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Economic Fundamentals and Monetary Policy Autonomy*

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Abstract

During a time of rising world interest rates, the central bank of a small open economy may be motivated to increase its own interest rate to keep from suffering a destabilizing outflow of capital and depreciation in the exchange rate. This is especially true for a small open economy with a current account deficit, which relies on foreign capital inflows to finance this deficit. This paper will investigate the underlying structural characteristics that would lead an economy with a floating exchange rate to adjust their interest rate in line with the foreign interest rate, and thus adopt a de facto exchange rate "peg". Using a panel data regression similar to that in Shambaugh (QJE 2004) and most recently in Klein and Shambaugh (AEJ Macro 2015), this paper shows that the method of current account financing has a large effect on whether or not the central bank will opt for exchange rate and capital flow stabilization during a time of rising world interest rates. A current account deficit financed mainly through reserve depletion or the accumulation of private sector debt will cause the central bank to pursue de facto exchange rate stabilization, whereas a current account deficit financed through equity or FDI will not. Quantitatively, reserve depletion of about 7% of GDP will motivate the central bank with a floating currency to adjust its interest rate in line with the foreign interest rate to where it appears that the central bank has an exchange rate peg.

JEL codes: F30, F40, E30, E50

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1 Introduction

In 2015, the Banco de México, the central bank in Mexico, rescheduled their monetary policy meetings to occur immediately following the meetings of the Federal Reserve. Monetary policy makers in Mexico knew that Fed lift-off from near-zero interest rate policy was imminent, and they wanted to arrange it such that the Banco de México could lift-off from their own extraordinarily low interest rates as soon as the Fed moved, and thus prevent a sudden shift in capital flows that would result in a sharp depreciation in the peso. When the Fed increased interest rates by 25 basis points on December 16th, the Banco de México matched them with a similar 25 basis point increase on December 17th.

The tendency for a central bank to mimic the monetary actions of a base currency central bank like the Federal Reserve is well documented. Usually the intention is to forestall a shift in capital flows that would lead to a sharp appreciation or depreciation of the currency. As shown in Shambaugh (2004), Obstfeld, Shambaugh, and Taylor (2005), and Klein and Shambaugh (2015), a way to measure monetary policy autonomy in the data is to regress changes in the policy interest rate in one country on changes in a base country interest rate. These papers find that the coefficient in this regression is much higher in countries with a pegged currency than in those with a floating currency, and the coefficient is higher for a country with an open capital account than in a country with a closed capital account.

In a country with a pegged exchange rate and an open capital account this need to match monetary policy actions is automatic, as implied by the famous trilemma from Mundell (1963) and Fleming (1962). By the same logic, monetary policy autonomy is automatic in a country with a floating exchange rate. Mechanically, a central bank with a floating currency has complete monetary policy autonomy and can do whatever it likes with its interest rate. But if the central bank has complete monetary policy autonomy, they can always choose to mimic a base country interest rate, and thus adopt a de facto exchange rate peg or soft peg. This paper will ask how economic fundamentals like a country's net external liability position might affect the central bank's choice of whether to pursue a monetary policy based solely on domestic concerns like the output gap or inflation, adopt a de facto exchange rate peg in an attempt to manage their external accounts.

Using a regression framework similar to that in Klein and Shambaugh (2015), we find that central banks in countries with a worsening external liability position (a current account deficit) are likely to move their interest rate in concert with a base country interest rate, and thus adopt some sort of de facto currency peg in an attempt to manage the external account. The intuition is as follows. A current account deficit needs to be financed by a positive net inflow of capital. An interest rate increase in the base country means that foreign investments are more attractive, and this leads to the possibility that those capital flows would reverse. As a result, central banks in countries with a current account deficit would find it necessary to raise their interest rate in order to retain foreign capital that would be tempted to flee.

A number of authors question the degree of monetary policy autonomy in a country with a floating exchange rate that is subject to exogenous swings in capital inflows and outflows (see e.g. Rey (2015)). Obstfeld (2015) discusses how financial globalization affects the trade-offs faced by monetary policy makers. Edwards (2015) examines the case of three Latin American countries with flexible exchange rates, inflation targeting and capital mobility and finds evidence that these countries tend to mimic Federal Reserve policy, and thus the degree of monetary policy autonomy is lower than would be expected. Dabrowski, Śmiech, and Papież (2015) argue that ex-ante exchange rate regimes do not fully predetermine monetary policy response to shocks. They liken this to a ”fear of floating” (Calvo and Reinhart 2002) or more specifically, a ”fear of losing international reserves” (Aizenman and Sun 2012, Aizenman and Hutchison 2012).

Forbes and Klein (2015) look at policy responses to a stop in capital inflows, and raising interest rates is one of them. But they argue that among possible policy options, raising interest rates leads to a sharp drop in GDP and is definitely not the most favorable option. Other options include reserve depletion or allowing the currency to depreciate. However, reserve depletion may not be an option for a country with already depleted reserves, and currency depreciation may not be favorable in a country with a large stock of foreign currency denominated debt.[1] Intuitively, we find that not all forms of external liability accumulation cause a central bank to opt away from monetary policy autonomy towards a de facto peg. Only a currency account deficit financed by reserve depletion or the accumulation of foreign currency denominated debt cause a central bank to willingly sacrifice monetary policy autonomy. Equity financing or domestic currency denominated debt do not have the same effect.

These results are based on regressions that end in 2011. But the "taper tantrum" episode of the summer of 2013 provides a nice out-of-sample example of the mechanisms involved in this paper. Eichengreen and Gupta (2014), Mishra, Moriyama, and N'Diaye (2014), and Shaghil, Coulibaly, and Zlate (2015) all find that economic fundamentals like the current account had an effect on relative performance among emerging markets during the taper tantrum. Countries that ran a large current account deficit prior to the summer of 2013 were most adversely affected during the summer of 2013. Although Aizenman, Binici, and Hutchison (2014) finds the opposite. In line with the subject of this paper, Arteta, Kose, Ohnsorge, Stocker, et al. (2015) argue that economic fundaments were important part of the policy response to the taper tantrum. In the next section we will show how the emerging markets with current account deficits were the ones that were most likely to raise interest rates after the first suggestion of Fed tapering. Furthermore, the difference in interest rate responses across emerging markets is due to cross-country differences in debt-based capital inflows. Emerging markets that prior to the announcement of tapering received positive net debt inflows saw a much greater increase in rates than those with negative net debt inflows. Whether a country had positive or negative net equity inflows prior to 2013 had no effect on the subsequent interest rate response.

