central bank securities

As a percentage of total holdings of government and central bank securities; regional averages[1] Table 3

	Latin America		Asia		Emerging Europe		Other emerging economies	
	Banks	Non-banks	Banks	Non-banks	Banks	Non-banks	Banks	Non-banks
2000	31.9	68.1	55.8	44.2	18.7	81.3	23.3	76.7
2005	36.0	64.0	39.2	60.8	38.5	61.5	25.8	74.3
2010	36.3	63.7	42.5	57.5	46.7	53.3	25.5	74.6
2011	35.8	64.2	39.6	60.4	48.2	51.8	26.2	73.8
Median	36.7	63.3	43.1	56.9	39.2	60.8	25.1	74.9

[1] Averages weighted by US dollar values of securities holdings. "Banks" refers to domestic commercial banks. "Non-banks" refers to other domestic financial institutions, non-residents and other holders of securities.

Sources: BIS central bank questionnaire, February 2013; BIS calculations.

As the table shows, the share of banks' holdings is typically high in all regions, a feature associated with relatively underdeveloped bond markets in EMEs and banks' strong preference for liquid assets. In emerging Asia, banks' share peaked at 56% in 2000 but fell in the following decade to a range of 39–43%.[12] The median ratio across economies was about 43% in 2011. In Latin America and emerging Europe, banks' share has been rising over the past decade. At the end of 2011, banks in Latin America held about 36% of all government and central bank securities, very close to the median value for the region. In emerging Europe, banks' share has risen

[12] Here, banks refer to commercial banks, while non-banks comprise other domestic financial institutions, non-residents and other holders of securities.

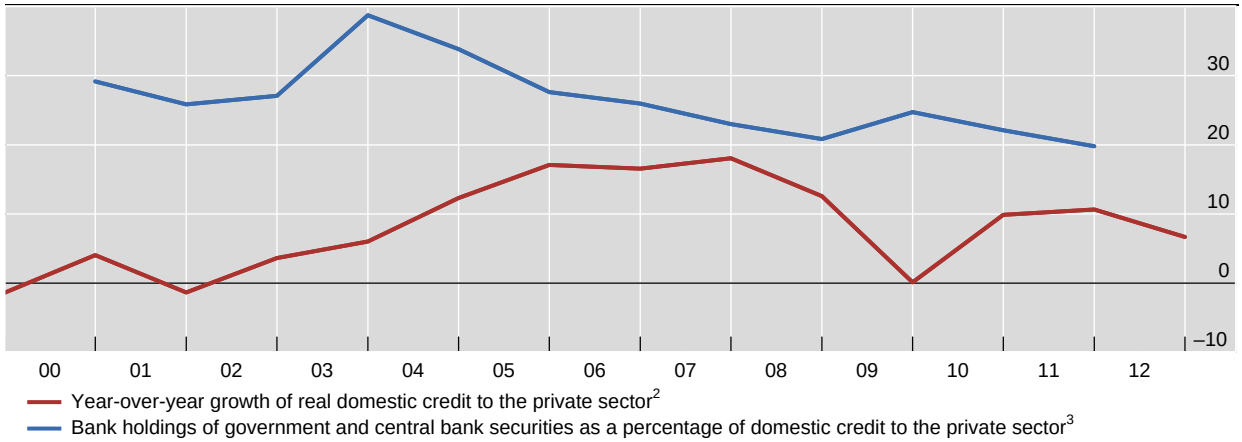
particularly rapidly between 2000 and 2011, with a median value of about 39%. Given the overall importance of banks as holders of liquid securities, an investigation into the broader monetary implications of sterilised intervention is warranted.

As a first gauge of the impact of sterilised intervention, in Graph 3 we plot banks' holdings of sovereign securities as a percentage of bank credit to the private sector in EMEs, together with the growth in real credit to the private sector.

Bank credit to the private sector and their holdings of government and central bank securities[1]

In per cent

Graph 3



[1] Simple average of Algeria, Argentina, Brazil, Chile, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Israel, Korea, Mexico, Peru, Poland, Russia, Saudi Arabia, South Africa, Thailand and Turkey. [2] For Algeria and Colombia from 2002. For Israel until 2011. [3] For Algeria and Colombia from 2001; for Korea and Poland from 2002; for Turkey from 2003; for the Czech Republic and Russia from 2004; for Peru from 2005; for Argentina and Chile from 2006; for Thailand from 2009.

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

We include both government and central bank securities in our data set. From the banks' point of view, both are sovereign securities. In addition, in some countries (eg India) the central bank is prohibited by law from issuing its own securities. Hence, the government issues additional securities over and above its own financing requirement and places these with the central bank for financing FX intervention. Finally, what matters for banks' securities holdings is the transfer of securities from/to the central bank through outright and repurchase operations, not just new issuance.

Graph 3 highlights two main aspects of banks' securities holdings and lending. At first glance, banks' securities holdings and credit growth appear to be negatively correlated. Banks' securities holdings as a share of credit have trended down since 2003, falling from a peak of 39% to about 20% in 2011. During this period, real lending grew rapidly before falling sharply to zero following the 2008 crisis. Lending growth has picked up again since 2010, though at a less spectacular rate than before.

However, delving deeper into the data, we find that there is a considerable lag between a rise in banks' securities holdings and lending growth. For instance, banks sharply increased their securities holdings-to-credit ratio in 2002–03 long before the pickup in lending growth. The fact that banks maintained a high level of securities

holdings throughout the first half of the 2000s before drawing them down suggests that some rebalancing of portfolios was under way. Another brief run-up in holdings occurred during 2008–09, preceding a revival in lending in 2010. We now turn to examine the empirical relationship between these two variables using a panel model.

3. Empirical framework

Two competing hypotheses: crowding-out versus credit expansion

As discussed in the Introduction, there are two competing hypotheses. According to the first one, securities holdings crowd out lending to the private sector. This is in line with the traditional view of monetary policy transmission, where banks' lending to the private sector is determined by loan demand, and holdings of liquid government securities crowd out lending.[13]

An alternative view is that bank holdings of liquid securities boost lending. This perspective emphasises the substitutability of liquid securities with excess reserves. The impact on lending also depends on the risk cycle, banks' liquidity or capital position, and the quality of their loan books. Relative to weak banks, healthier banks are more likely to use their securities holdings to expand credit (Jokipii and Milne (2011)).

