

What Makes a Currency Procyclical?

An Empirical Investigation

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Abstract

This paper looks at the correlation between the cyclical components of gross domestic product and the exchange rate and classifies countries' currencies as procyclical if they appreciate in good times, countercyclical if they appreciate in bad times, and acyclical otherwise. With this classification, the paper shows that: (i) the countries that are commodity exporters and experience procyclical capital flows tend to have procyclical currencies; (ii) countries with

procyclical currencies tend to restrict their capital accounts, perhaps as an attempt to reduce the degree of procyclicality; (iii) countries with procyclical currencies pursue procyclical monetary policy; (iv) however, in the last decade, there is a disconnect between the cyclicity of currency and monetary policy; and (v) the disconnect may reflect a decline in the fear of floating, which can be partially attributed to an improvement in countries' net foreign asset positions.

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1. Introduction

If countercyclical monetary policy has been the norm in advanced economies, at least until recently, this was not the case in emerging economies. Why has it been so difficult for emerging markets to adopt countercyclical monetary policies? If institutional weaknesses perhaps constitute one part of the story (Vegh and Vuletin, 2002, and McGettigan et al, 2013), the other common explanations point to specific factors that influence the way emerging markets are affected by, and cope with, the business cycle fluctuations.²

One such factor that has received the most attention in the literature is the cyclicity of capital flows. Kaminsky, Reinhart and Vegh (2005), KRV henceforth, show that capital flows to emerging markets are procyclical, that is, plentiful in good times and meager in bad times; as a result they tend to pursue procyclical macro policies. The combination of procyclical capital flows and procyclical policies contributes to the “when it rains it pours” phenomenon.³

While sharing KRV’s view that procyclical capital flows are a key driver of the business cycle in emerging markets, we look at a different variable in this paper: the degree of cyclicity of currencies. More precisely, we compute a currency cyclicity index (CCI) as the correlation between the cyclical components of the nominal (effective) exchange rate and GDP. We show that some currencies, particularly those of emerging markets, have a tendency to appreciate when the business cycle is strong and others, mainly those of advanced economies, have a tendency to appreciate when the business cycle is weak. We christen the former “procyclical,” and the latter “countercyclical.”⁴ Even though the degree of cyclicity of a currency differs sharply across emerging and advanced economies, it has not yet received much attention in the literature. The analysis of CCI helps us improve our understanding of the relationship between the cyclical co-movements of economic growth and exchange rate, the correlates of this relationship, and its impact on policies.

The relationship between economic activity and exchange rate behavior is a priori ambiguous. In the theoretical literature this relationship is model dependent. In the original Mundell-Fleming framework, if a positive income shock in a country deteriorates the current account, the adjustment occurs through a devaluation of the currency, predicting the correlation between economic growth and exchange rate to be countercyclical (i.e., the currency depreciates in good times). Instead, the correlation is predicted to be procyclical in monetary models, where the value of currency is a function of money demand (Lucas, 1982) and stronger growth increases the (domestic) demand for money under both flexible (Frenkel, 1976) or sticky prices (Dornbusch, 1976).⁵ The procyclical

² Vegh and Vuletin (2012) measure institutional strength by an index based on the international risk guide dataset, while McGettigan et al, 2013 proxy institutional strength by the adoption of inflation targeting and stability of government in the ICRG database.

³ KRV contrast the experience of developing, middle income (loosely overlapping with the set of emerging markets in the parlance that we have adopted in this paper) and developed economies and find that while capital flows are procyclical across all kinds of countries, fiscal policy is procyclical in developing and middle income countries, and the procyclicality of monetary policy is most pronounced in the latter. Thus, the “when it rains it pours” phenomenon, that is, the vicious circle of business cycle and policy cyclicity, affects emerging markets the most.

⁴ A preliminary discussion of currency cyclicity in emerging markets can be found in Cordella et al. (2014).

⁵ See Chinn (2013) for a recent survey.

behavior of currency is also predicted by the new open economy macro models *à la* Obstfeld and Rogoff (1995), where an increase in domestic output relative to foreign output leads to a depreciation of the exchange rate—a positive productivity shock increases the volume of the domestically produced varieties and decreases their relative price.

The empirical literature does not provide any clear guidance either on the relationship between economic activity and exchange rate behavior. The lack of a clear pattern between the growth rates of consumption and the real exchange rate is documented by Backus and Smith (1993) and subsequently by Chari et al. (1992) and Corsetti et al. (2002). Despite some important progress in empirical exchange rate modeling (see, for instance, Engel et al., 2008), the current knowledge on the behavior of exchange rate and its determinants remains quite limited (Rogoff, 2009).

We calculate the CCI using quarterly data for 63 countries over a period of 30 years. Following an identification strategy similar to that in KRV, we assume that the business cycle is driven by the capital flows that the countries receive and by their dependence on commodity exports; we also assume that these exogenous factors affect the CCI. We recognize that the relationship between these factors and the CCI is influenced by the institutional arrangements within the country such as the choice of the exchange rate regime and the degree of openness of its capital account; we discuss how the CCI affects the stance of monetary policy; and how these relationships have evolved over time.

We show that the countries that are commodity exporters and experience procyclical capital flows tend to have more procyclical currencies. This implies that currency procyclicality is more likely to be a feature of emerging economies, rather than of advanced countries, since the latter have more diversified exports and possibly experience less procyclical capital flows (due to “fly to quality” considerations).

While our results do not indicate any clear welfare implications of a particular degree of cyclicity, they underscore that the degree of currency cyclicity has important implications for the pursuit of macroeconomic policies, especially in emerging economies. Specifically, our results indicate that the countries with procyclical currencies tend to limit the degree of procyclicality by restricting their capital accounts. This partly reflects their fear of floating—that is, their intolerance to excessive variation in exchange rates (Calvo and Reinhart, 2002). The same fear of floating is reflected in a positive correlation between the procyclicality of currency and monetary policy. We observe that the countries with more procyclical currencies tend to pursue more procyclical monetary policy. Our final observation is that in the last decade a disconnect has emerged between the procyclicality of the currency and that of the monetary policy; this can be partially explained by an improvement in the countries’ net foreign asset position, translating into reduced fear of floating.

Before proceeding further, an important *caveat lector* is in order. Even though our analysis provides new interesting perspectives on the interaction between the exchange rate movements and policy challenges, the nature of the available data does not allow us to establish causality. It is thus

safer to offer our results as establishing stylized facts, rather than providing causal explanations. We need to leave this difficult task to future research.

The rest of the paper is organized as follows. In Section 2, we describe our data and methodology and present the currency cyclicity index that we calculated. In Section 3, we relate the degree of currency cyclicity with the countries' resource dependence and the nature of capital flows, as well as the conduct of monetary policy. In Section 4 we look at how these relationships have evolved over time and the implications for monetary policy. Section 5 concludes.

2. Data and Measurement of Currency Procyclicality

Our data set consists of an unbalanced panel of 63 countries from 1975q1 to 2013q1. The criterion for including countries in the sample is the availability of quarterly real GDP data, required to calculate the short term cyclical co-movements of GDP and the exchange rate. The data availability varies across countries, as reported in Appendix A.

For our analysis we compute the currency cyclicity index (CCI), as the coefficient of correlation between the cyclical component of real GDP and the cyclical component of the nominal effective exchange rate (NEER), where the cyclical components are calculated as deviations from the trend computed using an HP filter on log values of the respective series.⁶ A positive value of the CCI implies that higher GDP growth is associated with an appreciation of the exchange rate, and lower GDP growth is associated with a depreciation of the exchange rate; a negative value indicates the opposite relationship.⁷

We call a currency procyclical if the CCI is positive and significantly different from zero at the 10 percent level; countercyclical if it is negative and significantly different from zero at the 10 percent level; acyclical if it belongs to the residual category of currencies with insignificant CCI. To check the robustness of the significance threshold, we use a 15 percent confidence interval, as well as a one tailed test, and find the classifications according to the different significance criteria to be very similar (Appendix Table C.1). We also calculate the CCI using the real effective exchange rate and find a large overlap with the one calculated using the nominal effective exchange rate.⁸ The CCI calculated using NEER is presented in Figure 1a, and the one using REER is in Figure 1b.

⁶ We run the HP filter (with lambda equal to 1600) after seasonally adjusting the series using Census X11.

⁷ Since nominal exchange rates are relative prices we have a *numéraire* problem and we lose a degree of freedom, which in principle could affect the interpretation of the results. However the problem is not very severe in our analysis, which is based on nominal effective exchange rate with weights that differ across countries. We would like to thank Andrew Powell for raising this important point.

⁸ The Spearman rank correlation between NEER and REER procyclicality measures is 0.86.

From a simple inspection of Figures 1a and 1b, it is evident that the sets of countries that are procyclical, countercyclical and acyclical according to the real or nominal exchange rate based indices overlap significantly, as one would indeed expect in (high frequency) quarterly data. To get a clearer image of the phenomenon that we are discussing here, we plot the cyclical components of GDP and NEER for Brazil, a country with procyclical currency, and Japan, a country with countercyclical currency, in Figure 2a and 2b below.

We find preponderance of procyclical currencies among emerging economies and of countercyclical currencies among advanced economies. While many of the advanced economies such as Switzerland, Germany/Eurozone, Japan and the US (in the more recent period) have countercyclical currencies, we find no emerging economy with independent countercyclical currencies. The only emerging economies with a countercyclical currency in our sample are Euro Zone periphery countries that “inherited” a countercyclical currency—the euro has indeed the same degree of cyclicity as the Deutsche Mark.