[1]See Obstfeld, Shambaugh, and Taylor (2010) for a discussion of the importance of reserve accumulation for financial stability, and Cespedes, Chang, and Velasco (2005) for a discussion of the financial (in)stability role of foreign currency denominated debt.

This paper will proceed as follows. The out-of-sample example of comparing policy responses across emerging markets during the ”taper tantrum” is presented in section 2. The formal econometric model and data that is used to measure the effect of external debt accumulation on monetary policy autonomy is presented in section 3. The econometric results as well as the results from various robustness checks are presented in section 4. Finally, section 5 concludes.

2 Emerging market policy interest rates during the ”taper tantrum”

In congressional testimony in May 2013, then Fed chairman Ben Bernanke first suggested that the Fed may begin to curtail the large scale asset purchase program known as QE3. This suggestion sent shock-waves through the international markets as the suggestion of tapering was interpreted to mean that the days of extraordinarily loose monetary policy in the U.S. were soon to come to an end.

Many believed that this monetary policy had led to a surge of capital inflows into many emerging market countries in a search for yield. This surge in capital inflows led to a sharp appreciation in currency and asset values. The reasoning went that the end of this extraordinary monetary policy accommodation by the Federal Reserve would lead to a reversal of those capital flows, and thus a sharp drop in currency and asset values across the emerging world. Investors would be smart to sell their emerging market assets now, ahead of Fed action; this itself led to a wave of capital outflows and triggered a sort of a crisis in many emerging markets in the summer of 2013 that has come to be known as the “taper tantrum”.

In a bid to attract or retain capital which was now fleeing in the expectation of higher interest rates in the U.S., many emerging market central banks raised their interest rates following the tapering announcement. The path of the GDP weighted average of policy interest rates across many emerging markets is shown in the green dotted line in the top panel of figure 1.[2] The vertical dotted line in the chart marks May 2013, when Chairman Bernanke first mentioned tapering. The chart shows that the late spring of 2013 marked the end of a two year easing cycle across emerging markets that began in the summer of 2011. In the year following the May 2013 announcement, emerging market policy rates increased by an average of 80 basis points.

But this average masks considerable heterogeneity in monetary tightening across the emerging markets. Countries with a current account deficit tightened quickly and tightened sharply. In the chart in the top panel of figure 1, the average among countries with a current account deficit is represented by the red dashed line and that for countries with a current account surplus is shown with the blue solid line. In the year following the tapering announcement, emerging markets with a current account deficit raised their policy rate by an average of 137 basis points while those with a current account surplus raised their policy rate by an average of 25 basis points.

In the late summer of 2013, some of these emerging market countries with a current account deficit were dubbed the "fragile five", the large emerging market countries with current account deficits (Brazil, Indonesia, India, Turkey, and South Africa). A current account deficit needs to be financed by a positive net inflow of capital. The expectation of monetary policy normalization in the U.S. led to the possibility that those capital flows would reverse. As a result, central banks in countries with a current account deficit found it necessary to raise interest rates in order to retain foreign capital that would be tempted to flee.

2.1 Are all forms of deficit financing the same?

The current account is simply the negative of net capital inflows. Thus a country with a current account deficit must have positive net capital inflows. But these capital inflows

[2] Countries included in the average are Turkey, South Africa, Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, India, Indonesia, Malaysia, Thailand, Nigeria, Russia, China, Hungary, Poland, South Korea, and the Czech Republic.

can come in many forms. Capital inflows equity based, like FDI or portfolio equity, or they could be based on debt, like bank lending, portfolio debt, or central bank reserves.

Equity based capital inflows tend to be a much more stable form of financing than debt based capital inflows. Milesi-Ferretti and Tille (2011) and Lane and Milesi-Ferretti (2012) show that bank loans and other types of debt-based capital flows have seen the largest swings over the past few years. Forbes and Warnock (2014) show that debt based capital flows are more susceptible to episodes of stop or flight.[3] In the taper tantrum of 2013 central banks in countries with a current account deficit found it necessary to raise their interest rates in order to retain these capital flows. But this fear of capital flight should apply to countries that were financing this deficit through debt inflows, not countries that depend on equity capital inflows.

The middle panel in figure 1 plots the path of the policy interest rate in emerging markets, but whereas before these policy rates were plotted for the group of countries with a current account deficit and those with a current account surplus, here they are plotted for the group of countries with positive net debt inflows and negative net debt inflows. The average among countries with positive net debt inflows is represented by the red dashed line and that for countries with negative net debt inflows is shown with the blue solid line.

Those with positive net debt inflows were countries that at the time of Bernanke's tapering announcement were relying on foreign debt inflows. The chart shows that central banks in those countries sharply tightened policy immediately after the tapering announcement, but central banks in countries with negative net debt inflows did not. In the year following the tapering announcement, central banks in countries with positive debt inflows raised interest rates by an average of 165 basis points, central banks in the other set of countries lowered interest rates by an average of 10 basis points over the same year.

[3] See also Frankel and Rose (1996), Calderon and Kubota (2005), Aizenman, Jinjarak, and Park (2013), Aizenman, Chinn, and Ito (2010, 2011), Jongwanich and Kohpaiboon (2013), Lane and McQuade (2014), Tong and Wei (2011), and Davis (2015) who all show that debt-based capital flows tend to be more volatile and more likely to lead to features like asset price appreciation and credit expansion, and a general boom-bust cycle, than equity or FDI based capital flows.

