Monetary Trilemma, Dilemma or Something in Between?[1]

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ABSTRACT

This paper re-visits the monetary trilemma versus dilemma debate by empirically examining interest rate policy independence for a large sample of both advanced and developing countries over the period of 1973-2014. We broadly concur with the growing body of literature that suggests that the trilemma still holds, emphasizing the important insulating effects afforded by exchange rate flexibility. However, as with Han & Wei (2018), we also document the existence of an asymmetric pattern or 2.5-lemma between the trilemma and dilemma; though in contrast to them we find there seems to be evidence of a "fear of capital reversal" rather than a "fear of appreciation". We further find that holding higher levels of foreign reserves may help countries regain a degree of monetary policy autonomy.

Keywords: Asymmetry; Capital controls; Exchange rate regime; Trilemma; Dilemma

1. Introduction

For many economies large-scale cross-border capital flows have been a double-edged sword. Since the 1990s, debates have been centered on whether global capital mobility is welfare-enhancing or whether it has imparted greater instability to the national economy and complicated macroeconomic management (Ostry et al., 2012). The classical "monetary trilemma" suggests that if a peripheral small open country wishes to use monetary policy to manage the domestic economy it will need to forsake a fixed exchange rate regime (or will eventually be forced to do so via a currency crisis). A number of emerging market and developing economies (EMDEs hereafter) have, over time, been moving towards greater exchange rate flexibility (Corbacho & Peiris, 2018; Duttagupta et al., 2005; Rajan, 2012). This reflects in part the belief that more flexible exchange rates afford a country a greater degree of monetary policy autonomy in responding to foreign shocks such as surges and sudden stops in capital flows (Friedman, 1953).[2]

However, Rey (2015) challenged the relevance of the trilemma in this era of financial globalization, declaring that a country with an open capital account would inevitably be affected by the "global financial cycle" regardless of the exchange rate regime. She specifically emphasized the role of the VIX (the Chicago Board Options Exchange Volatility Index, which is commonly used as an indicator to measure market uncertainty and risk aversion) as being the key driver of large co-movements in asset prices, gross flows and bank leverage. In this sense the "trilemma" collapses into a "dilemma" due to the existence of the common global factor. Therefore, a small open economy can maintain an independent monetary policy if and only if it forsakes capital account openness (also see (Passari & Rey, 2015). In similar vein, Bruno & Shin (2015) have highlighted the role of the U.S. dollar cross-border lending and thus U.S. monetary policy in impacting EMDEs via the risk taking channel regardless of the type of exchange rate regime. From a policy perspective, acknowledging the concerns posed by the possible existence of a monetary dilemma, former RBI Governor Raghuram Rajan has repeatedly suggested the need for some "Rules of the Game" in managing cross-border monetary spillovers from the U.S. in particular and advanced economies in general.

[2] Using a sample of forty EMDEs covering the period 1986–2013, Obstfeld et al. (2019) find that the exchange rate system does matter and the transmission of global financial shocks is intensified under pegged regimes compared to more flexible exchange rate regimes.

This paper furthers the foregoing debate by investigating interest rate policy independence for a large sample of eighty-eight countries comprising both advanced economies (AEs hereafter) and EMDEs over the time period 1973-2014. While this paper builds on the earlier studies on this issue (Shambaugh, 2004; Obstfeld et al., 2005; Klein & Shambaugh, 2015), it differs from them in two substantive ways. One, we take into account possible asymmetries in the manner in which peripheral countries respond to changes in base country interest rate (Han & Wei, 2018). Two, we explicitly consider the role of reserves in overcoming the constraints in monetary policy autonomy imposed by an open capital account.

The remainder of the paper is organized as follows. Section 2 discusses the methodology and data. Section 3 presents the baseline results and confirms the findings of earlier studies that the trilemma seems to still very much hold and both exchange rate system and capital controls matter. Section 4 extends the earlier findings by considering the potential asymmetric responses by small open countries to an increase versus a decrease in the base interest rates and presents a partial dilemma pattern. In particular, we find that peripheral countries tend to follow suit when base countries raise interest rates independent of the exchange rate regime but not when base countries loosen their monetary policy stance. We interpret this so-called 2.5-lemma as due possibly to a "fear of capital reversal" or "fear of reserve loss". We then go on to examine this hypothesis further and find that the 2.5-lemma is in fact largely driven by the sub-sample of countries with low levels of foreign reserves. Section 5 extends the analysis to consider the case of intermediate exchange rate regimes and capital controls. Section 6 concludes the paper.

2. Methodology and Data

Following the general approaches by Shambaugh (2004), Obstfeld et al. (2005) and Klein & Shambaugh (2015), the methodology starts with the simple interest rate parity equation:

$$R_{it} = R_{bit} + (E^{e}_{i,t+1} - E_{it}) + \rho_{it} \quad (1)$$

R_{it} is the nominal local interest rate for country i at time t. R_{bit} is the nominal interest rate of the base country of the country i at time t. E_{it} is the log of the current bilateral exchange rate (domestic price of foreign currency) at time t, E^{e}_{it+1} is the log of the expected exchange rate next period at time $t+1$. The term in parenthesis captures the expected change in the nominal exchange rate between country i and the base country from this period to the next. If investors are risk neutral, ρ_{it} = 0. However, if we assume investors are risk averse, ρ_{it} is the premium for compensation for risk-taking.

It would be ideal to include the expected change in exchange rate and the risk premium in the regressions, though both are unobservable. Estimating equation (1) directly poses some further problems. Usually nominal interest rates exhibit strong persistence and there exists a unit root, so spurious regressions are possible if level regressions are estimated. Because of this we follow much of the literature and adopt the first difference estimation of equation (1). The baseline model specification is as follows:

$$\Delta R_{it} = \alpha + \beta \Delta R_{bit} + u_{it} \quad (2)$$

where u_{it} = $\Delta[(E^{e}_{i,t+1} - E_{it}) + \rho_{it} + \varepsilon_{it}]$, ε_{it} is the idiosyncratic error term or time-varying unobserved heterogeneity. We estimate regressions for different sub-samples of data to capture the effects of different combinations of exchange rate and capital account regimes. Specifically, we can divide the data into four sub-samples according to whether the exchange rate system is fixed or non-fixed, and whether the country imposes capital controls. The four sub-samples are peg with closed capital account (Quadrant 1), non-peg with closed capital account (Quadrant 2), peg with open capital account (Quadrant 3); and non-peg with open capital account (Quadrant 4).