Despite the preponderance of emerging markets in the procyclical currencies group, the group is a bit more mixed. While virtually all the emerging market commodity exporters such as Chile, Argentina, Brazil and Russia are in the group of procyclical currencies, we also find that some of the advanced commodity exporting countries, such as New Zealand, Australia, Finland and Iceland, have procyclical currencies.⁹

⁹ An interesting counter example is Norway, which, despite being one of the larger commodity exporters in the world, relative to the size of its economy, maintains a countercyclical currency. This is seemingly because of the operations of the Norway oil fund; see, e.g., Velculescu (2008).

Figure 1a: Currency Cyclicity Index (CCI), for Nominal Effective Exchange Rate

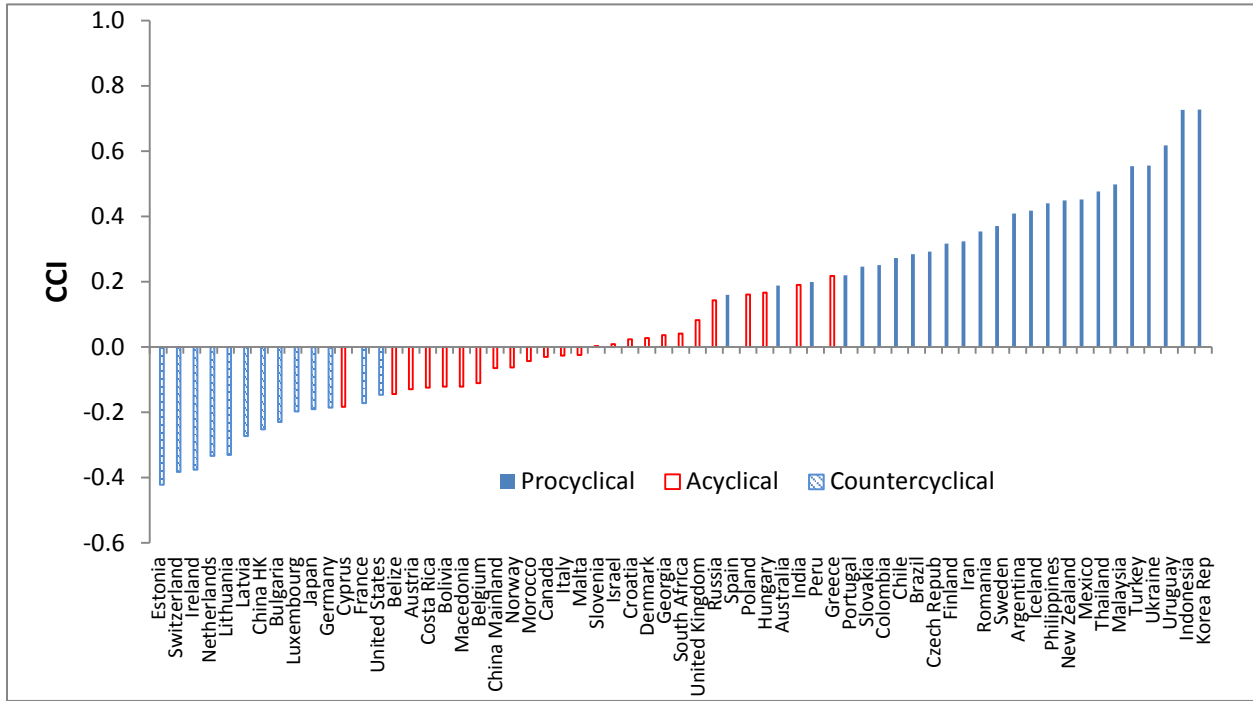
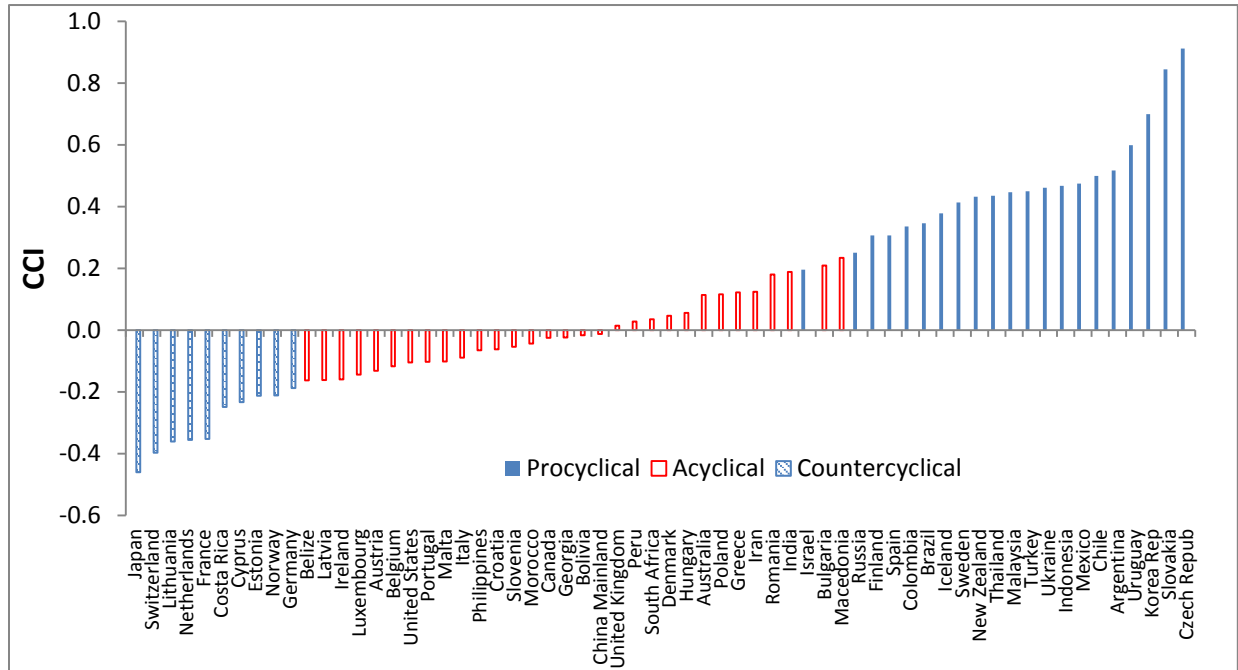


Figure 1b: Currency Cyclicity Index (CCI), for Real Effective Exchange Rate



Note: Correlations between exchange rates and GDP are calculated using quarterly data and HP trend filtered series. Two-tail tests with significance at 10 percent level are used to divide the countries into procyclical (positive and significant correlation), countercyclical (negative and significant correlation) and acyclical (non-significant).

Figure 2a: Cyclical Comovement of GDP and Exchange Rate– Brazil

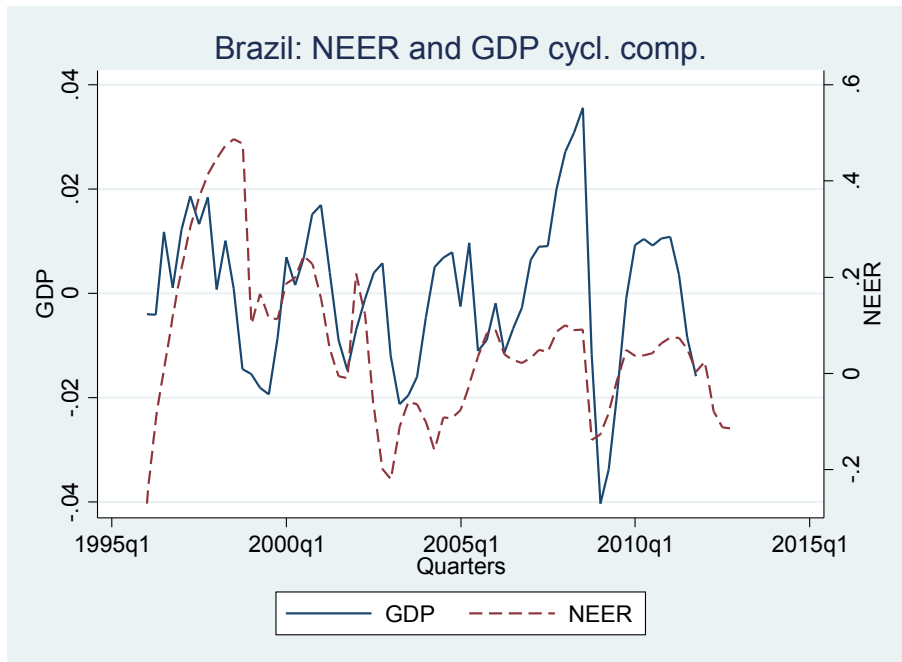
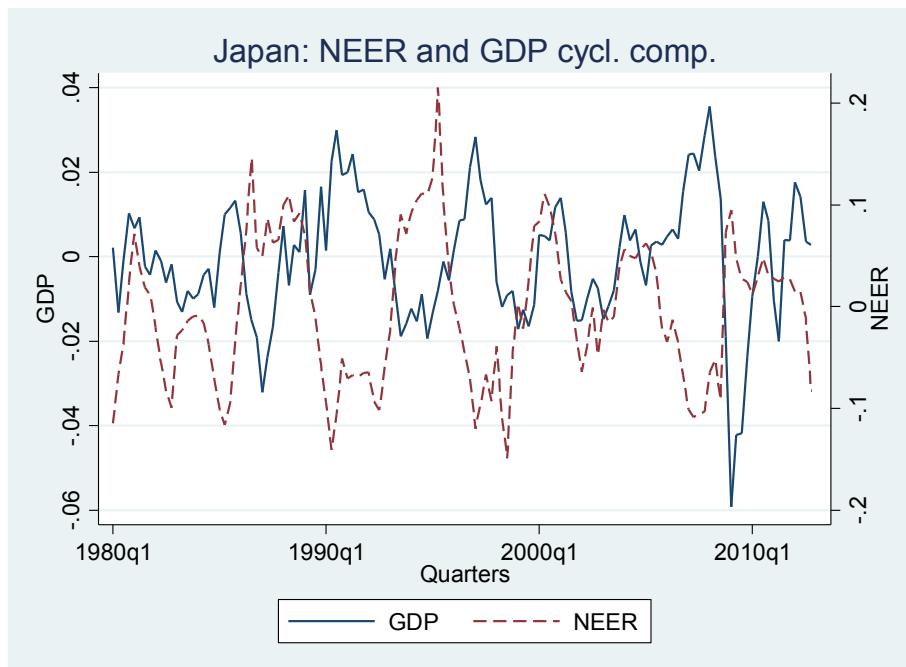


