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The Impact of Foreign Interest Rates on the Economy: The Role of the Exchange Rate Regime

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The Impact of Foreign Interest Rates on the Economy: The Role of the Exchange Rate Regime

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Abstract

This paper explores the connection between interest rates in major industrial countries and annual real output growth in other countries. The results show that high large-country interest rates have a contractionary effect on annual real GDP growth in the domestic economy, but that this effect is centered on countries with fixed exchange rates. The paper then examines the potential channels through which large-country interest rates affect small economies. The direct monetary policy channel is the most likely channel when compared with other possibilities, such as a general capital market effect or a trade effect.

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I. Introduction

Discussions of globalization often assert that the fortunes of small countries are driven by larger countries' economies. This notion contends that small countries are highly susceptible to conditions in large countries and that their economies often experience volatility for reasons independent of domestic policies. One assumption underlying this idea is that foreign interest rates have a strong impact on conditions in smaller countries. At the same time, the open economy "trilemma" and empirical tests of it suggest that only countries with pegged exchange rate regimes give up their domestic monetary autonomy.[2] The monetary policy constraints suggested by the trilemma imply that the channel through which foreign interest rates affect smaller economies determines whether large country interest rates have the same effect on pegs and floats.[3] Pegs are expected to be more affected if the channel is monetary; but if the main channel is simply a general capital market effect, the exchange rate regime may be irrelevant.

This paper answers two questions. First, what is the effect of interest rates in base countries on other countries' annual real GDP growth? Second, how does this effect vary by institutional arrangement (primarily the exchange rate regime) and other country characteristics? Answering the second question helps to disentangle the channels through which large-country interest rates affect other economies.

We find that annual real output growth in small countries is negatively associated with interest rates in base countries,[4] but that this effect holds only for countries with fixed exchange rates. This finding is robust across a wide set of specifications, and suggests that the primary impact of foreign interest rates is through the monetary policy channel and not as strongly through a general capital market effect. Additional work exploring potential channels supports these implications. This result suggests that there are real costs to the loss of monetary autonomy that comes with pegging and provides further support for the hypothesis that monetary policy and interest rates can have substantial effects on the real economy.

[2] The trilemma is the conjecture that at any one time a country can pursue only two of the three following options: a fixed exchange rate, open capital markets, and monetary autonomy; this is the case because a fixed exchange rate and open capital markets will imply by interest parity that a country has lost its monetary autonomy. See Obstfeld, Shambaugh, and Taylor (2005) for discussion of the trilemma and empirical tests.

[3] A "peg" will henceforth refer to a country whose exchange rate stays within a prescribed range, while "float" and "nonpeg" will be used interchangeably to refer to any country that is not pegged.

[4] The "base country" is the country to which a country pegs or the country to which it would peg if it were pegged. The discussion in Section IV regarding the definition of fixed exchange rates will elaborate.

Specifically, base-country interest rates that are 5 percentage points (500 basis points) higher lead to a 1 percentage point decline in annual GDP growth in pegged countries as opposed to no change in countries with floats. This result is robust to a variety of controls for year, country, income, and capital controls, and holds when we run the regressions on samples divided by region or income level. In addition, the results are consistent with a wide variety of specifications that add in base-country annual GDP growth and other covariates. Further, when one is considering a variety of country characteristics that could drive the relationship between domestic output movements and the base interest rate, the exchange rate regime is consistently an important factor and few other factors have such a robust effect.

By including a broad panel of countries that have different base countries, this study has an advantage over previous research, in that we are able to use time controls and focus on the specific effect of the base interest rate. Thus, our panel allows us to strip out both individual country effects and worldwide movements in growth rates providing a better identification of the effect we study. Furthermore, we find that countries pegged to currencies other than the U.S. dollar do not respond to dollar interest rates any more than floats do. This suggests that pegged economies are not simply more exposed to world markets, but in fact are more exposed to the interest rate of the countries to which they peg. Results such as these have never been pursued before, given small samples or a focus on one world rate of interest.

Finally, when examining channels, we find that the base rate does not appear to have an effect on variables such as exports to the base country. Furthermore, a variety of specifications of capital flows regressed on the base interest rate do not seem to show strong results for either pegs or floats. On the other hand, base interest rates do have an impact on domestic interest rates and the impact is much stronger for pegs. This finding, along with the differences seen across exchange rate regimes, suggests that the direct monetary policy channel may be the primary channel through which interest rates affect other countries. The finding that base interest rates affect pegs more than floats is consistent with recent evidence that while many countries may show “fear of floating,” countries that actually do float show far less connection to base interest rates than countries that peg (Shambaugh, 2004; and Obstfeld, Shambaugh, and Taylor, 2004, 2005).

These results are important both for understanding how and why monetary policy is transmitted around the world and how the exchange rate regime allows a country to insulate itself from conditions in large countries. Moreover, these results do not suggest that a pegged regime is either a good or bad idea, but instead add to the calculus of costs and benefits (in this case costs) an economy will face when it fixes its exchange rate.

This paper sits at the nexus of two literatures: (i) the impact of monetary policy on the economy, and (ii) the impact of large countries on smaller countries’ business cycles. There is an extensive literature on the impact of monetary policy on the economy.[5] In

[5] This literature is too broad to distill here, see Christiano, Eichenbaum, and Evans (1999) for discussion.

general, the literature finds that increasing interest rates has a negative effect on the real economy.

Di Giovanni, McCrary, and von Wachter's (2005) contribution is the most relevant for the present paper. The authors argue that the EMS/ERM era provides a "quasi-experimental" setting, whereby European countries were inclined to follow German monetary policy due to various institutional constraints, in order to test for the *causal* impact of domestic monetary policy in these other countries. As such, di Giovanni, McCrary, and von Wachter instrument domestic interest rates with the German one in order to test for the impact of domestic monetary policy, and find a strong effect. Furthermore, the paper quantifies the size of the bias between the ordinary least squares and instrumental variables estimates of the impact of monetary policy, provides a rigorous treatment that relates the size of the bias to underlying shocks in the system, and derives a dynamic interpretation of their results.[6]

The literature on how large countries affect developing countries' economies is also relevant. Dornbusch (1985) considers the role of large-country business cycles in determining commodity prices and, subsequently, other outcomes for developing countries. Calvo, Leiderman, and Reinhart (1993 and 1996) focus on the interest rates of large countries and argue that owing to capital market links, low interest rates in large countries tend to send investors looking for high-yield investments in other countries. This process generates capital inflows for developing countries, which could then reverse when large-country interest rates increase.

There also have been several attempts to untangle the impact of large-country interest rates on domestic annual GDP growth. Reinhart and Reinhart (2001) consider a variety of North-South links when examining Group of Three (G-3) interest rate and exchange rate volatility. They find that capital tends to flow to emerging markets when the U.S. eases its monetary policy, but they do not see a connection between such changes in the Fed Funds rate and growth in emerging market economies. However, they do find an effect of the U.S. real interest rate on growth in some regions. Frankel and Roubini (2001) also find a negative effect of G-7 real interest rates on developing countries' output. Since these papers consider many aspects of North-South relations, they do not have space to consider in detail how large-country interest rates and the domestic economy are connected. In particular, they do not consider how these relationships vary across institutional details (e.g., exchange rate or capital controls regimes), test what the channels may be, or conduct detailed robustness checks, nor do they have the sample breadth to exploit multiple base interest rates as we are able to do.

[6] See di Giovanni, McCrary, and von Wachter (2005) and Section III of the present paper for more details. Section III also provides an explanation of why the present paper does not undertake an IV strategy.

In addition to these two studies, there have been a number of papers that use vector autoregressions (VARs) to explore the transmission of international business cycles.[7] A notable contribution is Kim (2001), which finds that U.S. interest rates have an impact on output in the other six G-7 countries. This paper is one of the few to examine the potential channels through which the interest rate has an effect. It finds virtually no trade impact and that the impact on output comes from a reduction in the world interest rate.[8]

What has been largely absent from the literature, though, is the fact that the exchange rate regime should play a major role in how foreign interest rates are transmitted.[9] The open economy trilemma suggests that countries with open capital markets and pegged exchange rates sacrifice monetary autonomy and must follow the base country. Work by Shambaugh (2004) and Obstfeld, Shambaugh, and Taylor (2004 and 2005) confirm these predictions empirically. Thus, countries should not react to changes in large-country interest rates uniformly. Countries with fixed exchange rates should be the ones most directly affected. In addition, pegged countries should not react to simply any large country interest rate shock, but particularly to the interest rate of the country to which their currencies are pegged.[10]

In this paper we focus on these insights and try to uncover the impact of large-country interest rates on other countries while paying particular attention to the way the exchange rate regime may affect the transmission. The paper makes a number of new contributions to the literature. First, it takes the institutional differences across countries seriously. The study focuses on the exchange rate regime and capital control regimes of countries in order to examine the heterogeneous responses to base-country interest rates. Second, a broad data set is used which includes almost all countries and relies on differences across countries in the base interest rate to allow for an examination of year controls and to test whether countries respond to large country rates in general or only to the base country. This additional power increases

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[7] See, for example, Canova (2005); Maćkowiak (2003); and Miniane and Rogers (2003).

[8] All countries studied float their currencies against the U.S. dollar, so there is implicitly no discussion of exchange rate regime in the analysis.

[9] Broda (2004) considers how exchange rate regimes affect terms of trade shocks.

[10] Our results are consistent with many other strands in the literature. The fact that only pegged economies respond to base country interest rate changes makes sense when one considers that exchange rates tend to be quite disconnected from macroeconomic fundamentals and that uncovered interest parity does not tend to hold (See, e.g., Flood and Rose (1995 and 1999) regarding the irrelevance of fundamentals for exchange rates and see Froot and Thaler (1990) for discussion of uncovered interest parity.). Given these long-standing results, we would be surprised if base country rates were generating large impacts through either the monetary or exchange rate channels for floating countries.

confidence in the results. Finally, we consider the channels through which base-country interest rates affect domestic economies.

Section II briefly discusses a conceptual framework. Section III describes the empirical framework and any possible biases we expect to find. Section IV presents the data and results. Section V concludes.

II. CONCEPTUAL FRAMEWORK

When considering why the base interest rate should have any impact on other countries we begin from interest parity,[11]

$$R_t = R_t^b + \frac{\mathrm{E}_t e_{t+1} - e_t}{e_t}. \tag{1}$$

If the base interest rate rises, a floating country can allow e_t to rise (depreciate) creating a smaller expected future depreciation and no change in R_t. In doing so, local borrowing costs have not changed and floating rates have served their insulating purpose.

