Low Interest Rate Policy and the Use of Reserve Requirements in Emerging Markets [1][2]

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Abstract

The paper sheds light on the link between the interest rate policy in large advanced economies with international funding and reserve currencies (the United States and the Euro Area) and the use of reserve requirements in emerging markets. Using reserve requirement data for 28 emerging markets from 1998 to 2012 we provide evidence that emerging market central banks tend to raise reserve requirements when interest rates in international funding markets decline or financial inflows accelerate to preserve financial stability. In contrast, when global liquidity risk rises and funding from the large advanced economies dries up emerging markets lower reserve requirements to stabilize the banking system that is in need of liquidity.

Keywords: Reserve Requirements, Interest Rates, Emerging Markets.

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[2] Disclaimer: The findings, interpretations and conclusions are those of the authors and do not necessarily represent the views of the Deutsche Bundesbank.

1. Introduction

The bursting of the dot-com bubble at the turn of the millennium and the current Great Recession have been followed by substantial interest rate cuts in major advanced economies to stabilize financial markets and step-up growth. Not surprisingly, in our integrated global financial system monetary policy reactions in economies with major funding and reserve currencies (the United States and the Euro Area) do not leave the rest of the world unaffected (Portes 2012). In this respect, Borio and Disyatat (2011) suggest that during the 2000s low interest rates in major advanced economies contributed to a rise in gross financial flows, emerging market credit booms and global imbalances. Brana et al. (2012) provide empirical evidence of a relationship between global liquidity and inflation in emerging markets. White (2012) and McKinnon (2011) outline "unintended consequences" from the recent fall of US interest rates towards the zero-bound. Because the US dollar is a major reserve and funding currency low US interest rates and unconventional monetary policy measures can be seen as a driver of de-stabilizing carry trades and asset market bubbles in emerging markets that are likely to be unwound when US interest rates increase again (McKinnon 2011).

While much of the recent literature is concerned with macroeconomic consequences of the low interest rate policies, in this paper we shall focus on the policy reaction by emerging market central banks. In particular, we aim to analyze the link between the interest rate policies in the US and Euro Area and the use of reserve requirements in emerging markets. We argue that (i) in fear of financial inflows and currency appreciation emerging market central banks are inclined to follow the interest rate policy of countries with major funding and reserve currencies. But (ii) if lowering policy rates can itself fuel credit booms and endanger financial stability, required reserves are used as second policy tool. Reserve requirements provide a liquidity buffer for banks, which may be helpful when international funding dries up. Further, if required reserves are remunerated below market rates, they represent a tax on banks (reserve tax) that may increase the bank spread. Lower deposit rates make financial inflows less lucrative. Higher lending interest rates may limit the credit expansion of banks.

To throw some light at the link between the US and Euro Area interest rate policies and the use of reserve requirements in emerging markets we have collected annual reserve requirement and remuneration rate data from 1998 to 2012 for a panel of 28 emerging markets from central bank websites and annual reports. We regressed annual changes in reserve requirements on the relevant funding interest rate and a set of control variables to test the described policy feedback. We then go on to analyze whether reserve requirements are used when financial inflows accelerate. The paper provides evidence that emerging markets tend to lift reserve requirement ratios in response to declines in interest rates in the relevant funding markets to shield against volatile short-term financial inflows. In contrast, reserve requirement ratios seem to be lowered when global liquidity risk rises which makes an unwinding of financial flows likely.

Our finding suggests that emerging market central banks react towards changes in major interest rates or accelerating financial inflows in order to preserve financial stability even at the expense of financial disintermediation. The reserve tax tends to rise along with reserve requirement ratios (albeit to a lesser extent) when international funding conditions improve. Because global lending and emerging market finance has become increasingly dependent on low interest rates and unconventional monetary policies since 2009, a return to orthodox policies in advanced economies bears substantial risks of financial reversals for emerging markets.[3] Therefore, we believe that emerging markets face incentives to implement further measures that may reduce the vulnerability from financial reversals as long as US and Euro Area interest rates remain close to the zero-bound (Sanchez 2013).

The remainder of the paper is organized as follows. In section 2 we review the incentives emerging markets face to follow the monetary policy of large economies with internationally used currencies. Section 3 provides the rationale for the use of reserve requirements in emerging markets. In section 4 we empirically explore the link between interest rate policy in the major economies and the use of (low or unremunerated) reserve requirements in emerging markets. Section 5 concludes.

[3]When Ben Bernanke only announced that he might at some point stop purchasing bonds in May 2013, US bond yields rallied up one percent and world-wide asset markets showed signs of turbulence.

2. Monetary Policy Dependence in Emerging Markets

The US Federal Reserve (Fed) and the European Central Bank (ECB) pursue monetary policies that focus on domestic goals such as inflation, financial stability and growth. But the Fed and ECB also provide the international monetary system with important reserve currencies, namely the dollar and the euro. Therefore, it is likely that the monetary policies of the Fed and ECB affect (the policies of) other economies that hold dollar or euro reserves or use these currencies in transactions (Portes 2012).