Figure 2b Cyclical Comovement of GDP and Exchange Rate – Japan



Note: Left y-axis measures the cyclical component of quarterly real GDP; right y-axis measures the cyclical component of the nominal effective exchange rate (NEER). HP filter is used to extract the cyclical components.

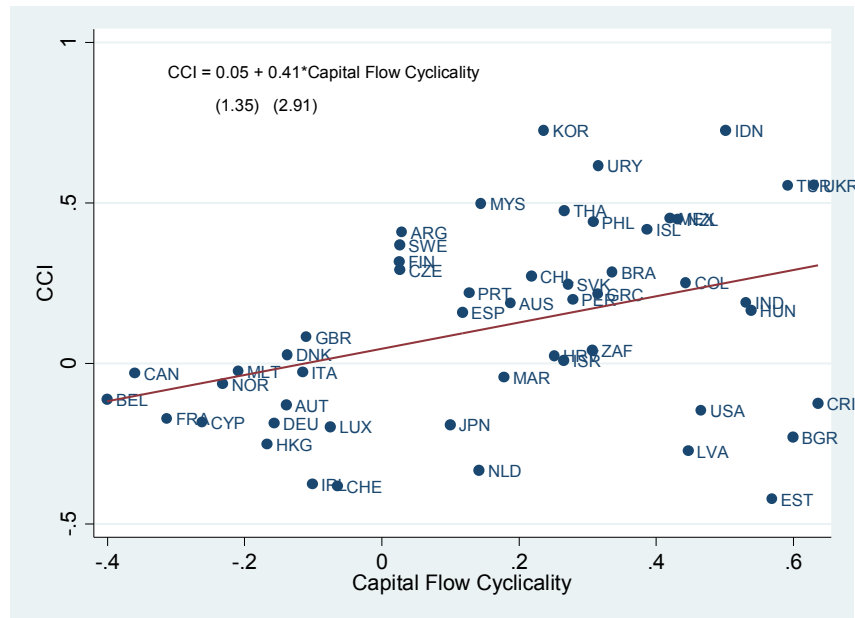
3. Which Country Characteristics Are Correlated with the Currency Cyclicity Index?

In what follows, we examine certain country characteristics that tend to be associated with procyclical, countercyclical or acyclical currencies. As is often the case in empirical macro analysis, it is difficult to argue convincingly about the exogeneity of any particular variable that we consider below. This, however, does not prohibit us from assuming that certain variables such as the cyclicity of capital flows and the intensity of commodity exports are “more exogenous” than other variables and can be thought of as the “determinants” of the CCI.

3.1 The “Determinants” of the CCI

Below, we examine the relationship between the cyclicity of capital flows and the CCI. As is customary in the literature, we measure the degree of cyclicity of capital flows by the correlation between the cyclical component of the quarterly GDP and that of the private net capital inflows.¹⁰ Just as observed in Bluedorn et al. (2013) emerging markets seem to experience more procyclical capital flows. In our data set, the average value for the index of capital flows cyclicity is 0.33 for emerging markets and 0.03 for advanced economies. We observe a strong positive correlation between the procyclicality of capital flows and the procyclicality of the currency, see Figure 3.

Figure 3: Cyclicity of Currency and the Cyclicity of Capital Flows

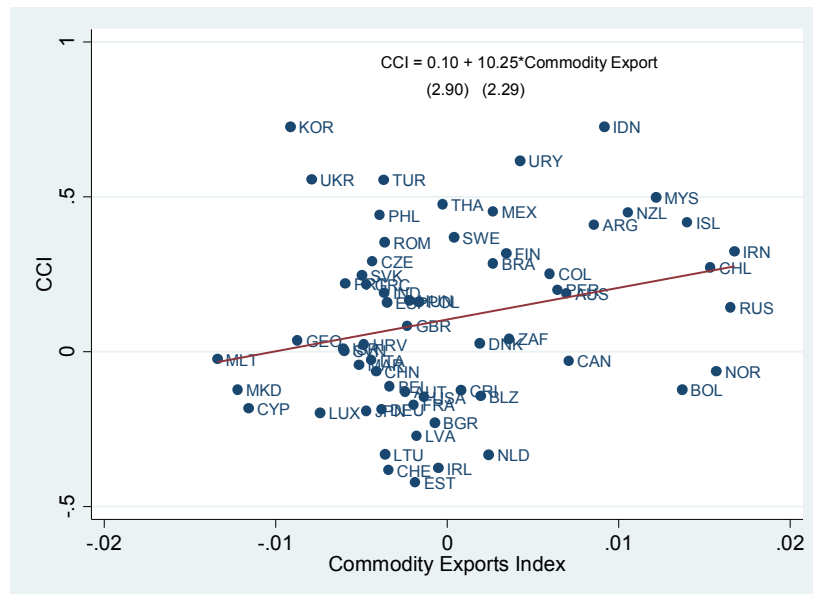


Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. Procyclicality of capital flows is measured by the correlation between the cyclical components of the quarterly nominal GDP and the cyclical component of the nominal total private net capital inflow. The t-statistics are reported in parentheses.

¹⁰ The data for capital flows come from Bluedorn et al. (2013). The database includes data on quarterly gross inflows, net capital inflows and GDP in current US\$, from 1970 Q1 to 2012 Q2. As before, the cyclical components are calculated as deviations from the HP filter, after both series have been seasonally adjusted.

Inspired by the large literature on commodity currencies, next we relate the cyclicity of a country's exchange rate to its exposure to shocks to commodity prices.¹¹ A priori, one would expect large commodity exporters to have procyclical currencies. The intuition is that they tend to grow faster when the demand for commodities and their prices are stronger, and the currency tends to appreciate because of the favorable movement in the terms of trade. To test whether this is indeed the case, we construct an index of the “intensity” of commodity exports following Lederman and Maloney (2008). The index, constructed as the net exports of commodities, as percent of GDP, averaged over the sample period, takes positive values if a country is a net commodity exporter and negative values if it is a net commodity importer. As expected we find a positive and significant correlation between the commodity export intensity index and the CCI (Figure 4). This positive correlation seems to transcend across the level of development of the countries in our sample. As noted above we find several advanced countries, which are commodity exporters, to have procyclical currencies.

Figure 4: Currency Cyclicity Index and Commodity Exports Index



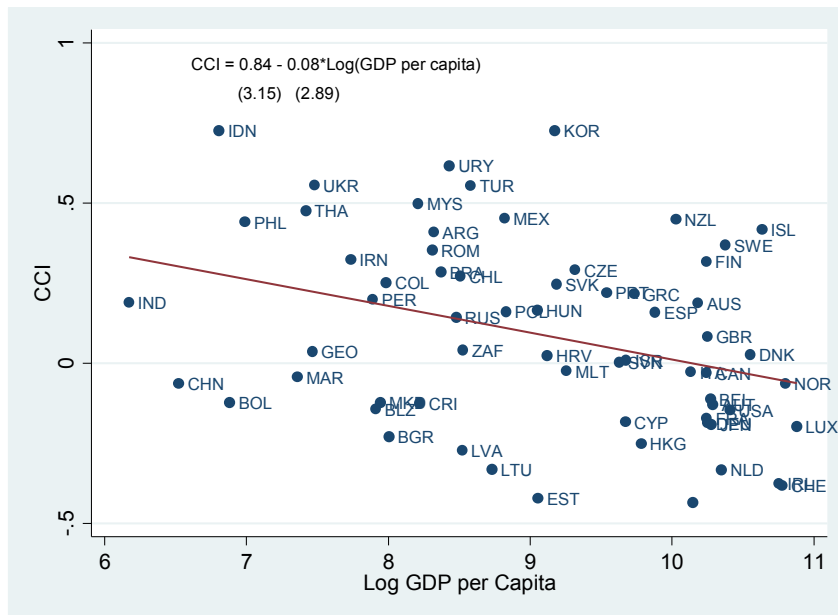
Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. The commodity exports index is constructed as the net exports of commodities, as percent of GDP, averaged over the sample period. The t-statistics are reported in parentheses.