		Peg	
		Yes	No
Capital Controls	Yes	Quadrant 1	Quadrant 2
	No	Quadrant 3	Quadrant 4

2.1 Priors

We compare β and R^2 across all four categories. The larger or more significant the β, the less the degree of monetary autonomy enjoyed. Assume in the first instance that u_{it} is uncorrelated with ΔR_{bit}. Theoretically β would be close to 1 for a sub-sample panel of pegged countries with open capital accounts (Quadrant 3) because a country with a fixed exchange rate regime and an open capital account would have to change its interest rate one-for-one with that of the base country, all else being constant, i.e. no monetary autonomy. The β coefficient ought to equal to 0 for Quadrant 2 where the country has a flexible exchange rate and has imposed capital controls, i.e. complete monetary autonomy.

However, as documented by Klein & Shambaugh (2015), in reality many situations can cause ΔR_{bit} to be correlated with components in u_{it}. For example, a common shock can cause similar responses in interest rates across countries. In addition, when the exchange rate operates within a credible band, $cov(\Delta R_{bit}, u_{it})$ could also be non-zero. Therefore, in practice we do not expect the benchmark estimated values of β to necessarily be 1 or 0 as there are possible correlations between ΔR_{bit} and u_{it} (also see Obstfeld et al., 2005). In addition, proxies for capital controls and exchange rate regime remain far from perfect. Therefore, more generally we would expect the β in Quadrant 3 to be greater than the rest and the β in Quadrant 2 to be the lowest, while the βs in Quadrants 1 and 4 ought to be somewhere in between if the country retains a degree of monetary policy autonomy. A priori one cannot tell whether the β in Quadrant 1 is greater or less than the β in Quadrant 4 as it depends on whether capital controls or peg grants a country relatively greater monetary autonomy. On the other hand, if the dilemma holds, one would expect that the βs in Quadrants 3 and 4 to each be closer to 1 than 0 as the exchange rate regime should not matter.

2.2 Data

The main interest rate data we use is short-term Treasury-bill rate (average monthly values) from the *Global Financial Data*.[3] In all, there are 176 countries in the dataset, but short-term Treasury-bill rates data are only available for 88 countries. For our baseline model we use the exchange rate regime data from the Shambaugh dataset which is based on de facto classification. It emphasizes the bilateral exchange rate between a given country and its base country. We use the Chinn-Ito index as the base to generate our binary index of capital controls in the baseline. Since Chinn-Ito index (KAOPEN) is a financial account openness index rather than one that directly measures capital controls, we define our index of capital controls as 1- ka_open. We first only

[3] The weblink for the databank: https://www.globalfinancialdata.com/.

consider a binary case, viz. no capital controls when our index takes the value of zero and with at least some capital controls when our index takes the value other than zero.

Overall, we have an unbalanced panel for the period 1973-2014[4] and our sample consists of 703 peg observations, 1309 non-peg observations, 1384 capital control observations and 630 no control observations. There are 25 advanced economies and 63 EMDEs in the sample. AEs constitute around 40 percent of observations while EMDEs account for the rest of 60 percent. Among them, 46 EMDEs and 19 AEs in the sample once adopted fixed exchange rate regime. In addition, there are 8 base countries in the sample, viz. the United States, Germany, France, South Africa, United Kingdom, India, Portugal and Malaysia[5]. The United States is the dominant one as 58 countries (about three-fifths of the observations) are pegged to the U.S. dollar.[6]

3. Baseline Results

3.1 Does the Trilemma Hold?

We first test the first-difference specification equation (2) using pooled OLS. The specification was run for these four sub-samples. To correct for potential heteroskedasticity and serial correlation problems, cluster-robust standard errors are reported, and the data are clustered at the country level. The results are reported in Table 1 (Panel A).

Insert Table 1 here

As the trilemma predicts, countries with a fixed exchange rate regime but with no capital controls must surrender monetary autonomy. This subgroup has the highest β coefficient of 0.94,

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[4] The time period is limited to 2014 as the Shambaugh dataset is only updated till then.

[5] The United States, Germany and France are clear bases. However, for some years, India was also the base for Bhutan, Nepal and Sri Lanka; Malaysia was the base for Singapore; Portugal was once the base for Cape Verde; Guinea-Bissau, Sao Tome and Principe; Angola; and Mozambique; and South Africa was the base for Botswana, Lesotho, Namibia, and Swaziland. Details can be found in the Shambaugh dataset https://www2.gwu.edu/~iiep/about/faculty/jshambaugh/data.cfm. According to Shambaugh (2004), the choice of the base country is determined by countries' previous pegging histories, which is relevant in almost all cases, but otherwise determined by the dominant currency in the region, i.e., the one to which neighbouring countries peg.

[6] Online Annex Table A1 summarizes the means, standard deviations, minimum values and maximum values of interest rate differential for different sub-samples.

which is statistically significant at the 99% confidence level, while the R^2 is relatively high at 0.42. At the other end of the spectrum, for countries without pegs but with capital controls, the β coefficient is 0.09 and is statistically insignificant with rather low R^2 of close to 0, suggesting multiple other factors impacting domestic interest rate changes. This is consistent with the priors of the trilemma. Even with capital controls, exchange rate regime choice is still meaningful as the β coefficient for pegged countries with capital controls is 0.31, statistically significant at the 99% level, which is far greater than that for non-pegged countries with capital controls (0.09). The β for the sub-sample of non-pegged countries with no capital controls is 0.48, significant at the 99% level, with a modest R^2 of 0.10. These results reaffirm the existence of the monetary trilemma rather than the dilemma. Since the coefficient for the sub-sample of non-pegged countries with no capital controls (0.48) is greater than the coefficient for the sub-sample of pegged countries with capital controls (0.31), this suggests that exchange rate flexibility offers somewhat less monetary policy autonomy than capital controls. Broadly these results are comparable to other studies using similar methodologies but different samples.[7]

It is plausible that the results are driven in part by common shocks. If the economic shocks facing every country are almost identical, we would expect the β coefficients to be biased upwards. To this end we re-estimate equation (2) but include year fixed effects. From Table 1 we see that there is hardly any change in the coefficients in the two peg sub-samples with and without capital controls when time dummies are added (Panel B). This suggests that global common shocks do not spuriously drive the significant results for the pegged samples. It shows that the value of β for the sub-sample of pegged countries with no capital controls is slightly lower but still relatively high at 0.80, and the R^2 indicates that the base interest rate changes explains over half of local country interest rate changes.[8] In comparison to the previous results, the β coefficient for the sub-sample of non-pegged countries with a closed capital account is even smaller, reaffirming the earlier findings. Thus, our priors still hold after accounting for common shocks. The β coefficient for countries with pegged regimes with capital controls is 0.30, very similar to the previous result,

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[7] See online Annex Table A2.