The incompatibility of pegged exchange rates, international capital mobility and national monetary policy autonomy is a basic postulate of open economy macroeconomics (impossible trinity). Based on the postulate, emerging markets with pegged exchange rates to the dollar or euro import the monetary policy of the anchor country unless they impose capital controls.

Calvo and Reinhart (2002) shows that most emerging markets are subject to *fear of floating*. Most emerging market central banks - at least softly - peg currencies in one way or another. Appreciation pressure and large exchange rate volatility seem to make independence costly. A rapid appreciation of the nominal exchange rate can endanger growth, go along with a loss in export shares and potentially contribute to unemployment. Building on the paper, e.g. McKinnon and Schnabl (2004) argue that the prospects of macroeconomic stability, the inability to lend long-term in domestic currency (original sin) and the fact that most international trade is invoiced in US dollars provided important rationales for the return to exchange rate stabilization in East Asia in the aftermath of the East Asian crisis.

Based on the impossible trinity postulate, emerging markets with flexible exchange rates such as Poland or Chile should have full autonomy in monetary policy making. Their central banks can target a domestic nominal anchor such as inflation. If, however, the economies that provide the international monetary system with reserve currencies cut interest rates and depreciate currencies, there are incentives for most emerging markets to follow the interest rate policy of the large economies even if exchange rates are not pegged.

Given that most emerging market trade is invoiced in US dollar a strong appreciation of the respective emerging market currency against the US dollar is tantamount to a large exogenous shocks to the terms of trade (Goldberg and Tille 2009). Further, economies with flexible exchange rates may be exposed to the problem of *destabilizing speculation* and buoyant capital inflows if appreciation expectations of the investment currency become self-reinforcing. This was perceived to be a major problem of flexible exchange rates during the inter-war period (Eichengreen 2008). By importing the anchor country's interest rate policy emerging markets can aim to curb volatile cross-border flows and prevent losses due to trade shocks even without foreign exchange interventions.

There may also be a policy-related rationale. Loeffler et al. (2010) show that even emerging market central banks that introduced inflation targeting (e.g. Colombia, Chile, Poland and Czech Republic) can come under pressure to follow the interest rate policy of the major economies if they still hold on to large stocks of foreign reserves. Such central banks (that operate under surplus liquidity) may be forced to stem against the appreciation of the domestic currency with respect to the former reserve currency to prevent a devaluation of its accumulated foreign reserves.[4]

The prospect of central bank losses can affect central bank policy if central banks fear the need to deal with potential losses themselves in the future. Indeed, permanent central bank losses would burden fiscal policy makers when central banks have to be recapitalized. This could undermine the independence of central banks or prevent them from adhering to policy goals (Stella and Lonnberg 2008). To circumvent losses emerging market central banks with floating exchange rates may follow the interest rate policy of the large, former anchor, economy instead of targeting inflation (even if they do not intervene in the foreign exchange market anymore) when the fall in foreign interest rates poses a threat to the central banks' capital bases (Loeffler et al. 2012).

Empirically, e.g., Edwards (2012) provides evidence for a spill-over of changes in Fed policy rates to short-term interest rates for sample of 7 emerging markets in the

[4]Additionally, falling international interest rates can depress the yield on foreign reserves and reduce the seigniorage income.

2000s, a period in which US policy rates were relatively low. His sample includes Brazil, Chile, Colombia, Mexico, Indonesia, the Philippines and Korea, which are all countries with more or less flexible exchange rates. He finds that those emerging market countries were not able to isolate their economies from interest rate shocks in the major funding economy.

3. The Use of Reserve Requirements in Emerging Markets

Because emerging market business cycles seem to have decoupled from those in advanced economies (Kose et al. 2012) following the interest rate policy of central banks in advanced economies in fear of financial inflows or currency appreciation may not be a recipe for long-term financial stability. While the decline in policy rates might indeed discourage cross-border bank flows, it could encourage bank lending at low rates particularly in fast-growing economies. Thus if emerging markets face a situation in which raising policy interest rates to stem against inflation encourages new financial inflows and a reduction of policy rates might fuel credit growth, the use of only one policy tool is insufficient to preserve both monetary and financial stability (Tinbergen 1952).

When financial stability is at stake emerging market central banks face an incentive for the use of capital controls "to limit or redirect capital account transactions" (Neely 1999). Kose et al. (2010) distinguish between direct and indirect controls. Direct controls limit or prohibit capital flows (transaction volumes, license requirements etc.). Indirect controls such as reserve requirements make financial inflows costly.[5] While most emerging market countries have taken steps to integrate into the world economy until the 2007-8 crisis, Reinhart et al. (2011) show that this trend might have come to an end and that a substantial amount of countries have even reintroduced measures to protect from capital in- and outflows.[6]

[5]In advanced economies capital controls were widely dismantled in the years after the break-down of the Bretton Woods system (Eichengreen 2008). In contrast, many emerging market economies never fully dismantled capital controls and kept on using reserve requirements. China, for instance, builds up a tight wall against capital flows to directly limits inflows (Klein 2012, Jeanne 2012).