Modelling approach: loan growth and the endogeneity of liquid asset holdings

To test these two hypotheses, we construct a reduced-form equation, which can be thought of as a representation of the clearing equilibrium between loan demand and supply. We are not modelling loan demand and supply separately. Following Pazarbaşioğlu (1997), Ghosh and Ghosh (1999), Mohanty and Turner (2012) and Bassett et al (2012), banks' aggregate loan supply can be written as a function of macroeconomic factors and banking sector characteristics:

$$S_L = f(r\text{-}r_d, LC, y) \quad (1)$$

where $r\text{-}r_d$ is the difference between the real interest rate on loans and banks' cost of funds (measured, for instance, by the deposit rate). LC denotes banks' lending capacity[14] and y represents current output, which also proxies for borrowers' creditworthiness. These factors influence banks' willingness to lend. We explicitly

[13] Chrystal (1999) argues that banks make optimising decisions about their assets and liabilities, subject to loan demand, the latter being the most important determinant of those choices. Kuttner and Lown (1998) empirically identify a crowding-out effect of banks' government debt holdings with respect to their lending to the private sector in the United States.

[14] Ghosh and Ghosh (1999) define lending capacity as total bank liabilities (plus net worth), minus required reserves and liquidity requirements, minus cash in vault, minus capital. This capacity cannot be greater than the maximum banking sector assets implied by the prevailing capital adequacy requirement.

introduce banks' holdings of liquid securities in our reduced-form loan growth equation, where they influence loan supply by affecting banks' lending capacity.

The demand for real credit can be assumed to depend on the real interest rate, on current, future and potential output, and on inflation:

$$D_L = f(r, y, y^{gap}, s, \pi) \quad (2)$$

In equation (2), s represents the price of the stock market, used as a proxy for future expected output. π is the inflation rate and captures the general macroeconomic environment. y denotes per capita income and y^{gap} the output gap.

The reduced-form loan growth equation is written as a representation of the clearing equilibrium between loan demand and supply:

$$\Delta L = f(\Delta LC, r, \Delta y, y^{gap}) \quad (3)$$

The real growth in bank credit to the private sector, ΔL, is determined by changes in banks' lending capacity (ΔLC), the real rate of interest (r), real per capita GDP growth (Δy) and the output gap (y^{gap}). The change in banks' lending capacity, ΔLC, is in turn influenced by changes in their holdings of liquid securities (see above), their capitalisation (the maximum banking sector assets implied by the prevailing capital adequacy requirement put a ceiling on total assets) and the quality of their loan books.

Incorporating these determinants of banks' lending capacity, our full model specification can be written as:

$$\Delta L_{it} = \alpha_i + ß_1 * \Delta NPL_{it} + ß_2 * r_{it} + ß_3 * y^{gap}{}_{it-1} + ß_4 * \Delta y_{it} + ß_5 * sechold_{it-2} + ß_6 * sechold_{it-2} * K_{it-2} + \varepsilon_{it} \quad (4)$$

where ΔL_{it} represents the real growth in bank credit to the private sector in country i in year t. ΔNPL stands for the change in banks' ratio of non-performing loans to total loans, *sechold* for their holdings of liquid securities (scaled by their portfolio of loans), and K for a measure of their capitalisation.[15] The macroeconomic controls for the real rate of interest (r), the output gap (y^{gap}) and real per capita GDP growth (Δy) are the same as above. We lag the output gap by one year to allow for the delay with which the macroeconomic environment impacts banks' lending decisions. We also lag securities holdings to allow for the delay with which these holdings can influence banks' credit extension.

All other things equal, we expect banks' credit extension to decrease as their stock of non-performing loans grows, consistent with a risk-averse behaviour. We anticipate a positive coefficient for the output gap and per capita GDP growth, in line with economic expansion and development requiring more bank financing. The coefficient sign on the liquid securities holdings variable will depend on which of the two hypotheses outlined above – crowding-out or leveraging-up – prevails in practice. If banks' holdings of safe government securities crowd out their lending to the private sector, the sign will be negative; if, on the other hand, such holdings boost lending to the private sector thanks to their close substitutability with reserves in waiting, the sign will be positive.

[15] We assume, for simplicity's sake, that the average residual maturity of banks' securities holdings is constant. We set the dummy variable K to 1 when a country's banking system capitalisation in a given year is greater than 20% of its banks' credit exposure to the private sector. About two thirds of countries are highly capitalised by this measure.

The interaction term *sechold*K* serves to test the hypothesis that healthier banks are more likely than weak ones to use their liquid securities holdings and extend credit to the private sector. The key point here is that weak banks follow a strategy often known as "narrow" or "lazy" banking. These banks are likely to thrive by investing in relatively risk-free assets until their balance sheets have fully recovered from any legacy problems.

There is a remaining endogeneity issue with respect to this model specification, namely that banks' loan extension and demand for liquid securities are simultaneously affected by a third factor, investor risk aversion. As such, not taking this simultaneity into account would result in biased estimates of the effect of securities holdings on bank lending. We therefore adopt a two-stage estimation procedure. We first estimate commercial banks' liquid securities holdings for a given year as a function of macroeconomic and banking system factors. Importantly for model identification purposes, we use the benchmark corporate bond yield as an exogenous determinant of securities holdings. The first-stage equation can be written as:

$$sechold_{it} = \alpha_i + ß_1*NPL_{it-1} + ß_2*corpbondyld_{it-1} + ß_3*y^{gap}{}_{it-1} + \varepsilon_{it} \quad (5)$$

where *sechold*, *NPL*, *corpbondyld* and y^{gap} stand for banks' holdings of liquid securities, their ratio of non-performing to total loans, the country's corporate bond yield benchmark and its output gap, respectively. To allow for the delay with which banks' balance sheet conditions affect their demand for liquid securities, we lag all right-hand-side variables by one year. As discussed in Acharya and Skeie (2011), Cornett et al (2011) and Berrospide (2012), the precautionary motive is likely to increase banks' holdings of liquid securities when they hold large amounts of non-performing loans or when corporate bond yields rise due to investor risk aversion. All other things equal, we expect a positive output gap to reduce banks' demand for liquid securities (as they increase their lending to the private sector when the economy is booming).