[8] The coefficient in the open peg sample is reduced from 0.94 to 0.80. Some effects are soaked up by the year effects. However, the value of the β is still the highest among all sub-samples which supports the trilemma proposition.

though the confidence level is slightly reduced. The one notable change is the sub-sample of non-pegged countries without capital controls. The β is now neither economically nor statistically significant, indicating that the β for the non-pegged samples may be driven by common shocks.[9]

Instead of time fixed effects we use the VIX index as a proxy to control for global common factors. We introduce ΔVIX_t in equation (2) as an additional control variable and re-estimate the sub-sample results. As can be seen in Table 1 (Panel C), we find that the sub-sample of countries with a fixed exchange rate regime and no capital controls still has the highest β coefficient of 0.87, significant at the 99% level and the β coefficient for non-pegged countries with capital controls, is still the lowest at 0.01 among all quadrants and insignificant. The trilemma pattern holds when we account for the global financial cycle effect.

3.2 Full Sample with Controls

To explicitly examine the differences in the $\widehat{\beta}$ across different regimes, we can also pool the data and run a regression that includes the interaction terms of the change in the base interest rate with the exchange rate regime dummy and with a capital control indicator and test for the statistical significance of the coefficients on the regime interactions (Shambaugh, 2004). The equation to be estimated is as follows:

$$\begin{aligned} \Delta R_{it} = \alpha + \beta \Delta R_{bit} + \beta_2 (peg)_{it} * \Delta R_{bit} + \beta_3 (no\ capital\ controls)_{it} * \Delta R_{bit} \\ + \beta_4 (peg)_{it} + \beta_5 (no\ capital\ controls)_{it} \\ + \varepsilon_{it} \end{aligned} \quad (3)$$

The variable $(\text{peg})_{\text{it}}$ is a dummy indicating the exchange rate system for the country i at year t. It equals one if it is a pegged regime and equals zero, otherwise. Similarly, the variable $(\text{no capital controls})_{\text{it}}$ is another dummy specifying the country i's capital account regime at year t. It equals one if there is no capital control, and zero otherwise. β captures the impact of a change in the base-country interest rate on the change in the domestic interest rate for a country

[9] However, since the vast majority of pegs are to the U.S. dollar and therefore the same (U.S.) base country, there is likely to be a high degree of collinearity between the year dummies and the base interest rate series. Thus, it can be problematic to use time fixed effects when the number of base countries is limited.

that does not peg its exchange rate and closes its capital account in year t. If β is statistically significantly different from zero, this is evidence of "fear of floating" or indicates the existence of common shocks. β_2 is the marginal impact of pegged regimes. If β_2 is positive it indicates that local interest rates follow more closely the base country interest rate when countries have a fixed exchange rate, everything else being equal. A t-test of the significance of the coefficient β_2 directly and explicitly demonstrates the difference between pegged and non-pegged observations. The expected positive value of β_3 indicates that local interest rate follows more closely the base country interest rate when countries do not impose capital controls, all else being equal.

Results are reported in Table 2.[10] It appears that the exchange rate regime and capital controls matter as the coefficients for the interaction terms are both significant at the 99 percent confidence level. In general, the results with interaction terms are consistent with the sub-sample results shown in Table 1, and the regime effects of different combinations still follow the same pattern. β_2 and β_3 are both positive, indicating that pegging and maintaining open capital accounts cause local interest rates to more closely follow their base interest rates. The magnitude of β_2 is 0.28 (the degree of monetary policy autonomy a flexible exchange rate regime has imparted), smaller than that of β_3 which is, 0.47 (the degree of monetary autonomy capital controls has conferred), suggesting that capital controls appear to matter somewhat more to preserve monetary autonomy than the role of exchange rate flexibility. In addition we include ΔVIX_t in equation (3) to control for global common factors in the interaction regression. β_2 and β_3 both are positive, indicating that both exchange rate regime and capital controls still matter. The trilemma is verified once again when the global financial cycle effect is captured in the model.

Insert Table 2 here

4. Beyond the Trilemma and Dilemma Debate

Overall, we can conclude that the monetary trilemma still holds in the modern era. Contrary to Rey's (2015) thesis we find that exchange rate regimes do matter in terms of ensuring monetary independence. The combination of floating regime with capital controls offers the greatest degree of monetary autonomy, while countries with fixed exchange rate regime and an open capital

[10] We omit reporting β_4 and β_5 for peg and capital control variables to conserve space.

account almost completely lose control over their domestic monetary policy. This is consistent with the monetary trilemma, though we partially concur with Rey in that there is evidence that capital controls are somewhat more effective in helping a country regain a degree of monetary autonomy compared to exchange rate flexibility.

However, countries might not feel equally compelled to follow the base country's policy changes depending on whether the base country raises or cuts its interest rate. In particular, Han & Wei (2018) suggest that there may exist a 2.5-lemma between trilemma and dilemma:

> "a flexible exchange rate regime appears to convey monetary policy autonomy to peripheral countries when the center country raises its interest rate but does not do so when the center lowers its interest rate…Capital controls provide insulation to peripheral countries from foreign monetary policy shocks even when the center lowers its interest rate" (p.206).[11]

4.1 Asymmetric Responses

We examine potential asymmetric responses of the peripheral country's monetary policy to a change in the base country's monetary policy. As noted, we have four sub-samples of different regime type combinations and within each sub-sample we further divide the sample into two more subgroups: one in which the base country raises its interest rate and the other where the base country lowers its interest rate. The specification equation (2) was run for these eight sub-samples. The results are reported in Table 3.