[6]The most recent calculation of the Chinn-Ito Index also suggests a return to financial market restrictions in many, particularly, emerging market countries (e.g. in Latin America).

In this paper we focus on the use of reserve requirements as a tool to preserve financial stability. (i) Reserve requirements can serve as a liquidity buffer. In the face of financial inflows they may be used to absorb abundant liquidity from the banking system. If financial flows reverse, reserve requirements can be lowered to free up liquidity again to stabilize financial markets. (ii) If reserve requirements are remunerated below market rates, they serve as a tax on financial intermediation and tend to have an impact on bank deposit and lending interest rates. Lower deposit interest rates discourage financial inflows in the first place.[7] Higher lending interest rates may dampen the credit cycle (Reinhart and Reinhart 1999).

The (reserve) tax incidence falls on bank customers with poor substitutes for banking products. If borrowers have access to other forms of financing and deposits are the only option for savers, banks will forward the tax burden to depositors by offering lower deposit interest rates. By contrast, banks tend to lift lending interest rates if the banking system faces competition for funds but has some market power over borrowers.[8]

Previous research suggests that reserve requirements can in fact help stabilize emerging market economies as they protect from currency appreciation and the vulnerability from rapid depreciation shocks (Edwards and Rigobon 2009, Stiglitz 2000). Forbes et al. (2012) show for Brazil that already the signal of raising reserve requirements has had a large impact in preventing speculative financial inflows by depressing expectations. Since the Great Recession, especially researchers that are connected to the International Monetary Fund (IMF) highlight the usefulness of capital controls - and reserve requirements in particular - in promoting financial and monetary stability (Korinek 2011, Lim et al. 2011, Jeanne 2012, Ostry et al. 2011, 2012, Tovar et al. 2012).[9]

[7] For instance, in the 1990s "Chile's system of unremunerated reserve requirements was equivalent to a tax on capital inflows" (Edwards and Rigobon 2009).

[8] Now, in countries with developed financial markets customers can (easily) circumvent the reserve tax, e.g. by substituting bank finance with stock market finance. In such markets reserve requirements may have adverse effects (besides the increase in the bank spread) by giving an incentive of moving banking activities into the shadow banking system.

[9] Also, e.g., the Bank of International Settlements (BIS) has set up a Committee on the Global Financial System (2012) to intensify research efforts on the transmission and efficiency of macroprudential tools including reserve requirements.

Several authors suggest that there is a link of the use of reserve requirements and world funding rates. For instance Klein (2012) argues that a number of emerging market countries made use of reserve requirements to shield against capital flows following the bursting of the dot-com bubble, when funding interest rates were low. Jara et al. (2009) document that reserve requirements in many Latin American countries were reduced in 2008 to free up liquidity in response to the withdrawal of capital from emerging markets. Since the global financial crisis, emerging market countries (such as Turkey, Poland or Brazil) are argued to have raised reserve requirements to curb speculative financial inflows and kill off inflationary pressure (Klein 2012, Jeanne 2012, Reinhart et al. 2011).[10]

4. US and Euro Area Interest Rate Policy and the Use of Reserve Requirements in Emerging Markets

4.1. Data Description and Empirical Model

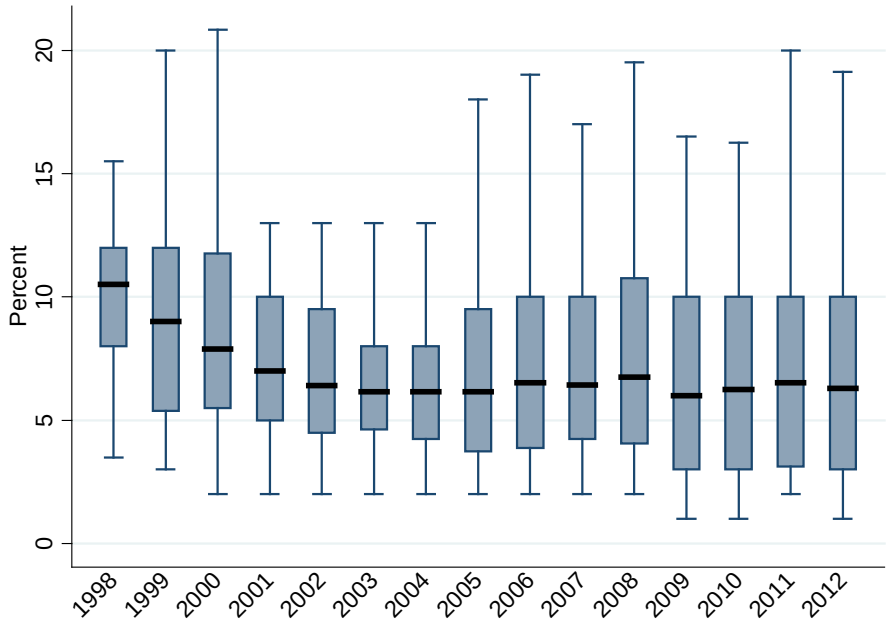
To empirically examine the link between the use of reserve requirements and changes in the world funding rates and liquidity conditions we collect annual reserve requirement and remuneration rate data (from 1998 to 2012) for a sample of 28 emerging market countries from central bank websites, annual reports, documents on banking regulations, press releases and the surveys on bank regulation and supervision from the World Bank.[11] The sample includes 13 Central and Eastern European countries (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia and Slovenia), 10 Asian economies (China, Indonesia, Korea, Malaysia, the Philippines, Russia, Singapore, Taiwan, Thailand and Turkey) and 5 Latin American countries (Bolivia, Brazil, Chile, Colombia and Peru).