If instead we divide this group of emerging market countries into those with positive net equity inflows and those with negative net equity inflows, this strong dichotomy disappears. This is plotted in the bottom panel in figure 1, where the average policy interest rate among countries with positive net equity inflows is represented by the red dashed line and that for countries with negative net equity inflows is shown with the blue solid line. Countries with positive net equity inflows relied on inflows of foreign capital, but since this capital was based on equity and not debt, there was much less fear of capital flight. In the year following the tapering announcement, countries with positive equity inflows raised their policy interest rates by an average of 84 basis points, while countries with negative equity inflows raised rates by an average of 58 basis points.

The large spike in policy rates in late 2014 for countries with negative net equity inflows is entirely due to Russia, which raised interest rates by 750 basis points in December 2014. Russia had a current account surplus in 2014, and thus was exporting capital to the rest of the world. But the central bank was forced to act so dramatically in late 2014 due to a sharp fall in foreign exchange reserves due to the falling price of oil, the main Russia export, and the effects of sanctions placed on Russia in response to the situation in the Ukraine. Thus the Russian experience in late 2014 provides the textbook example of how a central bank faced with rapid reserve depletion may opt to increase the policy interest rate to curtail capital flight.

3 Econometric model and data

3.1 Econometric Model

To derive the econometric specification we use in the estimations, it is necessary to begin with the familiar uncovered interest parity condition:

$$E_t\left(S_{it+1}\right) - S_{it} = R_{it} - R_{it}^{b} - \varepsilon_{it} \tag{1}$$

where S_t is the nominal exchange rate (in units of country i currency per units of the base country b currency), R_{it} is the country i nominal interest rate, R^b_{it} is the base country nominal interest rate, and ε_{it} is a risk premium. All variables are in log form.

If a central bank wants to stabilize their exchange rate, they should keep R_{it} close to $R^b_{it} + \varepsilon_{it}$.

The central bank in country i follows the following monetary policy rule:[4]

$$R_{it} = \theta_p \left(\pi_{it} - \bar{\pi}_i\right) + \theta_y \left(y_{it} - \bar{y}_{it}\right) + \theta^s_{it} \left(R^b_{it} + \varepsilon_{it}\right) + m_t \tag{2}$$

where m_t is a monetary policy shock, and where θ^s_{it} is the weight that the central places on exchange rate stabilization, we assume that θ^s_{it} is a function of a vector of institutional characteristics and the country's net external asset position:

$$\theta^s_{it} = f\left(\mathbf{X}_{it-1}, \eta_{it-1}\right) \tag{3}$$

where η_{it-1} is a vector of the country's net external assets at the end of the last period. For our purposes, η_{it-1} is a vector with 5 rows, the first is domestic currency denominated net external debt assets, the second is foreign currency denominated net external debt assets, the third is net external FDI assets, the fourth is net external portfolio equity assets, and the fifth is central bank reserve assets. $\mathbf{X}_{it-1}$ contains all the variables that might affect a central bank's preference for exchange rate stabilization that are unrelated to the country's net external asset position, η_{it-1}. Variables in the vector $\mathbf{X}_{it-1}$ include things like institutional characteristics that might affect central bank credibility, the extent of capital controls in the country, and a country's openness to trade and their trading partners.

While the variables in $\mathbf{X}_{it}$ are very important for determining a country's preference for exchange rate stabilization, they tend not to move very much from year to year. So the

[4]For robustness we will also estimate the model with an interest rate smoothing term in the Taylor rule, $\theta_i R_{it-1}$. All of the results in the estimations are robust to this smoothing term and the results from this specification are presented in the robustness section of the paper.

change in θ_{it}^{s} from one year to the next is given by:

$$\theta_{it}^{s} = \theta_{it-1}^{s} + \gamma' \Delta \eta_{it-1} \tag{4}$$

where the vector γ is simply the vector of first derivatives of the function f with respect to η_{it}. Thus the vector γ measures how a country's net external asset position might affect their preference for exchange rate stabilization.

The vector γ can either have the same entry in each row, in which case $\gamma' \Delta \eta_{it-1}$ is simply equal to a constant γ multiplied by the change in a country's net external asset position (which is approximately equal to the current account). If $\gamma < 0$ then in response to a current account deficit that needs to be financed by foreign capital inflows, the central bank will increase the weight they put on exchange rate stabilization in their policy rule. Alternatively the entries in the vector γ may vary, indicating that changes in some types of net external liabilities affect the central bank's preference for exchange rate stabilization more than others.

So after taking the first difference of the Taylor rule policy function:

$$\Delta R_{it} = \theta_p \Delta \pi_{it} + \theta_y \Delta y_{it} + \theta_{it}^{s} \left(\Delta R_{it}^{b} + \Delta \varepsilon_{it} \right) + \left(\theta_{it}^{s} - \theta_{it-1}^{s} \right) \left(R_{it-1}^{b} + \varepsilon_{it-1} \right) + \Delta m_t$$

which after a few substitutions becomes:

$$\Delta R_{it} = \theta_p \Delta \pi_{it} + \theta_y \Delta y_{it} + \theta_{it-1}^{s} \Delta R_{it}^{b} + \gamma' \Delta \eta_{it-1} \Delta R_{it}^{b} + \left(R_{it-1}^{b} + \varepsilon_{it-1} \right) \gamma' \Delta \eta_{it-1} + \theta_{it}^{s} \Delta \varepsilon_{it} + \Delta m_t \tag{5}$$

3.2 Data

The expression in (5) can be estimated to identify the terms in the vector γ, the vector that measures how a country's net external asset position might affect their preference for exchange rate stabilization. Considering that the risk premium term in the UIP condition, ε_{it} is not observable, the expression lends itself to the following reduced form empirical specification:

$$\Delta R_{it} = \theta_p \Delta \pi_{it} + \theta_y \Delta y_{it} + \theta^s_{it-1} \Delta R^b_{it} + \gamma' \Delta \eta_{it-1} \Delta R^b_{it} + \delta' \Delta \eta_{it-1} + \epsilon_{it} \tag{6}$$

The two terms ΔR_{it} and ΔR^b_{it} are simply the year-over-year change in the country i's nominal interest rate and the base country nominal interest rate. The base country will vary across countries and years. For most countries, the base country currency is the U.S. dollar, for some it may the euro, the yen, or the pound. In this estimation we consider an unbalanced panel consisting of 96 countries and 20 years, 1992-2011. Klein and Shambaugh (2015) assemble this data in an unbalanced panel including 132 countries over the years 1973-2011. Because of data availability when constructing variables for foreign and domestic currency denominated external debt, we are forced to limit the sample. By dropping the need to separately estimate the effects of domestic and foreign currency denominated debt, we can expand the sample to the sample used in Klein and Shambaugh (2015). This wider sample does not affect the results and this robustness check is presented in the last section.