The fact that the countries with procyclical currencies experience procyclical capital flows, and have a large commodity base, suggests that currency procyclicity is more likely to be a characteristic of developing or emerging economies rather than of advanced countries. In the latter case, the production base is generally more diversified and, more importantly, because of fly to quality considerations, their capital flows tend to be less procyclical and may even be countercyclical. Figure 5 shows that currency procyclicity is indeed a feature of emerging economies. The figure

¹¹ See, among others, Chen and Rogoff (2003) and Cashin et al. (2004).

depicts a negative and significant correlation between the CCI and per capita GDP. An increase of 1 standard deviation (1.23) in log GDP per capita is associated with a decline in the CCI of about 0.10.¹²

Figure 5: Cyclicity of Currency and GDP Per Capita



Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. GDP per capita is at US\$ 2005 prices. The t-statistics are reported in parentheses.

3.2 CCI and the Policy Stance

Next, we look at the way the degree of cyclicity of a currency relates to the choice of the broad policy framework, such as the exchange rate regime, and the degree of openness of the capital account. On the relationship between currency cyclicity and exchange rate regimes, one would expect that, by adopting a peg, a country reduces the volatility of exchange rate and thus the degree of currency cyclicity. This is what we observe in the data as well. Using Reinhart and Rogoff’s “coarse” classification of *de facto* exchange rate regime (which takes values from 1 for “strongly fixed” to 6 for “strongly flexible” regimes), we find a positive relationship between the flexibility of the exchange rate regime and the degree of procyclicality of the currency,¹³ as depicted in Figure 6.

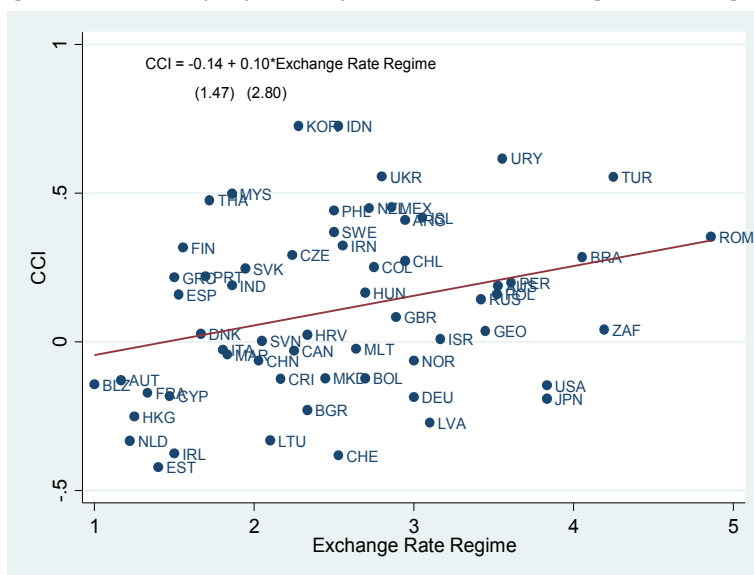
In addition, we find that the exchange rate regime conditions the impact of capital flows on the cyclicity of currency. Countries with flexible exchange rate regime (e.g. those above the median) have a positive and significant correlation between the cyclicity of capital flows and that of

¹² On the other hand, we do not find a robust correlation between the CCI and the economic size of a country, measured as a country’s share of world GDP.

¹³ More precisely, one should expect a positive relation between the flexibility of the exchange rate regime and the absolute value of the degree of cyclicity of a currency. The result in figure 6 is driven by the fact that countries with procyclical currencies outnumber those with countercyclical ones in our sample.

the currency, and those with less flexible exchange rate regime (e.g. those below the median) have an insignificant correlation between the cyclicality of capital flows and that of the currency.¹⁴

Figure 6: Currency Cyclical Index and Exchange Rate Regime



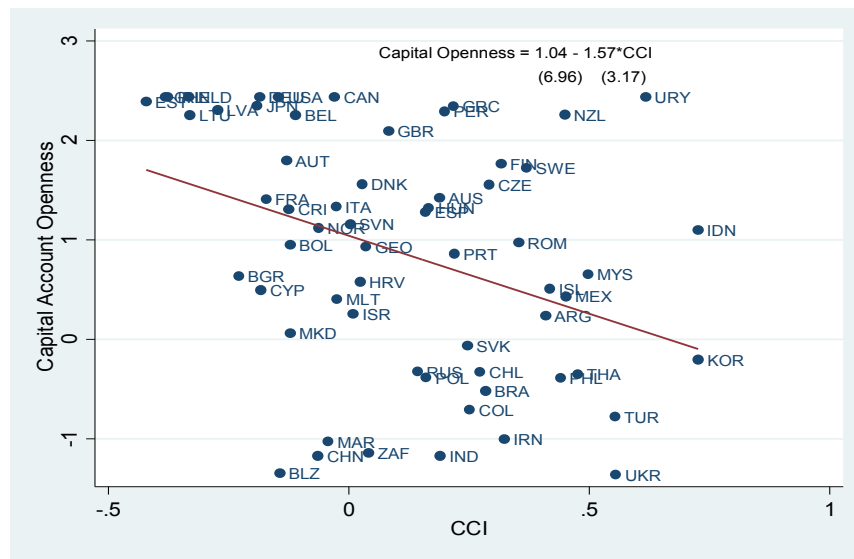
Note: Exchange rate regime takes values from 1 to 6, 1 indicating “strongly fixed” and 6 “strongly flexible” exchange rates. The t-statistics are reported in parentheses.

The implications that follow are that countries can influence the degree of cyclicality of their currency by choosing their exchange rate regime, as well as the degree of openness of their capital account. This is corroborated in Figure 7, which shows that the countries with more procyclical currencies seem more inclined to impose controls on the capital account (we use the Chinn and Ito’s index of capital account openness).¹⁵ Using a common parlance, these results indicate that the countries with procyclical currencies tend to “lean against the wind” by maintaining controls on their capital account.

¹⁴ Results are available upon request.

¹⁵ The Chinn and Ito index is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions*. The last update of the index (2011) gives a score of 2.44 to the “most financially open” country, and a score of -1.86 to the “least financial open” country. The annual data for this index goes from 1975 to 2011 and is obtained from http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

Figure 7: Currency Cyclicity Index and Openness of Capital Account

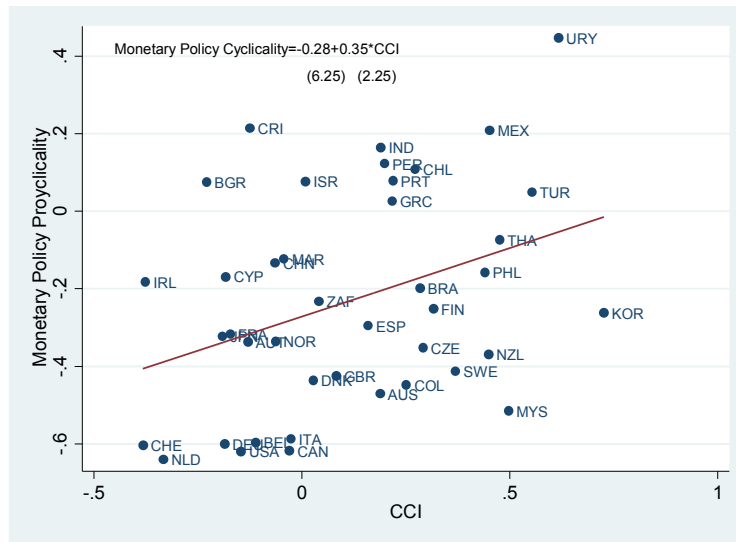


Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. The t-statistics are reported in parentheses.

One of the key observations we make is that the cyclicity of currency and that of monetary policy are positively correlated—the countries with procyclical currencies tend to pursue procyclical monetary policies, and countries with countercyclical currencies tend to pursue countercyclical monetary policies, Figure 8. While the level of development of an economy is likely to have some bearing on it, the relationships observed between currency cyclicity and policy variables point at the trilemma kind of considerations—the constraint that countries face in the policy space of capital account openness, exchange rate regime and monetary policy.¹⁶ It seems that the emerging markets that are more prone to procyclical currencies resolve the trilemma by choosing limited exchange rate flexibility, a less open capital account, as well as a more procyclical monetary policy.

¹⁶ See, among others, Obstfeld et al. (2005), Aizenman et al. (2013), and Klein and Shambaugh (2013).

Figure 8: Currency Cyclicity Index and Monetary Policy Procyclicality



Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. The cyclicity of monetary policy is calculated as the correlation between the cyclical components of real GDP and short-term interest rates. The t-statistics are reported in parentheses.

It would be apt to add here that, even though our analysis primarily looks at correlations, the positive correlation between currency and monetary policy procyclicality seems to have a “causal flavor.” The typical reverse causality argument that the monetary policy stance affects the cyclical behavior of a currency would indicate a relationship quite opposite from the one we are suggesting. A procyclical monetary policy would reduce the procyclicality of capital flows (by increasing their remuneration in bad times and decreasing it in good ones) and thus reduce the degree of procyclicality of a currency. This implies that, if anything, our estimated positive correlation between currency and monetary policy cyclicity is likely to be biased downward.

Finally, even though there are no clear a priori theoretical reasons to expect a link between the currency and fiscal policy cyclicity, we examine if the two are correlated in the real world. We compute the cyclicity of fiscal policy as the correlation between the cyclical components of real GDP and real total central government expenditure, as in Vegh and Vuletin (2012) and, perhaps unsurprisingly, we do not find it to be correlated significantly with the degree of cyclicity of the currency (not reported).