[10] According to the IMF (2012), there is no clear relation between, e.g., unconventional US monetary policy and a pick-up of portfolio flows to emerging markets. However, the BIS's consolidated banking statistics signals a rapid increase in foreign claims of US headquartered banks following the financial crisis of 2007-8. The development of such bank flows is more relevant for this paper as they are more likely to affect credit growth and endanger financial stability than equity flows (Forbes and Warnock 2012, Lane and McQuade 2012).

[11] For a description of the survey database see Barth et al. (2001).

Figure 1 plots the annual average (medians) of the reserve requirement ratios (in percent) for our country sample. We see that reserve requirement ratios are an actively used policy tool. The ratios were reduced until 2002 and raised from 2003 to 2007. Reserve requirement ratios fell again during the panic of 2008. But after 2008 they have been lifted again.

Figure 1: Average Reserve Requirements

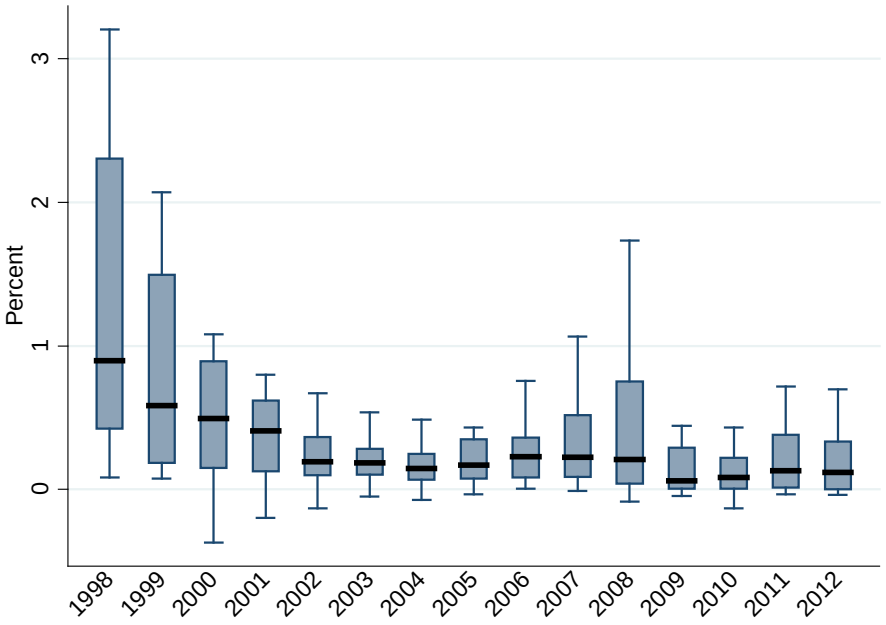


Note: Outside values (1.5 of IQR) are not displayed.
Data Source: Central bank websites, press releases and annual reports, and the World Bank Survey on Banking Regulation. In the case of a differentiated reserve requirement system, the reserve requirement ratio is calculated as average of the legal reserve requirement ratios.

Next, we use the remuneration rate data for required reserves to calculate the so-called reserve tax that shall be used as alternative policy variable. The reserve tax represents the opportunity cost of holding required reserves at the central bank. Consequently, if the remuneration rate for required reserves equals the domestic market interest rate, the reserve tax is zero. We use short-term market rates, either 3-month treasury or 3-month money market rates, from the IMF's International Financial Statistics (IFS), Haver Analytics or national sources for each emerging market economy and calculate the reserve tax by multiplying the respective reserve requirement ratio with the gap between the market interest rate and the remuneration rate for required reserves.[12] Figure 2 plots the reserve tax for our sample.