In the second stage,[16] we use the fitted values from equation (5) to estimate the loan growth equation:

$$\Delta L_{it} = \alpha_i + ß_1*\Delta NPL_{it} + ß_2*r_{it} + ß_3*y^{gap}{}_{it-1} + ß_4*\Delta y_{it} + ß_5*\widehat{sechold}_{it-2} + ß_6*\widehat{sechold}_{it-2}*K_{it-2} + \varepsilon_{it} \quad (6)$$

This model is essentially the same as equation (4) above, which uses the observed values of liquid securities holdings. We estimate the models first with country-level data, and subsequently bank-level data. The latter approach serves as a robustness check and allows for the supply of loans to be unique to each bank.

[16] This two-stage estimation is less accurate than a formal instrumental variable regression in terms of the variance-covariance matrix of the residuals, and it implies that the standard errors of the estimates are affected. However, the approach offers two advantages. First, it allows us to explicitly estimate banks' demand for liquid securities, which we interpret economically. Second, it also allows us to interact the endogenous securities holdings with the exogenous banking system capitalization. In unreported regressions, we have also performed the two-stage estimation with a correction of the variance-covariance matrix. That procedure yields estimates of the effects of liquid securities holdings on bank lending that are less consistently significant with a two-year lag across model specifications, although they are economically meaningful.

4. The results

Country-level panel

Starting with the country-level approach, the estimation was carried out as a panel for a sample of 18 emerging market economies[17] for the period 2001–11 (one country observation per year). We obtained the securities holdings data from a central bank survey and the rest of the macroeconomic variables from the IMF's *International Financial Statistics*. We used panel-corrected standard errors.[18] The results are reported in Tables A1 to A3 (first stage) and B1 to B3 (second stage). Each table focuses on one particular proxy of banks' holdings of liquid securities and shows the estimation results for the whole sample, as well as for the two subsamples (2001–07 and 2008–11). In all specifications, the dependent variable is the real change in (log) credit to the private sector.

We introduce banks' holdings of liquid securities through three proxies. The first one is our benchmark measure defined as banks' holdings of central bank and government securities divided by their credit to the private sector. It is a direct gauge of the arbitrage between safe and risky assets. Table A1 reports the results of the first-stage estimation for this variable. It is significantly related to borrower quality and investor risk aversion for the full sample, as well as before, during and after the recent financial crisis. On average, each percentage point rise in the ratio of non-performing to total loans or in the corporate bond yield benchmark is associated with an increase in holdings of government and central bank securities of 1–3% of banks' private sector loan book. Both results are consistent with our priors and with the precautionary liquidity hoarding motive. We do not find the output gap to be a significant determinant of banks' holdings of central bank and government securities.

The second proxy is banks' holdings of central bank securities divided by their credit to the private sector. This variable is similar to the first, but focuses on the most liquid and short-term component of safe securities: central bank paper. We find it to be positively correlated with the corporate yield benchmark during the crisis (Table A2). During the period 2001–11, each percentage point rise in the corporate bond yield benchmark raises banks' demand for central bank paper by half a percentage point (relative to their loan portfolio), again consistent with the precautionary hoarding motive. Holdings of central bank paper are also negatively

[17] Argentina, Brazil, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Israel, Korea, Malaysia, Mexico, Peru, Poland, Russia, Saudi Arabia, South Africa, Thailand and Turkey. Data availability limits the possibility to include all EMEs with significant increases in FX reserves and a policy of sterilised intervention in the sample.

[18] The panel-corrected standard error estimation method, developed by Beck and Katz (1995, 1996), treats disturbances as heteroskedastic and contemporaneously correlated across panels (due, in our case, to a common shock affecting all emerging market economies during the crisis). This method is shown to overcome the deficiencies of the Feasible Generalised Least Squares method in producing correct standard errors, especially when applied to relatively small panel data sets (our country panel sample size ranges from 45 to 122, depending on the period). We compared the panel-corrected standard errors with those obtained from an OLS estimation. We found the former to be significantly larger than the latter, which, indirectly, confirms the presence of heteroskedasticity in our data set.

correlated with the output gap (for the full sample and before the crisis), as banks prefer to lend to the private sector when the economy is in an expansionary phase.

The third proxy is the ratio of short-term central bank and government liabilities including base money to total consolidated official sector liabilities (government and central bank). As is well known, consolidated official sector debt excludes the central bank's holdings of government debt, and therefore provides a more accurate measure of holdings of debt by the public. This measure relates directly to Tobin's (1963) view of "money". According to this view, banks consider short-term government bonds as close substitutes for excess reserves. Although this metric does not explicitly identify the holders of government and central bank debt, it captures a broader measure of liquid assets in the economy. Like the previous indicator, this variable is significantly and negatively correlated with the output gap and positively correlated with the corporate bond yield benchmark, for selected periods (Table A3).

Benchmark results with government and central bank securities holdings

Next, we investigate the impact of sovereign securities holdings on bank credit. Our benchmark results, shown in Table B1 (regressions R10 to R15), provide several key messages. First, among the various determinants of bank credit growth, per capita GDP growth turns out to be the statistically most significant variable in all regressions, signalling a process of financial deepening. One percentage point faster per capita real GDP growth leads to 1.5 percentage points faster real credit growth. Second, as should be expected, bank credit is negatively correlated with the real interest rate, although the relevant coefficient is statistically significant only for the pre-2008 crisis period.[19]

Finally, banks' public sector securities holdings have a statistically significant effect on lending to the private sector. We find this effect to be expansionary when the banking system is well capitalised. In particular, when we interact the holding variable with the binary variable for high banking system capitalisation, we obtain a highly significant and positive coefficient of 0.23 (regression R11). This means that, with a two-year lag,[20] a highly capitalised banking system's lending to the private sector grows 0.2 percentage points faster for every 1 percentage point rise in banks' holdings of government and central bank securities as a proportion of their lending. Thus, well capitalised banks use their holdings of liquid government and central bank securities to increase their lending to the private sector. Graph 4 shows the relative contribution of our liquid securities holdings variables to the variance of real growth in lending to the private sector by well capitalised banks for the entire