The two variables $\Delta \pi_{it}$ and Δy_{it} are simply the year-over-year change in CPI inflation rate and real GDP.

As discussed earlier, the vector η_{it-1} contains five terms, domestic currency denominated net external debt assets, foreign currency denominated net external debt assets, net external FDI assets, net external portfolio equity assets, and central bank reserve assets at the end of the previous year. Most of this data is taken from the external wealth of nations dataset from Lane and Milesi-Ferretti (2007). The Share of external debt assets and liabilities that are denominated in the domestic or foreign currency is taken from Bénétrix, Lane, and Shambaugh (2015).

Before estimating this equation, it is helpful (but not necessary) to give some functional form to θ^s_{it-1}. As discussed earlier, Klein and Shambaugh (2015) show that θ^i_{st-1} is a function of whether or not a country has a pegged currency and the extent of capital controls. Klein and Shambaugh (2015) divide the country-year observations in their sample into those countries with a de facto exchange rate peg (where over the course of the year, a country's exchange rate relative to the base country never strays from within a ±2% band), those with a de facto soft peg (where the band is greater than ±2% but less than ±5%), and those with a floating currency (those that do not have a de facto peg or soft peg). In addition, the extent of capital account openness may be an important component of θ^s_{it-1}. Therefore, when presenting the estimation results, we will first consider the case where θ^s_{it-1} is a constant to be estimated, and alternatively we will consider the case where θ^s_{it-1} takes the following form:

$$\theta^i_{st-1} = \theta + \theta^{peg} peg_{it-1} + \theta^{soft} soft_{it-1} + \theta^K K_{it-1}$$

where peg_{it-1} and $soft_{it-1}$ are indicator variables equal to 1 if the country-year observation has a pegged currency or a soft peg (as defined by Klein and Shambaugh (2015)) and K_{it} is simply the Chinn and Ito (2008) capital account openness index for that country-year observation (the original index is then normalized on a 0-1 scale where 0 denotes a closed capital account and 1 denotes an open capital account).

4 Results

The baseline regression results are presented in table 1. The first two columns present the results from the regression where instead of estimating the effect of each component of the change in the international investment position, $\Delta\eta_{it-1}$, separately, we simply sum the components. The estimate of the interaction between $\sum \Delta\eta_{it-1}$ and changes in the foreign interest rate is the estimated value of γ in equation (6), where because we are treating each component of the vector $\Delta\eta_{it-1}$ equally, the coefficient vector γ is simply a scalar γ multiplied by a vector of ones. In this estimated value of the scalar γ is approximately equal to -0.006.

The sum of the change in the international investment position, $\sum \Delta\eta_{it-1}$, is closely related to, but not exactly equal to the current account. The difference is due to valuation effects and errors and omissions, and thus absent these factors, the results in the first two columns of the table show that for each 1 percentage point increase in the current account to GDP ratio, the coefficient on ΔR^b_{it} falls by 0.006.

Klein and Shambaugh (2015) show that this coefficient is greater by about 0.41 for countries with a pegged currency than for countries with a floating currency, and this coefficient is greater by about 0.22 for countries with a soft peg than for countries that float.[5] Given those Klein and Shambaugh estimates of differences in monetary policy autonomy across different de facto exchange rate regimes and the estimates in the first two columns of table 1, a current account deficit of 36 percent of GDP would cause a country with a de facto floating current in the previous year to adopt a de facto soft peg in the next ($36 \approx \frac{0.22}{.006}$) while a current account deficit of 31 percent of GDP would cause a country with a de facto soft peg to adopt a de facto strict exchange rate peg ($31 \approx \frac{0.41-0.22}{.006}$).

Current account deficits of 36 or 31 percent of GDP seem unlikely.[6] But the estimated regression coefficient of -0.006 assumes that the central bank treats all forms of foreign financing equally. The example from the taper tantrum in 2013 suggests that all forms of financing are not treated equally. A central bank with low reserves or high external debt obligations is more likely to follow a foreign monetary tightening by raising their own

[5] The Klein and Shambaugh (2015) results are from the 1973-2011 sample. Due to data availability, this paper uses a reduced 1992-2011 sample. In this shorter sample, the Klein and Shambaugh coefficients of 0.41 and 0.22 change to 0.48 and 0.33. Those replications of the Klein and Shambaugh regressions are available on request.

[6] As shown in (Lane and Milesi-Ferretti 2012), the Baltic countries of Estonia, Latvia, and Lithuania had some of the largest current account deficits on the eve of the global financial crisis. In 2007, Lithuania's current account deficit was 14% of GDP, Estonia's was 17% and Latvia's was 22%.

interest rate in an effort to attract foreign capital and prevent a stop, while a central bank with high external FDI obligations is less worried about a stop and thus less likely to use the interest rate to attract foreign capital inflows. The third through the sixth columns of table 1 present the results from the regression where we estimate the effect of each component of the international investment position separately. In the table, ΔD_{it-1} is the previous period's change in net external debt liabilities, and these can be divided into net home currency liabilities ΔD^{hc}_{it-1} and net foreign currency liabilities ΔD^{fc}_{it-1}. We also consider the change in net external FDI liabilities, ΔFDI_{it-1}, the change in net external portfolio equity liabilities, ΔPE_{it-1}, and the change in central bank reserve assets, ΔRES_{it-1}. In the third and fourth columns of the table we do not divide net external debt into its home and foreign currency components. In the fifth and sixth columns we do.