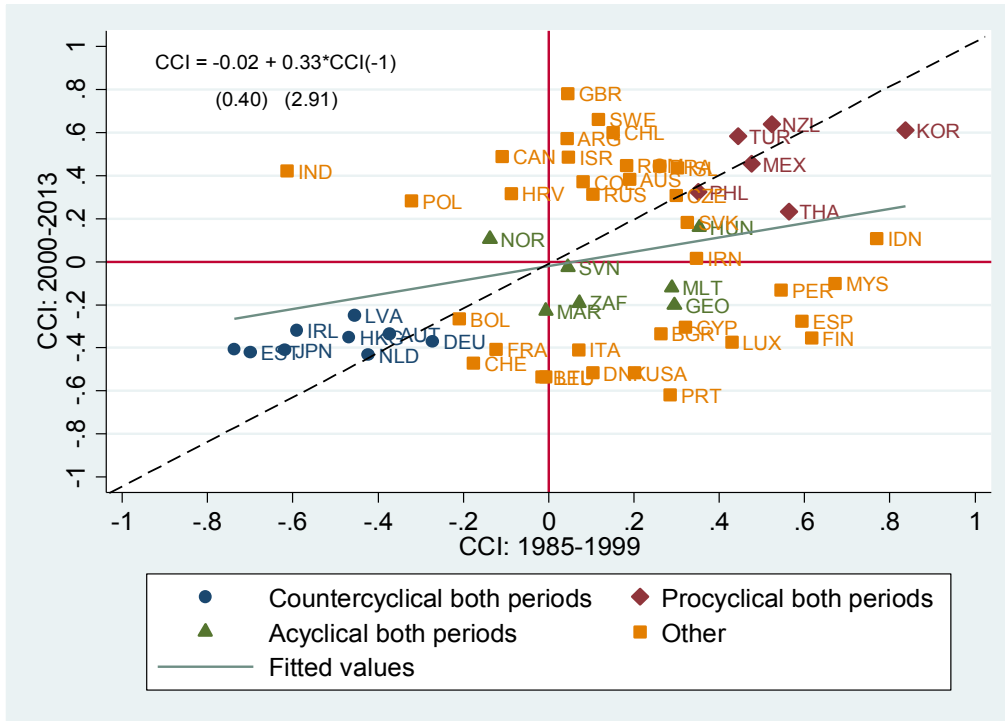
4 Currency Cyclicity over Time

Moving from the cross sectional dimension of the correlates of the cyclicity of currencies and their implications for economic policy, in this section, we focus also on the time series dimension of the CCI. In particular, we are interested in knowing whether currency cyclicity has evolved over time; whether its relationship with the policy variables and other correlates has changed over time; and how do the changes we observe reconcile with the monetary policy graduation phenomenon observed in Vegh and Vuletin (2012).

4.1 Is CCI Persistent over Time?

In order to look at the persistence of currency cyclicity, we split our sample in to two equal sub-periods, 1985-1999 and 2000-2013, and we compute the CCI in each of them. The scatterplots for the CCI in Figure 9 indicate a significant degree of persistence. Most of the countries that were countercyclical in the first period remained countercyclical in the second, while only a few moved from being countercyclical in the first period to procyclical in the second, one such notable exception being India. While some countries that were procyclical in the first period became countercyclical in the latter period, most of these are countries that changed their status after joining the Eurozone.¹⁷

Figure 9: Persistence of Currency Cyclicity Index Over Time



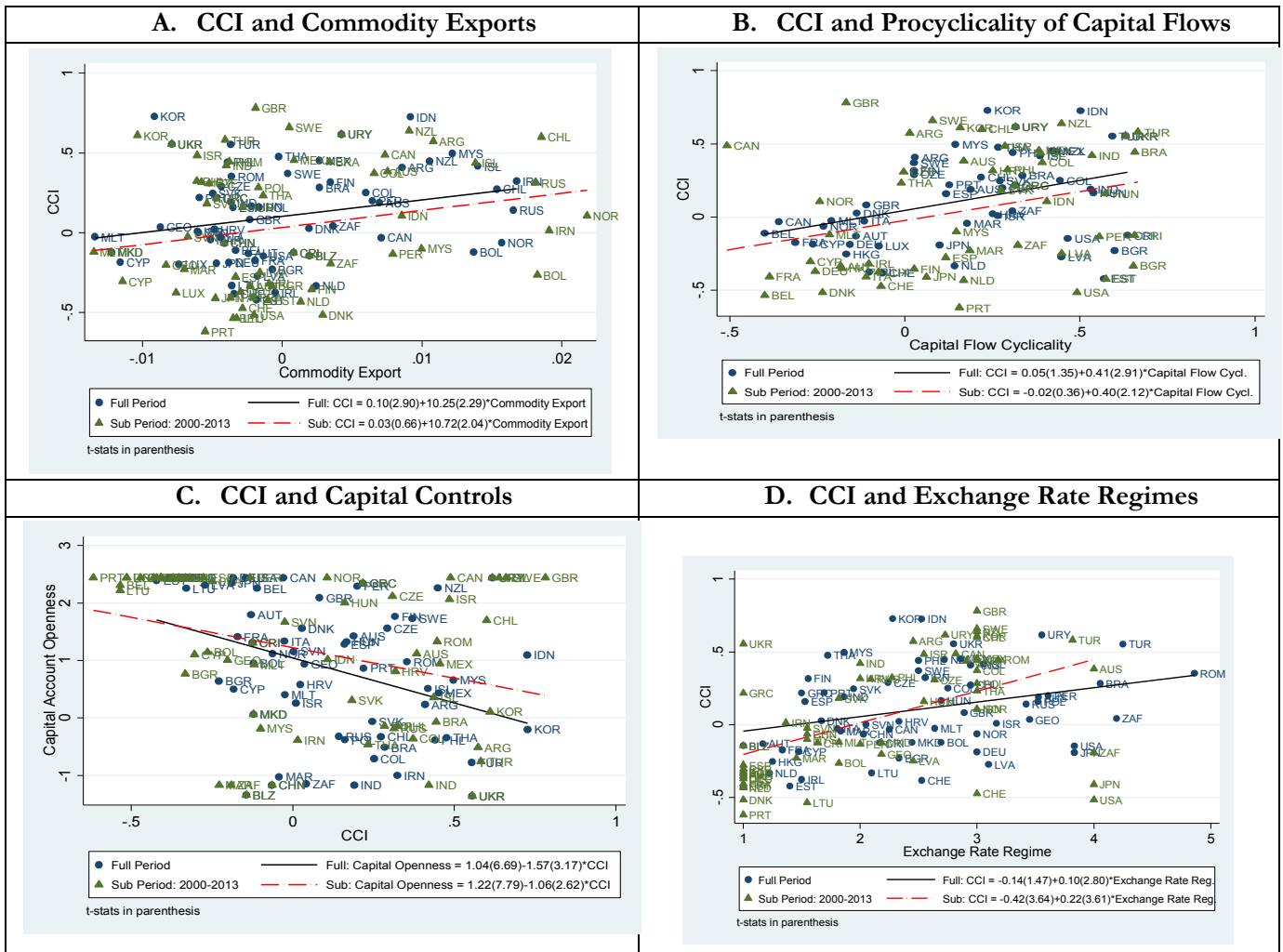
Note: CCI is the correlation between the HP filtered NEER and HP filtered real GDP. The black dashed line is the 45^o line. The t-statistics are reported in parentheses.

¹⁷ Interestingly, most of the Eurozone periphery countries (including those that experienced financial difficulties in the recent past such as Italy, Spain, Portugal, and Cyprus) are countries that had a procyclical currency in the first period but, with the adoption of the euro, they inherited the countercyclicity of the old German Mark, which did not change with the euro adoption. For what it is worth, also notice that, while the US and the UK were both acyclical in the first period, they became, respectively, countercyclical and procyclical in the second period.

4.2 CCI and Its Correlates over Time

We now explore the time variation in the relationship between the CCI and its correlates, comparing the pre and post 2000 periods. The results in Figure 10 suggest that while the relationship between the CCI and exogenous variables—that is, the cyclicity of capital flows and the commodity export base—is stable over time, the relationship between the CCI and the policy variables has changed somewhat. The results particularly indicate that the countries with more procyclical currencies have become more prone to maintaining flexible exchange rate regimes and open capital account in the latter period. This is suggestive of a decline in the fear of floating.