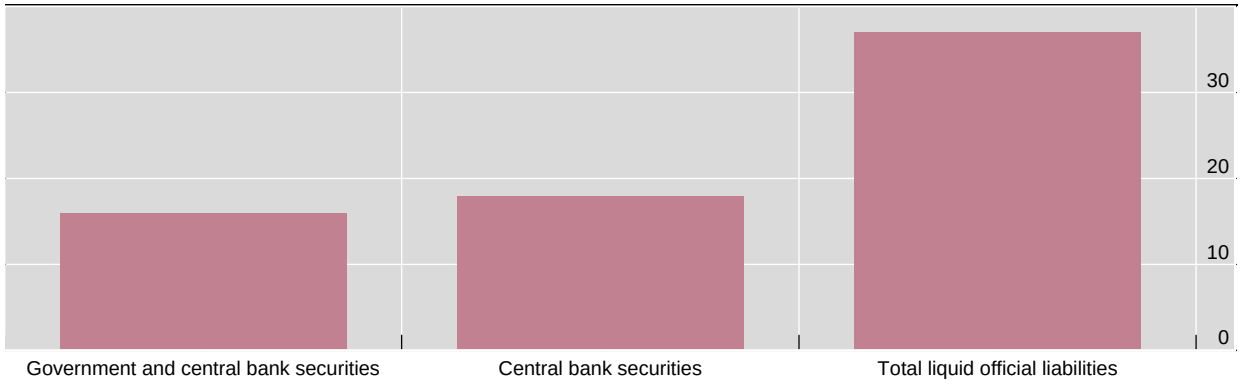
[19] We get similar results using FX-implied yields; the results are available upon request.

[20] Graph 3 provides evidence of this delay. The importance of the two-year lag is corroborated by our econometric analysis. In our loan regressions (4) and (6) (results discussed below), we tried various lags of the securities holdings, jointly and on their own. The two-year lag came out consistently and significantly with the correct signs. The one-year lag was not significant on its own, or in a model specification where the two-year lag was also present. Wald tests, available upon request, confirm the insignificance of the one-year lag. The results confirm that, on average, two years elapse between the central bank's sterilised intervention and the impact on banks' lending from the sale of sterilisation securities.

sample period. As can be seen from the graph, our benchmark liquid securities variable – government and central bank securities – explains 16% of the variance of the real growth in bank credit.

Variance of lending growth explained by liquid securities holdings (when interacted with capitalisation)

In per cent Graph 4



Sources: IMF, *International Financial Statistics*; BIS central bank questionnaire, 2012, 2013; national data; authors' calculations.

In contrast, when we do not control for their capital, banks' holdings of public sector securities have either no impact on their lending to the private sector or crowd it out. In such a case, we report an insignificant or a negative and significant coefficient on holdings of liquid securities (Table B1, regressions R10 and R11).

Our results reveal that this expansionary effect, obtained for well capitalised banks, was at play in the run-up to the international financial crisis (regression R13), when EMEs were facing significant amounts of capital inflows and their central banks were carrying out large-scale sterilised foreign exchange interventions to resist local currency appreciation. The relevant coefficient on securities holdings for 2000–07 is almost identical to the one we obtain for the entire sample period. The ensuing sales of government and central bank securities to the banking sector accelerated private sector credit growth with a lag. We also observe an equivalent and significant accelerating effect on lending to the private sector during 2008–11, but irrespective of bank capitalisation (regressions R14 and R15).

Is the expansionary effect due to banks' holdings of short-term securities?

We can answer this question by replacing the total securities holdings variable in the regression with holdings of just central bank securities. As shown in Section 2, these securities are primarily of short maturity (less than one year) and mostly issued to banks.

Table B2 shows that the accelerating effect on private sector lending of well capitalised banks' holdings of central bank securities only is even stronger. This is not surprising given their liquidity characteristics. A 1 percentage point rise in the ratio of holdings of central bank paper to the credit of well capitalised banking systems leads to 0.8 percentage points faster credit growth two years later (regression R17). The coefficients of most control variables remain largely unaltered

with the change in the securities holding variable. Judging by the explanatory power of the model (R^2), it is as good a fit as the one using the total securities holding variable. As shown in Graph 4, the contribution of central bank securities to the variance of lending growth is now slightly stronger, at around 18%.

Focusing on 2001–07, a period of heavy sterilised intervention, the impact is larger (1.2 percentage points faster credit growth; regression R19). When bank capitalisation is not controlled for, holdings of central bank paper crowd out lending to the private sector (regressions R17 and R19). Again, for 2008-11, we obtain an accelerating effect irrespective of bank capitalisation.[21]

Is the broader liquidity effect of FX intervention important for lending?

As mentioned above, we use a third variable to represent the supply of liquid assets, which is given by the sum of all short-term government and central bank securities and base money. We have already discussed the reasons for choosing short-term securities. The addition of reserve money is more controversial. For instance, as pointed out by Borio and Disyatat (2009), when the central bank has a target for the overnight rate, reserves are unimportant for bank credit. The central bank can satisfy any amount of reserve demand from banks at the chosen policy rate. Remunerating the free reserves of banks at market rates eliminates the problems of excess reserves. By contrast, the bank "lending" view argues that the supply of reserves is important when a significant number of banks has limited access to capital market financing (Kashyap, Stein and Wilcox (1993) and Kashyap and Stein (2000)).

In practice, the operating frameworks of many EME central banks are defined in terms of a corridor for the overnight interest rate, which allows for significant day-to-day volatility in the short-term interest rate. For instance, in Brazil, India, Korea and Turkey, such corridors have been set as wide as 100–200 basis points. In these cases, the supply of bank reserves can still play a role in banks' lending decisions. Even in instances where monetary policy is conducted with a single policy rate, the evidence presented by Filardo et al (2012) suggests that managing the excess supply of reserves has been a challenge for many EME central banks, especially during periods of heavy capital inflows and FX intervention. The authors point out that in a number of countries the interbank rate deviated persistently from the reference rate.