As the trilemma suggests though, absent capital controls, a pegged country will be forced to increase the domestic interest rate to match the base interest rate or the peg will break. If the expected change in the exchange rate equals zero, and the base interest rate rises above the local rate, money will flee the home country until it forces the domestic rate to rise or the peg breaks. Thus, borrowing costs increase for the home country. In this setting, when the base interest rate is high the cost of borrowing is high for pegs and growth will likely slow down in the domestic economy, but there is no impact on floats. Furthermore, the foreign interest rate that matters is specifically the base interest rate, not simply any large country. In practice, we see pegs moving their interest rate with the base rate while floats do not. On the other hand, while floats tend to depreciate over time, they do not do so in relation to moves in the base interest rate.

Alternatively, consider the supply of foreign capital. If base interest rates are low, there may be more investors unable to achieve some desired threshold of return at home leading to more capital available to other countries. Such a setting would again cause a negative relationship between the foreign interest rates and domestic output, but here the effect is identical across exchange rate regimes and it does not matter if the change in the interest rate is in the base country or any other large economy.

As this motivation focuses on interest parity relations and investors seeking high returns across borders, we see that it is the nominal foreign interest rate that requires our focus. At the same time, we focus on borrowing costs, suggesting that the local inflation rate may be a

[11] While uncovered interest parity tends to fail empirically, as we will show later, it holds reasonably for fixed exchange rate countries making it relevant to the discussion.

relevant consideration. We return to specific channels of the transmission later, but now turn to how we estimate the impact of the base interest rate on domestic growth.

III. Empirical Framework

Examining the impact of foreign interest rates opposed to domestic ones avoids several potential biases in measuring the effect of interest rates on domestic output growth. The first bias is that the measured coefficient for the domestic interest rate in an ordinary least squares (OLS) regression will be biased towards zero given a forward-looking behavior of monetary policy when the econometrician only has a subset of information that the central bank to condition on for estimation.[12] Second, it is often difficult to disentangle whether the interest rate drives output or vice versa—particularly for small developing countries (Neumeyer and Perri, 2005; Uribe and Yue, 2005). For example, poor fundamentals may drive up a country's borrowing costs, and also slow output growth, thus placing further upward pressure on interest rates. This circular pattern may also be caused by the expectations of investors outside the economy, who place a high probability on worsening economic situations in the future, which in turn give them impetus to demand a higher return for borrowing today, resulting in a self-fulfilling slow-down of the economy.

The potential bias or simultaneity problems can be characterized by the following reduced-form equations. Let the nominal interest rate's dependence on current annual output growth, for a single country, be represented by:

$$R_t = \alpha_0 + \varphi y_t + \delta' \mathrm{W}_t + \eta_t, \tag{2}$$

where R_t is the domestic nominal interest rate, y_t is annual real output growth, and W_t is a matrix of other variables as well as lags of variables in the system. Equation (2) may represent a policy maker's reaction function,[13] or a particular channel through which current output growth affects the domestic interest rate, as discussed above.

Next, a common specification used when estimating the impact of the interest rate on output is:

$$y_t = \alpha_1 + \beta R_t + \phi' \mathrm{X}_t + \varepsilon_t, \tag{3}$$

where X_t is a matrix of other variables as well as lags of variables in the system. The estimated impact of the interest rate on output growth in an OLS regression ($\hat{\beta}_{OLS}$) will not be identified given equation (2).

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[12] The concern of this forward-looking component of monetary policy has been discussed widely (Bernanke and Blinder, 1992; Bernanke and Mihov, 1998; and Romer and Romer, 1989).

[13] Taylor (1993) is the classic paper that formulates such policy rules, which are now common in the literature. Clarida, Galí, and Gertler (2000) is an early contribution in the empirical estimation of such rules.

A common approach in identifying the impact of the interest rate on output is the VAR framework, where the econometrician makes certain assumptions to identify the system (e.g., see Christiano and others and others and references within). Recently, di Giovanni and others and suggest a simple instrumental variable (IV) approach to identify the impact of monetary policy on output growth given a potential forward-looking bias problem. They use the German interest rate as an instrument for the domestic interest rate for European countries over the ERM/EMS period to estimate the causal impact of domestic monetary policy, and are able to measure a significant bias of this impact for several economics by comparing OLS and IV estimates.[14]

This instrumental variable approach will not work in all cases, however. In particular, as several papers have pointed out (e.g., Calvo, Leiderman, and Reinhart, 1993 and 1996), the fortunes of smaller economies may depend on the movements of large countries' interest rates for other reasons, such as the impact on capital flows to and from these countries. Therefore, the base country's interest rate may belong in the second stage of an IV regression, and therefore is not a suitable instrument. This paper does not try to estimate the domestic monetary policy effects and thus sidesteps many of these endogeneity issues. We ask what is the effect of interest rates in base countries on domestic countries' output. This question is explored by estimating the following output growth equation in a panel regression:

$$y_{it} = \alpha_2 + \theta R^b_{it} + \phi_1' \mathrm{X}_{it} + \nu_{it}, \tag{4}$$

where i represents a given country, R^b_{it} is the base country nominal interest rate, and X_{it} is a matrix of other covariates in the system. R^b_{it} varies across domestic countries since they have different base countries (see below for a further discussion). In this case, the OLS estimate of the impact of the base interest rate on domestic output growth ($\hat{\theta}_{OLS}$) is identified since domestic output growth will arguably not drive the base country's interest rate.

There is still a possibility that world shocks influence domestic output growth and the base interest rate contemporaneously. We control for these shocks by including various controls in the X_{it} matrix, such as time fixed effects.[15] Furthermore, the endogeneity of monetary policy in the *base country* may also bias the estimate of θ. In particular, the base interest rate may change in response to the base country policymaker's reaction to expected GDP growth, which might have a direct influence on domestic country GDP growth (i.e., on y_{it}). This effect

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[14] The success of this strategy depends on the fact that many countries followed German monetary policy in order to maintain parity in the exchange rate systems, while other countries chose Germany as an anchor in order to import low-inflation credibility. Though the German rate is not a perfect instrument, it can be shown that the IV bias is less than the OLS bias (see di Giovanni and others (2005) for details).

[15] Recent tests developed by Pesaran (2004) confirm that the inclusion of time fixed effects greatly decreases cross-sectional correlations of error terms to the point of insignficance in our sample.

actually biases against finding a strong response of domestic GDP growth, so we also include base country controls in X_{it}.

The second question that this paper seeks to answer is whether the impact of the base interest rate on domestic output growth varies across exchange rate regimes. This hypothesis is tested in the following regression framework:

$$y_{it} = \alpha_3 + \theta_1 R^b_{it} + \theta_2 Peg_{it} + \gamma R^b_{it} \times Peg_{it} + \phi_2' \mathrm{X}_{it} + \upsilon_{it}, \tag{5}$$

where Peg_{it} is a 0/1 dummy variable indicates whether country i is pegged or not to its base country. Testing the null hypothesis $\gamma = 0$ will answer whether there is a difference in the impact of the base country interest rate on domestic output growth across pegs and floats. In particular, we expect that $\gamma < 0$ if pegs are more affected by base country interest rates.

A matrix of controls, X_{it}, is also included. The potential bias due to the endogeneity of base country monetary policy is again a concern, but is expected to be larger for pegged countries because these economies are likely to be more dependent on the base country, thus biasing γ towards zero.

The growth rate of output and the level of the interest rate are considered rather then the level of output. First, using levels and including lagged output yields a coefficient extremely close to one on the lagged output coefficient, while not affecting our other results substantially. Given this result and potential concerns of heterogeneous dynamics across countries—see Section A—we choose the parsimonious approach of taking growth rates before running the regressions. Moreover, the use of growth rates and level of interest rates is not uncommon in the literature (Bernanke, Gertler, and Watson, 1997; and Hamilton and Herrera, 2004), as well as previous investigations of foreign interest rates' impact on the economy (Frankel and Roubini, 2001; and Reinhart and Reinhart, 2001). Recent theoretical models also show that the output-interest rate relationship is one where the deviation of output from a trend steady-state is dependent on the interest rate (e.g., Rotemberg and Woodford, 1997). Using GDP growth is similar in spirit to such a concept. It is also worth noting that this paper is not about long-run GDP growth, but about business cycle frequency acceleration and slowing of growth caused by base interest rates. We rely on the logic that while the interest rate is persistent, it is ultimately stationary, and thus the concern that our structure would imply that a permanently higher R would lead to a permanently lower growth rate does not hold as interest rates cannot be permanently higher.[16]

The concern of heterogeneity, short time-series samples and the use of annual data also preclude us from exploring more dynamic specifications. It is possible to show, however, that the estimated interest rate coefficient summarizes the instantaneous and historical effects of

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[16] From an econometric standpoint, we deal with this persistence by clustering the standard errors appropriately, see note 21.

interest rates on the economy.[17] Finally, the question of whether the effect of foreign interest rates differs across exchange rate regimes is ultimately a *cross-sectional* question.

A. Random Coefficients Model

Estimation of equation (5) poses certain limitations and assumptions, which may not be optimal. First, it assumes that the impact of the base rate (and other covariates) on domestic GDP growth is homogeneous across countries at time t, which need not be the case.[18] Second, we would like to interact the base interest rate with other potential controls, but doing so with too many variables makes the estimation and interpretation of estimated coefficients from equation (5) unwieldy. Therefore, given that the focus of the paper is to examine what cross-country characteristics matter for the impact of the base rate on domestic GDP growth, we estimate the following system of equations:

$$y_{it} = \mathrm{X}_1\beta_1 + \mathrm{X}_2\beta_{2i} + \omega_{it} \tag{6}$$
$$\beta_{2i} = \mathrm{Z}_i\widetilde{\gamma} + \xi_i, \tag{7}$$

where X_1 is a matrix of country-specific dummies, time dummies, domestic inflation, base GDP growth, and oil prices. The X_2 matrix contains the base country interest rate. A key assumption underlying equation (6) is that all the coefficients in β_1 are allowed to vary by country, except for the time dummies, which capture common shocks across countries. The coefficients for β_{2i} are treated as random, and are modeled as a function of country-specific covariates (Z_i) in equation (7). These covariates are country characteristics averaged over the sample period. For example, one such variables is the average of Peg_{it} over time, where a 0 would indicate never pegged vs. a value of 1, which would indicate continuously pegged.

