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Floating with a Load of FX Debt?

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Abstract

Countries with *de jure* floating exchange rate regimes are often reluctant to allow their currencies to float freely in practice. One reason why countries may wish to limit exchange rate volatility is potential negative balance sheet effects due to currency mismatches on the balance sheets of firms and households. In this paper, we show in a sample of 15 emerging market economies that countries with large foreign exchange (FX) debt in the non-financial private sector tend to react more strongly to exchange rate changes using both FX interventions and monetary policy. Thus, our results support the idea that an important source of "fear of floating" is balance sheet currency mismatches. This effect is asymmetric; that is, countries stem depreciation but not appreciation pressure. Moreover, FX debt financed through the domestic banking system is more important for fear of floating than FX debt obtained directly from external sources.

JEL Classification Numbers: F31, F34, E58

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I. INTRODUCTION

Many emerging markets are reluctant to let their currencies float. Even when *de jure* they announce themselves as having a floating exchange rate regime, *de facto* they are not allowing their exchange rates to move freely. One explanation why countries may fear to let their exchange rates float is a negative influence of exchange rate volatility on corporate and/or household balance sheets. When they borrow in foreign currency while receiving income in local currency, exchange rate depreciation may lead to a sharp rise in debt-service costs, bankruptcies, and disruption of investment and consumption demand. Corporate and household sector distress can further spill over to the financial sector generating deeper financial instability, in particular, if the foreign currency exposures have been financed by the domestic banking system. The issue of large foreign currency debt accumulation is especially important for emerging markets as they are usually less able to borrow abroad in their domestic currency than advanced economies. The problem is amplified by lack or high costs of hedging, especially for households and small and medium size firms. In addition, moral hazard could amplify the problem as households, companies, and banks that expect to be bailed out – directly by governments or indirectly by central bank policies aimed to curb depreciation pressures – do not internalize their risks and may borrow more in foreign currency.

There is a vast theoretical and empirical literature that focuses on whether and how countries react to movements in exchange rates. Calvo and Reinhart (2002) analyze the behavior of exchange rates, foreign exchange reserves, and interest rates across different exchange rate arrangements and find that countries that claim they are floating are often not. Many emerging market countries seem to be using interest rates and FX market interventions to stabilize exchange rates. Using domestic interest rates and FX interventions to stabilize exchange rates could be due of lack of credibility, high pass-through from exchange rates to prices, or negative balance sheet effects from exchange rate movements. The last channel is the focus of this paper.

In our paper we assess whether countries with high FX debt of non-financial firms and households tend to react more strongly to changes in exchange rates assuming that the decision to borrow in FX is exogenous. We rely on a set of 15 emerging market countries[1] using monthly data for 2002-15. We look at two instruments that can be used to manage exchange rates – adjustment of policy rates and FX interventions using central bank FX reserves – and analyze whether the level of FX debt affects the sensitivity of these instruments to changes in exchange rates.

The paper relates to literature that explores the effect of the currency denomination of debt on exchange rate behavior. Liability dollarization is considered to be one of the factors that cause central banks to care about exchange rate stability. Hausmann, Panizza and Stein (2000), Harms and Hoffmann (2011) and Honig (2005) among others show that liability

[1] The countries in our sample are: Brazil, Chile, Colombia, Georgia, Hungary, Indonesia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey.

dollarization plays a central role in producing fear of floating. The first two papers use the choice of exchange rate regime as a dependent variable and Honig (2005) explores the influence of the ability to borrow internationally in local currency on exchange rate volatility relative to the volatility of policy instruments. Devereux and Lane (2003) suggest that for developing economies bilateral exchange rate volatility is strongly negatively affected by the stock of external debt, while for industrial countries external debt is not significant in explaining exchange rate movements. In this paper, however, we take exchange rate behavior as given and focus on central bank policies.

Our paper is also closely related to a number of empirical and theoretical studies on the use of different policy instruments to stabilize exchange rates. For this purpose central banks can use monetary policy rates and FX interventions as well as less conventional instruments such as capital controls or exchange rate-linked instruments. Benes et al. (2011) gives theoretical justifications for including sterilized interventions as an additional central bank instrument alongside the Taylor rule and find that there can be advantages for combining inflation targeting with some degree of exchange rate management. Mohanty and Klau (2004), Filosa (2001), Roger, Restrepo, and Garcia (2009), among others, claim that central banks strongly respond to exchange rate movements. Roger, Restrepo, and Garcia (2009) argue that for financially-vulnerable emerging market economies, some exchange rate smoothing is beneficial, largely reflecting perverse effects of demand shocks on exchange rate movements. Adler et al. (2015), Blanchard et al. (2015), Adler and Tovar (2011), etc. suggest that (sterilized) FX interventions are effective in affecting exchange rates. The effectiveness depends on the depth of the financial market (Adler et al., 2015) and it decreases rapidly with the degree of capital account openness (Adler and Tovar, 2011). In our paper we look at how policies (policy rates and FX interventions) react to exchange rate changes allowing the variation of responses to differ with non-financial private sector FX debt.

Other literature focuses on how exchange regime choice and central bank policies may influence agents' borrowing behavior. Arteta (2003) suggests that floating exchange rate regimes exacerbate currency mismatches in domestic financial intermediation as those regimes seem to encourage deposit dollarization more strongly than they encourage matching via credit dollarization. On the contrary, Kamil (2012), using firm level data, finds that after countries switch from pegged to floating exchange rate regimes, firms decrease their levels of foreign currency exposures by reducing the share of debt contracted in foreign currency and matching more systematically their foreign currency liabilities with assets denominated in foreign currency and export revenues. Two-way causality is addressed by Chang and Velasco (2006) and Chamon and Hausmann (2005). In Chang and Velasco (2006) residents choose in which currency to borrow and the central bank, in turn, chooses exchange rate regime. Fear of floating emerges endogenously and in association with a currency mismatch in assets and liabilities. At the same time, the choice of currency to borrow in depends on the residents' expectations regarding the central bank's policy. Both fixed and floating exchange rate regimes can be equilibrium, while the latter is Pareto-efficient. Empirically, Berkmen and Cavallo (2009) confirm that countries with high liability dollarization (external, public, or financial) tend to be more actively involved in exchange rate stabilization operations. However, their results suggest that there is no evidence that floating, by itself, promotes de-dollarization. Throughout the paper, we treat FX debt as exogenous and do not directly

account for potential endogeneity of FX debt. However, we discuss why we believe the results should be robust to potential endogeneity of FX debt.

Our paper contributes to the existing literature in a number of dimensions. First, we focus on the influence of private sector FX exposures and account directly for externally and domestically financed FX borrowing, whereas most papers look either at banks' liability dollarization or the total FX debt of the country. This allows us to reach specific conclusions about which forms of FX debt matter more for the use of FX interventions and monetary policy rates and draw relevant policy conclusions from our findings. Second, we distinguish between the effects of appreciation and depreciation of exchange rates assuming that currency depreciation may threaten financial stability due to balance sheet effects while currency appreciation may negatively influence export performance.

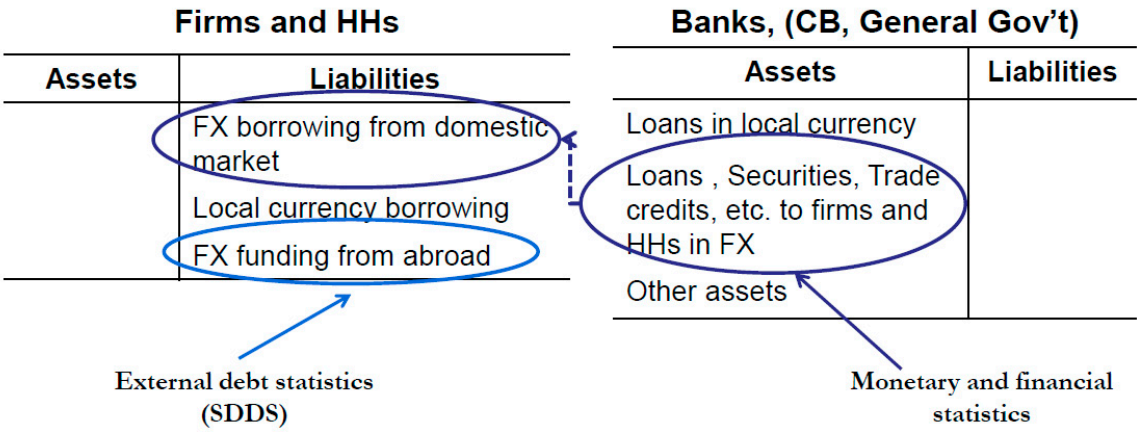
Our findings suggest that countries with large FX debt in the non-financial private sector tend to react more strongly to exchange rate changes using both FX interventions and monetary policy rates. The results are driven mainly by reactions to depreciation of exchange rates and we find that FX debt in the non-financial private sector from *domestic* sources is a more important driver of central bank policies than the debt obtained directly from abroad. The importance of FX debt in inhibiting central banks from allowing exchange rates to move freely implies that monetary policy could be overburdened by multiple goals. Policies should focus on limiting FX lending by the domestic banking system to ensure that monetary policy can work effectively.

The rest of the paper is organized as follows: In section II, we present the data and stylized facts about FX exposures, section III discusses empirical methodology, section IV presents our main results, in section V we perform a number of robustness checks and extensions, and section VI concludes.

II. STYLIZED FACTS ABOUT FX EXPOSURES

While balance sheet currency mismatches may appear in all sectors, in this paper we focus on the non-financial private sector (households and non-financial companies). Outright net open FX positions in the financial sector and government FX exposure are thus excluded. Banks in floating exchange rate regimes are likely to either keep a balance between their FX assets and liabilities or at least hedge on-balance sheet open positions through off-balance sheet operations. Government FX exposure, while being important for the public sector risk, is assumed not to be taken into account by the monetary authority as this can less easily be justified within a typical central bank mandate of maintaining price and financial stability. However, as section V shows, the results are robust if the scope is broadened to include the FX debt of banks and government.

We consider two sources of FX exposure of the non-financial private sector. The first is the borrowing directly from abroad, which we obtain from external debt statistics. The second is the FX lending from the financial sector – funded mainly through banks' borrowing abroad (in FX) as intermediaries of capital inflows or from accepting local FX deposits (deposit dollarization). We obtain this data from the IMF Monetary and Financial Statistics.