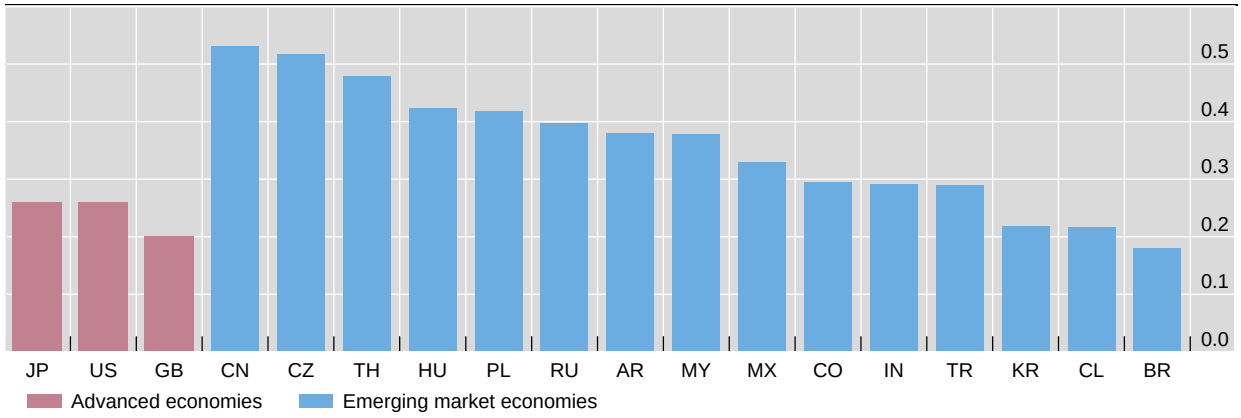
Graph 5 presents our broad measure of liquid assets in EMEs, given as the ratio of short-term official liabilities to total official sector liabilities at the end of 2011. For comparison, the relevant numbers are shown for advanced economies. One clear message emerging from the graph is that the supply of liquid assets is significantly higher in EMEs than that in a typical advanced economy. In several

[21] Over the past two decades, China has been a heavy accumulator of foreign exchange reserves. Unfortunately, detailed data are not available regarding the holders of government and central bank securities in China. We therefore estimated a synthetic securities holding variable by applying the average regression coefficients obtained in the first-stage estimation to China. Fortunately, however, data are available for the total outstanding stock of central bank securities for China. Hence, we re-estimated the first stage with this variable and took the estimates to the second stage. Even with this modification, the results (available upon request) remain fairly robust, without material changes to the size or significance of the coefficients of the securities holdings variable.

cases, this ratio is twice as high as that in the United States and the United Kingdom. This is surprising because the popular perception is that the monetary policy stance in advanced economies has been more accommodative than that in EMEs.

Short-term central bank and government securities and the monetary base[1]

As percentage of total official sector liabilities — Graph 5



AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; GB = United Kingdom; HU = Hungary; IN = India; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; PL = Poland; RU = Russia; TH = Thailand; TR = Turkey; US = United States.

[1] For China, Japan, the United Kingdom and the United States, 2010 (see Filardo et al (2012)).

Sources: Central banks; IMF, *International Financial Statistics*; BIS calculations.

Turning to the results, Table B3 shows that the supply of liquid assets has a significant positive impact on credit growth. Every time the ratio of short-term public sector debt and reserve money to total official sector debt increases by 1 percentage point, bank credit growth accelerates by 0.3 percentage points after two years. Again, this result is only valid in countries with well capitalised banking systems (regression R23). In the run-up to the international financial crisis, the effect is stronger (0.4 percentage points faster credit growth, regression R25), and there is a crowding-out of private sector financing by public sector exposure when bank capitalisation is not taken into account. It is important to note that the liquid asset ratio has a significantly powerful effect on changes in bank lending relative to the alternative securities holdings variables considered in the paper. As Graph 4 shows, this variable explains over one third of the variance of lending growth during 2001–11.

The results are robust to the inclusion of controls specific to the state of the economy. As expected, credit to the private sector grows faster when per capita GDP growth is higher and the real rate of interest is lower.

Bank-level results

As an additional robustness check, we also estimate the model using bank-level data. Our sample includes 79 large banks from 24 EMEs for the period 2001–2011

(one observation per bank per year).[22] We follow the same two-stage modelling procedure as in the country-level approach, equations (5) and (6). The only exception is the choice of proxies for banks' holdings of liquid public sector securities. Due to data availability in BankScope, we calculate two new proxies: holdings of government securities and holdings of available-for-sale securities (both of them scaled by credit to the private sector). The numerators of these two metrics are not quite the same as the ones employed for the country-level approach (government plus central bank securities; central bank securities). But they essentially capture two important characteristics of liquid public sector securities: perceived risk-free status (in the case of government securities) and liquidity (available-for-sale securities). We estimate panel-corrected standard errors, as for the country-level regressions. Tables C1-2 and D1-2 display the results for the first stage and the second stage, respectively.

At bank level, Tables C1 and C2 confirm our country-level results that banks' holdings of liquid securities rise as borrower quality deteriorates and when investor risk aversion intensifies. This is in line with investor risk aversion and the liquidity hoarding motive. On average, each percentage point rise in banks' ratio of non-performing-to-total loans or in the corporate bond yield benchmark is associated with an increase in holdings of liquid public sector securities by banks of 2–9% of their private sector loan book. Holdings of liquid public sector securities also decrease with the output gap, as banks prefer to lend to the private sector when the economy is expanding. Every percentage point rise in the output gap relative to potential output is associated with a decrease in securities holdings of 3–9% of the private sector loan book. All these estimates are quite comparable in significance and magnitude with our country-level estimates.

When banks hold larger amounts of government securities, this accelerates their lending to the private sector, especially when they are well capitalised. When well capitalised banks' holdings of government securities rise by 1 percentage point relative to their private sector loan book, their lending to the private sector two years later grows 0.3 percentage points faster (Table D1, regression R35). The magnitude and significance of the effect found at bank level is almost precisely equal to our country-level estimates of the same effect (Tables B1 and B3, regressions R11 and R23).

In the run-up to the international financial crisis, a period of heavy sterilised intervention resulting in large amounts of government securities being sold to banks, the accelerating effect is even stronger (0.5 percentage points, regression R36), irrespective of bank capitalisation. During 2008–11, holdings of government securities crowded out banks' lending to the private sector by the same amount as they accelerated it before (regressions R38 and R39), again irrespective of bank capitalisation. We interpret this asymmetric result as a reflection of exceptionally high investors' risk aversion and collapse in bank lending following the global financial crisis.