In line with the above reasoning, the results show that only the accumulation of net external debt or the depletion of central bank reserves can motivate a central bank to sacrifice monetary policy autonomy and instead use monetary policy to attract foreign capital inflows. Instead of estimating the vector γ as a scalar multiplied by a vector of ones, here we estimate each component of γ. The coefficient of the change in net external debt and the coefficient of the change in reserves are the only components of γ that are significant. The coefficient of net external debt is about -0.009 and the coefficient of reserves is about -0.056. This implies that for every 1 percentage point increase in net external debt liabilities, the coefficient on ΔR^b_{it} increases by 0.009, and for every 1 percentage point fall in the reserves to GDP ratio, the coefficient on ΔR^b_{it} increases by 0.056.

The results in the fifth and sixth column show that not all types of external debt liabilities evoke the same reaction from the central bank. An accumulation of home currency denominated debt liabilities does not have a significant effect, but for every 1 percentage point increase in net foreign currency denominated external debt liabilities, the coefficient on ΔR^b_{it} increases by 0.011.

Using the estimate of the difference on monetary policy autonomy from Klein and Shambaugh, an increase in the ratio of foreign currency denominated debt to GDP of 20 percentage points would make a country with a floating currency adopt a de facto soft float, while a 17 percentage point increase would make a country with a soft float adopt a strict exchange rate peg. A fall in the reserve to GDP ratio of only about 4 percentage points is enough to make a central bank with a floating currency adopt a de facto soft peg, and a fall of a little more than 3 percentage points is enough to make a central bank with a soft peg adopt a de facto strict exchange rate peg.

4.1 Robustness

To check the robustness of these results, we will first estimate this same regression in a longer, 1973-2011 sample period. Then we will test the robustness of the results to corrections for valuation effects when measuring the change in net foreign assets. And finally we will test the robustness to the inclusion of a lagged interest rate variable in the monetary policy rule.

4.1.1 Longer sample period

The results presented earlier were drawn from a panel of 96 countries over the period 1992-2011. The limiting factor in the estimation was the data on the currency denomination of external debt, which is only available beginning in 1990 (and since the term in the regression is last period's change in net external assets, the earliest date to begin the regression is 1992). If we don't need data on the currency denomination of external debt assets and liabilities, we can instead begin the estimation in 1973, like Klein and Shambaugh (2015).

The results for this longer sample period are presented in table 2. We of course can't fill in the last two columns of the earlier regression table, where we distinguish between domestic and foreign currency debt, but the results in the rest of the table are qualitatively identical. The change in net external debt liabilities and the change in central bank reserves are still the only two components of the change in the net external asset position that affect central bank autonomy. There is a quantitative change when using the longer sample period.

The coefficients are smaller. This is due to the fact that this longer sample tends to place greater weight on the advanced economies in the sample, simply for data availability reasons. Advanced economies are less subject to surges and stops and the swings of the global financial cycle than many emerging markets, so advanced economy central banks are less inclined to sacrifice monetary policy autonomy and adopt a de facto exchange rate peg out of the fear of a stop in foreign financing of an external deficit.

4.1.2 Correcting for valuation effects

The terms in $\Delta\eta_{it}$ are simply this year's stock of net external assets minus last year's stock of net external assets divided by GDP. These stocks are recorded in terms of U.S. dollars. Some variables, like reserves, are largely held in U.S. dollars, so it is fair to say that the flow of reserves in a given year is simply this year's USD stock minus last year's USD stock. However, as discussed by Bénétrix, Lane, and Shambaugh (2015) when compiling data on the currency denomination of external assets and liabilities, it is fair to assume that portfolio equity and FDI are domestic currency denominated. Thus a depreciation in the exchange rate over the year would mean that there was a decrease in the USD value of external equity assets and liabilities, and thus subtracting last year's stock from this year's stock would make it seem as if there was a large decrease in equity assets and liabilities, even though there was no active accumulation of new assets or liabilities over the period.

A useful robustness test is to correct for these exchange rate valuation effects. After doing this, the terms in $\Delta\eta_{it}$ are the changes to the net external asset position that are due to actual capital flows during the year, and not simply due to exchange rate changes, and the sum of the components of $\Delta\eta_{it}$ is approximately equal to the current account (less net errors and omissions). These foreign exchange valuation changes will only affect a few components of $\Delta\eta_{it}$, domestic currency denominated debt, portfolio equity, and FDI. Earlier where the terms in $\Delta\eta_{it}$ are simply this year's stock of net external assets minus last year's stock of net external assets divided by GDP:

$$\Delta FDI_{it} = (FDI_{it} - FDI_{it-1}) / GDP_t$$

When correcting for valuation effects, for these three components the entry in $\Delta\eta_{it}$ is this year's stock of net external assets minus last year's stock multiplied by the gross change in the exchange rate over the year, all divided by GDP:

$$\Delta FDI_{it} = \left(FDI_{it} - \frac{fx_{it}}{fx_{it-1}} FDI_{it-1} \right) / GDP_t$$

where fx_{it} is the end of the year value of the exchange rate (in terms of units of the domestic currency per USD).

The results from estimating the same regressions using these foreign exchange valuation corrected changes in net external assets are presented in table 3. The table shows that there is very little qualitative or quantitative change in the results. The reason for this is simple. These foreign exchange valuation changes do not affect the two main components of the change in net external assets that were found to be significant, the change in foreign currency denominated debt and the change in reserves. These valuation changes affect the components that were found to be insignificant in these regressions, so there is almost no effect on the results from the estimation.

4.1.3 A lagged interest rate in the monetary policy rule

The estimation equation in (6) is derived from a Taylor rule where the only terms are inflation, the output gap, and exchange rate stability. Alternatively, one could consider the effect of including the lagged nominal interest rate in the monetary policy rule. In this case, the regression equation in (6) has one more right-hand side term: the lagged change in the home nominal interest rate, ΔR_{it-1}.