* Based on Advancing the Work on Foreign Currency Exposures (IMF, 2015)

Our sample includes 15 emerging market countries with floating exchange rates.[2] We use monthly data for the period 2002-15 (subject to data availability). A full description of the variables and data sources as well as summary statistics is presented in the Appendix.

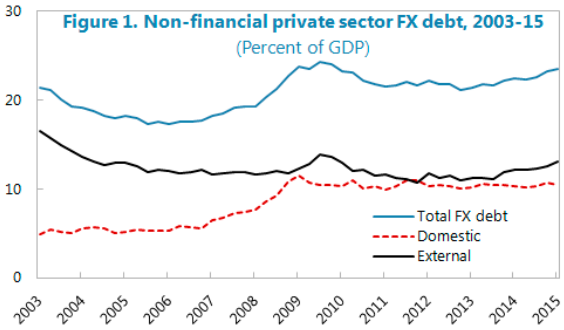
We use the change in the net foreign asset (NFA) position of the central bank in percent of GDP as proxy for FX interventions. As a robustness check we clean this measure for valuation effects. In addition, we use other proxies such as the change in official reserves minus gold in percent of GDP and the change in NFA relative to M2. For the policy rate we use the interbank rates, where possible, and short term government bond yields in the remaining cases.[3]

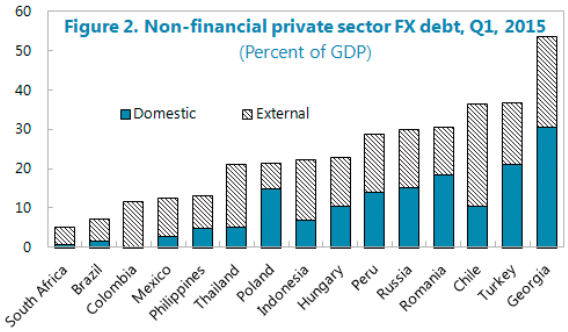
The average FX exposure of the countries in our sample increased during the global financial crisis to almost 25 percent of GDP on average from less than 20 percent before the crisis (Figure 1). Since then it has remained constant at 20-25 percent of GDP. The domestic part of FX debt increased over the observed period. In 2003, FX exposures from the domestic banking system only accounted for about ¼ of total FX exposures; since 2009 domestic and external FX debt has been roughly of the same size. Countries have not managed to bring down the overall FX exposures of the non-financial private sector and in many countries the exposures are large enough that exchange rate volatility (depreciations in particular) can have significant implications for corporate and household balance sheets. As shown in Figure 2, the size of FX exposures varies widely across countries from less than 5 percent of GDP to over 50 percent of GDP. In addition, the composition varies across countries. For some, the FX debt is almost exclusively a result of borrowing directly from abroad whereas for many

[2] We include countries that are classified as "emerging market and developing countries" in the April 2015 World Economic Outlook. In addition, the choice of countries into the final sample is restricted to those which have data for both domestic and external debt of the non-financial private sector.

[3] We also use the actual official monetary policy rates of the countries as dependent variables. However, for countries where the monetary policy framework is not based on only one policy rate to affect market rates (e.g. Turkey) but instead on several policy rates, we use market rates as a better indication of the monetary stance.

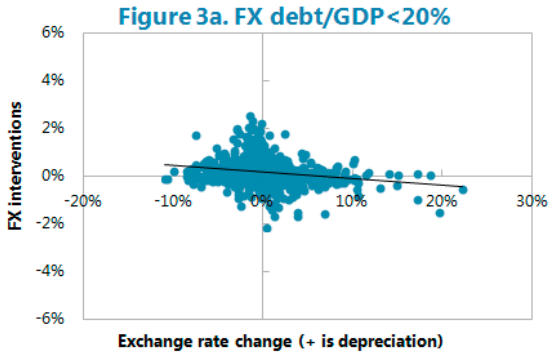
of the countries with large FX exposures, most of it is financed from domestic sources. Finally, the data shows that external FX debt shows less cross-country variation than domestic FX debt.

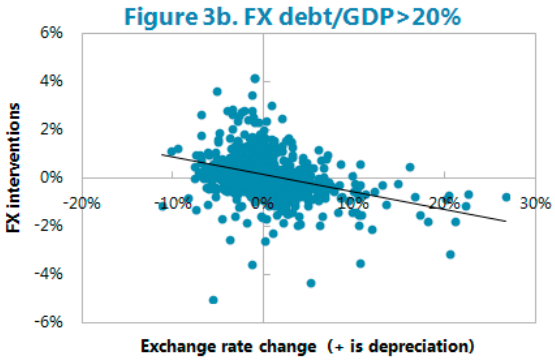




In countries with large FX exposures there is a stronger correlation between FX interventions and exchange rate changes. This is shown in Figure 3, where exchange rate changes are plotted against FX interventions (defined as the change in central bank net foreign assets as a proxy) using monthly data from 2002-15 for 15 countries. Splitting the sample into high FX exposure observations (more than 20 percent of GDP total FX exposure for a given country at a specific time)[4], FX interventions are generally larger when FX exposures in the non-financial private sector are large. Moreover, interventions are more negatively correlated when FX exposure is large. This correlation is driven by selling FX in the market when the currency depreciates rather than by buying FX during appreciation episodes.

Figure 3. Exchange Rate Changes and FX Interventions

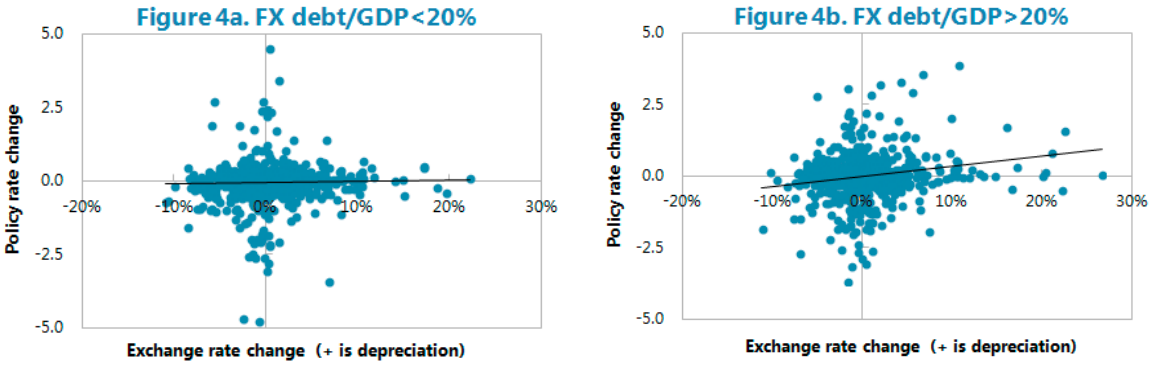




For policy rates, Figure 4 shows that in countries with low FX exposures policy rate changes are smaller than in countries with high FX exposures and the largest exchange rate depreciations occur in highly-FX-indebted countries with the correlation being more positive in these countries.

[4] The 20 percent threshold is chosen because roughly half of the observations fall in each group. The results are robust to the choice of the threshold.

Figure 4. Exchange Rate Changes and Policy Rates



If countries with large FX exposures are more reluctant to allow the exchange rate to float freely, this would manifest itself in more volatile reserves and interest rates (as they use these instruments more actively to try to stabilize exchange rates). Calvo and Reinhart (2002) show for a large sample of countries that many of them exhibit fear of floating. They find that their volatility in reserves and interest rates is generally higher than for the most free floating exchange rate regimes (such as the US, Japan, and Australia) and that the exchange rate volatility is lower. Following this approach, we calculate the fraction of months where changes in exchange rates, reserves, and interest rates exceed a certain threshold.[5] Countries with higher FX exposure show higher volatility in reserves and policy rates. However, exchange rate changes are not lower in these countries. This could indicate that countries with high FX exposures face larger exchange rate pressure. So despite their attempts to limit exchange rate volatility they experience as large exchange rate changes as countries that intervene less. When calculating two different intervention indexes, the results are confirmed. Countries with higher FX exposures show a higher degree of exchange rate management even though their official exchange rate regime is floating.

	High FX Debt (>20% of GDP)	**Low FX Debt (<20% of GDP)**
% of cases	51%	49%
ΔER (>2.5%)	36%	35%
ΔIR (>0.5 pp)	22%	14%
ΔNFA (>0.5% of GDP)	38%	21%
Intervention index 1	17%	14%
Intervention index 2	30%	20%

Note: Int. index 1 = $\Delta NFA^2/(\Delta NFA^2+\Delta ER^2)$; Int. index 2 = (ΔIR or ΔNFA/GDP > threshold and ΔER < threshold). Both indexes are high if exchange rate intervention is high.

[5] We use thresholds of 2.5 percent for exchange rates, 0.5 percentage points for policy rates, and 0.5 percent of GDP for changes in reserves. The results are robust for other choices of thresholds.

III. EMPIRICAL METHODOLOGY

Approach

We assume that emerging market central banks use policy rates and foreign exchange reserves as their two instruments for managing exchange rates.[6] We suppose that these instruments work independently of each other.[7] Therefore, we estimate two separate equations with FX interventions and policy rates as dependent variables and analyze whether policy reactions to exchange rate movements depend on the level of FX debt in the non-financial private sector. We estimate the following equation for FX interventions (FXI):

$$FXI_{j,t} = \alpha_j + \delta_1 \%\Delta S_{j,t} + \delta_2 FXL_{j,t-1} \%\Delta S_{j,t} + \boldsymbol{\beta} \cdot \boldsymbol{controls}_{j,t} + \epsilon_{j,t}\,, \qquad (1)$$
$$j = 1, \dots, 15;\ t = M10{,}2002, \dots, M3{,}2015$$

where the first term on the right hand side is a country specific fixed effect, the second is the percent change of country j's exchange rate, the third is the exchange rate change interacted with the FX debt to GDP (FXL). Control variables include trade openness, the current account balance, the change in the money stock (M2) to GDP, reserves relative to imports and M2, and the change and the level of FXL. The interaction term allows the coefficient on the exchange rate to vary with the level of FX debt and the expected negative sign of δ_2 would indicate that countries with high FX debt react more strongly to exchange rates using FX interventions. The sign on the exchange rate (δ_1) is ambiguous as this can be interpreted as the reaction to exchange rate movements of a country with zero FX debt.