[22] The sample covers Argentina, Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Singapore, South Africa, Thailand, Turkey, the United Arab Emirates and Venezuela. The data are from BankScope and the IMF *International Financial Statistics*.

When available-for-sale securities are used instead of government securities, we obtain a more significant accelerating effect on bank lending. This is not surprising given the liquidity and maturity characteristics of available-for-sale securities, and also corroborates our country-level results. We observe 1.3 percentage points faster credit growth with a two-year lag when banks' holdings of available-for-sale securities rise by 1 percentage point relative to their private sector loan exposure (Table D2, regressions R40 and R41).

To summarise, our bank-level estimates largely confirm the country-level results. They are also robust to the inclusion of bank and macroeconomic controls. As in the country-level analysis, bank credit grows faster when the output gap and per capita GDP also increase (as banks finance the economy during its expansion phase). Bank credit grows more slowly when the real rate of interest is higher and when banks are faced with a larger stock of non-performing loans.

5. Conclusion and policy implications

Our paper has explored the balance sheet effects of sterilised intervention in the context of EMEs. Even if the central bank holds bank reserves constant, increased holding of short-term liquid securities on commercial banks' balance sheets may impact bank lending in ways that run counter to the aims of the monetary authority. Such impacts may not be immediate, and could also depend on bank-level characteristics.

Both our country- and bank-level estimates suggest that, during the past decade, holdings of liquid government and central bank securities by banks have tended to lead to an expansion of credit to the private sector. The increase in credit occurs with a two-year lag. The expansionary impacts appear stronger during the run-up to the recent financial crisis. During this period, EMEs were mostly facing current account surpluses and significant amounts of capital inflows, and their central banks were carrying out sterilised foreign exchange intervention. How responsive a bank's lending is to greater liquidity depends on the capital position of the bank. Well capitalised banks increase their lending more than weakly capitalised banks.

In terms of other policy implications, our results support the "impossible trinity" theory in that FX intervention weakens the monetary authority's control over domestic monetary conditions. In many EMEs, persistent intervention to resist appreciation has been associated with a highly liquid banking system and strong credit growth. Not only does this bring about difficult trade-offs for EME monetary authorities in setting the appropriate monetary stance, it also creates risks for the financial system.

Annex tables

Determinants of banks' securities holdings,[1] country-level estimates

Table A1

Dependent variable: CBandGovHold/credit(t)	2001–11	2001–07	2008–11
	R1	R2	R3
NPL(t-1)	0.024***	0.030***	0.014***
	(0.004)	(0.003)	(0.004)
corpbondyld(t-1)	0.020***	0.019**	0.018***
	(0.005)	(0.008)	(0.005)
ygap(t-1)	–0.002	–0.008	0.000
	(0.006)	(0.012)	(0.005)
Constant	–0.056	–0.073	–0.008
	(0.039)	(0.079)	(0.039)
Observations	83	35	48
R^2	0.268	0.360	0.124

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***CBandGovHold/credit*** = bank holdings of central bank and government securities divided by bank credit to the private sector. ***NPL*** = commercial banks' ratio of non-performing loans to total loans. ***corpbondyld*** = benchmark corporate bond yield in the country. ***ygap*** = output gap, relative to potential output.

Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of banks' securities holdings,[1] country-level estimates

Table A2

Dependent variable: CBHold/credit(t)	2001–11	2001–07	2008–11
	R4	R5	R6
NPL(t-1)	0.003	0.002	0.000
	(0.003)	(0.004)	(0.002)
corpbondyld(t-1)	0.005*	0.007	0.003
	(0.003)	(0.004)	(0.002)
ygap(t-1)	–0.005**	–0.012**	–0.003
	(0.003)	(0.005)	(0.003)
Constant	0.026	-0.004	0.063***
	(0.028)	(0.051)	(0.019)
Observations	93	42	51
R^2	0.104	0.277	0.014

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***CBHold/credit*** = bank holdings of central bank securities divided by bank credit to the private sector. ***NPL*** = commercial banks' ratio of non-performing loans to total loans. ***corpbondyld*** = benchmark corporate bond yield in the country. ***ygap*** = output gap, relative to potential output.

Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of banks' securities holdings,[1] country-level estimates Table A3

Dependent variable: ST(t)	2001–11	2001–07	2008–11
	R7	R8	R9
NPL(t-1)	0.006	0.001	0.001
	(0.006)	(0.007)	(0.008)
corpbondyld(t-1)	0.030**	0.019	0.033***
	(0.012)	(0.017)	(0.012)
ygap(t-1)	–0.014*	–0.034**	–0.004
	(0.008)	(0.015)	(0.007)
Constant	–0.047	0.080	–0.062
	(0.095)	(0.125)	(0.089)
Observations	83	33	50
R^2	0.336	0.463	0.097

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***ST*** = ratio of short-term public sector debt and reserve money to total official sector debt. ***NPL*** = commercial banks' ratio of non-performing loans to total loans. ***corpbondyld*** = benchmark corporate bond yield in the country. ***ygap*** = output gap, relative to potential output.

Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of lending to the private sector,[1] country-level estimates

Table B1

Securities holdings proxy: CBandGovHold/credit	2001–11		2001–07		2008-2011	
Dependent variable: ΔL(t)	R10	R11	R12	R13	R14	R15
ΔNPL(t)	0.006	0.003	0.008	0.005	0.001	0.001
	(0.004)	(0.004)	(0.005)	(0.004)	(0.006)	(0.007)
r(t)	–0.001	–0.001	–0.009***	–0.008***	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ygap(t-1)	–0.002	0.001	–0.006	–0.001	–0.001	–0.001
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)
Δy(t)	1.524***	1.698***	0.632	1.247***	1.464***	1.468***
	(0.229)	(0.212)	(0.514)	(0.428)	(0.212)	(0.225)
$(\widehat{\text{CBandGovHold}}/\text{credit})(t-2)$	–0.024	–0.238***	–0.090*	–0.294***	0.381***	0.326***
	(0.030)	(0.058)	(0.047)	(0.054)	(0.077)	(0.090)
$(\widehat{\text{CBandGovHold}}/\text{credit}) * K(t-2)$	–	0.229***	–	0.238***	–	0.097
		(0.059)		(0.045)		(0.067)
Constant	0.031*	0.034**	0.147**	0.115***	–0.043	–0.045
	(0.016)	(0.014)	(0.058)	(0.041)	(0.028)	(0.031)
Observations	122	122	45	45	41	41
R^2	0.403	0.491	0.354	0.562	0.484	0.496