Equations (6) and (7) can be combined to produce a Random Coefficients Model (RCM) representation of the system:

$$y_{it} = \mathrm{X}_{\mathbf{1}}\beta_1 + \mathrm{X}_2\mathrm{Z}_i\widetilde{\gamma} + \epsilon_{it}, \tag{8}$$

where $\epsilon_{it} = \mathrm{X}_2\xi_i + \omega_{it}$. Thus, the coefficients in the vector $\widetilde{\gamma}$ capture how the impact of the base rate on domestic GDP growth varies by country characteristics.[19]

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[17] See di Giovanni and others for a formal analysis.

[18] For example, see Hsiao and Pesaran (2004); and Smith and Fuertes (2004).

[19] Following Amemiya (1978) and Hsiao (2003), equation (8) is estimated using Feasible Generalized Least Squares (FGLS). See Appendix II for details on estimation as well as assumptions and tests of the model. Note that the sample is restricted so that countries must have a minimum of fifteen observations to be included in this analysis. Results are robust to including a minimum of twenty observations, several countries are lost. We thus opt for fifteen observations given the importance of the cross-sectional dimension of the data.

This econometric technique, along with our broad data set and multiple base rates, allows us to control for world growth effects with time controls, allows country specific responses to variables such as oil prices and base country growth that may affect different countries differently, and control for local inflation and unobserved country fixed effects. Such a specification gives us far more power to isolate the impact of base interest rates on local economies than previous studies.

IV. Data and Results

A. Data

Data sources are described in detail in Appendix I. Most financial and exchange rate data comes from the IMF's International Financial Statistics while most real economy data (GDP, trade levels, etc.) come from the World Bank's World Development Indicators. The exchange rate regime classification is from Shambaugh (2004) and is a de facto classification, which is described in detail in the Appendix. Two financial openness variables are used, both based on information from the IMF. One is a binary variable created by the authors (see Appendix) and one a continuous variable from Chinn and Ito (2005). The sample runs from 1973–2002 for 160 countries, yielding roughly 4000 country/year observations for most specifications.[20]

The Appendix lists our country sample and Table A1 shows simple summary statistics. The sample is dived roughly equally between pegs and nonpegs and the average growth rates of the two are nearly identical. The growth rate of pegs does exhibit a slightly higher volatility; an unconditional finding, but one consistent with subsequent work showing that annual growth rates in pegs are affected by base interest rates.

B. Panel Estimation

Baseline results

The most basic result is obtained from testing equation (4) for the full sample. In this specification, we examine if on average, countries' annual real GDP growth varies with the base country interest rate. Column 1 of Table 1 shows this result where there is a negative

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[20] The sample is limited in a few ways. First hyperinflations are eliminated as they are generally outliers for many of the dimensions of interest (e.g., domestic interest rates). Second, we eliminate countries with GDP growth either above 20 percent or below −20 percent. We view these growth rates as either mistakes in the data or highly unusual circumstances that may cloud the results. As it turns out, moving the cutoffs or allowing these outliers in the data set does not change the results except in a few circumstances where they appear to strengthen our results. Finally, we drop countries with a population less than 250,000 as we view them as too small to be representative.

point estimate, but it is close to zero and not remotely statistically significant.[21] Thus, on average, countries do not seem to be affected by the base interest rate, or at least the biases towards zero discussed above dominate any relationship. The second and third columns, though, show that there is a significant relationship for pegged countries but none for nonpegs. The fourth column pools the data and uses the interaction term to highlight the exchange rate regime effect (equation (5)). Again, there is no general effect on countries (the coefficient on Base R is effectively zero) and yet there is a statistically significant negative coefficient on the interaction term. Pegs' economic activity appears to slow down when the base country interest rate is high.[22]

These results are economically significant as well. They imply that when the base interest rate is 1 percentage point (100 basis points) higher this cuts 0.1–0.2 percentage points off of annual GDP growth for pegged countries. Thus, if the base is in a tight monetary policy period vs. a loose period (often up to a 500 basis point swing in interest rates), this could have a full percentage point impact on pegged countries annual GDP growth while having no impact on floats. Again, these results are likely biased towards zero, and the gap should be biased down as well.

The positive coefficient on the peg variable should be interpreted carefully because the coefficient on the interaction of peg and base interest rate is negative and the base interest rate is a positive variable. The mean of base interest rate is 0.07, and when multiplied by the -0.18 coefficient on the interaction, we see the mean impact of a peg is zero (0.139 + -0.18×0.07). The lack of an impact on annual growth rates for a pooled sample is consistent with Husain, Mody, and Rogoff (2005).

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[21] The standard errors are clustered at the country level. This is the most conservative clustering setup in that it increases standard errors over other choices such as simply using robust standard errors or clustering at the base country level. The latter may be a preferable choice in that the base interest rate obviously repeats for all countries pegged to the same base. We choose to use local country clustering in part to be more conservative. Clustering allows an unspecified autocorrelation matrix removing concerns of serial correlation in the error term (see Bertrand, Duflo, and Mullainathan, 2004). GDP growth is persistent, but not strongly so. The autocorrelation is only 0.29. Base interest rates are more persistent, but the overall regression shows only a 0.28 serial correlation in the error. When time and country controls are included this serial correlation is even lower. Thus, the serial correlation appears low enough that clustering is a sufficient means to compensate.

[22] We also note that the fact that nonpegs includes many countries that are truly between pegging and floating, but are not pure pegs or countries that only peg for part of the year. This methodology should blur the distinction between the two regimes and makes our finding of a significant difference all the more surprising.

Fixed effects and other controls

As discussed, omitted variables are a concern. In particular, world shocks may raise interest rates and slow down growth around the world, and the base country's annual GDP growth may have direct effects on the domestic country's. Table 2 explores some of these issues by including a variety of fixed effects and base country GDP growth. First, the regression includes year effects to control for worldwide shocks and country fixed effects to control for the fact that growth rates may differ across countries. Most data sets are unable to explore such an effect because they only use one world interest rate as opposed to a base interest rate that can vary across countries depending on the base. The base interest rates are certainly correlated, so including such year controls takes some power away from the regressions, but it leaves a much improved identification that has not previously been exploited. Column 1 shows that year and country fixed effects alter the regression slightly, but the gap between pegs and floats is close to unchanged and remains significant.

The relevant external growth factor may not be worldwide, but may be more narrow; thus, we include base GDP growth. In addition, since the empirical work is in part motivated by the interest parity relationship and the costs of borrowing, it is important to examine the real cost of borrowing in the domestic country. In this case, the local inflation rate is relevant. Column 2 of Table 2 presents our core specification. The coefficient on the gap between pegs and floats strengthens slightly to -0.17 and is significantly different from zero at 99 percent. The effect on nonpegs is zero. Base growth is positive (as expected) but insignificant (it is significant if year effects are dropped) and inflation is negative and significant.

Beyond the core specification, the interest parity relationship suggests the expected change in the exchange rate should be included, so the change in the exchange rate is included but there is no significant effect. The inflation rate is highly correlated with the GDP deflator's growth rate, and thus it may be problematic to include contemporaneous inflation. No impact is found when including lagged inflation to proxy for expected inflation, though now the change in the exchange rate is significant and negative (inflation and the change in the exchange rate are highly correlated).[23] It is also noteworthy that the results change little or not at all if we drop crisis years, drop regime transition years, or drop observations that Reinhart and Rogoff (2004) describe as "freely falling" (see Table A3).

As the trilemma is motivation of the study, this suggests that capital controls should also be an important consideration. If a country has capital controls, it may be less sensitive to a capital markets channel, and its monetary policy should also be less constrained by the base interest rate even if it is pegged. Thus, we include both a measure of capital openness as well as the interaction of the base interest rate and capital openness with the expectation that more open countries will be more affected by interest rates in the base country. Columns 5 and 6 of

[23] Even when using lagged inflation, the change in the exchange rate is not significant if we exclude high depreciation countries (those depreciating more than 20 percent in a year).

Table 2 show a weak result in this direction. Using the Chinn-Ito variable, the point estimate is negative but not significant. Using a binary coding created by the authors yields a negative coefficient significant at 90 percent.[24]

Subsamples

Table 3 shows the results across different sub-samples of the data. First, the results hold in the very broad groupings of developing (LDC) and industrial countries (DC). In both cases, there is a significant negative relationship for the interaction term of base interest rate and pegging. There is a small and weakly significant positive coefficient on the base rate for developing countries in general, but this is most likely due to the omission of year effects.[25] Dividing further by income groupings, there are strong significant reactions in high income, lower middle income, and lower income countries. The only grouping not to show expected results is the upper middle income. According to geographical groups, the results are strongest in the Middle East, Europe, and sub-Saharan Africa. Importantly, no region has a significant coefficient on the non-interacted base rate, so no region shows evidence of nonpegs being affected by the base rate. The results are not always significant as sample size shrinks, but it does not appear that they are driven by any one type of country or region, and they seem to be representative across a broad cross-section of countries.[26]

Alternate base interest rates

While the results appear robust to a variety of fixed effects, we continue to explore the results

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[24] Including further interactions (peg times capital openness and peg times capital openness interacted with the base rate) generates slightly stronger results on the interaction of capital openness and the base rate, but a positive coefficient on the peg times capital openness interacted with the base rate. Thus, capital openness and pegging are not purely additive nor do they both need to be active for an impact. A basic trilemma prediction would be that pegging and capital openness only matter in conjunction, but the result we find is consistent with Obstfeld and others (2005) results on interest rate effects.

[25] We are unable to include year effects in these specifications because in some sub-samples there is insufficient variation in which country is the base. When we include year effects for the developing sample, the positive coefficient on the base rate disappears while the interaction term remains at -0.19 and is still significant.

[26] Much of the previous work on this topic has focused on Latin America. We note that this is the one region that comes close to having a significant reaction on the base interest rate regardless of exchange rate regime. In addition, if one does not exclude the very high inflation outliers in this region and one does not control for inflation and base GDP growth, the coefficient on base interest rate becomes significant, presenting a picture of all countries being affected by the base rate. Keeping high inflation countries in the full sample does not have this effect.

by taking further advantage of the fact that countries do not all peg to the same currency. Specifically, we check non-dollar based countries against the U.S. interest rate. If the only issue is a capital market effect, the dollar rate should be important, but if the effect is driven by the monetary channel suggested by the trilemma, only the actual base interest rate should matter. That is, if we see a gap between pegs and floats, does this gap exist for all large country interest rates, or only for the rate of the country to which they have pegged? Table 4 shows that, in the core regression, dollar based countries and non-dollar based countries look similar, though the results are stronger for countries pegged to the dollar. Year effects cannot be included in the dollar sample in column 1 because there is only one base interest rate used. Column 2 is the analogous regression for nondollar countries. Column 3 includes year effects as well. When the U.S. interest rate is substituted for the base interest rate for the non-U.S. based countries, the only significant relationship is a positive coefficient on the non-interacted US rate. This result is again likely due to the lack of year controls (this result is not apparent in many other specifications such as the one without country fixed effects shown in column 5.) There is no evidence, though, of a significant negative coefficient on the peg times the U.S. rate in any specification. Pegs do not respond negatively to the U.S. rate unless they are pegged to the dollar.