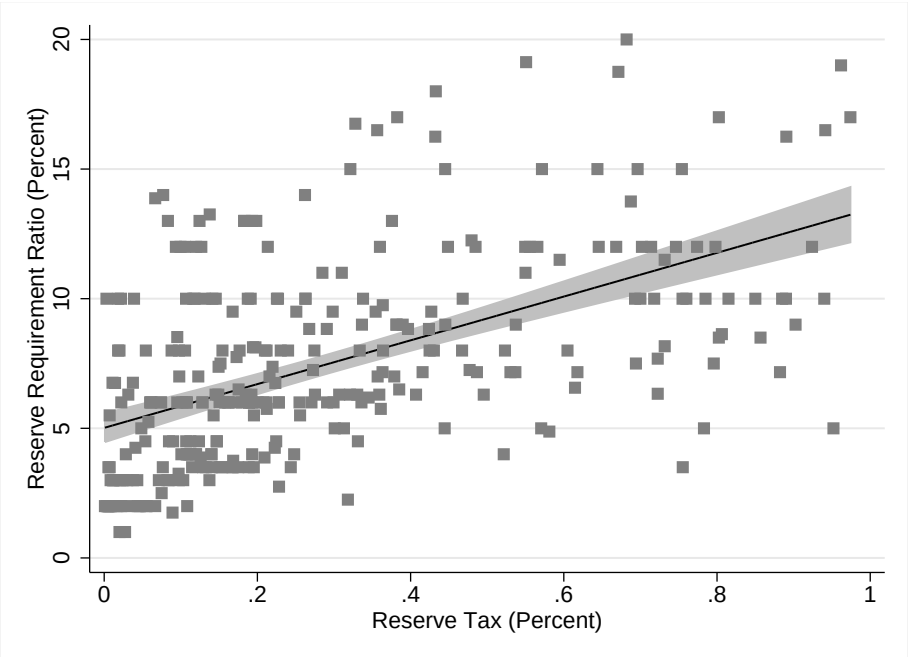
[12]If neither treasury nor money market rates were available we used an average of lending and deposit interest rates.

Figure 2: Average Reserve Tax



Note: Outside values (1.5 of IQR) are not displayed.
Data Source: IFS, Haver Analytics and central bank websites, press releases and annual reports, and the World Bank Survey on Banking Regulation.

Figure 3: Correlation of Reserve Requirement Ratios and Reserve Tax



The reserve tax and reserve requirement ratios are correlated (by construction) as illustrated in Figure 3. The reserve tax increases because, e.g., an increase of the reserve requirement ratio outweighs a drop of the domestic interest rate (which reduces the market rate - remuneration rate gap).

For our analysis we regress the year-over-year change of the reserve requirement ratio or the reserve tax on variables that capture foreign funding conditions (or, alternatively, financial inflows that can render emerging markets unstable.) The regression takes the form

$$(1) \quad (R_{i,t} - R_{i,t-1}) = \alpha_0 + \alpha_1 R_{i,t-1} + \alpha_2 L_{i,t} + \alpha_3 X_{i,t} + \epsilon_{i,t},$$

where the subscript i denotes the country and the subscript t the time period. R is the reserve requirement ratio or (alternatively) the reserve tax.

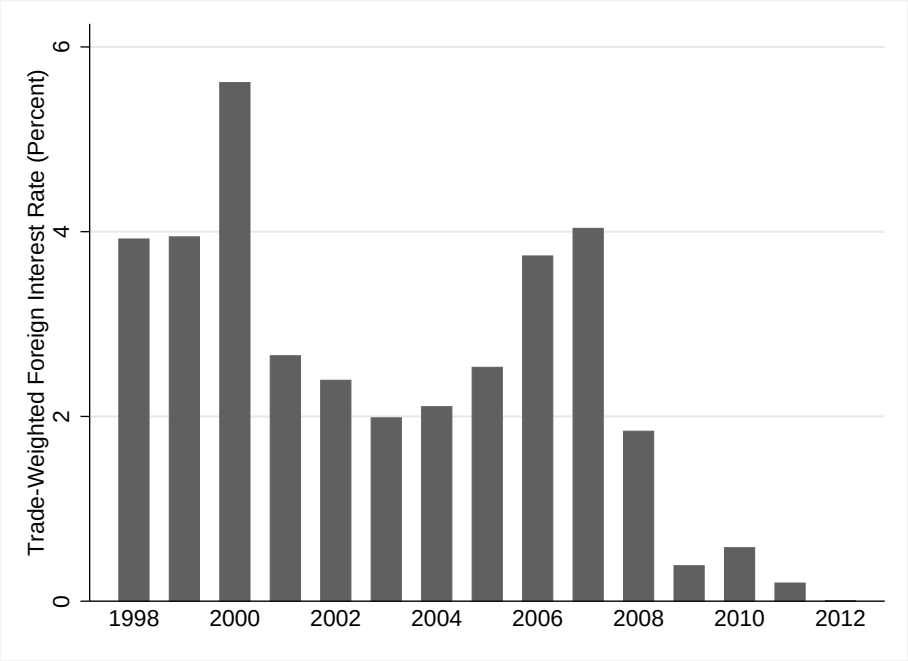
The explanatory variables include a constant α_0, a lag of the reserve requirement ratio (or reserve tax)($R_{i,t-1}$) to include a measure for financial development, the vector $L_{i,t}$ which includes variables that measure foreign funding conditions and some other variables that central banks may take into account in their policy decisions ($X_{i,t}$).