The second equation is an extended Taylor rule equation following Mohanty and Klau (2004), which is extended to include the interaction between exchange rate changes and non-financial private sector FX debt:

$$i_{j,t} = \alpha_j + \beta_{j,i} i_{j,t-1} + \beta_{j,\pi} \pi_{j,t} + \beta_{j,\hat{y}} \hat{y}_{j,t} + \delta_1 \%\Delta S_{j,t} + \delta_2 \%\Delta S_{j,t-1} + \qquad (2)$$
$$+\delta_3 FXL_{j,t-1} \%\Delta S_{j,t-1} + \delta_4 FXL_{j,t-1} + \epsilon_{j,t},$$
$$j = 1, \dots, 15;\ t = M10{,}2002, \dots, M3{,}2015$$

where $i_{j,t}$ is the nominal policy rate of country j at time t. As in a standard Taylor rule, the central bank is expected to react to inflation, π, and the output gap, $\hat{y}$, with the lagged policy rate included as explanatory variable to allow for persistence in adjusting policy rates. We assume that countries have different policy rules with regard to inflation, output gap, and lagged policy rates by allowing these coefficients to be country-specific.[8] We include lags of

[6] Central banks may use other instruments to manage exchange rates such as capital controls, changes in FX reserve requirements, exchange rate-linked instruments or other policies that affect FX markets. In this paper, however, we restrict the analysis to FX intervention and monetary policy rates.

[7] As a robustness check, in section V we also consider the case where the two instruments are interdependent.

[8] We do not include the inflation target and a natural real interest rate in the reaction function. However, these will be captured by the constant term (which in the fixed effect regression differs across countries) as long as they do not change over the sample period. Including an inflation target and a natural real interest rate that

(continued…)

exchange rate changes and the interaction term to take into account that central banks' policy rate reaction to exchange rate changes may happen with a lag. The parameter of interest is δ_3. As before, if it is significant – and now with an expected positive sign – it indicates that higher FX debt leads to a stronger reaction to exchange rates by increasing (lowering) policy rates when the exchange rate depreciates (appreciates).

Instrumental variables to account for endogeneity

Both equations suffer from an endogeneity problem as FX interventions and changes in the policy rate affect exchange rates. If countries intervene to stabilize exchange rates, exchange rate changes will be smaller and changes in interventions and policy rates will be larger. Thus, the coefficient for the exchange rate changes interacted with FX debt will be biased towards a larger reaction to exchange rate changes. However, while quantitatively, estimates will be biased, the significance of the interaction term is informative as there should be no reason why the coefficient for exchange rate changes should vary with the level of FX debt due to endogeneity in a simple regression since the bias relates to the exchange rate changes and not the FX debt.

To address the issue of endogeneity we use instruments for the exchange rate changes. A good instrument is one which is correlated with the exchange rate changes but not with FX interventions and policy rates. We use the change in the EMBI spread and the VIX separately and in combination.[9] The baseline results are reported using VIX as the only instrument for exchange rate changes.

VIX is associated with capital flows (Rey, 2015) and EMBI with the ability of debt repayment and both of them are used as proxies for risk aversion and uncertainty. Changes in VIX and EMBI show high degree of co-movement with changes in bilateral exchange rates. Correlation of the exchange rate changes with the change in VIX and the change in the EMBI spread is 0.35 and 0.48 respectively; that is, the rise in VIX and EMBI tends to exert depreciation pressure on the bilateral exchange rates. As shown in Figure 5, both indexes capture exchange rate changes well especially during periods of financial stress (highlighted in red).

At the same time, changes in VIX and EMBI spread are considered to be exogenous events which are not directly affected by the FX interventions and monetary policy decisions of the individual countries in our sample. We also assume that FX interventions and monetary policy rates are affected by VIX and EMBI spread only through changes in exchange rates.

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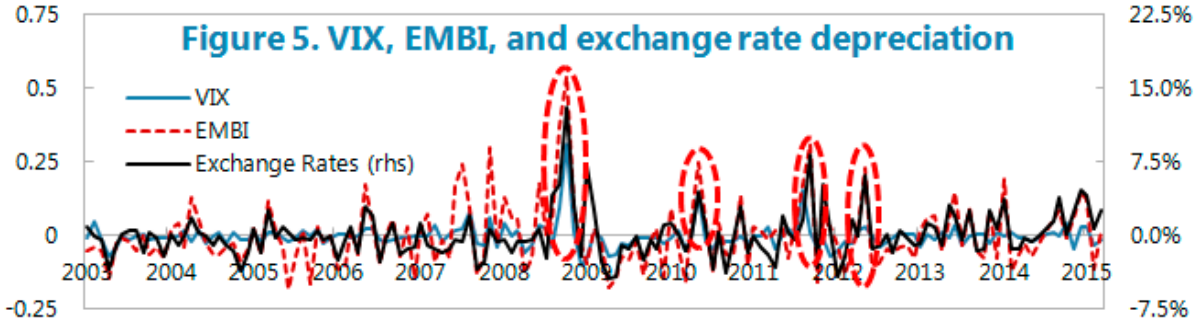
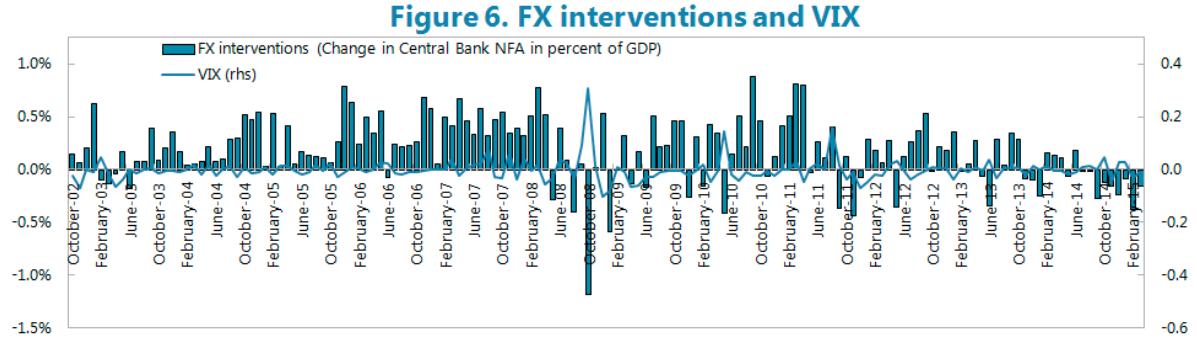
varies over time is challenging as 1) measuring the natural real interest rate over time for the countries is highly uncertain and 2) not all countries in the sample are inflation targeters.

[9] VIX is the Chicago Board Options Exchange Market Volatility index. It is a measure of the implied volatility of S&P 500 index options. EMBI is the J.P. Morgan Emerging Markets Bond index that measures the total return performance of international government issued by emerging market countries.





Other estimation approaches

Apart from estimating separate equations we estimate the equations as a system of seemingly unrelated regressions (SUR). This approach offers some efficiency gains as it incorporates potential correlation in error terms between the equations. Even though separate equations are still unbiased SUR provide more efficient estimates in a case of correlation of the disturbances. The system of equations is estimated by GLS using the variance-covariance matrix of the disturbances as a weighing matrix.

Further, we estimate a simultaneous equation model assuming that FX interventions and monetary policy rates are interdependent instruments in exchange rate management. We assume that FX interventions influence policy rates, and vice versa and estimate the model using GMM where policy rates and FX interventions are included as explanatory variables for the first and the second equation respectively. Excluded exogenous variables from the first equation are used as instruments for FX interventions in the second equation. The same approach is employed for the second equation. Finally, we apply the cross-equation correlations of the disturbances adjusted for heteroskedasticity as a weighing matrix for estimation of the system of equations (Greene, 2012).

IV. RESULTS

Main results

Table 1 presents the results of the regression with FX interventions as a dependent variable (equation 1) for a simple fixed effect regression and an IV estimation with fixed effects. The coefficient for the percent change in the nominal exchange rate is -0.02, i.e. for a country with no FX debt, a 10 percent nominal depreciation is associated with a 0.2 percent of GDP reduction of central bank net foreign assets. The coefficient is significant at 10 percent level

when controlling for the endogeneity. The coefficient of the interaction term is highly significant and with the right sign. The coefficient of -0.16 (for the IV estimation) implies that for 10 percent depreciation FX interventions increase by 0.16 percent of GDP for every additional 10 percent of GDP FX debt. Figure 7 shows the importance of FX debt in determining the FX intervention reaction to depreciation. Using the latest available level of FX debt of the non-financial private sector, the chart illustrates the level of FX intervention as a response to 10 percent depreciation.