Insert Table 3 here

Generally speaking, for each of four policy regime combinations the β coefficient for the sub-sample in which base countries raise interest rates is always higher than the β coefficient for the sub-sample where base countries lower interest rate. To be sure, for the set of pegged countries without capital controls, the β coefficient remains very high for the full sample as well as for the two sub-samples in this case. This seems to imply that no matter whether the base country raises or lowers its interest rate, a peripheral country follows suit if it has a pegged exchange rate regime

[11] There is a related literature that suggests that EMDEs especially in Asia undertake asymmetric foreign exchange in interventions, i.e. they more likely/more frequent to prevent sharp appreciations than depreciations due to a so-called "fear of appreciation" (see Levy-Yeyati et al., 2013; Pontines & Rajan, 2011; Ramachandran & Srinivasan, 2007).

and capital controls are not imposed. For non-pegged countries with capital controls, this group theoretically has complete monetary policy autonomy. For the sub-sample where base countries lower interest rate, the β coefficient is not significantly different from 0. However, when there is a rise in base interest rates, the β coefficient for this sub-sample rises to 0.30 and is statistically significant at the 95 percent level. This indicates that peripheral countries lose some degree of monetary policy independence and to some extent follow the changes in base interest rate. These results suggest two things. One, capital controls tend to be more effective in moderating inflows than in preventing outflows (IMF, 2012; Mathieson & Rojas-Suarez, 1992; Montiel, 2013; Reinert et al., 2010 Bird & Rajan, 2001). Two, there may be a "fear of capital reversal"[12] or possibly a "fear of reserve loss" (also see Aizenman & Hutchison, 2012; Aizenman & Sun, 2012).

To be sure, when base countries raise their interest rates, since capital controls have generally been proven to be rather ineffective at preventing outflows, countries may respond by raising interest rates to prevent capital outflows or the loss of reserves. However, when base country interest rates decline, while peripheral countries may experience massive surges in capital inflows if they stand pat on interest rates, they can maintain monetary policy autonomy via a combination of sterilized foreign exchange intervention (leading to sustained reserve accumulation) as well as tightening of capital controls and/or macroprudential policies (MaPs). To emphasize this point, note that if base countries raise their interest rates, the coefficients for pegs and non-pegs are fairly close no matter whether capital controls are present or not.[13] This indicates that the exchange rate regime does not appear to matter when the base country tightens its monetary policy but does matter when the base loosens its monetary policy stance.

We also re-estimate equation (3) to cross check whether the asymmetric responses hold by estimating the equation with interaction terms. As we can see, the results with interaction terms from Table 4 show that β_2 and β_3 are statistically significant and positive for the full sample and the sub-sample in which base countries lower interest rate. This is evidence broadly in support of the predictions of the trilemma. However, for the sub-sample in which base countries raise their

[12] Steiner (2013) also finds empirical evidence that central banks demand foreign reserves as a buffer against possible capital flight and refers to the rise in central banks' foreign exchange holdings in line with greater capital account liberalization as being due to a "fear of capital mobility" and therefore acts as a substitute for capital controls.

[13] If there are capital controls, the coefficient for pegs is 0.32, while it is 0.30 for non-pegs. If the capital account is open, the coefficient for pegs is 1 while it is 0.88 for non-pegs.

interest rates, β_2 is neither statistically nor economically significant, indicating that the role of exchange rate regime does not matter. Note that β_3 for this sub-sample is still significantly positive, suggesting the role of capital controls still matter. These results are consistent with the sub-sample results above. Regardless of whether capital controls are imposed, the coefficients do not differ very much between the pegged and non-pegged groups in the case of a rise in the base interest rate. This suggests that the trilemma does not hold perfectly when we account for the asymmetry in the movement of base interest rate. When there is a rise in the base interest rate a flexible exchange rate regime is no longer able to generate greater monetary policy independence. Once again this is evidence of a partial dilemma or a 2.5-lemma.

Insert Table 4 here

4.2 Is There a "Fear of Reserve Loss"?

On the basis of the foregoing discussion we hypothesize that countries with high levels of reserves may have more ability to maintain monetary autonomy, while countries with relatively low levels of reserves lack this policy option and hence are more likely to follow base countries' suit. We therefore further split the sample into two subgroups, country/year observations with high reserves and country/year observations with low reserves. Our foreign reserve (minus gold) data is scaled by country's GDP.[14] Based on the distribution of foreign reserves in the sample, the top 50 percent of the observations viz. country/year observations with foreign reserves that are greater than around 10 percent of total GDP are coded as high foreign reserves, while the bottom 50 percent of the observations are coded as low foreign reserves. Now for each quadrant (or regime combination), we have four more subgroups: observations with high foreign reserves when base countries raise interest rate; observations with high foreign reserves when base countries reduce interest rate; observations with low foreign reserves when base countries raise interest rate; and observations with low foreign reserves when base countries lower interest rate. The specification equation (2) was run for these sub-samples. The consolidated results are reported in Table 5.

Insert Table 5 here

[14] Reserves as a share of lagged monetary base offer similar results.

We first focus on the non-peg regime sub-samples. For country observations that have a non-peg regime and capital controls, we find that the coefficient on the base country interest rate is 0.30 and statistically significant at the 95% level of confidence when base countries raise interest rate for the full sample, higher than that in the baseline and that in the sub-sample where base countries lower interest rate, whose coefficients are both insignificant. When we further divide the sample into high reserves and low reserves sub-samples, what is interesting is that the significant effect for the sub-sample where there is a rise in the base interest rate mainly arises from the country observations with low level of foreign reserves and the coefficient for this sub-group is 0.38 and significant at the 95% level. In contrast, the coefficient for the sub-sample of country observations with high foreign reserves is not significantly different from 0. This is evidence in support of the argument of the "fear of reserve loss".

In particular, it suggests that when the base tightens the monetary policy, countries with low reserve levels are more likely to follow suit as they fear their already rather low levels of reserves might be depleted quickly if they attempt to undertake sterilized foreign exchange intervention. In contrast, countries with high reserve levels have a larger war chest to deal with capital outflows/reversals and thus they can opt to not to follow the base rate and have more capability to preserve monetary autonomy if they are willing to. On the other hand, when the base interest rates fall, peripheral countries with a flexible exchange rate regime can either allow their currency to appreciate or their central banks can intervene in the foreign exchange market to build up international reserves. Since reserves are accumulating in this case, there are no concerns of reserve loss, so the size of the reserves does not matter. Consistent with this, we see that in the case of the base interest rate declining there appears to be complete monetary autonomy regardless of the size for reserve holdings.