$L_{i,t}$ contains our variables of interest. We include two measures that represent foreign funding and liquidity conditions. (i) Because the US dollar and the euro are the most important world reserve and funding currencies we collect US and Euro Area interest rate data from the IMF's IFS. Because many countries have seen changes in EMU/US trade shares and in foreign reserve composition over time we construct a trade-weighted funding interest rate for each country based on the relative trade share with the US and Euro Area. Trade shares are taken from the IMF's Directions of Trade Statistics (DOTS).[13] Figure 4 plots the average (median) of the trade-weighted funding rate. In the regression we use changes of foreign funding rates. (ii) As common in the literature we also include the CBOE's VIX (y-o-y changes) as a measure of global liquidity risk to control for world funding conditions that are not (directly) related to the interest rate policy of the Fed and ECB (Brunnermeier

[13]The results do not depend on the use of the trade-weighted funding interest rate.

et al. 2009). When global liquidity risk rises and funding conditions in international markets worsen due to an increase of risk aversion we expect that central banks in emerging markets free up liquidity for the banking system by lowering reserve requirement ratios or the reserve tax.

Figure 4: Average Foreign Funding Interest Rate



Note: Median of 28 countries.

$X_{i,t}$ is the vector of control variables. Previous literature suggests that reserve requirements may complement the interest rate tool in small open economies when financial stability is a concern of central banks (Vargas and Cardozo 2012, Tovar et al. 2012, Glocker and Towbin 2012). Therefore, we include variables usually found in monetary policy reaction functions. Following Clarida et al. (1998) these variables are inflation expectations[14], the output gap and potentially exchange rate changes. We take inflation rates, annual real GDP growth rates from the World Bank's World Development Indicator, and exchange rates (used in log changes) from the IMF's IFS. We use real GDP growth rates to calculate output gaps as deviations of growth from its HP-filtered trend. Table 1 provides the summary statistics of our data.

[14]We do not have this variable. Therefore, as frequently done in the literature that estimates monetary policy rules we use the 1-year ahead inflation rate as approximation (assuming rationale expectations).

Table 1: Country Data: Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Reserve Requirement Ratio	384	8.288	5.993	1.000	36.667
Δ Reserve Requirement Ratio	376	-0.281	1.555	-13.750	7.875
Reserve Tax	374	0.477	1.011	-0.371	11.455
Δ Reserve Tax	364	-0.097	0.508	-4.887	1.726
Foreign Interest Rate	402	2.336	1.662	-0.009	6.400
Δ Foreign Interest Rate	402	-0.307	1.171	-4.58	2
Inflation	402	4.430	3.427	-1.410	18.680
Growth	402	4.077	3.963	-17.960	14.780
Exchange Rate Change	402	0.579	7.613	-18.362	44.663

Note: All variables in percent.

The use of a lagged dependent variable is likely to produce biased OLS estimates. Furthermore, the use of a panel data set comprising 28 countries from different regions suggests that it may make sense to choose a fixed effects model to take into account potential heterogeneity between countries. In fixed effects models the use of a lagged dependent variable would cause coefficient estimates to be biased unless the sample size is very large (Nickell 1981). The lagged policy variable might be correlated with the country specific fixed effect as it differs more across the cross-section than over time.

To account for potential heterogeneity of countries and control for endogeneity and heteroscedasticity of explanatory variables (lagged dependent variable, future inflation, output gap, exchange rate changes and liquidity risk) we estimate our equation using the system GMM estimator following Arellano and Bover (1995) and Blundell and Bond (1998). Using the system GMM method we estimate both a first-differenced equation that removes the fixed effect and the original equation in levels to make use of the information of variables with high cross-sectional variation but low variation over time. System GMM extracts lags of the explanatory variables as instruments (both differenced and in levels) to deal with potential endogeneity problems. Following Roodman (2009a) we restrict and "collapse" instruments to prevent overfitting our endogenous variables by the use of too many instruments.

4.2. Foreign Funding Conditions and the Use of Reserve Requirements

We begin our analysis by regressing the absolute year-over-year change in reserve requirement ratios (Δ RR-Ratio) on our explanatory variables. Table 2 presents our main estimation results.[15]

Column 1 in Table 2 shows that a fall of the relevant foreign interest rate is associated with an increase of the reserve requirement ratios with respect to the previous year. The coefficients on our other explanatory variables have the expected signs (even though they are not always significant at commonly used levels). The positive coefficient on inflation and the output gap signals that a rise in inflation expectations or the output gap is followed by more restrictive reserve policies. Reserve requirements seem to be used in an anticyclical fashion, perhaps to lean against the wind, and complement the interest rate as policy tool. The negative coefficient on exchange rate changes suggests that currency appreciation tends to contribute to a tightening of policy.

Second, we add changes of liquidity risk to our model (ΔVIX). In Column 2 of Table 2 we can see that the coefficient on foreign interest rates remains stable and significant. As expected, a rise in global liquidity risk goes along with a reduction of reserve requirement ratios.

In Columns 3 and 4 we present the results for the use of the absolute year-over-year change of the reserve tax (Δ RR-Tax) as alternative policy variable. Column 3 in Table 2 shows that the a fall of the respective foreign interest rates is associated with a rise of the reserve tax relative to the previous year. The policy feedback is highly significant. Using the reserve tax also the coefficient on output gap turns out positive and significant.