Figure 10: Currency Cyclicity Index and its Correlates over Time

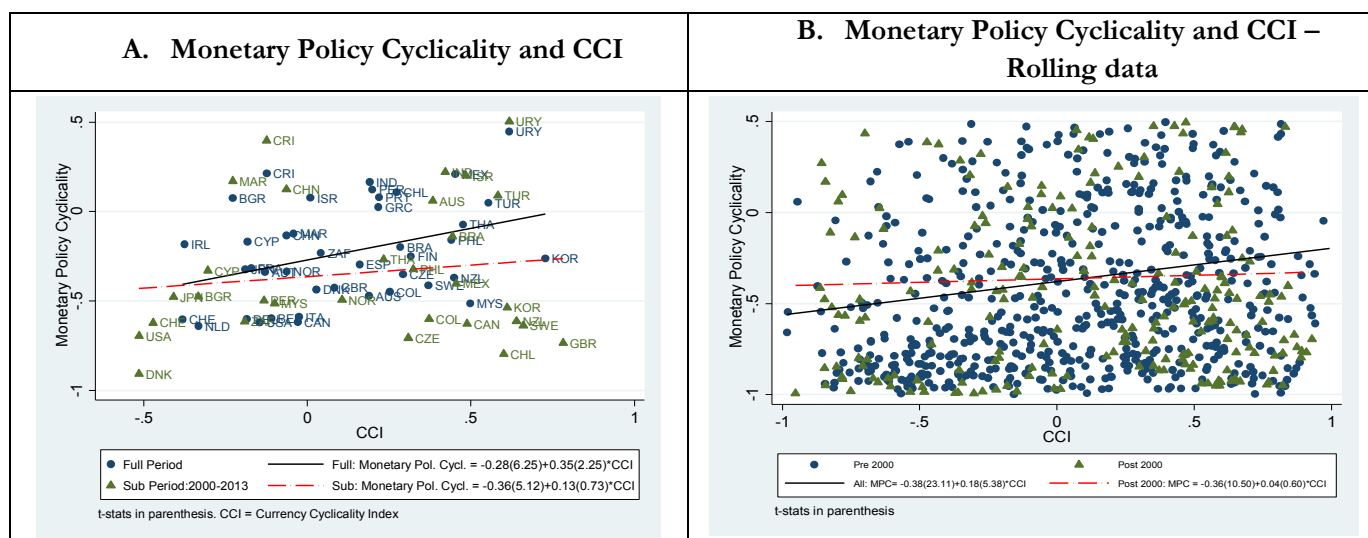


These patterns confirm the observation made in Vegh and Vuletin (2012) that even if a large number of developing countries have continued to pursue procyclical monetary policies, several of them have “graduated” in the last decade and have adopted a countercyclical monetary policy stance. They attribute this transition to a decline in their fear of floating but also indicate that many emerging markets that have transitioned have done so after adopting an explicit inflation targeting

framework.¹⁸ This, together with the fact that the transition has occurred while maintaining open capital accounts, reflects an improvement in the quality of their institutions; this strength is further reflected in the waning of the fear of exchange rate volatility.¹⁹

We notice a related phenomenon below. We observe that a “disconnect” has occurred between the procyclicality of currency and monetary policy since 2000. In Figure 11, Panel A, while the CCI and monetary policy procyclicality are positively correlated when calculated for the entire period or for the pre-2000 period separately, the correlation is insignificant in the post-2000 period. The same phenomenon is observed when we use rolling observations. Specifically, we calculate the CCI over overlapping five year periods, each time dropping the data for the first four quarters and adding the data for four quarters at the end. We similarly calculate the rolling averages of the monetary policy procyclicality.²⁰ The same disconnect that we observed earlier between the procyclicality of monetary policy and the CCI is seen in the rolling observations as well. In Figure 11, Panel B, below, the linear fit between monetary policy procyclicality and the CCI is positive and significant when estimated for the entire period, but insignificant when estimated for the data since 2000.

Figure 11: Monetary Policy Cyclicity and Currency Cyclicity Index over Time



Similar trends are observed in Table 1 below where, using the rolling observations, we regress monetary policy cyclicity on the CCI interacted with a dummy for the pre 2000 period, and

¹⁸ Vegh and Vuletin (2002) measure the fear of floating as the correlation between the cyclical component of the short-term interest rate and the rate of depreciation of the exchange rate.

¹⁹ A similar point is made in Adler and Magud (2013) who show that better policies, particularly the sizable increase in aggregate saving rates, may explain why Latin America did relatively well during the recent commodity boom and may also be able to face better the downturn.

²⁰ Rolling regressions provide more robust estimates of how the CCI has evolved and its relationship with other correlates changed over time.

on the CCI interacted with another dummy for the post 2000 period. We estimate these regressions including either time fixed effects or a dummy for post 2000, with and without country fixed effects. Results quite decisively show that while the CCI and monetary policy procyclicality are positively correlated prior to 2000, their correlation is insignificant in the post 2000 period.

Table 1: Monetary Policy and Currency Cyclicity Index over Time

Dependent Variable	(1) Monetary Policy Cyclicality	(2) Monetary Policy Cyclicality	(3) Monetary Policy Cyclicality	(4) Monetary Policy Cyclicality
CCI x Dummy pre 2000	0.25*** (3.24)	0.25*** (3.14)	0.20** (2.70)	0.22*** (3.03)
CCI x Dummy post 2000	0.09 (0.79)	0.04 (0.31)	0.01 (0.07)	0.07 (0.58)
Dummy post 2000		0.02 (0.28)	-0.08 (1.13)	
Constant	-0.38*** (7.02)	-0.38*** (9.24)	-0.35*** (18.92)	-0.31*** (4.84)
Observations	910	910	910	910
Time Effect	Yes	No	No	Yes
Fixed Effect	No	No	Yes	Yes
R-squared	0.05	0.04	0.03	0.05
Number of Countries	40	40	40	40

Robust t statistics (clustered by country) are in parentheses. ***, **, * indicate significance at 1, 5 and 10 percent levels respectively. Since the rolling observations introduce serial correlation, we cluster our standard errors by countries in the estimations using these data

In an endeavor to understand the factors behind the trends observed in the conduct of monetary policy and its relationship with the cyclical currency movements we make three more observations. First, the countries with procyclical currencies and negative net foreign currency positions (using the Lane and Shambaugh's, 2010, measure of net foreign currency position) are the one that pursue procyclical monetary policy.²¹ This is evident in Chart 12, Panel A and B, where we find a positive and significant relationship between the net foreign asset position and the cyclicality of monetary policy for countries with a positive CCI but no distinct relationship for countries with a negative CCI. This is consistent with the hypothesis that the countries with procyclical currency and currency mismatches in their balance sheet fear large movements in the exchange rate and use monetary policy to tame them. This may imply tightening their monetary policy in the midst of an economic

²¹ Lane and Shambaugh (2010) calculate net foreign currency position as the weighted sum of net foreign assets to capture the sensitivity of a country's external balance sheet to a uniform movement of its domestic currency against all foreign currencies. The variable takes values between -1 and 1, where a value of -1 corresponds to a country that has zero foreign-currency foreign assets and it only holds foreign-currency foreign liabilities, a country afflicted by an extreme form of original sin. A value 1 corresponds to a country that has foreign assets only in foreign-currency and foreign liabilities only in domestic-currency. The figures we use are those updated by Benetrix et al. (2014).

slowdown to avoid depreciation, or loosening their monetary policy in the midst of an economic boom to avoid excessive appreciation.

Our second observation, consistent with Benetrix et al. (2014), is that the countries have increasingly improved their net foreign currency positions over time.

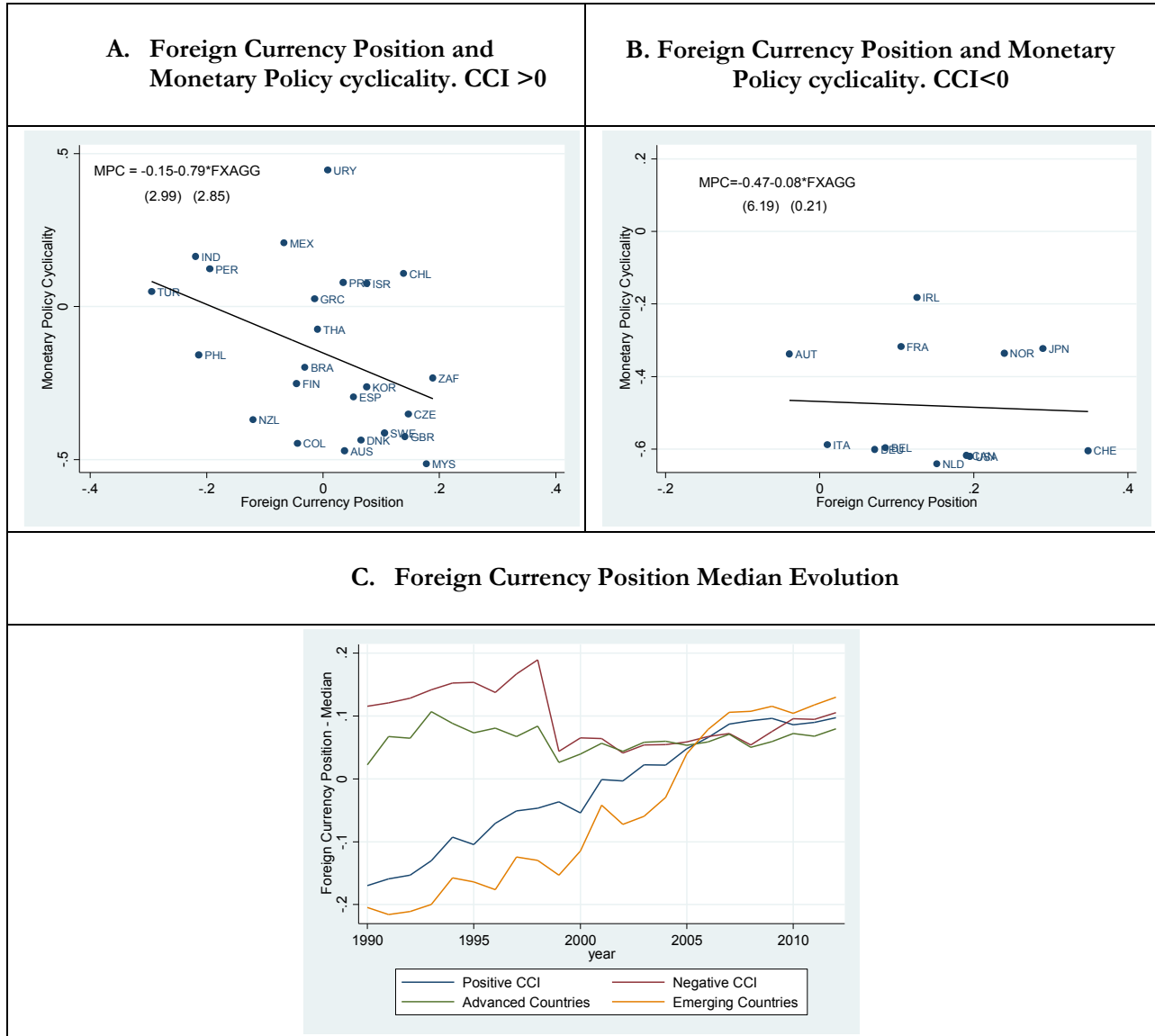
Improving net foreign currency position depends crucially on the relation between currency cyclicity and the debt dynamics of a country, and thus it may imply different things for different countries. If a country with a procyclical currency issues debt in foreign currency, the cost of servicing debt would be low in good times (when the domestic currency is strong) and high in bad times (when the domestic currency is weak). This means that, for the debt service or consumption smoothing argument, a country with a procyclical currency would be better off if it has a long net foreign currency position. For the same reason, countries with countercyclical currencies should be better off if they have a short net foreign currency position.²²