Table 1. Dependent Variable: FX Interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	-0.017	-0.022**	-0.054***	-0.041***	-0.015	-0.016*
	(0.010)	(0.009)	(0.013)	(0.011)	(0.008)	(0.009)
Δ Nominal ER x FX debt/GDP (lagged)	-0.165***	-0.098***			-0.186***	-0.164***
	(0.029)	(0.038)			(0.033)	(0.044)
Δ Nominal ER (lagged)			-0.016***	-0.017***	-0.014**	-0.015***
			(0.005)	(0.006)	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.005	-0.005			-0.004	-0.005
	(0.005)	(0.005)			(0.004)	(0.003)
Δ FX debt/GDP					0.031***	0.029***
					(0.008)	(0.007)
Money coverage (lagged)			-0.000	-0.000	-0.006*	-0.006*
			(0.001)	(0.001)	(0.003)	(0.003)
Import coverage (lagged)			0.001	0.001	0.002**	0.002**
			(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP			0.129	0.119	0.128*	0.124*
			(0.077)	(0.078)	(0.072)	(0.075)
Trade openness (% of GDP)			0.051	0.052	0.040	0.041
			(0.032)	(0.032)	(0.039)	(0.038)
Current Account balance (% of GDP, lagged)			0.017	0.017	0.033**	0.032**
			(0.012)	(0.013)	(0.014)	(0.014)
Observations	1,920	1,920	2,191	2,191	1,920	1,920
R-squared	0.109	0.103	0.116	0.111	0.157	0.157

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

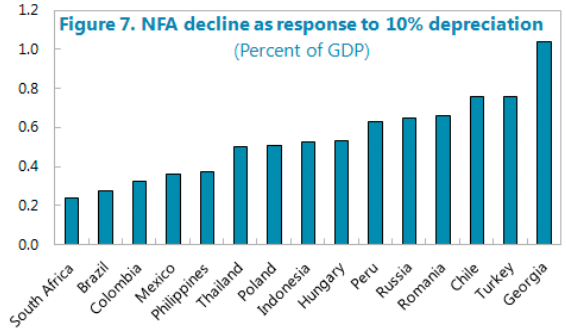
For the monetary policy rate, higher FX debt is associated with a stronger reaction to exchange rate changes (see table 2). Again, the reaction to the exchange rate change interacted with FX debt is highly significant. The results indicate that in the absence of FX exposures, the policy rate reaction to exchange rate movements is limited. This is in line with a traditional Taylor rule approach where monetary policy reacts to inflation and the output gap. When exchange rate changes are interacted with FX debt, the reaction of policy rates to exchange rate changes (with a one month lag) is significant. The coefficient of 0.08 implies that a country with 10 percent of GDP FX debt will react to 10 percent depreciation by increasing its policy rate by 0.08 percentage point in the following month. The reason why the coefficient is significant with a one month lag – instead of contemporaneously – is likely that usually policy rate decisions are decided in planned policy consultation meetings, which occur with lower frequency than decisions to do FX interventions. Moreover, since policy rate inertia is high for all countries in the sample (the coefficient for the lagged policy rate is 0.80-0.99 for all countries but Indonesia) a longer lasting depreciation will lead to further increases in policy rates.

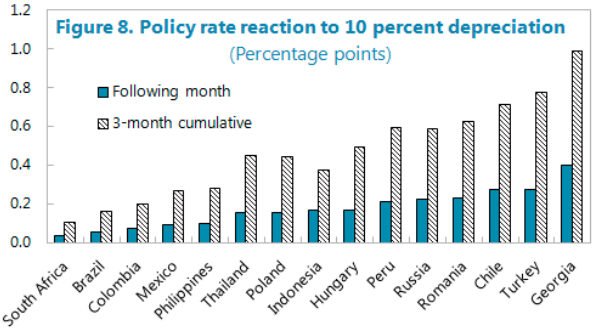
Table 2. Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	0.018	0.030**	0.019	0.020**	0.019	0.024**
	(0.015)	(0.012)	(0.015)	(0.009)	(0.016)	(0.010)
Δ Nominal ER (lagged)	0.000	-0.001	0.017*	0.017*	0.002	0.002
	(0.005)	(0.006)	(0.009)	(0.009)	(0.006)	(0.007)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.070***	0.070***			0.075***	0.075***
	(0.016)	(0.017)			(0.016)	(0.016)
FX debt/GDP (lagged)	-0.001	-0.001			-0.003	-0.003
	(0.003)	(0.003)			(0.003)	(0.003)
Policy rate (lagged)	0.938***	0.939***	Country specific		Country specific	
	(0.009)	(0.009)				
Inflation	0.036***	0.036***	Country specific		Country specific	
	(0.008)	(0.008)				
Output gap	0.064***	0.064***	Country specific		Country specific	
	(0.011)	(0.011)				
Observations	1,897	1,897	2,218	2,218	1,897	1,897
R-squared	0.958	0.958	0.960	0.960	0.960	0.960

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In Figure 8 we show the total increase in the policy rate for the countries in our sample over the first month and quarter (cumulative) following 10 percent deprecation based on their level of FX debt as of Q1, 2015. The effect is the largest for countries with high levels of FX debt in their non-financial private sector.





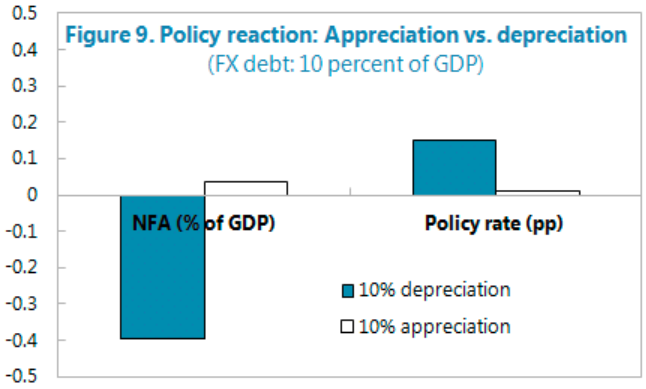
Note: Estimates are based on most recent data for FX debt (Q1, 2015 for most countries).

External vs. domestic FX borrowing

We separate our analysis into domestically and externally funded FX exposures. Central banks are likely to be more concerned about FX exposures in the non-financial private sector if these are financed from lending by the domestic banking system. The reason is that real sector negative consequences of depreciation may spill over to the financial sector. The real economic effects work through lower consumption and investment demand as firms and households experience a deterioration of their balance sheets and would subsequently start deleveraging (by cutting back their consumption and investment). The financial instability effect will be more pronounced if these FX exposures are financed by the domestic banking system as depreciation will then affect banks' balance sheets negatively through non-performing FX loans. Our analysis confirms this as shown in the Appendix. When we include only domestically financed FX debt, the coefficient on the interaction term increases in absolute values for the policy rate and FX intervention regressions whereas for the external debt, the results become insignificant.

Appreciation vs. depreciation of exchange rates

Next, we differentiate between exchange rate depreciation and appreciation. Central banks may be more sensitive to depreciation of exchange rates as sharp currency depreciations threaten financial stability when the non-financial private sector has FX liabilities. On the other hand, the central bank may also be induced to counteract appreciations as real appreciations negatively affect export performance. To account for potential asymmetries, we multiply the interaction term of FX debt and exchange rate changes by a dummy variable that takes the value 1 if the exchange rate change is negative (appreciation). As shown in the Appendix, both FX interventions and policy rate changes are mostly driven by reaction to depreciation of exchange rates. On average, if a country has 10 percent FX debt to GDP it reacts to 10 percent depreciation by decreasing its NFA by 0.4 percent of GDP and increasing its policy rates by 0.15 percentage points (Figure 9). The reaction to appreciation is much smaller and not statistically significant.



V. ROBUSTNESS AND EXTENSIONS

Robustness

The definition of FX interventions

We check if our results are robust to a number of alternative specifications of FX interventions. Apart from using changes in net foreign assets (NFA) relative to GDP, we use changes in NFA relative to M2 and change in reserves minus gold relative to GDP as dependent variables in equation 1. Using these alternative specifications does not change the results qualitatively (see Appendix).

Our proxy for FX interventions – the change in NFA of the central bank – could change for reasons other than FX interventions. Importantly, we implicitly assume that the reserves are denominated in USD, while in reality it is a mix of currencies. To correct for valuation effects, we use the Currency Composition of Official Foreign Exchange Reserves (COFER) database for Emerging Markets and calculate the changes in NFA adjusted for valuation effects. Additionally, we correct for movements in the net position of derivatives as central banks may intervene in the FX currency market by engaging in forwards or futures

operations which do not show in the NFA of the central banks. None of these adjustments change the overall conclusion.[10]

The choice of exchange rate measure

For our main results, we use the nominal bilateral exchange rate with the USD. While we believe this is likely to be the variable of concern for most of the countries in our sample, we explore different specifications for robustness check. We use real bilateral exchange rate with the USD, nominal effective exchange rate, and mixed series where we choose bilateral euro exchange rate for European countries and USD exchange rate for the remaining countries (see Appendix). Again, our results are robust to these alternative specifications.

Instruments

Finally, while in our baseline result we use VIX change as the only instrument, we also estimate regressions using the EMBI change and a combination of both as additional instruments (see Appendix). The differences in the results from using these alternative specifications are also small and the main conclusions hold.

System of equations

Apart from estimating equations separately we evaluate them as a system of equations assuming correlation of the disturbances for the first case and interdependence of FX interventions and monetary policy rates for the second case. The results do not differ from what we get by estimation of separate equations; that is, countries with high FX debt react more strongly to exchange rate movements using both FX interventions and policy rates. Additionally, countries that use policy rates to stem exchange rate depreciation intervene less in the FX market. At the same time, the effect of FX interventions on policy rates is not statistically significant (see Appendix).

Extensions

Next, we present a number of extensions to the results in section IV. We include in the analysis banks' (on-balance sheet) net open FX positions as well as the government's external borrowing; we analyze whether reactions to exchange rate changes depend on FX debt and exchange rates in a non-linear fashion and whether low reserves changes the reaction pattern; and, finally, we discuss and make a (rough) attempt to control for potential natural hedges of the corporate sector.

Including the FX debt of banks and government

Throughout the paper we assume that banks' FX exposures do not affect central bank policies. To account for banks' FX exposures we include the net open position of the banking system in addition to the FX debt of non-financial corporates and households. An important

[10] The data on currency composition of reserves is available only on an aggregated level for emerging markets and advanced economies. By using the average composition for EMs, we thus assume that the currency composition is the same across the countries in our sample. It is highly likely that there are large variations across countries (e.g. countries in Europe may have a larger share of euros than Asian or Latin American countries) and the valuation adjustment may add more noise than information. For our baseline regressions we therefore use the unadjusted NFA series.

caveat here is that we are only able to take into account the *on-balance* sheet net open FX positions of the banks and thus ignore off-balance sheet hedges. These can be large as it is the case, for example, for Turkey at the end of the sample period.[11] With this caveat in mind, the results remain robust when we include the banking system exposures. Adding government external debt to the non-financial private sector FX debt also does not alter the conclusion that higher FX debt is associated with a stronger policy reaction to exchange rate changes (see Appendix). However, when we run regressions separately for government debt and bank net open position as the only FX exposures, the reaction of both FX reserves and policy rates to exchange rate changes interacted with FX debt becomes statistically insignificant. This suggests that the FX debt of non-financial corporates and households is indeed more important than that of the government and banks in affecting the policy reaction to exchange rate changes.