These regressions show that pegs are not simply more affected by large country interest rates, but are affected by the interest rates of their base in particular. Second, the fact that U.S. rates do not have a negative effect on non-U.S. based countries suggests that the capital market effect is not the primary channel. For almost any country, the U.S. interest rate is important in financial markets, but, pegs only respond to their base, not to the dollar interest rate.

Other controls and robustness checks

Including more controls and characteristics increases the number of interaction and cross interaction terms required such that the results are less straightforward to interpret. The RCM framework is thus exploited to explain the reaction of countries' growth rate to the base interest rate using a number of different institutional and country characteristics ranging from the exchange rate regime to capital controls to trade levels.

Before turning to these results, we briefly summarize other controls and estimation issues we have considered. First, we have run regressions using a dynamic specification of equation (5). In particular, we include lagged domestic GDP growth. There is very little difference in the results, most likely because output growth is not necessarily a very persistent variable (unlike the level of GDP, for example). Real interest rates are used instead of nominal interest rates. While the rate that is relevant in interest parity or other international conditions is the nominal rate, we also examine base real interest rates. Results vary depending on how the base real interest rate is defined (subtracting current or lagged inflation from the nominal rate). Alternatively, including the base interest rate and base inflation separately continues to give our standard results. In addition, regressions are conducted across subsets of countries divided by debt levels. Least indebted countries appear to be the least exposed to foreign interest rates, yet the core result of pegs reacting more than floats appears to hold across quartiles by debt level, though the significance varies.

In addition, since we discuss borrowing costs as a potential channel, we check that our results hold for real investment growth in addition to real GDP growth. Results (see Table A2) are even stronger than our main results in both size and significance. Again, there is a strong difference between pegs and nonpegs. Pegs exhibit a strong negative response in real investment growth rates after a base interest rate increase. And, again, non-dollar pegs do not respond to dollar interest rates despite responding quite strongly to their own base country interest rates.

Finally, other exchange rate regime classifications are examined. Replicating Table 1 using de jure codes (countries' declared regime status), shows directionally similar but weaker results (see columns 5 and 6 of Table A4). This is not surprising given the fact that some of the observations are miscoded in the de jure codes mixing pegs and floats together. Using Reinhart and Rogoff's classification codes (condensed to a binary coding) yields similar, though weaker, results without fixed effects and controls, and opposite reactions with full effects and controls (the base rate is weakly significantly negative and the interaction term is insignificant). When restricting the sample to the 80 percent of the observations where the Reinhart and Rogoff and Shambaugh classifications agree, the results are similar without effects and unclear with the effects. As columns 1 and 2 show, a significant number of observations are lost when using Reinhart and Rogoff codes. Furthermore, their codes show fewer switches making finding significant results with country fixed effects less likely. Finally, we use the disaggregated Reinhart and Rogoff codes as well (see Table A5). Here, with no fixed effects or controls, only pegs have a significant relationship with the base interest rate and only crawling pegs have strongly significant reactions with fixed effects. The results for floating countries and freely falling countries are always close to zero and not remotely significant. Thus, the reactions are not identical across classifications, but they are similar in a number of specifications.[27]

C. Random Coefficients Estimation

We next turn to results from estimating equation (8). As discussed above, using a random coefficients framework provides a method that not only allows for greater flexibility in estimating the impact of the base interest rate on domestic annual GDP growth using the time series data while controlling for global shocks, but also allows us to take into account many cross-country controls when trying to explain this impact of the base interest rate.

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[27] We see an advantage in using the Shambaugh classification based on data coverage, availability, and the annual nature of the coding used which matches the frequency of our other analysis and data. Thus, we use it for the bulk of our analysis. See Shambaugh (2004) for an extensive discussion of the different classifications.

This estimation methodology confirms the importance of the exchange rate regime. In particular, Table 5 presents the estimated coefficients for the whole sample and the less developed country sub-sample, respectively.[28] The country-specific variables used in the regressions (i.e., the X_1 variables) include a constant, domestic inflation, base GDP growth, and the oil price. Furthermore, a time effect is included for all countries. We also experimented with including exchange rate changes, but, like in the panel estimation, including this variable does very little to our estimates.

Before turning to the precise quantitative results, the main result can be summarized in Figure 1. The vertical axis represents estimated coefficients of the impact of the base rate on annual GDP growth, and are calculated from a first-step estimation of a FGLS procedure (see the Appendix for details). The horizontal axis represents how pegged a country was over the sample; i.e., it is an average of the exchange rate regime binary indicator over the period. A value of zero implies that the country was always a nonpeg, while a one indicates that country always fixed to its base. The figure depicts a negative relationship, implying that the average impact of a foreign interest rate on domestic real annual GDP growth will be larger the more fixed a country is on average.

Table 5 shows that this result is robust across all specifications, and is both economically and statistically significant. The core result in column 1 indicates that foreign interest rates being 1 percentage point higher result in a 0.30 percentage point greater impact on annual real GDP growth for countries that were pegged throughout the sample compared to those that were floating, while the impact is 0.29 percentage points for the less developed country sample. This result is even larger than in the panel regressions now that multiple country characteristics are included. Given that base country interest rates can move by up to 500 basis points over a cycle, it suggests a very large impact on pegs versus floats. The inclusion of several controls and the high statistical significance of the peg coefficient in Table 5 indicates that the results are robust. Interestingly, the majority of other control variables are not significant. However, it is worth noting that the sign of the coefficients in general line up with what one would expect.

First, the Trade/GDP coefficient is generally negative indicating that foreign interest rates have a larger impact for economies that are open to trade. There is no *a priori* reason to expect this result, but trade and financial openness are strongly correlated, and more financially open countries may be impacted more by foreign interest rates. Second, the impact of the base rate on domestic output growth is weaker the more a country exports to its base country (as a ratio of GDP), which makes sense given the identification problem resulting

[28] Results were broadly consistent for the developed country sub-sample, but statistical significance is lower given a smaller cross-sectional component. Results are available from the authors upon request.

from the forward-looking bias of the foreign monetary policymaker and common shocks.[29] This result is significant in columns 5 and 6.[30] Income variables are not significant, except for columns 5 and 6, where low income countries appear to be positively affected, though due to the inclusion of other variables, there are very few low income countries left in the sample in these specifications. Finally, the capital control variable (KA open) is never significant and the point estimate is practically zero. We have experiment with other capital controls data (Chinn-Ito), and have not found any strong results for this indicator, though the peg variable remains strong.

Financial markets, both domestic and international, may also affect how strongly the domestic economy reacts to movements in the base rate. We therefore examine the impact of the average level of financial development, external capital flows, and financial openness. Only the ratio of credit to GDP in column 4 is significant, and has it a positive coefficient, indicating that the base rate has a smaller impact in more financially developed economy (viz. credit).[31]

D. Channels

Foreign interest rates should not have a direct effect on the domestic economy. However, they may operate through some channel and have an indirect impact either by affecting domestic interest rates, investment flows, or other variables that contribute to annual GDP growth. In many ways, the channels have already been tested by examining characteristics and base rates. Our results that pegs are more affected than floats is consistent with an interest rate channel. The lack of an effect of the U.S. interest rate on both pegs and floats that are based to countries other than the U.S. is inconsistent with a strong capital market channel. Similarly, the fact that the exchange rate regime is the most dominant characteristic driving the relationship between base rates and GDP growth in the RCM framework is again consistent with the interest rate channel.

To further determine through which channel(s) the foreign interest rate operates, we test a series of variables against the base interest rate and see if they move in a direction consistent with the direction that GDP growth moves. If there is no relationship between a particular variable and the base interest rate, this suggests that the channel is not operational. Finding

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[29] Note that we also control for this effect in the time series part of the estimation by including base GDP growth in X_1.

[30] It is also interesting to note that the coefficient on the peg increases (in absolute terms) when including the exports to base variable (the specification with only the peg is not reported, but is available upon request).

[31] This result points to a potential dampening effect of financial depth on the impact of the base interest rate on annual output growth. This dampening effect of financial depth has been highlighted in recent work by Aghion and others (2005).

significant relationships does not establish that a channel is the primary one affecting domestic growth definitively, however, but establishes the existence of a potential channel.

This methodology is analogous to that of Kim (2001), who applies the same identification strategies he uses to identify the impact of monetary policy on output to other channel variables (e.g., trade). He then asks what models the resulting impulses of these variables are consistent with. We do not follow a VAR strategy to identify monetary shocks, but we expect that the impact of base interest rates on economic variables to differ given potential channels, as well as across different exchange rate regimes.

Interest rate channel

We consider a wide variety of potential channels. As noted often in the paper, one focus is on the direct effect of base interest rates on domestic interest rates. The presumption is that domestic interest rates have some impact on the economy, and if movements in base interest rates force movements in the local rate, this will have an impact on the economy. Thus, we test the impact of changes in base interest rates on domestic rates.

This channel has been tested in Shambaugh (2004) and Obstfeld, Shambaugh, and Taylor (2004 and 2005) with a series of controls and robustness checks. We do not repeat all tests here but simply check the basic specifications with our data.[32] Table 6 shows that domestic rates do seem to move with base interest rates, but this is driven by pegs. There is no effect on floats, but the peg interaction term shows a statistically significant and economically meaningful coefficient of roughly 0.4 depending on the specification, implying that 40 percent of base rate changes are passed through to domestic rates in fixed exchange rate countries.[33] Thus, the direct monetary channel appears to be a possible explanation for the growth impact. When base interest rates rise, domestic rates in pegged countries rise. The direction and difference between pegs and nonpegs are consistent with our growth results.

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[32] Shambaugh (2004) discusses the fact that we should be worried about persistence in nominal interest rates and should consider a specification in differences. We follow that here. Domestic rates are far more persistent than the other variables we consider for channels, that is why we turn to differences only for the interest rate and spreads regressions.

[33] These results are also consistent with findings in Miniane and Rogers (2003) who find that local interest rates respond to base interest rates more for pegs. Borensztein, Zettelmeyer, and Philippon (2001) also find pegs respond more to monetary shocks when looking at a small group of countries. Frankel, Schmukler, and Servén (2004) agree that short-run reactions are slower in nonpegs than in pegs, though they argue that long run reactions are more similar (cf Shambaugh). Finally, Hausmann and others (1999) do not find this relationship when using a small panel of Latin American countries and using real interest rates.