While in the 1990s, consistent with the original sin literature (Eichengreen et al. 2007), countries with procyclical currencies, or the emerging economies, tended to be very long in domestic currency, the situation has changed dramatically in the last decade. Nowadays, countries with procyclical currencies have a longer net foreign asset position. Panel C in Figure 12 shows this marked increase in the average net foreign currency positions of countries with a positive CCI, while countries with a negative CCI didn't change much their net foreign asset position or moved to a slightly shorter one. Lane and Shambaugh (2010) note that the transition of emerging markets to more positive foreign currency position has been made possible partly by their improved current account positions and larger foreign reserves, a shift in capital flows to equity from debt, as well as by the success in developing local currency debt markets.

Adoption of an inflation targeting framework by countries could be another reason for this transition, as noted in McGettigan et al (2013). Evidence therein shows that the countries that have successfully transitioned to countercyclical monetary policy are the ones that have adopted the inflation targeting framework, possibly reflecting strengthened monetary institutions allowing them to pursue independent monetary policy. We obtain similar regression results which show that the countries that have adopted an inflation targeting framework have less procyclical monetary policy.

²² Lane and Shambaugh (2010) indeed pointed out that, for countries whose exchange rates depreciate after a negative shock, there is an advantage in holding a net long position in foreign currency, since the latter acts as a hedge against asymmetric shocks.

Figure 12: Foreign Currency Position and Monetary Policy Procyclicality



Note: The t-statistics are reported in parentheses.

5 Conclusions

International finance literature is quite inconclusive as to whether currencies are expected to appreciate or depreciate over the business cycle. While theoretical contributions offer different predictions, which are often model dependent, no clear pattern has yet emerged from the empirical literature. In an attempt to fill this gap, in this paper we develop an index of currency cyclicity, and use it to study the cyclical behavior of a large number of currencies, over many decades.

We unveil a number of empirical regularities. First, countries with procyclical currencies—the currencies that have a penchant to appreciate in good times and depreciate in bad ones—tend to be

more exposed to commodity price shocks and are more likely to receive procyclical capital inflows than countries with countercyclical currencies. This very simple characterization suggests that emerging markets are more susceptible to have procyclical currencies, whereas advanced economies, especially those with refuge currencies, to have countercyclical ones.

Second, the degree of procyclicality of a currency affects the policy trade-offs that the countries face. Particularly, the countries with procyclical currencies (and an open capital account) may find it difficult to pursue countercyclical monetary policy, as it would amplify the exchange rate fluctuations.

Third, in the last decade countries seem to have become more immune to the procyclicality of their currencies, as their fear of floating seems to have faded. Thus, many emerging markets have adopted more countercyclical monetary policies, often in conjunction with an inflation targeting framework.

Our analysis does not provide any a priori reasons for which a country would do better with a procyclical than with a countercyclical currency. On the one hand, if countries with procyclical currency are less able to pursue countercyclical monetary policy, they might be less able to avoid the credit booms that often end up in bust and lead to financial crises.²³ Indeed, we find some preliminary evidence that countries with procyclical currencies tend to be more prone to banking crises, but further analysis is needed to check the robustness of these findings. On the other hand, for export oriented countries with a large manufacturing base, procyclical currency may have the countercyclical property of leading to “competitive devaluations” in bad times and this may be one of the reasons why the adoption of the (countercyclical) euro had created significant problems to the Eurozone periphery countries.

Although our analysis does not support any measures aimed at modifying the degree of cyclicity of a currency, we emphasize the fact that the cyclical property of a currency should affect debt management policies. In a country with a procyclical currency, moving from a short to a long net foreign asset position may mean a significant reduction in vulnerability to external shocks. A good example is Brazil, a country with a procyclical currency, which was short in dollars during the previous episodes of financial turmoil. A depreciation of its currency increased its indebtedness and acted as an amplifier to the effect of the financial crises. However, Brazil braced the recent global financial crisis better with a much improved debt position. It was long in dollars at the outset of the crisis and a depreciation of its currency improved its debt position further, creating the much needed space for countercyclical fiscal policies.

²³ See, among others, Reinhart and Rogoff (2009), and Schularick and Taylor (2012).

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Appendix A

Number of observations by country used to compute the “procyclicality” of REER for the entire period

Our dataset has 63 countries. Data series go, at best, from 1975q1 to 2013q1 (for quarterly data series), and from 1975 to 2013 (for annual data series). The criterion for the choice of countries is availability of real GDP (in quarterly data).

Table A1: Countries included in the data and the data availability

	Quarterly NEER data (from when to when)	Quarterly REER data (from when to when)	Quarterly GDP data (from when to when)
Argentina	1994q1-2013q1	1994q1-2013q1	1990q1-2012q4
Australia	1979q1-2013q1	1980q1-2013q1	1975q1-2012q4
Austria	1975q1-2013q1	1975q1-2013q1	1975q1-2012q4
Belgium	1975q1-2013q1	1975q1-2013q1	1980q1-2012q4
Belize	1975q1-2013q1	1980q1-2013q1	2000q1-2012q4
Bolivia	1975q1-2013q1	1980q1-2013q1	1990q1-2010q4
Brazil	1975q1-2013q1	1980q1-2013q1	1995q1-2011q4
Bulgaria	1992q1-2013q1	1992q1-2013q1	1999q1-2012q4
Canada	1975q1-2013q1	1975q2-2013q1	1975q1-2013q1
Chile	1975q1-2013q1	1980q1-2013q1	1980q1-2012q4
China	1975q1-2013q1	1980q1-2013q1	2000q1-2011q4
Colombia	1975q1-2013q1	1980q1-2013q1	1994q1-2012q4
Costa Rica	1975q1-2013q1	1980q1-2013q1	2000q1-2011q4
Croatia	1992q1-2013q1	1992q1-2013q1	1993q1-2012q4
Cyprus	1975q1-2013q1	1980q1-2013q1	1995q1-2012q3
Czech Republic	1994q1-2012q4	1990q1-2013q1	1990q1-2013q1
Denmark	1975q1-2013q1	1975q1-2013q1	1977q1-2012q3
Estonia	1994q1-2013q1	1994q1-2013q1	1993q1-2012q3
Finland	1975q1-2013q1	1975q1-2013q1	1975q1-2012q3
France	1975q1-2013q1	1980q1-2013q1	1975q1-2012q3
Georgia	1993q4-2013q1	1993q4-2013q1	1996q1-2011q4
Germany	1975q1-2013q1	1975q1-2013q1	1975q1-2012q3
Greece	1975q1-2013q1	1980q1-2013q1	2001q1-2012q4
Hong Kong SAR, China	1975q1-2013q1		1975q1-2013q1
Hungary	1975q1-2013q1	1980q1-2013q1	1995q1-2012q4
Iceland	1975q1-2013q1	1975q2-2013q1	1997q1-2012q3
India	1994q1-2013q1	1994q1-2013q1	1996q4-2012q3
Indonesia	1994q1-2013q1	1994q1-2013q1	1997q1-2013q1
Iran, Islamic Rep.	1975q1-2013q1	1975q2-2013q1	1988q1-2007q4
Ireland	1975q1-2013q1	1975q2-2013q1	1997q1-2012q3
Israel	1975q1-2013q1	1975q1-2013q1	1975q1-2013q1