Non-linearities

We analyze two types of non-linearities. The first is a non-linearity with respect to FX debt; i.e., is it the case that the reaction of FX interventions and policy rates to exchange rate changes not only increases with the level of FX debt but becomes much stronger as FX debt rises? The second is a non-linearity with respect to the exchange rate changes; i.e., is policy reaction more sensitive to large changes in the exchange rates? We do not find support for any of these non-linearities as shown in the Appendix.

What happens when reserves are low?

When FX reserves are low, the central bank's ability to use them to stem exchange rate pressure is limited and the interest rate becomes the predominant tool. The main regression for FX interventions includes the level of reserves coverage of M2 and imports as control variables. In addition, we define a dummy that takes the value 1 if reserves are low and interact it with our variable of interest. Reserves are defined as being low if they are less than 5 percent of GDP (7 percent of the total observations). We find that the reaction to exchange rate changes using reserves declines when reserves are low (the effect is negligible for higher reserve threshold values). The interest rate reaction to exchange rate volatility increases (as expected) when reserves are limited but the effect is not statistically significant (see Appendix).

Endogeneity of FX debt

One potential bias in the estimates may arise from endogeneity in the level of FX debt of the non-financial private sector. As mentioned earlier, the choice of whether to borrow in FX may depend on expectations of the future policy reactions to exchange rate movements. However, the empirical evidence for this is unclear. For example, Berkmen and Cavallo (2009) find that floating exchange rate regimes, by themselves, do not promote de-dollarization. It suggests that the differences in FX indebtedness across countries and time

[11] Turkey shows as the country with the largest banking sector on-balance sheet net open FX position in Q1, 2015 (about 8 percent of GDP). However, due to off-balance sheet hedges (for which data exists for Turkey) of roughly the same amount, the overall FX exposures of the banking system in Turkey are almost negligible as of Q1, 2015.

are unlikely to be mainly the result of differences in policy reactions to exchange rate changes.

Changes in FX debt are likely to be less affected by expectations of central bank policies far into the future. To limit potential endogeneity of FX debt we therefore run the regressions using a much longer lag (3 years) for FX debt. Our results are robust to this specification (see Appendix). However, we acknowledge that if high FX exposures 3 years ago are driven by expectations (which can be self-fulfilling) that today's policy will react strongly to exchange rate movements, the use of longer lags will not guarantee that the results are unbiased. This would require measurement of the exogenous component of the level of FX exposure in the non-financial private sector, which is not a part of this paper.

One more potential source of endogeneity is institutional aspects of monetary and exchange rate policy that may affect both monetary policy design and choice of the currency of debt denomination. In particular, three countries in our sample agreed on Flexible Credit Line Agreement (FCL) with the IMF in 2009 (Mexico, Poland, and Colombia). This augments the access to official liquidity and thus supplements the potential FX reserves available to dampen exchange rate volatility. To account for this we introduce a dummy variable for FCL agreement and its interaction with exchange rate changes multiplied by FX debt. Both coefficients are statistically insignificant for the NFA regression but are significant (with the opposite sign) for the policy rate regression. While the overall results remain unchanged we find that after the FCL agreement the three countries use policy rates less to manage exchange rates.

Accounting for natural hedging

Non-financial corporates and households may be hedged against exchange rate movements if they hold FX assets abroad or domestically, use financial hedging instruments, or they can be naturally hedged via FX income from exports. Testing the first two types of hedging requires micro level data on FX assets and financial hedges of individual households and firms in order to match such hedges with individual FX debt. Such data is generally not available. Similarly, for natural hedging, the relevant measure is a micro level data matching of FX liabilities and FX revenues, which is also not available. As a rough proxy for FX revenues at the aggregate level we use exports and interact it with our variable of interest (exchange rate changes interacted with FX debt). A significant coefficient of the opposite sign as compared to an interaction term of FX debt and exchange rates changes would signal that in countries with high exports the concern about exchange rates could be smaller as firms are naturally hedged. The coefficients for an interaction term of exports and exchange rate changes are statistically insignificant in both equations (not reported). It most likely confirms that micro level data is necessary to account for the actual FX exposures of the non-financial private sector as the non-financial companies holding FX debt need not be the same as those that have export revenues.

VI. CONCLUSION

Countries with floating exchange rate regimes are often reluctant to allow their currencies to float freely. In this paper, we show that balance sheet currency mismatches are important for producing fear of floating. We find that policymakers react more to exchange rate

movements – depreciations in particular – when FX debt in the non-financial private sector is high by using FX interventions and monetary policy rates. For FX interventions, we find that for every additional 10 percent of GDP FX debt in the non-financial private sector, the reaction to 10 percent depreciation increases by 0.2 percent of GDP. For monetary policy rates, we claim that 10 percent additional FX debt to GDP increases the monetary policy reaction to 10 percent depreciation by 0.08 percentage points in the next month and by about 0.2 percentage points cumulative over the following three months. Moreover, the funding source of these FX exposures matters. Non-financial private sector FX debt financed from the domestic banking sector seems to be more important than FX debt obtained directly from abroad.

Such reaction might be optimal given the negative implications for financial stability from excessive exchange rate movements in countries with large FX exposures. However, our findings do not allow us to corroborate optimality. Other factors such as pressure on central banks to protect important sectors in the economy (and possibly large financial and non-financial firms and households) where FX indebtedness is high could also be at work. One should therefore be careful about drawing policy conclusion based on the assumption that the observed policies reflect optimal monetary policy. However, theoretical literature supports that when foreign currency balance sheet mismatches are large, some exchange rate management may be the optimal central bank policy (while not necessarily a Pareto efficient equilibrium).

When the FX exposure of the non-financial private sector is high, policies to reduce it should be considered to ensure monetary policy can work effectively. The importance of FX debt in inhibiting central banks from allowing exchange rates to move freely implies that monetary policy could be overburdened by multiple goals. Our finding that FX debt financed from the domestic banking system seems to be more important suggests that policies should focus first and mainly on limiting the FX lending by the banking system. Such policies could include strengthening of supervision of FX lending by the domestic banking sector, prohibiting banks to take too large outright currency risks, higher reserve requirements for foreign currency funding, higher capital requirements and risk-weights on FX lending, and potentially outright quantity restrictions on banks' borrowing in foreign currency. More generalized capital flow management policies – while likely effective in reducing the overall FX exposures – would be less targeted and, thus, less effective in specifically reducing the banking system FX lending.

Our analysis is based on macro level data. A highly relevant alternative approach would be to estimate the level of stress in the financial and non-financial system from exchange rate movements by using household and firm level data on FX assets, liabilities, hedging, and income. However, such micro level data is difficult to obtain on a consistent basis for several countries. More granular data from credit registries or surveys may allow for further research to shed light on the importance of foreign currency balance sheet exposures.

The choice of exchange rate regime and shifts between regimes may also depend on the level of corporate and household FX indebtedness. The analysis could thus be extended to look at

whether countries with high levels of balance sheet FX exposures are more likely to choose a fixed exchange rate regime.

Finally, while we treat the decision of households and firms to borrow in FX as purely exogenous, policies to limit exchange rates movements (depreciations mainly) may incentivize increased FX borrowing as explained by Chang and Velasco (2006). Emerging market countries may be diverging towards different equilibria with some on a suboptimal path of high and increasing FX borrowing and more exchange rate management, and others on a path of low and declining FX borrowing and less exchange rate management. Studying this dual causality empirically would also be an interesting (yet challenging) extension.

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VIII. APPENDIX: COUNTRIES IN A SAMPLE AND DATA SOURCES

Variable name	Definition	Source
ΔReserves/GDP	Change in the reserves minus gold normalized by annual US dollar GDP (%)	IMF International Financial Statistics (IFS); IMF World Economic (WEO) Outlook database
ΔNFA/GDP	Change in the central bank's net foreign assets normalized by annual US dollar GDP (%)	IFS
IR	Policy rate (%)	IMF statistical database, respective CBs
PR	Money market rate (%)	IMF statistical database, respective CBs
ΔNominal ER	Change in nominal bilateral exchange rate to US dollar (increase=depreciation) (%)	IFS
ΔReal ER	Change in real bilateral exchange rate to US dollar (increase=depreciation) (%)	IFS; Haver analytics
ΔNEER	Change in nominal effective exchange rate (increase=depreciation) (%)	BIS
ΔVIX	Change in Chicago Board Options Exchange Market Volatility index (VIX) (%)	Haver analytics
ΔEMBI	Change in Emerging markets bond index (EMBI) (%)	Bloomberg
Inflation	Yearly inflation, computed from CPI (%)	Haver analytics
Output gap	Deviation from hp-trend of a real seasonally adjusted GDP in national currency (%)	WEO, author's calculations
FX Debt/GDP	Foreign exchange debt of non-financial sector (households, enterprises) normalized by annual US dollar GDP (%)	Quarterly External Debt Statistics, The World Bank; Monetary and Financial Statistics; WEO, author's calculations
Net open position of the banking system/GDP	Liabilities minus assets in FX of banks normalized by annual US dollar GDP (%)	IMF Monetary and Financial Statistics
Government external debt/GDP	Government liabilities of the International Investment position normalized by annual US dollar GDP (%)	IFS, International Investment Position
Import coverage	Central bank's net foreign assets over yearly seasonally adjusted imports (%)	DOTS; IFS
Money coverage	Central bank's net foreign assets over M2 (%)	IFS; WEO
Current account balance/GDP	4-quarter rolling current account balance divided by 4-quarter rolling GDP.	IFS; WEO
Trade openness	Seasonally adjusted imports plus exports normalized by annual US dollar GDP (%)	DOTS; WEO
ΔM2/GDP	Change in seasonally adjusted M2 normalized by annual GDP in national currency (%)	IFS; WEO

The sample is represented by 15 countries: Brazil, Chile, Colombia, Georgia, Hungary, Indonesia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey.