The results from these regressions are presented in table 3. The table shows that the inclusion of the lagged interest rate in the Taylor rule has no effect on the estimates of the other coefficients. The change in net external debt liabilities and the change in central bank reserves are still the only two components of the change in the net external asset position that affect central bank autonomy.

5 Conclusion

Mechanically, a central bank with a floating currency has complete monetary policy autonomy and can do whatever they want with their interest rate instrument. But when setting policy, central banks face trade-offs. One of these trade-offs is between the need to stabilize the domestic economy and the need to stabilize capital flows, the exchange rate, and the external accounts.

A country's economic fundamentals can affect this trade-off. A country with a current account surplus that is accumulating central bank reserves and claims on the rest of the world has little to fear from a sudden stop in capital inflows. Thus the central bank in this country can focus on the domestic economy and has no need to trade-off domestic stabilization for exchange rate and capital flow stabilization. On the other hand a country with a current account deficit, especially a deficit financed by reserve depletion or the accumulation of foreign currency denominated debt, has a lot to fear from a sudden stop in capital inflows, and the central bank will be forced to use their interest rate to attract capital inflows and thus stabilize the external accounts, even if that comes at the cost of destabilizing the domestic economy.

Nowhere is this more evident than when a central bank drastically raises interest rates in an attempt to curtail a sudden drop in net capital inflows. The central bank of Russia's increase of 750 basis points in December 2014 or the central bank of Turkey's increase of 550 basis points in January 2014 are just two recent examples.

But apart from these dramatic cases, this paper shows that even modest reserve depletion or modest increases in foreign currency denominated debt can lead a central bank with a floating currency to adopt a de facto exchange rate peg. The estimates in this paper show that reserve deplection of 7% of GDP over the past year can so change the trade-offs faced by the central bank that they would be willing to abandon the floating currency and adopt a de facto peg in the interest of stabilizing capital flows.

This in turn has implications for the global effect of a monetary tightening by a base country central bank like the Federal Reserve. Since many central banks that are concerned about the stability of capital flows and their external accout would be tempted to mimic Fed action in raising interest rates, the actual effect of Fed tightening on global liquidity is greater than it would have been if the Fed acted alone.

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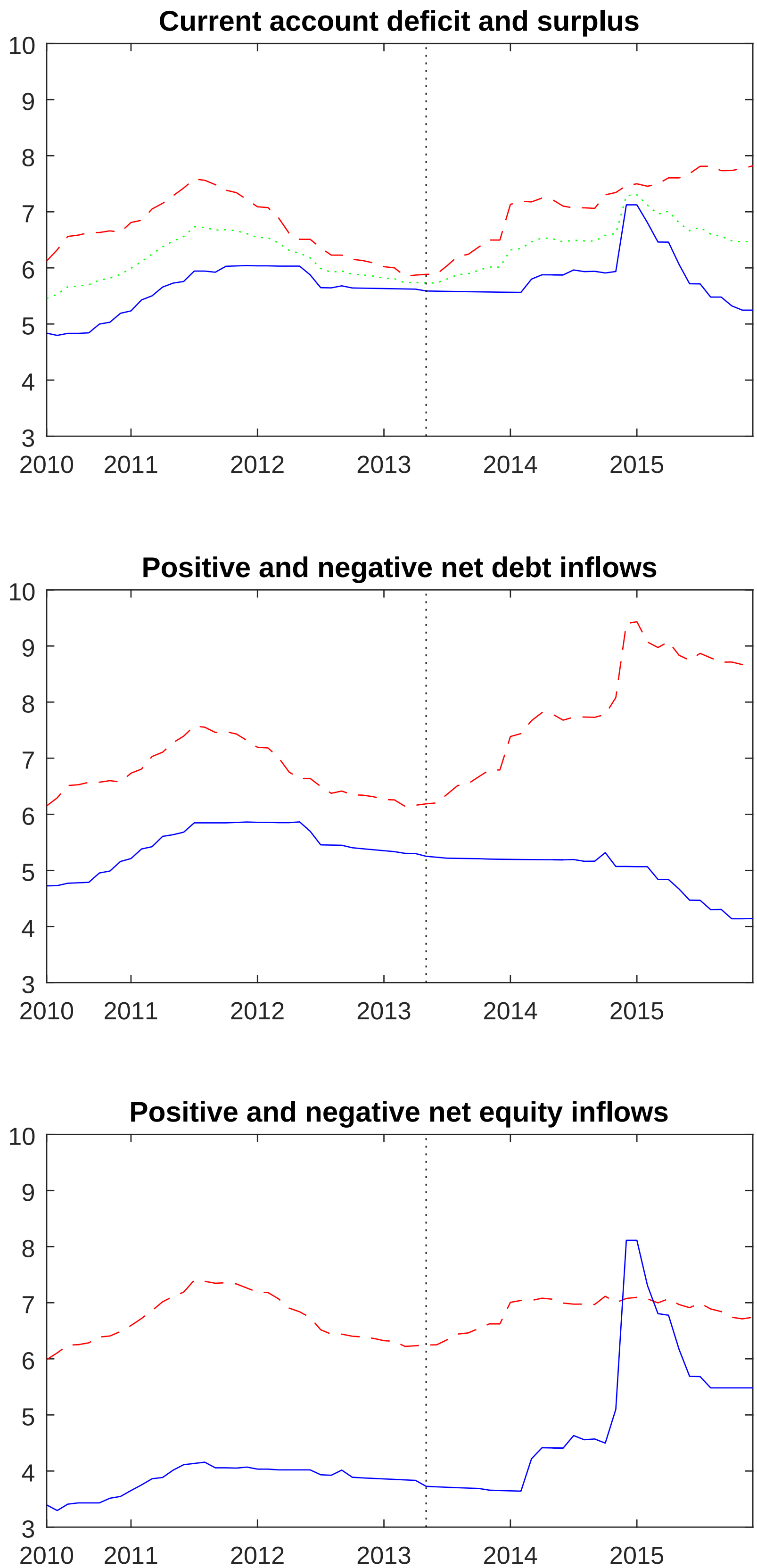

Figure 1: Policy rates in emerging market economies with a current account deficit or surplus, positive or negative nebt debt inflows, and positive or negative net equity inflows. The red dashed line represents those with a current account deficit or positive net capital inflows and the blue solid line represents those with a current account surplus or negative net capital inflows.