Interest rate gap channel

Alternatively, the foreign interest rate may not only move the domestic rate directly, but also have an impact on the spread. Consider the equation:

$$R_{it} = R^b_{it} + \Delta e_{it} + \delta_{it}, \tag{9}$$

where R_{it} is the local rate, Δe_{it} is the expected change in the exchange rate, and δ_{it} is a relative risk premium on domestic vs. foreign assets. The change in the base rate may not simply affect the domestic rate directly, but it may also change expectations on the exchange rate and the risk premium causing a change in the spread between the domestic and foreign rates. Uribe and Yue (2005) note that an increase in the base rate might not only increase the domestic rate directly, but may also increase the spread generating the possibility of a more than one for one increase in domestic rates.[34] We thus test the impact of the base rate on the spread between domestic and base rates.[35]

Examining the interest rate gap (defined as the domestic minus the base interest rate) and the base interest rate yields statistically significant results, but the direction of the reactions would not explain a decrease in GDP growth after an increase in base rates. Column 2 of Table 6 shows the results. There is a strongly negative reaction implying that the spread declines after an increase in base interest rates, and this reaction is stronger for nonpegs. This result is not surprising. If the domestic rate does not respond to the base rate in floating countries, as column 1 shows, then the spread automatically moves opposite the base interest rate. The spread shifts less for pegs because domestic interest rates do go up with the base interest rate to some extent in these countries. A declining spread should be positively correlated with GDP growth, but there is no improvement in GDP after a base rate increase. Thus, these results seem to imply there is not a strong spreads channel largely because for most countries, there is no affect of base interest rates on domestic rates, and the spread is not acting like a multiplier of base rate changes, but is simply the residual arising from domestic rates not moving with the base rate fully.[36]

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[34] They find that the U.S. rate and the spread can explain up to 20 percent of domestic aggregate activity. However, the standard error bands on the output response to U.S. interest rate changes generally include zero and the sample size is restricted for data reasons. See also Neumeyer and Perri (2005). They examine the volatility of business cycles in five emerging economies, discern that real interest rate volatility contributes to the volatility of the cycle, and that both foreign rates and country risk contribute to the volatility of the real rate.

[35] Note that Uribe and Yue (2005) look at foreign currency denominated bonds, so their spread is strictly δ_{it} , whereas our interest rates are domestic, so our spread is $\delta_{it} + \Delta e_{it}$.

[36] These results are almost identical if one looks at the the spread rather than the change in the spread itself. The only difference being that the difference between pegs and nonpegs becomes less significant. We use differences because spreads, like domestic interest rates, are quite persistent.

Exports to base channel

The base country interest rate may also have real effects in the base country. To the extent that some countries are economically dependent on the base country, a primary channel through which this may have a direct effect on the domestic GDP growth is changes in exports to the base country. There are two reasons to be somewhat skeptical that this channel will have strong effects, however. First, to the extent that interest rates in the base countries are counter-cyclical, one would expect the classic monetary policy result that high rates are simply offsetting higher expected growth, and not actually slowing the economy down to recession levels. Thus, it would be surprising to see an impact through the growth rates of the base economy. In addition, base country GDP growth has been included in the output growth regressions, and it does not weaken the base interest rate effect. Still, we test here the impact of base rates on exports to the base country to see if there is a possibility of such a channel.

Table 7 column 1 shows that exports to the base do not move in a direction consistent with our results. Nonpegs' exports are unaffected, but there is a weakly significant increase in exports to the base by pegs. This result fits the theory that base countries may be acting counter-cyclically and this counter-cyclicality may in fact be mitigating our main results. It appears that pegs are helped by an increase in exports to the base when the base rate is high, but that this relationship is overwhelmed by the monetary channel.[37]

Capital flows channel

Calvo, Leiderman, and Reinhart (1993 and 1996) consider the impact of large country interest rates on financial flows. Their concern is that interest rate movements in developed countries may affect the volume of capital flows to developing countries. The hypothesis is that an increase (decrease) in base interest rates would shrink (expand) the pool of capital available outside the base country because more base country funds would stay (leave) home. Thus, we test the impact of base interest rates on domestic country financial flows. There is no *a priori* reason for this effect to differ across exchange rate regime.

Table 7 columns 2 and 3 show the effect of the base rate on capital flows. Two indicators of the impact are considered. The first is the percentage change in total external liabilities against the base rate. The second is the change in total liabilities to GDP. In general, the results do not support a capital flows channel. The change in external liabilities does not show

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[37] The exports to base/GDP series is quite persistent as well, suggesting the possibility of using changes for this channel as well. When changes in exports to base (divided by GDP) are regressed on changes in the base interest rate, there is no significant coefficient on the interaction, but the non-interacted base interest rate coefficient is now small and weakly significant positive coefficient implying that the boost in exports that comes with growing base countries may hit pegs and nonpegs alike. Regardless, this does not seem to be a channel that explains slower growth when base interest rates are high.

a relationship in either specification.[38] Thus, it does not appear that the base interest rate significantly affects capital flows into these countries. The point estimates are negative, but there is no statistically significant evidence supporting a capital flows channel.

Exchange rate change channel

The base interest rate will potentially move the domestic exchange rate and hence affect the economy through an exchange rate change channel. An increase in the base rate may cause the base currency to appreciate against all other currencies (that float) meaning that any floating country will depreciate against the base. Thus, we test the nominal exchange rate relative to the base country against the base interest rate. Table 7, column 4 shows the results. There are no significant reactions to the base interest rate. The peg and domestic inflation are the only significant variables. We see that pegs tend to appreciate (a negative coefficient) relative to nonpegs though country fixed effects as well as the constant and other controls obscure the exact pattern. Given the insignificant reaction to the base interest rate, though, this does not appear to be a primary channel.

Thus, while these explorations of the channels are not intended to be definitive on any one relationship measured, the one effect that seems to both run in the direction that would slow annual growth and differ significantly by exchange rate regime is the impact of base rates on domestic interest rates. This finding does not establish it as the only channel, but it seems to be an important one.

V. Conclusion

This paper shows that while interest rates in large countries may have an effect on other countries' real economies, this impact only exists for pegged countries. Countries without a fixed exchange rate show no relationship between annual real GDP growth and the base interest rate, but countries with a fixed exchange rate grow between 0.1 to 0.2 percentage points slower when base interest rates are 1 percentage point higher. The results appear robust to a wide variety of controls and specifications. Controlling for time, region, income, base-country GDP growth, and other controls all present the same picture. In addition, pegged countries do not respond to any world interest rate, but only the rate of the country to which they peg—further suggesting the importance of the peg in this relationship. We have exploited variation in base rates and used RCM techniques to achieve better identification and increase confidence in the robustness of the results.

Our work on channels suggests that the effect of base rates on domestic interest rates in pegged countries is the primary channel through which this impact on GDP takes place. Pegged countries move their interest rates with the base-country interest rates while floats do not. On the other hand, there does not seem to be a robust relationship consistent with the direction that growth moves between the base-country interest rate and numerous other

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[38] We have also experimented with examining changes in the base rates and results are similar.

potential channels such as the exchange rate, capital flows, and the interest rate spread over the base country.

While the fact that fixed-exchange-rate countries' growth rates move with the base interest rate matches our theoretical predictions, the results are surprising on two levels. First, the lack of a reaction in the floating countries runs counter to conventional wisdom regarding the extent to which large-country interest rates affect the rest of the world. Second, with the findings that the primary channel is the direct monetary policy channel, we add to our understanding of how and why large-country interest rates matter for pegs and demonstrate that exogenous monetary policy can have a palpable effect on the economy.

For many years, economists have struggled with the difficulty of finding robust macroeconomic relationships that vary across exchange rate regime. Recently, there has been additional work suggesting that monetary policy autonomy, growth, inflation, and trade may all vary with the exchange rate regime, at least to some extent. Stretching back further, Flood and Rose (1995) found a negative relationship between the exchange rate and output variability. The results here suggest that being forced to follow the base-country's monetary policy even when it is not optimal for the domestic economy may cause increased volatility in GDP for fixed exchange rate countries.

These results do not suggest that pegging is either a good or bad idea, but instead add to the calculus of costs and benefits (in this case costs) an economy will face when it fixes its exchange rate. Furthermore, our results suggest that losing monetary autonomy when pegging has real impacts on the economy. Obviously, by floating, a country may expose itself to volatility owing to changes in the nominal exchange rate, but pegging does not eliminate volatility. Pegging forces a country's interest rates to follow the base-country rates, which may generate more volatility in GDP by eliminating countercyclical monetary policy as an option.

I. Data

The exchange rate regime classification comes from Shambaugh (2004) and is described there in detail. In short, a country is classified as pegged if its official nominal exchange rate stays within ± 2 percent bands over the course of the year against the base country. The base country is chosen based on the declared base, the history of a countries' exchange rate, by comparing its exchange rate to a variety of potential bases, and by looking at regional dominant currencies. In addition, single year pegs are eliminated as they more likely represent a random lack of variation rather than a true peg. Finally, realignments, where a country moves from one peg level to another with an otherwise constant exchange rate are also considered pegs. Nonpegs are also assigned a base determined by the country they peg to when they are pegging at other times in the sample. While we typically use the term "nonpeg" and the more colloquial "float" interchangeably, any country/year observation not coded as a peg is considered a nonpeg, so they are not all pure floats, but include all sorts of nonpegged regimes. Shambaugh makes extensive comparisons of this methodology and other classifications. The de jure measure is based on the IMF *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* compiled in Shambaugh and extended by the authors. The Reinhart-Rogoff classification is from Reinhart and Rogoff (2004) and is available on Carmen Reinhart's website. Their coding uses parallel market data and assesses the conditional probability an exchange rate will move outside a certain range over a five-year window. See Reinhart and Rogoff (2004) for more detail. In some specifications, we collapse the five-way classification into a binary one, considering all observations that are not coded pegs as nonpegs.

There are two financial openness variables used. One is the financial openness variable as defined by Chinn and Ito (2005). This is a continuous index based on information across four major categories of restrictions in the IMF *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*. The other variable, is a binary indicator created by the authors based on data from the IMF *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* line E2, which signifies "restrictions on payments for capital transactions." For 1973–95, we begin with data provided by Gian Maria Milesi-Ferretti and augment it with data from Shambaugh (2004). After 1995, the IMF stopped reporting this series and reported disaggregated information. The series is extended for 1996–2002 using changes in the disaggregated coding and descriptions in the yearbook to determine changes in the binary codes. Shambaugh discusses the coding in more detail including the fact that this series is highly correlated with other more detailed or disaggregated measures.