IX. APPENDIX: SUMMARY STATISTICS

Variable name	Obs.	Mean	Std. Dev	Min	Max
NFA/GDP (change)	2,233	0.002	0.007	-0.050	0.042
Reserves/GDP (change)	2,250	0.002	0.007	-0.042	0.069
Policy rate (official)	2,232	0.073	0.050	0.005	0.460
Policy rate (market rates)	2.243	0.068	0.051	0.004	0.471
Exchange rate (percent change)	2,250	0.001	0.036	-0.138	0.267
REER (percent change)	2,250	-0.001	0.036	-0.150	0.232
VIX (change)	2,250	-0.002	0.042	-0.102	0.309
EMBI (change)	2,250	0.394	0.252	-0.790	1.177
Inflation	2,250	0.054	0.383	-0.043	0.333
Output gap	2,245	-0.000	0.020	-0.115	0.093
FX debt of non-financial private sector (% of GDP)	1,965	0.209	0.122	0.027	0.587
Import coverage of reserves	2,250	0.629	0.484	-0.214	2.702
Money coverage of reserves	2,250	0.394	0.252	-0.790	1.177
Trade openness (% of GDP)	2,250	0.052	0.027	0.011	0.147
Current Account Balance (% of GDP)	2,250	-0.020	0.051	-0.255	0.117
M2/GDP (change)	2,250	0.004	0.010	-0.057	0.131

X. APPENDIX: REGRESSION OUTPUTS

1. External vs. domestic borrowing

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	-0.015	-0.016*	-0.030**	-0.026***	-0.014	-0.026
	(0.008)	(0.009)	(0.011)	(0.010)	(0.017)	(0.018)
Δ Nominal ER x FX debt/GDP (lagged)	-0.186***	-0.164***				
	(0.033)	(0.044)				
Δ Nominal ER x FX debt/GDP (domestic, lagged)			-0.262***	-0.298***		
			(0.044)	(0.067)		
Δ Nominal ER x FX debt/GDP (external, lagged)					-0.333	-0.166
					(0.202)	(0.179)
Δ Nominal ER (lagged)	-0.014**	-0.015***	-0.017***	-0.017***	-0.012**	-0.013**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
FX debt/GDP (lagged)	-0.004	-0.005				
	(0.004)	(0.003)				
FX debt/GDP (domestic, lagged)			-0.010	-0.010		
			(0.007)	(0.007)		
FX debt/GDP (external, lagged)					-0.002	-0.002
					(0.009)	(0.010)
Δ FX debt/GDP	0.031***	0.029***				
	(0.008)	(0.007)				
Δ FX debt/GDP (domestic)			0.067***	0.071***		
			(0.006)	(0.014)		
Δ FX debt/GDP (external)					0.018	0.018
					(0.014)	(0.013)
Money coverage (lagged)	-0.006*	-0.006*	-0.005	-0.005*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Import coverage (lagged)	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.124*	0.124	0.124	0.134*	0.124
	(0.072)	(0.075)	(0.074)	(0.076)	(0.073)	(0.076)
Trade openness (% of GDP)	0.040	0.041	0.039	0.038	0.042	0.044
	(0.039)	(0.038)	(0.038)	(0.036)	(0.038)	(0.038)
Current Account balance (% of GDP, lagged)	0.033**	0.032**	0.032**	0.033**	0.027*	0.027*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Observations	1,920	1,920	1,920	1,920	1,920	1,920
R-squared	0.157	0.157	0.159	0.159	0.142	0.137

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	0.019	0.024**	0.020	0.024**	0.019	0.023**
	(0.016)	(0.010)	(0.016)	(0.010)	(0.016)	(0.010)
Δ Nominal ER (lagged)	0.002	0.002	0.008	0.007	0.008	0.008
	(0.006)	(0.007)	(0.007)	(0.008)	(0.010)	(0.009)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.075***	0.075***				
	(0.016)	(0.016)				
Δ Nominal ER (lag) x FX debt/GDP (domestic, lag)			0.110***	0.110***		
			(0.025)	(0.026)		
Δ Nominal ER (lag) x FX debt/GDP (external, lag)					0.088	0.086
					(0.074)	(0.073)
FX debt/GDP (lagged)	-0.003	-0.003				
	(0.003)	(0.003)				
FX debt/GDP (domestic, lagged)			-0.006	-0.006		
			(0.006)	(0.006)		
FX debt/GDP (external, lagged)					-0.002	-0.002
					(0.004)	(0.004)
Observations	1,897	1,897	1,897	1,897	1,897	1,897
R-squared	0.960	0.960	0.960	0.960	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

2. Appreciation vs. depreciation of exchange rates

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model
Δ Nominal ER	-0.015	-0.012
	(0.008)	(0.008)
Δ Nominal ER x FX debt/GDP (lagged)	-0.217***	-0.279***
	(0.025)	(0.064)
Δ Nominal ER x FX debt/GDP (lag) x Dummy (ΔER<0)	0.098	0.360***
	(0.082)	(0.123)
Δ Nominal ER (lagged)	-0.014**	-0.014***
	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.002	0.003
	(0.004)	(0.004)
Δ FX debt/GDP	0.032***	0.030***
	(0.008)	(0.007)
Money coverage (lagged)	-0.006*	-0.005
	(0.003)	(0.003)
Import coverage (lagged)	0.002*	0.001
	(0.001)	(0.001)
Δ M2/GDP	0.126*	0.112
	(0.071)	(0.072)
Trade openness (% of GDP)	0.038	0.036
	(0.039)	(0.038)
Current Account balance (% of GDP, lagged)	0.031**	0.028**
	(0.014)	(0.014)
Observations	1,920	1,920
R-squared	0.159	0.143

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model
Δ Nominal ER	0.019	0.026**
	(0.016)	(0.010)
Δ Nominal ER (lagged)	0.003	0.002
	(0.006)	(0.007)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.126***	0.126***
	(0.021)	(0.022)
Δ Nominal ER (lag) x FX debt/GDP (lag) x Dummy (ΔER<0)	-0.161***	-0.160***
	(0.036)	(0.036
FX debt/GDP (lagged)	-0.007*	-0.007**
	(0.003)	(0.003)
Observations	1,897	1,897
R-squared	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

3. System of equations

	(1) SUR	(2) SEM
Dependent variable: foreign exchange interventions (% GDP)		
Δ Nominal ER	-0.016	-0.027
	(0.014)	(0.018)
Δ Nominal ER x FX debt/GDP (lagged)	-0.160*	-0.187**
	(0.084)	(0.096)
Δ Nominal ER (lagged)	-0.015***	-0.013***
	(0.004)	(0.004)
FX debt/GDP (lagged)	-0.005	-0.003
	(0.004)	(0.004)
Money coverage (lagged)	-0.006**	-0.009***
	(0.003)	(0.003)
Import coverage (lagged)	0.003**	0.002
	(0.001)	(0.001)
Δ M2/GDP	0.113***	0.128**
	(0.044)	(0.050)
Δ FX debt/GDP	0.028**	0.031**
	(0.013)	(0.015)
Trade openness (% of GDP)	0.041	0.026
	(0.031)	(0.038)
Current Account balance (% of GDP, lagged)	0.031***	0.037***
	(0.008)	(0.009)
Policy rate		-0.018***
		(0.006)
Dependent variable: policy rate		
Δ Nominal ER	0.024***	-0.006
	(0.009)	(0.018)
Δ Nominal ER (lagged)	0.003	-0.002
	(0.006)	(0.007)
Δ Nominal ER (lagged) x FX debt/GDP (lagged)	0.072**	0.078**
	(0.030)	(0.031)
FX debt/GDP	-0.003	0.000
	(0.005)	(0.004)
Policy rate (lagged)	Country	0.938***
	specific	(0.010)
Inflation	Country	0.038***
	specific	(0.010)
Output gap	Country	0.083***
	specific	(0.013)
ΔNFA/GDP		-0.337
		(0.214)
Observations	1,897	1,897

SUR is estimated by GLS using variance-covariance matrix of the disturbances as a weighting matrix. SEM is estimated by GMM using cross-equation correlations of the disturbances adjusted for heteroskedasticity as a weighting matrix.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4. Alternative definitions of FX interventions

Dependent variable: foreign exchange interventions (% GDP)

	Baseline regression (ΔNFA/GDP)		ΔNFA/GDP, valuation adjustment & off balance position		ΔReserves/GDP		ΔNFA/M2	
	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model	(7) Country FE	(8) IV model
Δ Nominal ER	-0.015	-0.016*	-0.015	0.006	-0.006	-0.007	-0.038	-0.037
	(0.008)	(0.009)	(0.012)	(0.008)	(0.008)	(0.012)	(0.025)	(0.026)
Δ Nominal ER x FX debt/GDP (lagged)	-0.186***	-0.164***	-0.224***	-0.275***	-0.286***	-0.258***	-0.455***	-0.454***
	(0.033)	(0.044)	(0.040)	(0.046)	(0.031)	(0.072)	(0.093)	(0.156)
Δ Nominal ER (lagged)	-0.014**	-0.015***	-0.025***	-0.026***	-0.011	-0.011*	-0.043**	-0.043***
	(0.005)	(0.005)	(0.008)	(0.009)	(0.006)	(0.007)	(0.015)	(0.015)
FX debt/GDP (lagged)	-0.004	-0.005	0.002	0.001	0.000	-0.000	-0.030	-0.030*
	(0.004)	(0.003)	(0.006)	(0.005)	(0.006)	(0.006)	(0.017)	(0.017)
Δ FX debt/GDP	0.031***	0.029***	0.066	0.065*	0.054***	0.051***	0.086***	0.085***
	(0.008)	(0.007)	(0.038)	(0.038)	(0.016)	(0.014)	(0.023)	(0.026)
Money coverage (lagged)	-0.006*	-0.006*	-0.010*	-0.010*	-0.006*	-0.006**	-0.016	-0.016
	(0.003)	(0.003)	(0.005)	(0.006)	(0.003)	(0.003)	(0.011)	(0.011)
Import coverage (lagged)	0.002**	0.002**	0.004**	0.004**	0.003***	0.003***	0.004	0.004
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Δ M2/GDP	0.128*	0.124*	0.090	0.085	0.134*	0.129*	0.467*	0.467*
	(0.072)	(0.075)	(0.086)	(0.092)	(0.065)	(0.070)	(0.263)	(0.273)
Trade openness (% of GDP)	0.040	0.041	0.020	0.018	-0.008	-0.007	0.184	0.184
	(0.039)	(0.038)	(0.054)	(0.053)	(0.030)	(0.027)	(0.123)	(0.119)
Current Account balance (% of GDP, lagged)	0.033**	0.032**	0.034*	0.035**	0.022	0.022	0.105**	0.105**
	(0.014)	(0.014)	(0.017)	(0.017)	(0.016)	(0.016)	(0.042)	(0.043)
Observations	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920
R-squared	0.157	0.157	0.139	0.136	0.151	0.146	0.113	0.114