Table 1: Benchmark regression results

	Dependent Variable: ΔR_{it}					
$\Delta\hat{y}_t$	0.011**	0.013**	0.014**	0.015**	0.014**	0.015**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\Delta\pi_t$	0.103***	0.103***	0.102***	0.102***	0.102***	0.102***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
ΔR^b_{it}	0.209***	-0.187	0.320***	-0.083	0.322***	-0.091
	(0.052)	(0.119)	(0.060)	(0.121)	(0.060)	(0.121)
$peg_{it-1} \times \Delta R^b_{it}$		0.363***		0.371***		0.388***
		(0.122)		(0.121)		(0.122)
$soft_{it-1} \times \Delta R^b_{it}$		0.191		0.207*		0.210*
		(0.123)		(0.122)		(0.122)
$K_{it-1} \times \Delta R^b_{it}$		0.366**		0.368**		0.381***
		(0.145)		(0.144)		(0.145)
$\sum \Delta\eta_{it-1} \times \Delta R^b_{it}$	-0.006**	-0.006***				
	(0.002)	(0.002)				
$\Delta D_{it-1} \times \Delta R^b_{it}$			-0.008**	-0.009***		
			(0.004)	(0.004)		
$\Delta D^{hc}_{it-1} \times \Delta R^b_{it}$					-0.003	-0.002
					(0.008)	(0.008)
$\Delta D^{fc}_{it-1} \times \Delta R^b_{it}$					-0.009**	-0.011***
					(0.004)	(0.004)
$\Delta FDI_{it-1} \times \Delta R^b_{it}$			-0.001	0.000	0.001	0.003
			(0.008)	(0.008)	(0.008)	(0.008)
$\Delta PE_{it-1} \times \Delta R^b_{it}$			-0.001	-0.002	0.002	0.002
			(0.008)	(0.008)	(0.009)	(0.008)
$\Delta RES_{it-1} \times \Delta R^b_{it}$			-0.057***	-0.056***	-0.055***	-0.054***
			(0.014)	(0.014)	(0.015)	(0.015)
$\sum \Delta\eta_{it-1}$	-0.017***	-0.017***				
	(0.006)	(0.006)				
ΔD_{it}			-0.026***	-0.027***		
			(0.008)	(0.008)		
ΔD^{hc}_{it}					-0.030**	-0.036***
					(0.012)	(0.012)
ΔD^{fc}_{it}					-0.025***	-0.026***
					(0.008)	(0.008)
ΔFDI_{it-1}			-0.002	-0.001	-0.003	-0.004
			(0.012)	(0.012)	(0.012)	(0.012)
ΔPE_{it-1}			-0.002	-0.001	-0.004	-0.004
			(0.011)	(0.011)	(0.011)	(0.011)
ΔRES_{it-1}			-0.074***	-0.072***	-0.075***	-0.075***
			(0.021)	(0.021)	(0.022)	(0.021)
Obs.	1453	1453	1453	1453	1453	1453
Adj R^2	0.123	0.133	0.138	0.149	0.139	0.150
CXFE	yes	yes	yes	yes	yes	yes

notes: Standard errors are in parenthesis. ***/**/* denote significance at the 1/5/10% levels.

Table 2: Estimation results using a sample from 1973-2011

		Dependent Variable: ΔR_{it}		
$\Delta \hat{y}_t$	-0.001	0.000	0.001	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
$\Delta \pi_t$	0.051***	0.052***	0.051***	0.052***
	(0.006)	(0.006)	(0.006)	(0.006)
ΔR^b_{it}	0.258***	-0.173***	0.292***	-0.151**
	(0.029)	(0.066)	(0.032)	(0.066)
$peg_{it-1} \times \Delta R^b_{it}$		0.437***		0.458***
		(0.069)		(0.069)
$soft_{it-1} \times \Delta R^b_{it}$		0.247***		0.259***
		(0.075)		(0.075)
$K_{it-1} \times \Delta R^b_{it}$		0.371***		0.393***
		(0.087)		(0.087)
$\sum \Delta \eta_{it-1} \times \Delta R^b_{it}$	-0.001	-0.001		
	(0.002)	(0.002)		
$\Delta D_{it-1} \times \Delta R^b_{it}$			-0.004*	-0.006***
			(0.002)	(0.002)
$\Delta FDI_{it-1} \times \Delta R^b_{it}$			0.006	0.010**
			(0.005)	(0.005)
$\Delta PE_{it-1} \times \Delta R^b_{it}$			0.003	0.003
			(0.003)	(0.003)
$\Delta RES_{it-1} \times \Delta R^b_{it}$			-0.022***	-0.024***
			(0.008)	(0.008)
$\sum \Delta \eta_{it-1}$	-0.005*	-0.005**		
	(0.002)	(0.002)		
ΔD_{it}			-0.015***	-0.015***
			(0.004)	(0.004)
ΔFDI_{it-1}			0.000	0.000
			(0.004)	(0.004)
ΔPE_{it-1}			0.002	0.002
			(0.003)	(0.003)
ΔRES_{it-1}			-0.054***	-0.054***
			(0.014)	(0.014)
Obs.	2745	2745	2745	2745
Adj R^2	0.089	0.109	0.098	0.120
$CXFE$	yes	yes	yes	yes

notes: Standard errors are in parenthesis. ***/**/* denote significance at the 1/5/10% levels.

Table 3: Regression results correcting for valuation effects in the change in net external assets.