Broadly similar evidence can be found for country observations that have non-peg regime without capital controls. We see that for country observations with high reserve levels, the coefficients on the base interest rate are not significant regardless of whether there is a rise or a fall in the base country interest rate. However, for the sub-sample of low reserves, the coefficient on the base interest rate is over 1 and statistically significant at the 99% level for the subgroup where base countries raise interest rates, signifying that peripheral countries perfectly follow the base rate in this case and no monetary policy autonomy is retained.[15]

In addition to estimating the sub-sample results, based on the reserve levels, we run interaction regressions based on equation (3). The results indicate for countries with low levels of reserves, the 2.5-lemma pattern still holds.[16] Specifically, when base countries raise interest rate, exchange rate regime does not matter, and a flexible exchange rate regime cannot afford peripheral countries a degree of monetary autonomy so pegs and non-pegs both follow suit. When base countries lower interest rate on the other hand, the exchange rate flexibility induces a greater degree of insulation from foreign monetary policy transmission. For countries with high level of reserves, however, peripheral countries tend not to co-move with base country interest rate regardless of whether base countries raise or lower interest rate. For a fixed exchange rate regime, when base countries raise interest rates, capital tend to flow out of peripheral countries to base countries and local currency will depreciate. To maintain the peg, conceptually peripheral countries may have to raise domestic interest rate to follow suit. However, with sufficient foreign reserves, these countries can undertake sterilized foreign exchange intervention to defend the currency and maintain monetary policy autonomy. In this sense, a fixed exchange rate regime does not necessarily have to follow base country interest rate as reserves provide an additional policy tool to cushion the external impact. Similarly, if a peripheral country does not have capital controls it can still manage to maintain monetary autonomy by using reserves to deal with external shocks if it has sufficient reserves. This may explain why the coefficients on the regime interaction terms turn insignificant for high reserves sample when base countries raise interest rate.

4.3 Sub-period

It is generally believed that 1990 onwards has been the start of an "inflation targeting" era during which the "fear of appreciation" has become a major concern for these regimes. This era ended when the Fed and major central banks entered the "zero-bound" era from 2009. Accordingly,

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[15] To confirm the results, we rerun the specification on all non-pegged regimes regardless of capital controls. The results are shown in the online Annex Table A3. We find that the "fear of reserve loss" hypothesis is largely verified for all non-pegged regimes regardless of capital controls.

[16] See online Annex Table A4.

we rerun the regression for this sub-period (1990-2009).[17] In the interest of space we only show the interaction regression results based on equation (3), as reported in Table 6.[18] The results validate the findings of the asymmetric responses. Consistently, β_2 and β_3 are significant and positive for the full sample in this sub-period as well as the sub-sample in which base countries lower interest rate, which is evidence supportive of the predictions of the trilemma. However, for the sub-sample in which base countries raise interest rate, β_2 is 0.09. While this is slightly greater than that in Table 4, it is still not statistically significant, indicating that the role of exchange rate regime does not matter in impacting monetary policy autonomy, validating the dilemma story noted earlier.[19] Based on these results, the asymmetric finding is reaffirmed by the 1990-2009 sub-sample. The evidence that non-pegs follow suit when base countries raise interest rates but not when base countries lower interest rates, indicates that there is indeed a "fear of capital reversal" or "fear of reserve loss" rather than a "fear of appreciation".

Insert Table 6

4.4 Modified Taylor Rules

Thus far we have not incorporated the role of domestic factors in impacting domestic interest rates. This omission could lead to concerns about misspecification, especially in the case of countries with non-pegged regimes. Accordingly, we re-estimate an augmented equation (2) which now incorporates domestic variables, viz. inflation and output. Following Klein and Shambaugh (2015) the model is specified as follows:

$$\Delta \mathrm{R}_{\mathrm{it}} = \alpha + \beta \Delta \mathrm{R}_{\mathrm{bit}} + \gamma \Delta Y_{it-1} + \delta \Delta \pi_{it-1} + \mathrm{u}_{\mathrm{it}} \quad (4)$$

ΔY_{it-1} is the lagged GDP growth and $\Delta \pi_{it-1}$ is the lagged change in inflation. As indicated by the Taylor monetary policy rule, the change in the policy interest rate is a function of the change in

[17] We are indebted to an anonymous referee for suggesting this.

[18] We omit reporting β_4 and β_5 for peg and capital control variables to conserve space.

[19] However, in this sub-period β_3 also turns insignificant, suggesting the role of capital controls does not matter either. This may be due to the more proactive use of macroprudential policies from the 1990s, especially in EMDEs.

the domestic economic conditions i.e., the change in growth rate of the economy and the change in the inflation rate. Conventional countercyclical monetary policy suggests that the coefficients γ and δ should be positive. However, given the rather complex and often unpredictable impact of exchange rate changes on the domestic economy, many EMDEs have included the exchange rate explicitly in the monetary policy rule (Hutchison et al., 2010; Taylor, 2001; Cavoli & Rajan, 2006). Thus, we further include the role of exchange rate and extend equation (4) to estimate a modified Taylor rule. In addition, we are interested in investigating whether the asymmetric responses hold by estimating the equation with interaction terms and Taylor rule variables. The specification is as follows：

$$\Delta R_{it} = \alpha + \beta\Delta R_{bit} + \beta_2(peg)_{it} * \Delta R_{bit} + \beta_3(no\ capital\ controls)_{it} * \Delta R_{bit} + \beta_4(peg)_{it} + \beta_5(no\ capital\ controls)_{it} + \gamma\Delta Y_{it-1} + \delta\Delta\pi_{it-1} + \zeta\Delta e_{it-1} + \varepsilon_{it} \quad (5)$$

where Δe_{it-1} is the lagged change in bilateral nominal exchange rate (log) relative to the U.S. dollar. Since e is the domestic price of foreign currency, an increase in e indicates a domestic currency depreciation. ζ is expected to be positive implying a higher domestic policy interest rate if the local currency depreciates. This is because when the domestic currency depreciates there is an expansionary effect on aggregate demand; the depreciation makes domestic goods cheaper and stimulates net exports. The depreciation may also induce inflation because the price of the imported goods will also rise.

Since we are not adopting high-frequency data and we do not account for the forward-looking monetary policy, we do not focus on estimates of γ, δ and ζ in the monetary policy reaction function. Instead, we estimate equation (5) to see if ΔR_{it} responds to these three variables or it is simply constrained by the trilemma predictions. In the first instance, to account for potential reverse causality that policy rate changes affect current output, inflation and exchange rate, we include lagged rather than contemporaneous GDP growth, inflation change and exchange rate change. We also focus on the F-test of the joint significance of coefficients on the three Taylor rule variables.

Estimation results are reported in Table 7. When incorporating domestic factors, including the change in the inflation rate, the change in the bilateral exchange rate and the GDP growth, we see from the results that for the full sample and the sub-sample where there is a fall in the base interest rate, β_2 and β_3 are still statistically significant, reaffirming the trilemma pattern. However, for the sub-sample in which base countries raise interest rate, β_2 is still statistically and economically insignificant, indicating that the role of exchange rate regime does not matter. These results are broadly comparable to the results from Table 4. F-statistic of the joint significance of inflation, exchange rate and growth are 6.86 for the full sample and 5.69 for the sub-sample where base countries lower interest rate, implying the significance at the 99 percent confidence level. However, the F-statistic is only 1.54 for the sub-sample where base countries increase interest rate, indicating no joint significance of local condition variables in this case.