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***ΔL*** = yearly real growth in bank credit to the private sector; $\widehat{CBandGovHold/credit}$ = bank holdings of central bank and government securities divided by bank credit to the private sector, fitted values as determined by the first-stage equation; ***ΔNPL*** = yearly percentage point change in commercial banks' ratio of non-performing loans to total loans; ***r*** = real rate of interest, in per cent; ***ygap*** = output gap, relative to potential output, in per cent; ***Δy*** = yearly real growth in terms of per capita GDP; ***K*** = dummy variable for highly capitalised banking system, taking the value of 1 if a country's banking system capitalisation exceeds 20% of its bank credit in a given year; 0 otherwise. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of lending to the private sector,[1] country-level estimates

Table B2

Securities holdings proxy: CBHold/credit	2001–11		2001–07		2008–11	
Dependent variable: ΔL(t)	R16	R17	R18	R19	R20	R21
ΔNPL(t)	0.007*	0.004	0.010*	0.006*	–0.004	–0.005
	(0.004)	(0.004)	(0.005)	(0.004)	(0.008)	(0.008)
r(t)	–0.001	–0.001	–0.008***	–0.007***	0.002*	0.002
	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
ygap(t-1)	–0.002	0.001	–0.004	–0.001	0.000	0.001
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.002)
Δy(t)	1.495***	1.742***	0.919*	1.480***	1.424***	1.413***
	(0.225)	(0.197)	(0.556)	(0.400)	(0.150)	(0.155)
$(\widehat{\text{CBHold/credit}})(t-2)$	0.026	–0.812***	–0.027	–1.261***	0.838***	0.750*
	(0.117)	(0.234)	(0.149)	(0.294)	(0.346)	(0.417)
$(\widehat{\text{CBHold/credit}}) * K(t-2)$	–	0.806***	–	1.167***	–	0.185
		(0.213)		(0.252)		(0.131)
Constant	0.023	0.033	0.089	0.091**	–0.040	–0.042
	(0.017)	(0.015)	(0.062)	(0.042)	(0.036)	(0.039)
Observations	122	122	45	45	41	41
R^2	0.400	0.498	0.297	0.554	0.441	0.449

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***ΔL*** = yearly real growth in bank credit to the private sector; $\widehat{\boldsymbol{CBHold/credit}}$ = bank holdings of central bank securities divided by bank credit to the private sector, fitted values as determined by the first-stage equation; ***ΔNPL*** = yearly percentage point change in commercial banks' ratio of non-performing loans to total loans; ***r*** = real rate of interest, in per cent; ***ygap*** = output gap, relative to potential output, in per cent; ***Δy*** = yearly real growth in terms of per capita GDP; ***K*** = dummy variable for highly capitalised banking system, taking the value of 1 if a country's banking system capitalisation exceeds 20% of its bank credit in a given year; 0 otherwise. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of lending to the private sector,[1] country-level estimates

Table B3

Securities holdings proxy: ST	2001–11		2001–07		2008–11	
Dependent variable: ΔL(t)	R22	R23	R24	R25	R26	R27
ΔNPL(t)	0.007*	0.005	0.010*	0.007*	–0.003	–0.002
	(0.004)	(0.004)	(0.005)	(0.004)	(0.008)	(0.007)
r(t)	–0.001	–0.001	–0.008***	–0.007***	0.003	0.002
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
ygap(t-1)	–0.002	0.001	–0.004	–0.001	–0.001	–0.002
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.002)
Δy(t)	1.495***	1.694***	0.974*	1.486***	1.334***	1.268***
	(0.224)	(0.199)	(0.570)	(0.383)	(0.161)	(0.168)
$\widehat{\mathrm{ST}}(\mathrm{t}-2)$	0.009	–0.258***	0.006	–0.437***	0.254***	0.235**
	(0.023)	(0.079)	(0.053)	(0.095)	(0.095)	(0.107)
$\widehat{\mathrm{ST}} * \mathrm{K}(\mathrm{t}-2)$	–	0.261***	–	0.403***	–	0.163***
		(0.076)		(0.079)		(0.053)
Constant	0.023	0.031**	0.077	0.095**	–0.016	–0.028
	(0.017)	(0.014)	(0.065)	(0.044)	(0.027)	(0.027)
Observations	122	122	45	45	41	41
R^2	0.400	0.479	0.297	0.560	0.489	0.524

[1] The sample period goes from 2001 to 2011 and is yearly for each country. ***ΔL*** = yearly real growth in bank credit to the private sector; $\widehat{ST}$ = ratio of short-term public sector debt and reserve money to total official sector debt , fitted values as determined by the first-stage equation; ***ΔNPL*** = yearly percentage point change in commercial banks' ratio of non-performing loans to total loans; ***r*** = real rate of interest, in per cent; ***ygap*** = output gap, relative to potential output, in per cent; ***Δy*** = yearly real growth in per capita GDP; ***K*** = dummy variable for highly capitalised banking system, taking the value of 1 if a country's banking system capitalisation exceeds 20% of its bank credit in a given year; 0 otherwise. Panel-corrected standard errors in parentheses.***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: Central banks; IMF; authors' calculations.

Determinants of banks' securities holdings,[1] bank-level estimates

Table C1

Dependent variable: GovSecHold/credit(t)	2001–11	2001–07	2008–11
	R28	R29	R30
NPL(t-1)	0.025***	0.024***	0.009
	(0.006)	(0.005)	(0.011)
corpbondyld(t-1)	0.029**	0.086***	–0.004
	(0.012)	(0.018)	(0.006)
ygap(t-1)	–0.044***	–0.086***	–0.005
	(0.014)	(0.028)	(0.007)
Constant	–0.007	–0.556***	0.340***
	(0.099)	(0.2122)	(0.065)
Observations	344	140	204
R^2	0.136	0.431	0.015

[1] The sample period goes from 2001 to 2011 and is yearly for each bank. GovSecHold/credit = bank's holdings of government securities divided by its credit to the private sector; NPL = ratio of non-performing loans to total loans; corpbondyld = benchmark corporate bond yield in the country; ygap = output gap, relative to potential output. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: IMF; BankScope; authors' calculations.