It is noteworthy that the impact of foreign interest rates on the change in reserve requirements is by and large similar to the impact on the reserve tax. The increase

[15]Our results are robust to different sets of instruments (e.g. without "collapsing" and making use of all information). Further we checked whether the exchange rate regime has explanatory power for the use of reserve requirements but could not find a significant impact. We also added changes in terms of trades (taken from the World Development Indicators). They enter the regression with a positive sign but leave our results unchanged.

Table 2: Reserve Requirements and Foreign Funding Conditions (1998-2012)

Variables	Δ RR-Ratio		Δ Reserve Tax	
(Standard errors in parentheses)	(1)	(2)	(3)	(4)
Lagged Dependent Variable				
Lag RR-Ratio	-0.145***	-0.111***	-	-
	(0.039)	(0.024)	-	-
Lag Reserve Tax	-	-	-0.282***	-0.289***
	-	-	(0.022)	(0.020)
Foreign Funding Conditions				
Δ Foreign Interest Rate	-0.135**	-0.126*	-0.162*	-0.098**
	(0.054)	(0.075)	(0.088)	(0.039)
Δ VIX	-	-0.007	-	-0.006**
	-	(0.016)	-	(0.003)
Controls				
Output Gap	0.062	0.038	0.033*	0.021
	(0.042)	(0.034)	(0.018)	(0.017)
Inflation (t+1)	0.110	0.102**	0.097	0.038
	(0.090)	(0.046)	(0.077)	(0.023)
Exchange Rate Change	-0.008	-0.013	-0.028**	-0.011*
	(0.025)	(0.027)	(0.012)	(0.006)
Estimation	GMM	GMM	GMM	GMM
Observations	344	344	334	334
Countries	28	28	28	28
No. instruments	21	26	21	26
AR2 test	0.179	0.162	0.442	0.577
Sargan test	0.393	0.473	0.356	0.589

Note: System GMM estimation using the Stata program xtabond2 written by Roodman (2009b); Robust standard errors in parentheses; Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

of the reserve requirement ratios outweighs the fall of the market rates relative to remuneration rates. Adding changes in global liquidity risk (ΔVIX) to the regressions does not qualitatively change our results. But central banks seem to address changes in global funding conditions. When global funding conditions worsen as liquidity risk in global markets rises ($\Delta VIX > 0$) emerging market central bankers seem to lower the reserve requirement ratio, perhaps to support their domestic banking sector by freeing up liquidity when global banks withdraw funds.

4.3. Financial Inflows and the Use of Reserve Requirements

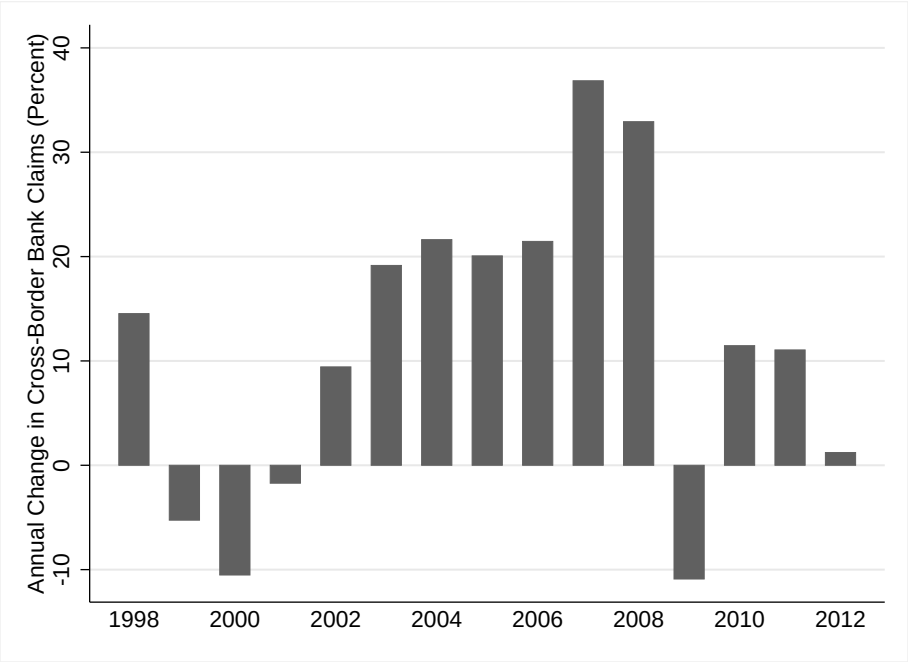
Lifting reserve requirements in response to a drop in foreign funding rates may be reasonable if countries fear currency appreciation and want to reduce the incentive for domestic banks to borrow from abroad. But as such prudential policy is hard to implement, it is likely that central banks react when international lending picks up[16] and reserve requirements are used to absorb abundant liquidity from the banking sector. To test this we augment our regression framework and directly take into account financial flows.