Our financial flows and debt variables are updated data from Lane and Milesi-Ferretti (2001). The Credit/GDP variable is defined as private credit by banks and other Financial institutions to GDP, and comes from the updated financial Development and Structure database of Beck, Demirgüç-Kunt, and Levine (1999), which can be found at *http://econ.worldbank.org*.

The rest of the macroeconomic data come from standard sources. Real GDP, oil prices, M2/GDP, Trade/GDP, income levels, and regional and income dummies come from the World

Development Indicators database of the World Bank. Exchange Rates and inflation come from the International Monetary Fund's International Financial Statistics database. Interest rates are from the IFS as well as Datastream and Global Financial Database. Exports to the base country are derived from the IMF Direction of Trade Statistics.

The countries in the sample whose output growth rates are used are Afghanistan, I.S. of (8), Albania (4), Algeria (3), Angola (8), Argentina (8), Armenia (8), Australia (8), Austria (4), Azerbaijan (8), Bahamas,The (8), Bahrain (8), Bangladesh (8,9), Barbados (8,9), Belarus (8), Belgium (4), Benin (3), Bhutan (5), Bolivia (8), Bosnia & Herzegovina (4), Botswana (8,10), Brazil (8), Bulgaria (4,8), Burkina Faso (3), Burundi (8), Cameroon (3), Canada (8), Cape Verde (7), Central African Rep. (3), Chad (3), Chile (8), China, People's Rep. (8), China, People's Rep. (8), Colombia (8), Comoros (3), Congo, Democratic Rep. of (8), Congo, Republic of (3), Costa Rica (8), Côte d'Ivoire (3), Croatia (4), Cyprus (3), Czech Republic (4), Denmark (4), Djibouti (8), Dominican Republic (8), Ecuador (8), Egypt (8), El Salvador (8), Equatorial Guinea (3), Estonia (4), Ethiopia (8), Fiji (8,9), Finland (4), France (4), Gabon (3), Gambia, The (8,9), Georgia (8), Germany (8), Ghana (8), Greece (4,8), Guatemala (8), Guinea (8), Guinea-Bissau (3,7), Guyana (8,9), Haiti (8), Honduras (8), Hungary (4,8), Iceland (4,8), India (8,9), Indonesia (8), Iran, I.R. of (8), Iraq (8), Ireland (4,9), Israel (8), Italy (4), Jamaica (8), Japan (8), Jordan (8), Kazakhstan (8), Kenya (8), Korea (8), Kuwait (8), Kyrgyz Republic (8), Lao People's Dem. Rep. (8), Latvia (8), Lebanon (8), Lesotho (10), Liberia (8), Libya (8), Lithuania (12), Luxembourg (2), Macedonia, FYR of (4), Madagascar (3), Malawi (8), Malaysia (8), Maldives (8), Mali (3), Malta (3), Mauritania (3,8), Mauritius (9), Mexico (8), Moldova (8), Mongolia (8), Morocco (3), Mozambique (8), Myanmar (8), Namibia (10), Nepal (5,8), Netherlands (4), New Zealand (1), Nicaragua (8), Niger (3), Nigeria (8), Norway (4), Oman (8), Pakistan (8), Panama (8), Papua New Guinea (9), Paraguay (8), Peru (8), Philippines (8), Poland (4), Portugal (4), Romania (8), Russia (8), Rwanda (8), Saudi Arabia (8), Senegal (3), Sierra Leone (8,9), Singapore (6), Slovak Republic (4), Slovenia (4), Solomon Islands (9), Somalia (8), South Africa (8), Spain (4), Sri Lanka (5,8,9), Sudan (8), Suriname (8), Swaziland (10), Sweden (4), Switzerland (4), Syrian Arab Rep. (8), Tajikistan (8), Tanzania (8), Thailand (8), Togo (3), Trinidad & Tobago (8,9), Tunisia (3), Turkey (8), Turkmenistan (8), Uganda (8), Ukraine (8), United Arab Emirates (8), United Kingdom (4), Uruguay (8), Venezuela (8), Vietnam (8), Yemen (8), Zambia (8), and Zimbabwe (8), where the numbers in parentheses refer to the base countries:

Base Countries

1: Australia	6: Malaysia
2: Belgium	7: Portugal
3: France	8: United States
4: Germany	9: United Kingdom
5: India	10: South Africa

II. Estimation of RCM Model

The the RCM regression presented in Section III.A, equation (8), can be re-written in the following matrix notation:

$$\mathrm{y} = \mathrm{X}_1\beta_1 + \mathrm{X}_2\mathrm{Z}\widetilde{\gamma} + \epsilon, \qquad \text{(B.1)}$$

where the matrices are as follows for N countries over T time periods:

$$\mathrm{y} = \underbrace{\begin{pmatrix} \mathrm{y}_1 \\ \vdots \\ \mathrm{y}_N \end{pmatrix}}_{NT\times 1}, \quad \mathrm{X}_1 = \underbrace{\begin{pmatrix} \mathrm{YEAR} & \mathrm{X}_{11} & 0 & 0 \\ \vdots & 0 & \ddots & 0 \\ \mathrm{YEAR} & 0 & 0 & \mathrm{X}_{1N} \end{pmatrix}}_{NT\times(T+N\times K1)},$$

$$\mathrm{X}_2 = \underbrace{\begin{pmatrix} \mathrm{X}_{21} & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \mathrm{X}_{2N} \end{pmatrix}}_{NT\times N}, \quad \mathrm{Z} = \underbrace{\begin{pmatrix} \mathrm{Z}_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \mathrm{Z}_N \end{pmatrix}}_{NT\times N}, \quad \epsilon = \underbrace{\begin{pmatrix} \epsilon_1 \\ \vdots \\ \epsilon_N \end{pmatrix}}_{NT\times 1},$$

$$\beta_1 = \underbrace{\begin{pmatrix} \beta_{\mathrm{YEAR}} \\ \beta_{11} \\ \vdots \\ \beta_{1N} \end{pmatrix}}_{(T+N\times K1)\times 1}, \quad \widetilde{\gamma} = \underbrace{\begin{pmatrix} \widetilde{\gamma}_1 \\ \vdots \\ \widetilde{\gamma}_M \end{pmatrix}}_{M\times 1},$$

and note that $\beta_2 = \mathrm{Z}\widetilde{\gamma} + \xi$ and that $\epsilon = \mathrm{X}_2\xi + \omega$.

The vector y contains output growth, X_1 is a matrix of year dummies (YEAR) and country-specific variables that vary over time (e.g., base country output growth, inflation, oil price, etc.) and a country-specific intercept, X_2 is a matrix of base-country interest rates, and Z is matrix of country variables that are averaged over the sample period (e.g., the average time a country is pegged, or has capital controls). By making parts of X_1 and X_2 block-diagonal, we allow country dynamics to be heterogenous.[39] Finally, the coefficient matrix of interest, $\widetilde{\gamma}$, relates country "fundamentals" (Z) to the average dynamic impact of the base country interest rate (X_2) on output growth (y). The null hypothesis is that this impact will be negative for countries that are pegged more on average: $\widetilde{\gamma}_1 < 0$.

We assume that ω and ξ are both independent, normally distributed errors with mean zero, and are independent of each other. The main reason for making these assumptions is tractability in the estimation procedure. Imposing a common coefficient on year effects helps alleviate any

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[39] Tests of coefficient homogeneity rejected the null hypothesis of equality.

cross-country correlation arising from global shocks in the ω vector.[40] Furthermore, including these dummies and the impact of oil prices also helps alleviate autocorrelation in the errors of ω.[41] By forcing ξ to be distributed independently across sections and homoscedastic, we are assuming that the $\beta_{2,i}$'s are uncorrelated across countries, and have a constant variance. Inspection and tests of the covariance matrix of equation (7) indicate that these are reasonable assumptions to make. Finally, assuming that ω and ξ are independent implicitly assumes that the dynamic and cross-sectional error structures are uncorrelated, which is standard in panel analysis. Many of these assumptions can be relaxed by using GMM estimation techniques, but would result in a loss of efficiency.

Given the assumptions made on the error structure, one can easily apply a two-step FGLS estimation technique based on Amemiya (1978), and found in Hsiao (2003). In particular, first regress y on X_1 and X_2 and calculate a variance-covariance matrix, Σ_1. Next, take the estimated country-specific base rate coefficients, $\hat{\beta}_{2i}$, and regress these on Z to produce OLS estimates of $\widetilde{\gamma}$, $\widehat{\widetilde{\gamma}}_{OLS}$.[42] The variance-covariance matrix, Σ_2, of these estimates is then calculated taking into account the uncertainty of the estimated base rate coefficients from the first regression. The final output of this first-step procedure is a total variance-covariance matrix, which is the sum of the two variance-covariance matrices $(\Sigma_1 + \Sigma_2)$ and is block diagonal. This matrix captures the uncertainty of the estimated β and $\widetilde{\gamma}$ coefficients. The second-step of the procedure is to estimate equation (B.1) by weighting with this total variance-covariance matrix. This estimation produces the most efficient estimates of $\widetilde{\gamma}$, $\widehat{\widetilde{\gamma}}_{GLS}$, and $\hat{\beta}_1$, $\hat{\beta}_{1GLS}$.

[40] See Hsiao and Pesaran (2004), Section 9, on the difficulties of modeling cross-section correlation when N is large (> 10) and for a discussion on other possible ways to model cross-section correlation in a RCM set-up. Note that a SURE framework would not work since $N > T$ in our sample. Furthermore, including common year effects greatly alleviates cross-sectional correlation as in the panel regressions according to the test statistics developed by Pesaran (2004).

[41] See the discussion on the panel results in footnote 21.

[42] It is these estimated $\widetilde{\gamma}$ that are plotted against the average peg variables (Z_1) in Figure 1.