Determinants of banks' securities holdings,[1] bank-level estimates

Table C2

Dependent variable: ASSec/credit(t)	2001–11	2001–07	2008–11
	R31	R32	R33
NPL(t-1)	0.015*	0.015**	–0.007**
	(0.008)	(0.008)	(0.003)
corpbondyld(t-1)	0.018	0.069***	–0.006*
	(0.013)	(0.025)	(0.003)
ygap(t-1)	–0.034**	–0.072***	–0.005
	(0.014)	(0.028)	(0.004)
Constant	0.014	–0.382*	0.251***
	(0.111)	(0.226)	(0.037)
Observations	335	128	207
R^2	0.158	0.406	0.039

[1] The sample period goes from 2001 to 2011 and is yearly for each bank. ***ASSec/credit*** = bank's holdings of available-for-sale securities divided by its credit to the private sector; ***NPL*** = ratio of non-performing loans to total loans; ***corpbondyld*** = benchmark corporate bond yield in the country; ***ygap*** = output gap, relative to potential output. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: IMF; BankScope; authors' calculations.

Determinants of lending to the private sector,[1] bank-level estimates

Table D1

Securities holdings proxy: GovSecHold/credit(t)	2001–11		2001–07		2008–11	
Dependent variable: ΔL(t)	R34	R35	R36	R37	R38	R39
ΔNPL(t)	–0.002	0.002	0.024	0.028	–0.023***	–0.023***
	(0.013)	(0.013)	(0.033)	(0.032)	(0.009)	(0.009)
r(t)	–0.008	–0.007	–0.034***	–0.032***	0.005	0.006
	(0.007)	(0.007)	(0.009)	(0.010)	(0.004)	(0.004)
ygap(t-1)	0.003	–0.001	0.026**	0.021	0.000	–0.000
	(0.011)	(0.010)	(0.013)	(0.014)	(0.004)	(0.004)
Δy(t)	0.334	0.326	0.708**	0.788***	0.093	0.095
	(0.278)	(0.265)	(0.291)	(0.227)	(0.154)	(0.154)
$(\widehat{\text{GovSecHold}}/\text{credit})(t-2)$	0.100	0.022	0.511**	0.344	–0.508*	–0.466*
	(0.091)	(0.077)	(0.243)	(0.232)	(0.278)	(0.282)
$(\widehat{\text{GovSecHold}}/\text{credit}) * K(t-2)$	–	0.270***	–	0.164	–	0.075
		(0.086)		(0.114)		(0.100)
Constant	0.070	0.056	–0.028	–0.004	0.259***	0.232**
	(0.043)	(0.040)	(0.098)	(0.103)	(0.100)	(0.102)
Observations	269	269	82	82	187	187
R^2	0.036	0.074	0.266	0.271	0.087	0.095

[1] The sample period goes from 2001 to 2011 and is yearly for each bank. ***ΔL*** = yearly real growth in the bank's credit to the private sector; $\widehat{GovSecHold}/credit$ = bank's holdings of government securities divided by its credit to the private sector, fitted values as determined by the first-stage equation; ***ΔNPL*** = yearly percentage point change in the bank's ratio of non-performing loans to total loans; ***r*** = real rate of interest, in per cent; ***ygap*** = output gap, relative to potential output, in per cent; ***Δy*** = yearly real growth in terms of per capita GDP; ***K*** = dummy variable for highly capitalised bank, taking the value of 1 if a bank's capitalisation exceeds 20% of its bank credit in a given year; 0 otherwise. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: BankScope, IMF, authors' calculations.

Determinants of lending to the private sector,[1] bank-level estimates

Table D2

Securities holdings proxy: ASSec/credit(t)	2001–11		2001–07		2008–11	
Dependent variable: ΔL(t)	R40	R41	R42	R43	R44	R45
ΔNPL(t)	–0.001	–0.001	0.021	0.025	–0.022***	–0.023***
	(0.012)	(0.011)	(0.032)	(0.000)	(0.008)	(0.008)
r(t)	–0.011	–0.009	–0.033***	–0.032	0.005	0.005
	(0.007)	(0.007)	(0.009)	(0.000)	(0.004)	(0.004)
ygap(t-1)	0.001	–0.001	0.026**	0.022	–0.001	–0.001
	(0.010)	(0.010)	(0.013)	(0.000)	(0.004)	(0.004)
Δy(t)	0.210	0.248	0.727**	0.805	0.068	0.076
	(0.242)	(0.243)	(0.287)	(0.000)	(0.150)	(0.147)
$(\widehat{\mathrm{ASSec/credit}})(\mathrm{t}-2)$	1.337***	1.060***	0.536**	0.378	–0.842	–0.726
	(0.360)	(0.324)	(0.247)	(0.000)	(0.661)	(0.727)
$(\widehat{\mathrm{ASSec/credit}}) * \mathrm{K}(\mathrm{t}-2)$	–	0.355**	–	0.159	–	0.180
		(0.154)		(0.000)		(0.195)
Constant	–0.199**	–0.178**	–0.014	0.003	0.239*	0.201
	(0.087)	(0.081)	(0.089)	(0.000)	(0.126)	(0.142)
Observations	269	269	82	82	187	187
R^2	0.112	0.135	0.273	0.278	0.078	0.090

[1] The sample period goes from 2001 to 2011 and is yearly for each bank. ***ΔL*** = yearly real growth in the bank's credit to the private sector; $\boldsymbol{\widehat{ASSec/credit}}$ = bank's holdings of available-for-sale securities divided by its credit to the private sector, fitted values as determined by the first-stage equation; ***ΔNPL*** = yearly percentage point change in the bank's ratio of non-performing loans to total loans; ***r*** = real rate of interest, in per cent; ***ygap*** = output gap, relative to potential output, in per cent; ***Δy*** = yearly real growth in terms of per capita GDP; ***K*** = dummy variable for highly capitalised bank, taking the value of 1 if the bank's capitalisation exceeds 20% of its bank credit in a given year; 0 otherwise. Panel-corrected standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively.

Sources: IMF; BankScope; authors' calculations.

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