We use the development of gross financial inflows rather than the current account balance (which is a net measure and comprises debt and equity flows) as a proxy of financial flows for two reasons. (i) Financial globalization may affect credit growth even in countries that do not have current account deficits when emerging market banks are able to fund themselves in global markets (Borio and Disyatat 2011, Lane and McQuade 2012). (ii) Especially debt-led financial inflows are considered to be drivers of credit booms and episodes of severe capital flow volatility (Forbes and Warnock 2012, Lane and McQuade 2012). Data on cross-border bank flows is taken from the BIS Locational Banking Statistics. We construct annual averages of the quarterly data on outstanding foreign claims to include y-o-y changes in percent in our regression analysis. Figure 5 signals that the level of outstanding foreign bank claims can rise and fall strongly on a year over year basis.

Following the "carry trade literature" a rise of the interest differential is assumed to increase (ex-post) carry trade returns which are often considered a proxy for speculative financial flows (Brunnermeier et al. 2009, Hoffmann 2012). We use the interest differential as alternative variable in the regression as it captures both push (e.g. foreign interest rates) and pull factors (domestic macroeconomic conditions) of capital flows. The higher the differential the lower the funding interest rate and/or the more favorable the investment opportunities in emerging markets. Table 3 shows the summary statistics for the two measures.

[16]Using annual reserve requirement data we cannot address the timing issue in this paper. But as argued we believe that central banks do both: they try to prevent flows in the first place if possible, otherwise they react to inflows.

Figure 5: Debt-Flows Relative to Total Foreign Claims



Note: Median of 28 countries.

Table 3: Foreign Bank Claims and Interest Rate Differential: Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Δ Foreign Bank Claims	401	15.8	32.869	-71.602	191.864
Interest Differential	394	3.343	4.470	-4.044	27.319

Note: Variables in percent.

As above, we regress the y-o-y changes in reserve requirement ratios and the reserve tax on our proxies for financial flows and the vector of control variables (as in equation 1). Table 4 provides the results. The signs of the estimated coefficients on inflation expectations, the output gap and exchange rate changes are widely robust to previous results. Turning our attention to the proxies of financial flows, Column 1 of Table 4 suggests that a rise in foreign bank claims by 100 percent with respect to the previous year would bring about an increase of the reserve requirement ratio of 1.6 percent. The reserve tax would react as well, but only rise by 0.5 percent (Column 3).[17]

We further find that emerging market central banks do not only react to an easing in foreign funding rates but also to a rise of the interest rate differential (see

[17]Not surprisingly, the use of net debt flows would also enter the regression with a positive sign.

Table 4: Reserve Requirements and Financial Flows (1998-2012)

Variables	Δ RR-Ratio		Δ Reserve Tax	
(Standard errors in parentheses)	(1)	(2)	(3)	(4)
Lagged Dependent Variable				
Lag RR-Ratio	-0.169***	-0.230***	-	-
	(0.052)	(0.075)	-	-
Lag Reserve Tax	-	-	-0.301***	-0.501***
	-	-	(0.016)	(0.045)
Financial Flows				
Financial Inflows	0.016**	-	0.005*	-
	(0.007)	-	(0.003)	-
Interest Rate Differential	-	0.222***	-	0.112***
	-	(0.085)	-	(0.037)
Controls				
Output Gap	0.006	0.037	0.019	0.030***
	(0.049)	(0.038)	(0.021)	(0.011)
Inflation (t+1)	0.144	0.125	0.026**	0.003
	(0.095)	(0.097)	(0.012)	(0.876)
Exchange Rate Change	0.002	-0.041	-0.002	-0.013***
	(0.022)	(0.026)	(0.004)	(0.004)
Estimation	GMM	GMM	GMM	GMM
Observations	344	337	334	334
Countries	28	28	28	28
No. instruments	21	26	21	26
AR2 test	0.094	0.209	0.551	0.314
Sargan test	0.150	0.455	0.379	0.227

Note: System GMM estimation using the Stata program xtabond2 written by Roodman (2009b); Robust standard errors in parentheses; Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

column 2 and 4). As we consider the interest rate differential as an indicator for the attractiveness of financial flows to emerging markets, the positive and significant coefficient on the interest differential may indicate that emerging market central banks aim to (partially) conduct an autonomous monetary policy by setting higher interest rates than in the reserve currency region (reflecting domestic macroeconomic conditions) but using reserve requirements as second policy instrument to safeguard financial stability.

5. Conclusion

In this paper we have thrown light at the link between US and Euro Area monetary policy and the use of reserve requirements in emerging markets. We have argued that fast-growing emerging markets cannot simply follow the low interest rate policy of major economies when they fear financial inflows or currency appreciation. Instead, central banks have incentives to use reserve requirements as additional tool to prevent an overheating of the economy and promote financial stability.

Using reserve requirement data for 28 emerging markets from 1998 to 2012 we have provided evidence that emerging markets tend to raise reserve requirements when interest rates in the US or Euro Area decline or financial inflows accelerate. In contrast, we have found that when global liquidity risk rises and funding from the large advanced economies dries up emerging markets lower reserve requirements to stabilize the banking system that is in need of liquidity.

Our findings suggest that the use of reserve requirements complements the interest rate as policy tool. Further, emerging market central banks react towards changes in major interest rates in order to preserve financial stability even at the expense of financial disintermediation. We found that the reserve tax rose along with reserve requirement ratios (albeit maybe to a lesser extent) when international funding conditions improve.

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