Insert Table 7 here

5. Intermediate Regimes and Capital Controls

Thus far the focus has been on the binary classification of peg versus non-peg. As emphasized by Aizenman et al. (2010) and others, many EMDEs in particular have chosen the middle ground of managed floats and partial capital controls. Accordingly, we reconsider a slightly more nuanced classification of peg, managed float and float and full, partial and no capital controls in our estimation.

Our emphasis in this section is to measure the degree of monetary autonomy in the mid-range of the policy regime between a fixed exchange rate and a pure float and when capital accounts are partially open. With regard to the exchange rate regime, we use dummy variable "soft peg"[20] compiled from Shambaugh dataset to indicate the middle-ground of the exchange rate regime policy. For the capital account regime, we use continuous Chinn-Into index ("kaopen") as the base to construct three dummy variables, one for open capital accounts, one for closed accounts

[20] A soft peg is defined as occurring when a country-year observation is not classified as a peg, but the bilateral exchange rate with the base country fluctuates by less than +/-5 percent in a given year, or when there is no month where the exchange rate changed by more than 2 percent up or down (Klein & Shambaugh, 2015, p.41). Hence, *peg* refers to a +/- 2% band and *soft peg* refers to a +/-5% band and *float* refers to all other observations. In our previous binary coding, pegs versus non-pegs, the latter include both floats and soft pegs.

and the third for a middle level of openness. Based on the empirical distribution function of "kaopen" in the sample, the classification puts 669 observations in the closed category, 664 observations in the mid-range of capital controls category, and 681 observations in the open category.

Since we have three exchange rate regime categories and three capital account openness categories, we have nine subsamples/regime combinations. The baseline specification equation (2) is re-estimated for these nine sub-samples of different regime combinations. The estimates are reported in Table 8. The sub-sample results are shown in the 3 by 3 matrix in bold. We can compare coefficients across rows so as to check the differences across exchange rate systems and down columns to see the differences across capital account openness arrangements. The marginal columns and rows show the results estimated from an interaction regression. The estimates of the differences among open, mid-open and closed capital account are presented in the marginal columns in the right pane, and the estimates of the differences among peg, soft peg and float are reported in the marginal rows in the bottom[21].

Insert Table 8 here

As we can see, the first row shows that the coefficient on the base country interest rate for the open peg sub-sample (0.94) is greater than the coefficient for the open soft peg sub-sample (0.52), which is also greater than the coefficient for the open float sub-sample (0.45). This supports the implications of monetary trilemma concerning the three broad types of exchange rate regimes. The same pattern holds for mid-open capital account sub-samples, as documented in the second row. However, this pattern no longer holds for closed capital account sub-samples as shown in the third row.[22] For pegged sub-samples, we find that the coefficients are statistically significant at the 99 percent confidence level with the exception of closed pegs. However, we cannot reject the null hypothesis that the coefficients are equal to zero for each of the floating sub-samples except for

[21] The numbers reported in these columns represent more open capital account minus less open capital account, and those in the rows represent less exchange rate flexibility minus more exchange rate flexibility, so the expected values of these estimates are always positive.

[22] Other than the fact that the coefficient for the closed soft-peg sub-sample is 0.25 and marginally significant at the 90 percent confidence level, the coefficients for closed peg and closed float are both insignificant, which may indicate that the most stringent capital controls make the role of the exchange rate regime irrelevant and insulate countries from foreign monetary shocks.

the open float sub-sample. The marginal rows at the bottom indicate that there is a statistically significant difference between the coefficients on pegs and floats, between soft-pegs and floats, but we cannot reject the hypothesis that pegged observations have the same β coefficient as soft pegged ones, with a difference of only 0.13 that is not significant. These estimation results from an interaction regression suggest that monetary autonomy is only conferred by the most flexible exchange rate regime and soft pegs or managed floating regime has no role to play in terms of gaining a degree of monetary policy autonomy.

Now we turn to the columns which allow for comparisons across capital account openness arrangements. For the first and the second columns, we see that the open capital account sub-samples (in the top row) always have higher coefficients than the mid-open sub-samples (in the middle) and mid-open sub-samples have greater coefficients than the closed sub-samples (in the bottom). In addition, the coefficients for the open capital account sub-samples are all statistically different from 0 at better than 95 percent confidence level. However, the coefficients for some mid-open and closed capital account sub-samples become insignificant. The estimates in the marginal columns on the right suggest that the difference of the coefficients is 0.39 when comparing open and mid-open capital accounts, which is significantly different from zero at the 99 percent confidence level. The difference of the coefficients between open and closed is also significant and greater (0.55). Nevertheless, we fail to reject the null hypothesis that mid-open observations have the same β coefficient as closed ones. The difference is 0.16 but not statistically significant. These estimates therefore imply that mid-open financial accounts can indeed afford a country more monetary policy autonomy compared to instances of complete open capital accounts and the effects are comparable to those provided by the closed capital accounts. In addition, based on our sample results, there is little evidence that the mid-range of exchange rate regime, i.e., soft pegs or intermediate degrees of flexibility, can confer monetary policy independence.

6. Conclusion

In this paper we have re-investigated the monetary trilemma versus the dilemma debate for a large sample of eighty-eight countries over the period 1973-2014. Broadly, we find evidence that the trilemma still holds and a flexible exchange rate affords insulating effects from international monetary policy transmission. However, similar to Han & Wei (2018), we have documented the existence of "2.5-lemma" pattern. However, unlike their results, we find that for peripheral countries without capital controls a flexible nominal exchange rate allows them to maintain some degree of monetary policy autonomy when the base countries loosen their monetary policy (likely via a combination of sterilized foreign exchange intervention and tightening of MaPs to manage possible credit growth). On the other hand, when the center countries tighten their respective interest rates, peripheral countries may fear sharp capital reversals which lead them to pursue similarly tighter monetary policy domestically.

There are two important caveats to the foregoing findings. One, while completely flexible exchange rates allow a country to maintain a degree of monetary policy autonomy (albeit in an asymmetric manner), intermediate degrees of flexibility do not seem to do so. Two, it appears that interest rates of countries with high level of reserves tend not necessarily to co-move with base country interest rate even when the center countries tighten their monetary policy stances, while countries with low reserve levels closely follow the base country rate and tighten their monetary policy as well. This suggests that the asymmetric reaction to base country monetary policy may be due to a “fear of capital reversal/reserve loss” as opposed to “fear of appreciation”.