	Dependent Variable: ΔR_{it}					
$\Delta\hat{y}_t$	0.012**	0.014**	0.013**	0.014**	0.013**	0.015**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\Delta\pi_t$	0.102***	0.103***	0.102***	0.102***	0.102***	0.102***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
ΔR^b_{it}	0.205***	-0.190	0.332***	-0.071	0.338***	-0.075
	(0.052)	(0.119)	(0.062)	(0.123)	(0.062)	(0.123)
$peg_{it-1} \times \Delta R^b_{it}$		0.356***		0.374***		0.391***
		(0.122)		(0.121)		(0.122)
$soft_{it-1} \times \Delta R^b_{it}$		0.189		0.207*		0.205*
		(0.123)		(0.122)		(0.122)
$K_{it-1} \times \Delta R^b_{it}$		0.369**		0.364**		0.380***
		(0.145)		(0.144)		(0.145)
$\sum \Delta\eta_{it-1} \times \Delta R^b_{it}$	-0.006**	-0.006**				
	(0.003)	(0.003)				
$\Delta D_{it-1} \times \Delta R^b_{it}$			-0.009***	-0.010***		
			(0.003)	(0.003)		
$\Delta D^{hc}_{it-1} \times \Delta R^b_{it}$					-0.002	-0.001
					(0.009)	(0.009)
$\Delta D^{fc}_{it-1} \times \Delta R^b_{it}$					-0.010***	-0.011***
					(0.003)	(0.003)
$\Delta FDI_{it-1} \times \Delta R^b_{it}$			0.005	0.005	0.007	0.008
			(0.008)	(0.008)	(0.008)	(0.008)
$\Delta PE_{it-1} \times \Delta R^b_{it}$			0.003	0.003	0.005	0.005
			(0.009)	(0.009)	(0.009)	(0.009)
$\Delta RES_{it-1} \times \Delta R^b_{it}$			-0.054***	-0.054***	-0.053***	-0.053***
			(0.014)	(0.014)	(0.014)	(0.014)
$\sum \Delta\eta_{it-1}$	-0.018***	-0.018***				
	(0.006)	(0.006)				
ΔD_{it}			-0.026***	-0.027***		
			(0.008)	(0.008)		
ΔD^{hc}_{it}					-0.033**	-0.039***
					(0.013)	(0.013)
ΔD^{fc}_{it}					-0.025***	-0.026***
					(0.008)	(0.008)
ΔFDI_{it-1}			-0.006	-0.006	-0.008	-0.009
			(0.011)	(0.011)	(0.012)	(0.012)
ΔPE_{it-1}			-0.005	-0.004	-0.007	-0.007
			(0.011)	(0.011)	(0.011)	(0.011)
ΔRES_{it-1}			-0.073***	-0.072***	-0.075***	-0.074***
			(0.021)	(0.021)	(0.021)	(0.021)
Obs.	1453	1453	1453	1453	1453	1453
Adj R^2	0.123	0.133	0.139	0.149	0.140	0.151
CXFE	yes	yes	yes	yes	yes	yes

notes: Standard errors are in parenthesis. ***/**/* denote significance at the 1/5/10% levels.

Table 4: Regression results where the lagged nominal interest rate is part of the estimated equation.

	Dependent Variable: ΔR_{it}					
ΔR_{it-1}	-0.014	-0.021	-0.024	-0.031	-0.024	-0.031
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
$\Delta \hat{y}_t$	0.022***	0.023***	0.025***	0.025***	0.025***	0.025***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\Delta \pi_t$	0.099***	0.100***	0.098***	0.098***	0.098***	0.099***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
ΔR^b_{it}	0.204***	-0.088	0.320***	0.022	0.322***	0.011
	(0.052)	(0.122)	(0.060)	(0.125)	(0.060)	(0.125)
$peg_{it-1} \times \Delta R^b_{it}$		0.290**		0.298**		0.318***
		(0.120)		(0.120)		(0.120)
$soft_{it-1} \times \Delta R^b_{it}$		0.048		0.068		0.070
		(0.124)		(0.123)		(0.123)
$K_{it-1} \times \Delta R^b_{it}$		0.296**		0.288**		0.303**
		(0.145)		(0.144)		(0.144)
$\sum \Delta \eta_{it-1} \times \Delta R^b_{it}$	-0.005**	-0.005**				
	(0.002)	(0.002)				
$\Delta D_{it-1} \times \Delta R^b_{it}$			-0.007**	-0.008**		
			(0.003)	(0.003)		
$\Delta D^{hc}_{it-1} \times \Delta R^b_{it}$					0.000	0.001
					(0.007)	(0.007)
$\Delta D^{fc}_{it-1} \times \Delta R^b_{it}$					-0.008**	-0.010***
					(0.003)	(0.003)
$\Delta FDI_{it-1} \times \Delta R^b_{it}$			0.000	0.001	0.002	0.004
			(0.008)	(0.008)	(0.008)	(0.008)
$\Delta PE_{it-1} \times \Delta R^b_{it}$			-0.001	-0.001	0.002	0.003
			(0.008)	(0.008)	(0.008)	(0.008)
$\Delta RES_{it-1} \times \Delta R^b_{it}$			-0.056***	-0.054***	-0.054***	-0.052***
			(0.014)	(0.014)	(0.014)	(0.014)
$\sum \Delta \eta_{it-1}$	-0.015***	-0.014***				
	(0.005)	(0.005)				
ΔD_{it}			-0.023***	-0.024***		
			(0.008)	(0.008)		
ΔD^{hc}_{it}					-0.028**	-0.033***
					(0.012)	(0.012)
ΔD^{fc}_{it}					-0.023***	-0.023***
					(0.008)	(0.008)
ΔFDI_{it-1}			0.000	0.001	-0.002	-0.002
			(0.011)	(0.011)	(0.011)	(0.011)
ΔPE_{it-1}			-0.002	0.000	-0.005	-0.004
			(0.010)	(0.010)	(0.010)	(0.010)
ΔRES_{it-1}			-0.074***	-0.073***	-0.075***	-0.075***
			(0.021)	(0.021)	(0.021)	(0.021)
Obs.	1308	1308	1308	1308	1308	1308
Adj R^2	0.132	0.140	0.151	0.158	0.152	0.160
CXFE	yes	yes	yes	yes	yes	yes

notes: Standard errors are in parenthesis. ***/**/* denote significance at the 1/5/10% levels.