Table 1. Effects of Base Interest Rate on Real Output Growth:
Baseline Least Square Estimates

	(1) Full Sample	(2) Nonpegs	(3) Pegs	(4) Full Sample
Base R	−0.046	0.046	−0.137**	0.046
	(0.032)	(0.039)	(0.044)	(0.039)
Base R×Peg				−0.183**
				(0.055)
Peg				0.014**
				(0.004)
Constant	0.036**	0.030**	0.043**	0.030**
	(0.002)	(0.003)	(0.003)	(0.003)
Observations	3831	2078	1753	3831
R^2	0.001	0.001	0.009	0.005

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on annual real economic growth. The sample period is 1973–2002. Estimates in columns (1)-(4) do not include any additional controls. Robust standard errors are clustered at the country level.
+ significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 2. Effects of Base Interest Rate on Real Output Growth: Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)
Base R	−0.046	−0.014	−0.015	−0.019	−0.042	−0.011
	(0.045)	(0.046)	(0.046)	(0.047)	(0.047)	(0.048)
Base R×Peg	−0.137*	−0.174**	−0.171**	−0.168**	−0.143**	−0.159**
	(0.053)	(0.050)	(0.050)	(0.049)	(0.050)	(0.049)
Peg	0.010*	0.011**	0.011*	0.010*	0.006	0.009*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Inflation		−0.029**	−0.024*		−0.011	−0.023*
		(0.007)	(0.011)		(0.012)	(0.011)
Lagged inflation				0.000		
				(0.001)		
Base GDP growth		0.113	0.112	0.117	0.165*	0.139+
		(0.076)	(0.076)	(0.080)	(0.080)	(0.075)
Δ NER			−0.008	−0.024**	−0.020+	−0.008
			(0.009)	(0.007)	(0.011)	(0.009)
KA open						0.015**
						(0.005)
Base R×KA open						−0.119+
						(0.063)
KA open (CI)					0.003*	
					(0.002)	
Base R×KA open (CI)					−0.010	
					(0.021)	
Observations	3831	3419	3415	3385	3117	3380
R^2	0.177	0.204	0.203	0.197	0.210	0.205

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on annual real economic growth.The sample period is 1973–2002. Country and year effects are included. "CI" stands for the Chinn-Ito measure of capital account openness. Robust standard errors are
clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 3. Effects of Base Interest Rate on Real Output Growth: Subsamples of Data

	(1) Full	(2) LDC	(3) DC	(4) HI	(5) UMI	(6) LMI	(7) LI
Base R	0.053	0.073+	−0.013	0.001	−0.022	0.104*	0.098
	(0.032)	(0.039)	(0.044)	(0.041)	(0.075)	(0.049)	(0.081)
Base R×Peg	−0.170**	−0.195**	−0.260**	−0.242*	0.021	−0.341**	−0.213*
	(0.047)	(0.053)	(0.072)	(0.101)	(0.120)	(0.087)	(0.088)
Peg	0.016**	0.019**	0.013**	0.013*	0.007	0.032**	0.015+
	(0.004)	(0.005)	(0.005)	(0.006)	(0.013)	(0.007)	(0.009)
Inflation	−0.025**	−0.025**	−0.028	−0.009	−0.014	−0.041**	−0.017+
	(0.007)	(0.007)	(0.024)	(0.015)	(0.022)	(0.010)	(0.010)
Base Y	0.248**	0.200**	0.492**	0.613**	0.221*	0.085	0.100
	(0.048)	(0.055)	(0.066)	(0.084)	(0.092)	(0.077)	(0.075)
Observations	3419	2753	666	883	518	923	1095
R^2	0.173	0.165	0.300	0.330	0.169	0.216	0.117

	(8) EAP	(9) ECA	(10) LAC	(11) MNA	(12) SA	(13) SSA
Base R	0.050	0.016	−0.055	0.122	0.061	0.073
	(0.063)	(0.053)	(0.094)	(0.099)	(0.112)	(0.074)
Base R×Peg	−0.061	−0.307**	−0.020	−0.491*	0.026	−0.203**
	(0.207)	(0.079)	(0.125)	(0.201)	(0.122)	(0.071)
Peg	0.020	0.016*	0.012	0.030*	0.000	0.010
	(0.018)	(0.007)	(0.009)	(0.011)	(0.012)	(0.009)
Inflation	−0.032	−0.059**	−0.009	−0.011	−0.015	−0.017
	(0.032)	(0.013)	(0.014)	(0.014)	(0.031)	(0.010)
Base Y	0.399**	0.402**	0.335**	0.024	0.092	0.109
	(0.102)	(0.078)	(0.100)	(0.251)	(0.063)	(0.077)
Observations	454	814	679	339	153	950
R^2	0.238	0.322	0.124	0.134	0.177	0.122

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on annual real economic growth. The sample period is 1973–2002. The estimates are based on specification (2) of Table 2, and include country, but no year effects. Base Y stands for Base GDP Growth. The following country classifications are used LDC (less developed), DC (developed/industrial), HI (high income), UMI (upper middle income), LMI (lower middle income), LI (lower income), EAP (East Asia and Pacific), ECA (Europe and Central Asia), LAC (Latin America and the Carribean), MNA (Middle East and North Africa), SA (South Asia), and SSA (Sub Sahara Africa). Classifications based on World Development Indicators. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 4. Considering Non-Base Interest Rates

	(1) Dollar	(2) Non-Dollar	(3) Non-Dollar	(4) Non-Dollar	(5) Non-Dollar
Base R	0.083+	−0.035	0.031		
	(0.047)	(0.045)	(0.060)		
Base R×Peg	−0.198*	−0.116*	−0.127*		
	(0.076)	(0.058)	(0.060)		
Peg	0.020**	0.005	0.006	0.004	0.000
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
U.S. R				0.091*	0.054
				(0.042)	(0.046)
U.S. R×Peg				−0.043	−0.028
				(0.065)	(0.075)
Inflation	−0.027**	−0.014	−0.031	−0.020	−0.013
	(0.008)	(0.020)	(0.021)	(0.020)	(0.019)
Base GDP growth	0.191**	0.326**	0.184		
	(0.064)	(0.069)	(0.121)		
U.S. GDP growth				0.243**	0.245**
				(0.068)	(0.067)
Constant	0.025**	0.031**	0.036**	0.021**	0.024**
	(0.004)	(0.004)	(0.008)	(0.005)	(0.005)
Country FE	yes	yes	yes	yes	no
Year FE	no	no	yes	no	no
Observations	2065	1354	1354	1406	1406
R^2	0.176	0.190	0.236	0.174	0.016

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on annual real economic growth. The sample period is 1973–2002. Estimates in columns (1)-(5) do not include any additional controls. Robust standard errors are clustered at the country level.
+ significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 5. Explanation of Base Interest Rate Impact on Real Output Growth: Random Coefficients Model

	Full	LDC			Full	
	(1)	(2)	(3)	(4)	(5)	(6)
Peg	−0.301*	−0.287*	−0.450*	−0.289*	−0.467**	−0.448**
	(0.114)	(0.119)	(0.158)	(0.122)	(0.149)	(0.142)
KA open	0.045	−0.089	0.041	0.165	−0.140	−0.164
	(0.148)	(0.181)	(0.201)	(0.167)	(0.160)	(0.151)
Trade/GDP	−0.113	−0.230	−0.219	−0.184	−0.269	−0.270
	(0.121)	(0.164)	(0.205)	(0.140)	(0.196)	(0.183)
Exports to base/GDP	0.796	0.561	1.367	0.701	2.104+	1.941+
	(0.822)	(0.824)	(1.100)	(0.848)	(1.033)	(1.026)
High Income	−0.106		−0.065	−0.278	−0.049	−0.051
	(0.140)		(0.208)	(0.169)	(0.138)	(0.135)
Lower mid income	−0.115		0.053	−0.092	0.086	0.068
	(0.135)		(0.173)	(0.140)	(0.137)	(0.136)
Low income	−0.123		0.094	−0.083	0.548*	0.509*
	(0.141)		(0.190)	(0.153)	(0.218)	(0.218)
Real GDP per capita		0.000				
		(0.000)				
M2/GDP			0.002			
			(0.003)			
Credit/GDP				0.517+		
				(0.239)		
Liab/GDP					0.012	
					(0.088)	
NFA/GDP						−0.088
						(0.129)
Observations	2681	1936	2233	2477	1637	1662
Countries	99	73	86	92	59	60
R^2_{whole}	0.369	0.348	0.374	0.386	0.449	0.451
$R^2_{\beta_2}$	0.135	0.151	0.163	0.182	0.331	0.350

Notes: The table give the RCM estimates of the coefficients $\hat{\gamma}$ from the model $y_{it} = \mathrm{X}_1\beta_1 + \mathrm{X}_2\mathrm{Z}_i\widetilde{\gamma} + \epsilon_{it}$, where X_1 is a matrix containing country specific intercepts, base country GDP growth, real oil prices, and a matrix of year dummies, X_2 is a matrix of base country interest rates, and Z_i is a matrix of the variables in the table, which have been averaged over the sample period per country. 'Full' refers to the full sample of countries and 'LDC' refers to less developed countries. R^2_{whole} refers to the R^2 from estimation of equation (8). $R^2_{\beta_2}$ refers to the R^2 from estimation of equation (7)—this is done using estimates from a first-step of a FGLS procedure. The sample period covers 1973–2002. Estimates are calculated using a FGLS estimator, as described in Appendix II.
+ significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 6. Impact of Change in Base Interest Rates and Spread on Change in Domestic Interest Rates

	(1)	(2)
	ΔOwn R	ΔSpread
ΔBase R	0.172	−0.828**
	(0.216)	(0.216)
ΔBase R×Peg	0.360*	0.360*
	(0.176)	(0.176)
Peg	−0.011	−0.011
	(0.009)	(0.009)
Inflation	0.156**	0.156**
	(0.055)	(0.055)
Base GDP growth	−0.017	−0.017
	(0.079)	(0.079)
Observations	1933	1933
R^2	0.204	0.216

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2002. Country and year effects are included. Estimates in columns (1)-(4) do not include any additional controls. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table 7. Other Channels and Base Interest Rate

	(1) Exports to Base	(2) %ΔLiab	(3) Δ(Liab/ GDP)	(4) ΔNER
Base R	−0.064	−0.075	0.244	−0.120
	(0.077)	(0.232)	(0.207)	(0.213)
Base R×Peg	0.256+	−0.223	−0.283	−0.105
	(0.153)	(0.247)	(0.370)	(0.229)
Peg	−0.025+	0.040+	0.023	−0.070**
	(0.015)	(0.022)	(0.034)	(0.020)
Inflation	0.018**	−0.022	0.029	0.593**
	(0.006)	(0.016)	(0.025)	(0.032)
Base GDP growth	−0.002	0.324	−0.932**	0.216
	(0.061)	(0.263)	(0.233)	(0.136)
Observations	3236	1895	1890	3503
R^2	0.573	0.292	0.216	0.550

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2002. Country and year effects are included. "Liab" stands for external liabilities. Estimates in columns (1)-(4) do not include any additional controls. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table A1. Sample Summary Statistics

	Full	Pegs	Nonpegs
Observations	3831	1753	2078
Mean GDP growth	0.033	0.033	0.033
Std dev GDP growth	0.047	0.052	0.043
Mean base R	0.072	0.075	0.070
Std dev base R	0.034	0.036	0.033

Notes: Data summarized reflect the sample used in estimation of the baseline results in Table 1. The sample period is 1973–2002.