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Table 1. Two by Two Classification of Exchange Rate and Capital Control Regimes

		PEG			
		Yes		No	
		Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]
		(A) First-difference			
CAPITAL CONTROLS	Yes	0.31***	426	0.09	956
		(0.09)	[0.05]	(0.07)	[0.00]
	No	0.94***	277	0.48***	353
		(0.08)	[0.42]	(0.11)	[0.10]
		(B) Time fixed effects			
CAPITAL CONTROLS	Yes	0.30*	426	-0.05	956
		(0.15)	[0.19]	(0.11)	[0.13]
	No	0.80***	277	0.13	353
		(0.19)	[0.54]	(0.14)	[0.31]
		(C) Adding $\Delta \mathrm{VIX}_t$			
CAPITAL CONTROLS	Yes	0.31***	332	0.01	758
		(0.12)	[0.04]	(0.09)	[0.01]
	No	0.87***	266	0.34***	303
		(0.08)	[0.39]	(0.12)	[0.06]

Note: Cluster-robust standard errors are reported.

*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 2. Interaction Terms with Regime Types

VARIABLES	(1) Pool	(2) Pool (Adding ΔVIX_t)
β	0.07	-0.02
β std. error	(0.07)	(0.08)
β_2	0.28***	0.36***
β_2 std. error	(0.08)	(0.10)
β_3	0.47***	0.41***
β_3 std. error	(0.10)	(0.10)
β_6		0.02***
β_6 std. error		(0.01)
Observations	2,012	1659
R-squared	0.05	0.04

Note:
β = coefficient on ΔR_b.
β_2= coefficient on (peg) $\times$ ΔR_b.
β_3= coefficient on (no capital controls) $\times$ ΔR_b.
β_6 = coefficient on ΔVIX_t.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 3. Asymmetric Responses – Sub-sample Results

		PEG											
		Yes						No					
		Baseline		Raise IR		Lower IR		Baseline		Raise IR		Lower IR	
		Coef. (s.e.)	N $[R^2]$	Coef. (s.e.)	N $[R^2]$	Coef. (s.e.)	N $[R^2]$	Coef. (s.e.)	N $[R^2]$	Coef. (s.e.)	N $[R^2]$	Coef. (s.e.)	N $[R^2]$
CAPITAL CONTROLS	Yes	0.31*** (0.09)	426 [0.05]	0.32** (0.15)	198 [0.03]	0.00 (0.15)	228 [0.00]	0.09 (0.07)	956 [0.00]	0.30** (0.12)	362 [0.01]	-0.19 (0.12)	594 [0.00]
	No	0.94*** (0.08)	277 [0.42]	1.00*** (0.21)	129 [0.27]	0.87*** (0.12)	148 [0.25]	0.48*** (0.11)	353 [0.10]	0.88*** (0.22)	143 [0.11]	0.35** (0.14)	210 [0.03]

Note: Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 4. Interaction Terms with Regime Types

VARIABLES	Full sample	base countries raise interest rate	base countries lower interest rate
β	0.07	0.31***	-0.22*
β std. error	(0.07)	(0.11)	(0.11)
β_2	0.28***	-0.01	0.30**
β_2 std. error	(0.08)	(0.17)	(0.14)
β_3	0.47***	0.57***	0.65***
β_3 std. error	(0.10)	(0.19)	(0.15)
Observations	2,012	832	1,180
R-squared	0.05	0.04	0.04

Note:
β = coefficient on ΔR_b.
β_2= coefficient on (peg) × ΔR_b.
β_3= coefficient on (no capital controls) × ΔR_b.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 5. Is There a "Fear of Reserve Loss"?

		Peg						Non-Peg					
		Baseline		Raise IR		Lower IR		Baseline		Raise IR		Lower IR	
		Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]
Capital Controls	Full sample	0.31*** (0.09)	426 [0.05]	0.32** (0.15)	198 [0.03]	0.00 (0.15)	228 [0.00]	0.09 (0.07)	956 [0.00]	0.30** (0.12)	362 [0.01]	-0.19 (0.12)	594 [0.00]
	High Reserves	0.22 (0.16)	250 [0.02]	0.29 (0.36)	112 [0.01]	-0.14 (0.18)	138 [0.00]	0.07 (0.07)	476 [0.00]	0.16 (0.10)	156 [0.01]	-0.02 (0.12)	320 [0.00]
	Low Reserves	0.38*** (0.10)	176 [0.11]	0.22 (0.15)	86 [0.02]	0.18 (0.20)	90 [0.01]	0.08 (0.11)	480 [0.00]	0.38** (0.18)	206 [0.01]	-0.34 (0.22)	274 [0.01]
No Capital Controls	Full sample	0.94*** (0.08)	277 [0.42]	1.00*** (0.21)	129 [0.27]	0.87*** (0.12)	148 [0.25]	0.48*** (0.11)	353 [0.10]	0.88*** (0.22)	143 [0.11]	0.35** (0.14)	210 [0.03]
	High Reserves	0.71*** (0.13)	115 [0.24]	0.68** (0.23)	49 [0.09]	0.57*** (0.18)	66 [0.11]	0.23** (0.11)	182 [0.02]	0.42 (0.33)	70 [0.02]	0.18 (0.17)	112 [0.01]
	Low Reserves	1.11*** (0.10)	162 [0.59]	1.16*** (0.29)	80 [0.46]	1.19*** (0.12)	82 [0.43]	0.74*** (0.14)	171 [0.28]	1.28*** (0.25)	73 [0.27]	0.57** (0.20)	98 [0.10]

Table 6. Interaction Terms with Regime Types 1990-2009

VARIABLES	(1) Full sample	(2) base countries raise interest rate	(3) base countries lower interest rate
β	-0.11	0.23**	-0.29*
β std. error	(0.09)	(0.12)	(0.16)
β_2	0.45***	0.09	0.49**
β_2 std. error	(0.11)	(0.23)	(0.19)
β_3	0.45***	0.22	0.62***
β_3 std. error	(0.10)	(0.20)	(0.17)
Observations	1,177	478	699
R-squared	0.04	0.03	0.04

Note:
β = coefficient on ΔR_b.
β_2= coefficient on (peg) × ΔR_b.
β_3= coefficient on (no capital controls) × ΔR_b.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 7. Interaction Terms with Regime Types in Modified Taylor Rules