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Alternative definitions of exchange rate volatility

Dependent variable: foreign exchange interventions (% GDP)

	Baseline regression (Nominal ER)		Real ER		Nominal ER (Europe – EUR, other – USD)		Real ER (Europe – EUR, other – USD)		Nominal effective exchange rate	
	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model	(7) Country FE	(8) IV model	(9) Country FE	(10) IV model
Δ ER	-0.015	-0.016*	-0.016	-0.017*	-0.012	0.000	-0.018***	-0.018***	0.003	-0.017
	(0.008)	(0.009)	(0.009)	(0.010)	(0.007)	(0.015)	(0.006)	(0.005)	(0.009)	(0.012)
Δ ER x FX debt/GDP (lagged)	-0.186***	-0.164***	-0.181***	-0.165***	-0.199***	-0.293*	-0.013*	0.001	-0.295***	-0.276**
	(0.033)	(0.044)	(0.034)	(0.044)	(0.059)	(0.162)	(0.008)	(0.014)	(0.069)	(0.127)
Δ ER (lagged)	-0.014**	-0.015***	-0.016**	-0.016***	-0.018***	-0.017***	-0.190***	-0.313*	0.004	-0.001
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.058)	(0.163)	(0.007)	(0.008)
FX debt/GDP (lagged)	-0.004	-0.005	-0.005	-0.005	-0.004	-0.004	-0.005	-0.004	-0.006	-0.006
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Δ FX debt/GDP	0.031***	0.029***	0.029***	0.028***	0.033***	0.039***	0.031***	0.039***	0.022**	0.025**
	(0.008)	(0.007)	(0.008)	(0.007)	(0.009)	(0.015)	(0.008)	(0.014)	(0.008)	(0.012)
Money coverage (lagged)	-0.006*	-0.006*	-0.006*	-0.006**	-0.006*	-0.007*	-0.007*	-0.007**	-0.006	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Import coverage (lagged)	0.002**	0.002**	0.003**	0.003**	0.002**	0.002**	0.003**	0.003**	0.002*	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.124*	0.129*	0.127*	0.116	0.123	0.118	0.129	0.100	0.106
	(0.072)	(0.075)	(0.073)	(0.077)	(0.071)	(0.078)	(0.073)	(0.081)	(0.070)	(0.071)
Trade openness (% of GDP)	0.040	0.041	0.043	0.044	0.050	0.047	0.052	0.049	0.047	0.046
	(0.039)	(0.038)	(0.040)	(0.038)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Current Account balance (% of GDP, lagged)	0.033**	0.032**	0.034**	0.033**	0.030**	0.031**	0.031**	0.032**	0.034**	0.033**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
Observations	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920
R-squared	0.157	0.157	0.154	0.153	0.111	0.108	0.108	0.102	0.081	0.078

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	Baseline regression (Nominal ER)		Real ER		Nominal ER (Europe – EUR, other – USD)		Real ER (Europe – EUR, other – USD)		Nominal effective exchange rate	
	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model	(7) Country FE	(8) IV model	(9) Country FE	(10) IV model
Δ ER	0.019	0.024**	0.017	0.023**	0.019	0.014**	-0.001	-0.002	0.031*	0.048***
	(0.016)	(0.010)	(0.016)	(0.010)	(0.020)	(0.007)	(0.006)	(0.006)	(0.017)	(0.016)
Δ ER (lagged)	0.002	0.002	0.001	0.001	0.119**	0.120**	0.111**	0.112**	0.207**	0.205**
	(0.006)	(0.007)	(0.006)	(0.006)	(0.050)	(0.050)	(0.049)	(0.048)	(0.081)	(0.082)
Δ ER (lag) x FX debt/GDP (lag)	0.075***	0.075***	0.075***	0.076***	-0.001	-0.001	0.017	0.013*	-0.015	-0.020
	(0.016)	(0.016)	(0.016)	(0.017)	(0.006)	(0.006)	(0.019)	(0.007)	(0.015)	(0.016)
FX debt/GDP (lagged)	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Observations	1,897	1,897	1,897	1,897	1,897	1,897	1,897	1,897	1,897	1,897
R-squared	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6. Alternative instruments for baseline regressions

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) IV model	(4) IV model
Δ Nominal ER	-0.015	-0.016*	-0.019	-0.019
	(0.008)	(0.009)	(0.012)	(0.012)
Δ Nominal ER x FX debt/GDP (lagged)	-0.186***	-0.164***	-0.121***	-0.123***
	(0.033)	(0.044)	(0.046)	(0.046)
Δ Nominal ER (lagged)	-0.014**	-0.015***	-0.015***	-0.015***
	(0.005)	(0.005)	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.004	-0.005	-0.005	-0.005
	(0.004)	(0.003)	(0.003)	(0.003)
Δ FX debt/GDP	0.031***	0.029***	0.025***	0.026***
	(0.008)	(0.007)	(0.008)	(0.007)
Money coverage (lagged)	-0.006*	-0.006*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)
Import coverage (lagged)	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.124*	0.117	0.118
	(0.072)	(0.075)	(0.076)	(0.076)
Trade openness (% of GDP)	0.040	0.041	0.044	0.044
	(0.039)	(0.038)	(0.038)	(0.038)
Current Account balance (% of GDP, lagged)	0.033**	0.032**	0.032**	0.032**
	(0.014)	(0.014)	(0.014)	(0.014)
Instruments		VIX	EMBI	VIX, EMBI
Observations	1,920	1,920	1,920	1,920
R-squared	0.157	0.157	0.152	0.152

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) IV model	(4) IV model
Δ Nominal ER	0.019	0.024**	0.017**	0.018**
	(0.016)	(0.010)	(0.007)	(0.007)
Δ Nominal ER (lagged)	0.002	0.002	0.002	0.002
	(0.006)	(0.007)	(0.006)	(0.006)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.075***	0.075***	0.075***	0.075***
	(0.016)	(0.016)	(0.016)	(0.016)
FX debt/GDP (lagged)	-0.003	-0.003	-0.004	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)
Instruments		VIX	EMBI	VIX, EMBI
Observations	1,897	1,897	1,897	1,897
R-squared	0.960	0.960	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

7. Including the FX debt of banks and government

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	-0.018*	-0.020**	-0.016	-0.020	-0.016	-0.022*
	(0.009)	(0.009)	(0.013)	(0.012)	(0.014)	(0.011)
Δ Nominal ER x FX debt/GDP (+banks, lagged)	-0.183***	-0.147**				
	(0.047)	(0.065)				
Δ Nominal ER x FX debt/GDP (+government, lagged)			-0.104***	-0.083***		
			(0.014)	(0.019)		
Δ Nominal ER x FX debt/GDP (+banks+government, lagged)					-0.105***	-0.076***
					(0.019)	(0.024)
Δ Nominal ER (lagged)	-0.014**	-0.014***	-0.014**	-0.014**	-0.014**	-0.014**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
FX debt/GDP (+banks, lagged)	-0.007	-0.008*				
	(0.004)	(0.004)				
FX debt/GDP (+government, lagged)			-0.001	-0.002		
			(0.001)	(0.001)		
FX debt/GDP (+banks+government, lagged)					-0.003	-0.003
					(0.002)	(0.002)
Δ FX debt/GDP (+banks)	0.037**	0.035***				
	(0.013)	(0.011)				
Δ FX debt/GDP (+government)			0.034**	0.035***		
			(0.012)	(0.012)		
Δ FX debt/GDP (+banks+government)					0.036**	0.037**
					(0.013)	(0.015)
Money coverage (lagged)	-0.006*	-0.006*	-0.006*	-0.006*	-0.006*	-0.006*
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Import coverage (lagged)	0.003**	0.003**	0.002**	0.002**	0.002*	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.121	0.135	0.129	0.138	0.130
	(0.071)	(0.076)	(0.078)	(0.079)	(0.079)	(0.080)
Trade openness (% of GDP)	0.040	0.043	0.046	0.049	0.046	0.050
	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)	(0.037)
Current Account balance (% of GDP, lagged)	0.032**	0.032**	0.037**	0.037**	0.037**	0.038**
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
Observations	1,917	1,917	1,920	1,920	1,917	1,917
R-squared	0.159	0.157	0.161	0.160	0.163	0.161

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	0.019	0.024**	0.020	0.024**	0.020	0.024**
	(0.016)	(0.010)	(0.016)	(0.010)	(0.016)	(0.010)
Δ Nominal ER (lagged)	-0.001	-0.001	0.003	0.003	0.000	-0.000
	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)
Δ Nominal ER (lag) x FX debt/GDP (+banks, lag)	0.099***	0.098***				
	(0.023)	(0.023)				
Δ Nominal ER (lag) x FX debt/GDP (+government, lag)			0.042***	0.043***		
			(0.009)	(0.009)		
Δ Nominal ER (lag) x FX debt/GDP (+banks+government, lag)					0.052***	0.053***
					(0.010)	(0.010)
FX debt/GDP (+banks, lagged)	-0.002	-0.002				
	(0.005)	(0.005)				
FX debt/GDP (+government, lagged)			-0.004**	-0.004**		
			(0.002)	(0.002)		
FX debt/GDP (+banks+government, lagged)					-0.004*	-0.004*
					(0.002)	(0.002)
Observations	1,897	1,897	1,897	1,897	1,897	1,897
R-squared	0.960	0.960	0.960	0.960	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model
Δ Nominal ER	-0.047***	-0.038***	-0.032*	-0.030*
	(0.012)	(0.009)	(0.018)	(0.015)
Δ Nominal ER x FX debt/GDP (banks, lagged)	0.392**	0.180		
	(0.171)	(0.140)		
Δ Nominal ER x FX debt/GDP (government, lagged)			-0.135**	-0.079
			(0.062)	(0.065)
Δ Nominal ER (lagged)	-0.017***	-0.017***	-0.016**	-0.016**
	(0.005)	(0.006)	(0.006)	(0.006)
FX debt/GDP (banks, lagged)	-0.008	-0.008		
	(0.014)	(0.014)		
FX debt/GDP (government, lagged)			0.000	-0.000
			(0.005)	(0.005)
Δ FX debt/GDP (banks)	0.008	0.013		
	(0.010)	(0.012)		
Δ FX debt/GDP (government)			0.036	0.046*
			(0.023)	(0.024)
Money coverage (lagged)	-0.000	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Import coverage (lagged)	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.132	0.123	0.141	0.132
	(0.081)	(0.080)	(0.083)	(0.081)
Trade openness (% of GDP)	0.047	0.050*	0.052*	0.056**
	(0.030)	(0.029)	(0.028)	(0.029)
Current Account balance (% of GDP, lagged)	0.015	0.015	0.021*	0.022*
	(0.011)	(0.011)	(0.012)	(0.013)
Observations	2,184	2,184	2,188	2,188
R-squared	0.126	0.125	0.129	0.119