Table A2. Effects of Base and U.S. Interest Rates on Real Investment Growth

	(1) Full	(2) Full	(3) Full	(4) Full	(5) Non-Dollar	(6) Non-Dollar	(7) Non-Dollar
Base R	−0.188	−0.173	−0.328	−0.191	0.346	−0.056	
	(0.198)	(0.200)	(0.227)	(0.224)	(0.268)	(0.199)	
×Peg	−0.589**	−0.599**	−0.567*	−0.600**	−0.612+	−0.620+	
	(0.211)	(0.220)	(0.227)	(0.221)	(0.340)	(0.342)	
Peg	0.053**	0.056**	0.048**	0.053**	0.028	0.029	−0.008
	(0.018)	(0.018)	(0.018)	(0.019)	(0.030)	(0.029)	(0.038)
Inflation		−0.029	−0.019	−0.025	0.105	0.087	0.077
		(0.039)	(0.047)	(0.040)	(0.152)	(0.135)	(0.136)
Base Y		−0.093	−0.026	−0.085	0.338	0.608*	
		(0.202)	(0.221)	(0.206)	(0.305)	(0.232)	
KAO (CI)			0.008				
			(0.008)				
×Base R			−0.021				
			(0.074)				
KAO				0.052**			
				(0.019)			
×Base R				−0.446+			
				(0.248)			
U.S. R							−0.086
							(0.182)
×Peg							0.055
							(0.340)
U.S. Y							0.527*
							(0.234)
Country FE	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	no	no
Obs.	3089	2891	2620	2863	1212	1212	1255
R^2	0.096	0.097	0.091	0.100	0.109	0.077	0.069

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2002. "Y" stands for GDP Growth, KAO stands for capital account openness (KA open), and (CI) stands for Chinn-Ito. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table A3. Different Cuts of Data to Exclude Outlier Periods and Observations

	(1) Full	(2) No Trans	(3) No Crisis	(4) No Free Fall	(5) No Bases
Base R	−0.014	−0.029	−0.036	−0.002	−0.018
	(0.046)	(0.051)	(0.045)	(0.045)	(0.049)
Base R×Peg	−0.174**	−0.157**	−0.159**	−0.193**	−0.180**
	(0.050)	(0.058)	(0.050)	(0.051)	(0.052)
Peg	0.011**	0.008	0.009*	0.013**	0.012**
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
Inflation	−0.029**	−0.025**	−0.025**	−0.011	−0.029**
	(0.007)	(0.007)	(0.008)	(0.013)	(0.007)
Base GDP growth	0.113	0.093	0.115	0.136+	0.107
	(0.076)	(0.081)	(0.078)	(0.076)	(0.080)
Observations	3419	2938	3212	3129	3169
R^2	0.204	0.202	0.212	0.209	0.200

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2002. Country and year effects are included. "No Trans(ition)" refers to periods where a country moves from peg to float or vice versa. In this case, the year before pegging the first year of pegging, the last year of pegging and the first year after pegging are all dropped. "Crisis" is based on the definition suggested by Frankel and Rose (1996): any year where depreciation is greater than 25 percent and is at least 10 percent more than the previous year's depreciation. "Free Fall" refers to observations deemed to be freely falling (large depreciation and high inflation) by Reinhart and Rogoff. "No Bases" drops base countries from the analysis. The U.S. is automatically dropped in all regressions, but, other bases, such as France, are both a base country for some other countries and a domestic country (with Germany as the base). Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table A4. Examination of Different Exchange Rate Regimes' Classifications

	(1) R&R Sample	(2) R&R Sample	(3) R&R Sample	(4) R&R Sample	(5) Full Sample	(6) Full Sample	(7) Cons w/R&R	(8) Cons w/R&R
Base R	0.039	−0.054	−0.015	−0.107+	0.000	−0.060	0.038	−0.083
	(0.048)	(0.052)	(0.055)	(0.056)	(0.043)	(0.046)	(0.051)	(0.056)
Base R	−0.210**	−0.119*					−0.202*	−0.069
×Peg	(0.068)	(0.057)					(0.080)	(0.061)
Peg	0.015**	0.006					0.016*	0.009
	(0.005)	(0.005)					(0.006)	(0.007)
Base R			−0.129+	−0.031				
×R&R Peg			(0.077)	(0.060)				
R&R Peg			0.012*	0.009+				
			(0.006)	(0.005)				
Base R					−0.096	−0.098+		
×DJ Peg					(0.063)	(0.051)		
De Jure Peg					0.004	0.006		
					(0.005)	(0.005)		
Inflation		−0.032**		−0.030**		−0.029**		−0.028**
		(0.007)		(0.007)		(0.007)		(0.008)
Base Y		0.133+		0.141+		0.111		0.163+
		(0.075)		(0.075)		(0.076)		(0.091)
Constant	0.031**	0.058**	0.034**	0.056**	0.034**	0.056**	0.031**	0.054**
	(0.004)	(0.007)	(0.004)	(0.007)	(0.003)	(0.007)	(0.004)	(0.012)
CFE	no	yes	no	yes	no	yes	no	yes
YFE	no	yes	no	yes	no	yes	no	yes
Obs.	2940	2700	2940	2700	3830	3418	2415	2211
R^2	0.008	0.233	0.005	0.233	0.003	0.201	0.007	0.244

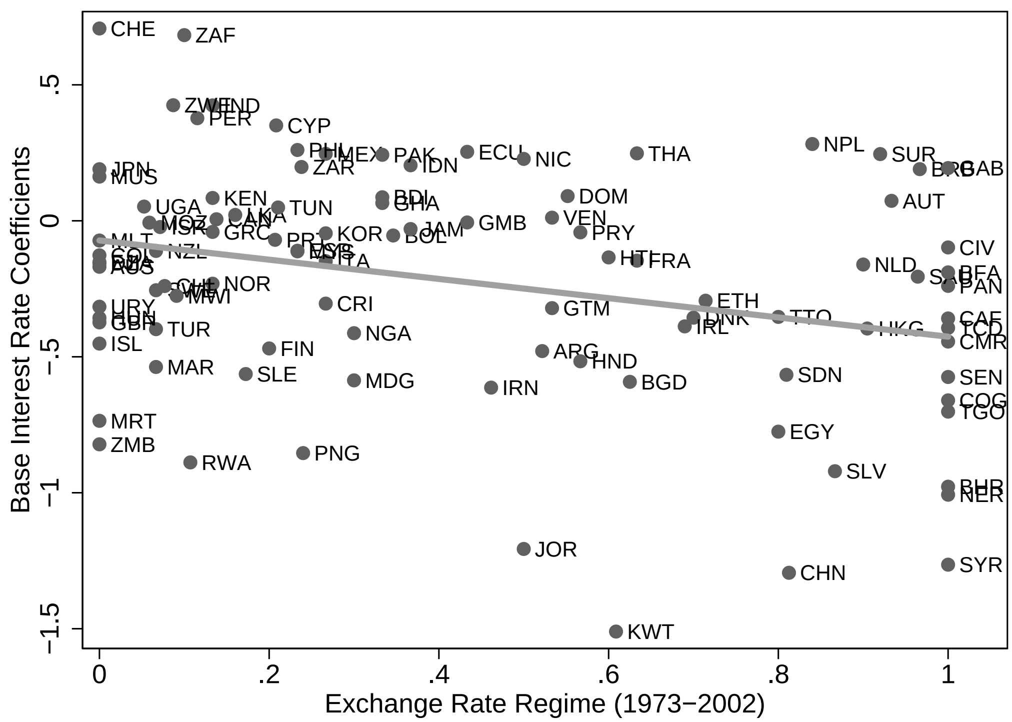
Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2000. R&R stands for Reinhart and Rogoff's classification scheme, De Jure refers to codes from the International Monetary Fund's *Annual Report on Exchange Arrangements and Exchange Restrictions* where countries self report their exchange rate regime status, and the Cons(ensus) sample includes observations only where Shambaugh's and Reinhart and Rogoff's classifications match. CFE stands for country fixed effects and YFE stands for year fixed effects. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Table A5. Examination on Reinhart and Rogoff's Five-Way Breakdown of Exchange Rate Regimes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	R&R 1	R&R 2	R&R 3	R&R 4	R&R 5	R&R 1	R&R 2	R&R 3	R&R 4	R&R 5
Base R	−0.144**	0.011	−0.091	0.034	0.047	−0.067	−0.144*	−0.211+	−0.018	−0.150
	(0.054)	(0.081)	(0.067)	(0.165)	(0.118)	(0.063)	(0.063)	(0.123)	(0.698)	(0.166)
Inflation						0.034	−0.010	−0.089**	0.009	−0.019*
						(0.022)	(0.035)	(0.031)	(0.084)	(0.009)
Base GDP growth						0.184	0.244*	−0.015	0.539	0.061
						(0.122)	(0.122)	(0.173)	(0.656)	(0.169)
Constant	0.046**	0.039**	0.041**	0.030+	0.007	0.042**	0.078**	0.075**	0.009	0.033*
	(0.004)	(0.006)	(0.005)	(0.016)	(0.010)	(0.011)	(0.013)	(0.022)	(0.056)	(0.015)
Country FE	no	no	no	no	no	yes	yes	yes	yes	yes
Year FE	no	no	no	no	no	yes	yes	yes	yes	no
Observations	991	852	665	122	310	888	796	626	100	290
R^2	0.011	0.000	0.004	0.001	0.001	0.269	0.433	0.294	0.651	0.332

Notes: The table gives OLS estimates of the effect of the base country nominal interest rate on domestic nominal interest rates. The sample period is 1973–2000. R&R stands for Reinhart and Rogoff's classification scheme. 1 indicates a peg, 2 indicates a crawling peg, 3 indicates intermediate/managed float, 4 indicates float, and 5 indicates a freely falling. Column (10) has no year fixed effects because nearly all observations are countries based to the dollar making year effects and the base interest rate redundant. Robust standard errors are clustered at the country level. + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent.

Figure 1. Impact of Exchange Rate Regime on Estimated Base Interest Rate Coefficients



Notes: This figure plots the estimated impact of the base interest rate ($\hat{\beta}_{2i}$) from running regression (6) against the average of the Peg indicator over the sample period for each country. The country codes refer to World Bank codes, and can be accessed at: *http://siteresources.worldbank.org/DATASTATISTICS/Resources/CLASS.XLS*

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