VARIABLES	(1) Full sample	(2) base countries raise interest rate	(3) base countries lower interest rate
β	0.08	0.24**	-0.07
β std. error	(0.07)	(0.11)	(0.13)
β_2	0.26***	-0.03	0.28**
β_2 std. error	(0.08)	(0.17)	(0.12)
β_3	0.46***	0.60***	0.61***
β_3 std. error	(0.10)	(0.22)	(0.16)
β_4	-0.28***	0.07	-0.31**
β_4 std. error	(0.10)	(0.20)	(0.15)
β_5	0.16	-0.18	0.45***
β_5 std. error	(0.10)	(0.19)	(0.17)
γ	2.79***	0.97	3.45***
γ std. error	(0.91)	(1.31)	(1.02)
δ	-0.09***	-0.09*	-0.08***
δ std. error	(0.02)	(0.05)	(0.03)
ζ	1.80**	0.52	2.50**
ζ std. error	(0.83)	(1.09)	(1.07)
F-stat	6.86***	1.54	5.69***
Observations	1,848	737	1,111
R-squared	0.07	0.06	0.06

Note:
β = coefficient on ΔR_b.
β_2= coefficient on (peg) × ΔR_b.
β_3= coefficient on (no capital controls) × ΔR_b.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table 8. Three by Three Classification of Exchange Rate and Capital Control Regimes

	Peg		Soft Peg		Float			
	Coef. (s.e.)	**N [R^2]**	**Coef. (s.e.)**	**N [R^2]**	**Coef. (s.e.)**	**N [R^2]**	Versus Mid-open	Versus Closed
Open	**0.94*** (0.07)**	**295 [0.39]**	**0.52** (0.22)**	**189 [0.11]**	**0.45*** (0.12)**	**197 [0.09]**	0.39*** (0.10)	0.55*** (0.11)
Mid-open	**0.41*** (0.10)**	**198 [0.10]**	**0.34*** (0.10)**	**242 [0.03]**	**0.04 (0.13)**	**224 [0.00]**		
Closed	**0.21 (0.15)**	**210 [0.02]**	**0.25* (0.15)**	**167 [0.02]**	**-0.08 (0.14)**	**290 [0.00]**	0.16 (0.11)	
Versus Soft Peg	0.13 (0.11)				0.24** (0.11)			
Versus Float	0.37*** (0.10)							

Note: Entries in shaded areas in marginal columns and rows based on an interaction regression.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.

Table A1. Summary Statistics of the Interest Rate Differential $(R_{it} - R_{bit})$

	Full sample		Pegged countries		Non-pegged countries		Industrial countries		Developing countries	
Time	All	Post 1990s	All	Post 1990s	All	Post 1990s	All	Post 1990s	All	Post 1990s
$(R_{it} - R_{bit})$ mean	4.82	5.30	2.07	2.15	6.28	7.09	1.84	1.15	6.30	7.34
$(R_{it} - R_{bit})$ std dev	8.11	8.40	4.01	3.59	9.29	9.74	3.48	2.49	9.01	9.08
$(R_{it} - R_{bit})$ min	-10.71	-8.37	-10.71	-8.20	-9.76	-8.37	-9.76	-5.59	-10.71	-8.37
$(R_{it} - R_{bit})$ max	128.32	128.32	27.44	27.44	128.32	128.32	14.01	13.18	128.32	128.32

Unit: percent

Table A2. Comparison of Sub-sample Results from Main Papers

Journal Article	Sample	Methods	Interest Rates	Exchange Rate	Capital Controls	Sub-sample Results: Capital Controls	Peg: Yes Coef. (s.e.)	Peg: Yes N [R^2]	Peg: No Coef. (s.e.)	Peg: No N [R^2]
Shambaugh (2004)	1973-2000 Over 100 developing and industrial countries	First-difference/ pooled OLS	Short-term treasury bill and money market rate	Shambaugh regime	Official IMF de jure	**Yes**	0.41*** (0.04)	531 [0.18]	0.15 (0.11)	738 [0.00]
						No	0.67*** (0.09)	214 [0.27]	0.56*** (0.08)	338 [0.07]
Obstfeld et al. (2005)	1973-2000 **(**for the post-BW era**)** 103 countries	First-difference/ pooled OLS	Short-term treasury bill and money market rate	Shambaugh regime	Official IMF de jure	**Yes**	0.36*** (0.04)	739 [0.13]	0.15 (0.11)	753 [0.00]
						No	0.61*** (0.05)	613 [0.30]	0.53*** (0.07)	423 [0.06]
Klein & Shambaugh (2015)	1973-2011 **(**using the Chinn-Ito capital control data**)** 134 countries in the sample using Chinn-Ito data	First-difference/ pooled OLS	Policy rate	Shambaugh regime	Chinn-Ito	**Yes**	0.40*** (0.06)	967 [0.14]	0.09* (0.05)	1145 [0.00]
						No	0.68*** (0.08)	433 [0.28]	0.23** (0.10)	581 [0.02]

Table A3. "Fear of Reserve Loss" for Non-peg Regimes Regardless of Capital Controls?

	Non-Peg					
	Baseline		Raise IR		Lower IR	
	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]	Coef. (s.e.)	N [R^2]
Full sample	0.18*** (0.07)	1309 [0.01]	0.39*** (0.12)	505 [0.02]	-0.05 (0.10)	804 [0.00]
High Reserves	0.11* (0.06)	658 [0.00]	0.20* (0.10)	226 [0.01]	0.04 (0.10)	432 [0.00]
Low Reserves	0.23** (0.11)	651 [0.02]	0.54*** (0.16)	279 [0.03]	-0.12 (0.20)	372 [0.00]

Table A4. Interaction Terms with Regime Types Based on Reserves

VARIABLES	Low reserves sample		High reserves sample	
	base countries raise interest rate	base countries lower interest rate	base countries raise interest rate	base countries lower interest rate
β	0.39**	-0.35*	0.16	-0.06
β std. error	(0.16)	(0.21)	(0.10)	(0.12)
β_2	-0.22	0.58***	0.13	0.03
β_2 std. error	(0.16)	(0.21)	(0.32)	(0.16)
β_3	0.89***	0.96***	0.27	0.34*
β_3 std. error	(0.25)	(0.21)	(0.25)	(0.19)
Observations	445	544	387	636
R-squared	0.06	0.08	0.02	0.01

Note:
β = coefficient on ΔR_b.
β_2= coefficient on (peg) × ΔR_b.
β_3= coefficient on (no capital controls) × ΔR_b.
Cluster-robust standard errors are reported.
*** Significantly different from 0 at the 99% level. ** At 95% level. * At 90% level.