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model
Δ Nominal ER	0.019	0.024**	0.019	0.023**
	(0.016)	(0.011)	(0.015)	(0.010)
Δ Nominal ER (lagged)	0.017*	0.017*	0.011	0.010
	(0.009)	(0.009)	(0.007)	(0.008)
Δ Nominal ER (lag) x FX debt/GDP (banks, lag)	0.017	0.012		
	(0.202)	(0.207)		
Δ Nominal ER (lag) x FX debt/GDP (government, lag)			0.045	0.047
			(0.034)	(0.033)
FX debt/GDP (banks, lagged)	0.007	0.007		
	(0.007)	(0.007)		
FX debt/GDP (government, lagged)			-0.002	-0.002
			(0.008)	(0.008)
Observations	2,158	2,158	2,173	2,173
R-squared	0.957	0.957	0.957	0.957

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

8. Non-linearities

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model
Δ Nominal ER	-0.008	0.001	-0.014	-0.012
	(0.008)	(0.014)	(0.008)	(0.009)
Δ Nominal ER x FX debt/GDP (lagged)	-0.267*	-0.371*	-0.192***	-0.132***
	(0.149)	(0.211)	(0.048)	(0.032)
Δ Nominal ER x (FX debt/GDP)^2 (lagged)	0.156	0.425		
	(0.272)	(0.360)		
Δ Nominal ER^2 x FX debt/GDP (lagged)			0.052	-0.544
			(0.240)	(0.342)
Δ Nominal ER (lagged)	-0.014**	-0.014***	-0.015**	-0.014***
	(0.005)	(0.005)	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.004	-0.004	0.006	0.003
	(0.004)	(0.003)	(0.014)	(0.015)
Δ FX debt/GDP	0.031***	0.027***	0.031***	0.030***
	(0.008)	(0.007)	(0.008)	(0.008)
Money coverage (lagged)	-0.006*	-0.006*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)
Import coverage (lagged)	0.002**	0.002**	0.003**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.122*	0.128*	0.119
	(0.071)	(0.072)	(0.072)	(0.073)
Trade openness (% of GDP)	0.040	0.042	0.039	0.035
	(0.039)	(0.038)	(0.039)	(0.038)
Current Account balance (% of GDP, lagged)	0.032**	0.031**	0.034**	0.032**
	(0.013)	(0.014)	(0.014)	(0.015)
(FX debt/GDP)^2 (lagged)			-0.017	-0.009
			(0.020)	(0.021)
Observations	1,920	1,920	1,920	1,920
R-squared	0.158	0.155	0.158	0.150

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model
Δ Nominal ER	0.019	0.024**	0.020	0.025**
	(0.016)	(0.010)	(0.016)	(0.010)
Δ Nominal ER (lagged)	-0.003	-0.003	0.003	0.002
	(0.009)	(0.009)	(0.006)	(0.007)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.139	0.134	0.049*	0.049*
	(0.157)	(0.161)	(0.026)	(0.025)
Δ Nominal ER (lag) x (FX debt/GDP)^2 (lagged)	-0.121	-0.112		
	(0.278)	(0.286)		
Δ Nominal ER^2 (lag) x FX debt/GDP (lagged)			0.333	0.336
			(0.317)	(0.320)
(FX debt/GDP)^2 (lagged)	-0.004	-0.004	-0.005	-0.005
	(0.003)	(0.003)	(0.004)	(0.004)
Observations	1,897	1,897	1,897	1,897
R-squared	0.960	0.960	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

9. What happens when reserves are low?

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model
Δ Nominal ER	-0.019**	-0.016*
	(0.009)	(0.009)
Δ Nominal ER x FX debt/GDP (lagged)	-0.178***	-0.164***
	(0.033)	(0.044)
Δ Nominal ER x FX debt/GDP (lag) x Dummy (Reserves<5% of GDP) (lagged)	0.377***	0.430*
	(0.102)	(0.222)
Δ Nominal ER (lagged)	-0.014**	-0.015***
	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.004	-0.004
	(0.004)	(0.003)
Δ FX debt/GDP	0.030***	0.028***
	(0.008)	(0.007)
Money coverage (lagged)	-0.006*	-0.006**
	(0.003)	(0.003)
Import coverage (lagged)	0.002**	0.002**
	(0.001)	(0.001)
Δ M2/GDP	0.129*	0.124*
	(0.071)	(0.075)
Trade openness (% of GDP)	0.039	0.040
	(0.039)	(0.037)
Current Account balance (% of GDP, lagged)	0.033**	0.033**
	(0.014)	(0.014)
Observations	1,920	1,920
R-squared	0.161	0.160

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model
Δ Nominal ER	0.019	0.024**
	(0.016)	(0.010)
Δ Nominal ER (lagged)	0.001	0.001
	(0.006)	(0.006)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.077***	0.077***
	(0.015)	(0.016)
Δ Nominal ER (lag) x FX debt/GDP (lag) x Dummy (Reserves<5% of GDP) (lagged)	0.094	0.097
	(0.111)	(0.109)
FX debt/GDP^2 (lagged)	-0.003	-0.003
	(0.003)	(0.003)
Observations	1,897	1,897
R-squared	0.960	0.960

Inflation, output gap and lagged policy rates are country-specific and are not reported.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

10. Accounting for endogeneity

Dependent variable: foreign exchange interventions (% GDP)

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	-0.015	-0.016*	-0.010	-0.006	-0.014	-0.016
	(0.008)	(0.009)	(0.007)	(0.010)	(0.009)	(0.010)
Δ Nominal ER x FX debt/GDP (lagged)	-0.186***	-0.164***			-0.185***	-0.165***
	(0.033)	(0.044)			(0.033)	(0.045)
Δ Nominal ER x FX debt/GDP (lagged) – FX debt lagged 3 years			-0.251***	-0.247***		
			(0.045)	(0.068)		
Δ Nominal ER x FX debt/GDP (lagged)*FCL agreement dummy					-0.029	0.009
					(0.049)	(0.116)
Δ Nominal ER (lagged)	-0.014**	-0.015***	-0.016**	-0.016***	-0.015**	-0.015***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
FX debt/GDP (lagged)	-0.004	-0.005			-0.004	-0.005
	(0.004)	(0.003)			(0.004)	(0.003)
FX debt/GDP (lagged) – FX debt lagged 3 years			-0.003	-0.003		
			(0.008)	(0.008)		
Δ FX debt/GDP	0.031***	0.029***	0.028***	0.026***	0.031***	0.029***
	(0.008)	(0.007)	(0.006)	(0.007)	(0.008)	(0.008)
Money coverage (lagged)	-0.006*	-0.006*	-0.010**	-0.010***	-0.006*	-0.006*
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
Import coverage (lagged)	0.002**	0.002**	0.005**	0.005**	0.002**	0.002**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Δ M2/GDP	0.128*	0.124*	0.128*	0.125*	0.128*	0.124*
	(0.072)	(0.075)	(0.067)	(0.073)	(0.072)	(0.075)
Trade openness (% of GDP)	0.040	0.041	0.007	0.008	0.039	0.040
	(0.039)	(0.038)	(0.046)	(0.045)	(0.040)	(0.039)
Current Account balance (% of GDP, lagged)	0.033**	0.032**	0.051**	0.051**	0.033**	0.032**
	(0.014)	(0.014)	(0.020)	(0.020)	(0.014)	(0.014)
FCL agreement dummy					0.000	0.000
					(0.000)	(0.000)
Observations	1,920	1,920	1,425	1,425	1,920	1,920
R-squared	0.157	0.157	0.204	0.204	0.158	0.157

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: policy rate

	(1) Country FE	(2) IV model	(3) Country FE	(4) IV model	(5) Country FE	(6) IV model
Δ Nominal ER	0.019	0.024**	0.020	0.016***	0.020	0.023**
	(0.016)	(0.010)	(0.017)	(0.005)	(0.016)	(0.010)
Δ Nominal ER (lagged)	0.002	0.002	0.001	0.002	0.004	0.003
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)
Δ Nominal ER (lag) x FX debt/GDP (lag)	0.075***	0.075***			0.077***	0.077***
	(0.016)	(0.016)			(0.015)	(0.015)
Δ Nominal ER (lag) x FX debt/GDP (lag) – FX debt lagged 3 years			0.073***	0.072***		
			(0.015)	(0.012)		
Δ Nominal ER (lag) x FX debt/GDP (lag)*FCL agreement dummy					-0.086***	-0.084***
					(0.027)	(0.030)
FX debt/GDP (lagged)	-0.003	-0.003			-0.004	-0.004
	(0.003)	(0.003)			(0.002)	(0.003)
FX debt/GDP (lagged) – FX debt lagged 3 years			0.003	0.003		
			(0.005)	(0.004)		
Policy rate (lagged)	Country specific		Country specific		Country specific	
Inflation	Country specific		Country specific		Country specific	
Output gap	Country specific		Country specific		Country specific	
FCL agreement dummy					-0.002***	-0.002***
					(0.001)	(0.001)
Observations	1,897	1,897	1,407	1,407	1,897	1,897
R-squared	0.960	0.960	0.941	0.941	0.960	0.960

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1