Italy	1975q1-2013q1	1980q1-2013q1	1980q1-2012q4
Japan	1975q1-2013q1	1980q1-2013q1	1975q1-2012q4
Korea, Rep.	1994q1-2013q1	1994q1-2013q1	1975q1-2012q4
Latvia	1994q1-2013q1	1994q1-2013q1	1990q1-2012q4
Lithuania	1994q1-2013q1	1994q1-2013q1	1993q1-2012q4
Luxembourg	1975q1-2013q1	1975q2-2013q1	1995q1-2013q3
Macedonia, FYR	1992q1-2013q1	1992q1-2013q1	2004q1-2012q4
Malaysia	1975q1-2013q1	1975q1-2013q1	1988q1-2012q4
Malta	1975q1-2013q1	1975q1-2013q1	1996q1-2012q4
Mexico	1975q1-2013q1	1980q1-2013q1	1980q1-2012q4
Morocco	1975q1-2013q1	1980q1-2013q1	1990q1-2012q2
Netherlands	1975q1-2013q1	1975q1-2013q1	1977q1-2012q3
New Zealand	1975q1-2013q1	1975q2-2013q1	1982q2-2012q4
Norway	1975q1-2013q1	1975q1-2013q1	1975q1-2013q1
Peru	1994q1-2013q1	1994q1-2013q1	1979q1-2012q4
Philippines	1975q1-2013q1	1975q2-2013q1	1981q1-2012q4
Poland	1975q1-2013q1	1980q1-2013q1	1995q1-2012q3
Portugal	1975q1-2013q1	1975q1-2013q1	1977q1-2011q4
Romania	1975q1-2013q1	1990q4-2013q1	1998q1-2012q4
Russian Federation	1994q1-2013q1	1994q1-2013q1	1995q1-2012q1
Slovak Republic	1993q1-2012q4	1990q1-2013q1	1990q1-2013q1
Slovenia	1994q1-2013q1	1994q1-2013q1	1992q1-2012q4
South Africa	1975q1-2013q1	1975q1-2013q1	1975q1-2012q4
Spain	1975q1-2013q1	1980q1-2013q1	1975q1-2012q3
Sweden	1975q1-2013q1	1975q1-2013q1	1975q1-2012q4
Switzerland	1975q1-2013q1	1975q1-2013q1	1975q1-2012q4
Thailand	1994q1-2013q1	1994q1-2013q1	1993q1-2013q1
Turkey	1994q1-2013q1	1994q1-2013q1	1987q1-2012q4
Ukraine	1992q1-2013q1	1992q1-2013q1	2001q1-2012q4
United Kingdom	1975q1-2013q1	1975q2-2013q1	1975q1-2012q4
United States	1975q1-2013q1	1980q1-2013q1	1975q1-2013q1
Uruguay	1975q1-2013q1	1980q1-2013q1	2005q1-2011q4

Appendix B: Data Sources and Data Details

We calculate the currency cyclicity measures CCI(REER/NEER) using quarterly data for GDP and REER/NEER respectively (indexes 2005=100). We also use quarterly capital flow data. All other data series in our final database are annual.

- GDP data

For the calculation of the currency cyclicity we used real GDP quarterly data (index, 2005=100) from the IMF's IFS database (annual data is from IFS as well). The cyclical component of the GDP series is derived using a H-P filter with lambda 1600. Only 16 countries had seasonally adjusted data. For the other countries we use the CensusX11 in E-Views to deseasonalize the data series. The availability of data varies across countries, as indicated in Table1. The annual GDP (2005 US\$) series are from WDI.

- GDP per capita

We use GDP and GNI per capita data from WDI, September 2013. We also include GDP in current US\$US\$ and real GDP (constant 2005 US\$USUS\$\$) from WDI.

- World GDP

For the calculation of the economy size measure, we used real GDP data from WDI in constant 2005 US\$USUS\$\$.

- Economic Size

We consider the ratio of real GDP over world GDP per country using data from for domestic GDP and world GDP in constant 2005 US\$US\$ from WDI.

- Exchange rates data

The data on Nominal Effective Exchange Rate (NEER) and the Real Effective Exchange Rate (REER) were also from the IFS database; and just like for the GDP series, the cyclical component of the exchange rate series is extracted using the H-P filter. For a few countries, data is complemented with data from the BIS database. Countries for which BIS data are used: Argentina; Hong Kong SAR, China; Estonia; India; Indonesia; the Republic of Korea; Latvia; Lithuania; Peru; Slovenia; Thailand; and Turkey.

- Capital Account Openness index

We use the index of financial openness developed in Chinn and Ito (2006). The index is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial

transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The index values range is variable. The last update of the index (2011) gives a score of 2.44 to the “most financially open” country, whereas it gives a score of -1.86 to the “least financial open”. The annual data for this index goes from 1975 to 2011 (http://web.pdx.edu/~ito/Chinn-Ito_website.htm).

- De facto exchange rate regime

We use the *de facto* exchange regime classification of Reinhart and Rogoff (<http://www.carmenreinhart.com/data/browse-by-topic/topics/11/>). The database covers the period 1940-2010. We use the “coarse” classification (scale 1-6) of de facto exchange rate regime annual data from 1975 to 2010. (-1 is for “strongly fixed” exchange rates; 6 is for “strongly flexible” exchange rates)

- Intensity of Net Commodities Exports:

We construct a measure of the “intensity” of commodity exports for the different countries in our sample. We define it as net exports of commodities over GDP. Following Lederman and Maloney (2008), we compute net exports of commodities as exports minus imports of natural resources related goods based on Leamer (1995) commodity clusters. Annual data from 1975 to 2011 is taken from the World Integrated Trade Solution (WITS) database. GDP annual data is taken from the IFS database.

- Exports, Imports

We use the series “Exports of goods and services (% of GDP)”, “Imports of goods and services (% of GDP)”, “Exports of goods and services (current US\$)” and “Imports of goods and services (current US\$)” from WDI, September 2013.

- Capital flows

We use the Bluedon et al. (2013) database, which includes data on quarterly gross inflows, net capital inflows and GDP in current US\$. The data range from 1970 Q1 to 2012Q2. The capital flow cyclicity is calculated the same way as the currency cyclicity.

- Monetary and Fiscal Database

We use the databases on Monetary and Fiscal procyclicality by Vegh and Vuletin that accompany their paper: Vegh, C., and G. Vuletin, .Overcoming the fear of free falling: Monetary policy graduation in emerging markets, *NBER Working Paper* No. 17753 (2012), forthcoming in “*The Role of Central Banks in Financial stability: How has it changed?*” (Federal Reserve Bank of Chicago).

Table B1: Summary statistics of the procyclicality measures

	Mean	Median	Min	Max
CCI _{NEER}	0.099	0.041	-0.422	0.727
CCI _{REER}	0.107	0.041	-0.460	0.912

Table B2: Summary statistics of the Dependent Variables

Variable	Quarterly/ Annual	Mean	Std. Dev.	Min	Max	Observations	Countries
NEER (index 2005=100, seas. adj.)	quarterly	5.14E+1 0	9.95E+1 1	3.30	2.81E+1 3	8214	63
REER (index 2005=100, seas. adj.)	quarterly	107.51	62.36	20.84	1149.61	7769	62
Real GDP (index 2005=100, seas. adj.)	quarterly	82.50	24.79	13.25	196.28	6467	63
World GDP (index 2005=100, seas. adj.)	quarterly	72.23	26.04	35.51	123.49	152	
NEER (index 2005=100)	annual	5.32E+1 0	1.01E+1 2	3.98	2.78E+1 3	1982	63
REER (index 2005=100)	annual	107.73	62.57	37.51	1123.83	1843	63
Real GDP (index 2005=100)	annual	73.89	26.67	8.26	187.91	2101	63
GDP (constant 2005 US\$US\$)	annual	5.44E+1 1	1.38E+1 2	2.09E+0 8	1.35E+1 3	2192	63
World GDP (index 2005=100)	annual	72.61	25.68	36.87	123.23	38	
World GDP (constant 2005 US\$US\$)	annual	3.41E+1 3	1.06E+1 3	1.85E+1 3	5.37E+1 3	38	
Capital Account Openness Commodity	annual	1.01	1.46	-1.86	2.44	1342	61
Exporters Monetary	annual	0.00	0.01	-0.02	0.03	1386	62
Procyclicality	annual	-0.23	0.27	-0.68	0.46	1238	41
Fiscal Procyclicality	annual	-0.07	0.29	-0.71	0.52	1441	42
Total Net Private Capital Inflow (US\$, millions)	quarter	1,513.36	18,588.68	-250,020	447,450	6,288	52

Appendix C

Table C1: Currency Cyclicalities across Countries

Quarterly data				Annual Data
two tailed test (0.10)		Two tailed test (0.15)	One tailed (0.10)	two tailed test (0.10)
CC _{REER}	CC _{NEER}	CC _{REER}	CC _{REER}	CC _{REER}
Argentina*	Argentina*	Argentina*	Argentina*	Argentina*
Australia	Australia*	Australia	Australia*	Australia
Austria	Austria	Austria ⁺	Austria ⁺	Austria
Belgium	Belgium	Belgium	Belgium ⁺	Belgium
Belize	Belize	Belize	Belize	Belize ⁺
Bolivia	Bolivia	Bolivia	Bolivia	Bolivia
Brazil*	Brazil*	Brazil	Brazil	Brazil
Bulgaria	Bulgaria ⁺	Bulgaria	Bulgaria	Bulgaria
Canada	Canada	Canada	Canada	Canada
Chile*	Chile	Chile	Chile	Chile
China	China	China	China	
Mainland	Mainland	Mainland	Mainland	China Mainland
Colombia	Colombia	Colombia	Colombia	Colombia
Costa Rica ⁺	Costa Rica	Costa Rica ⁺	Costa Rica ⁺	Costa Rica
Croatia	Croatia	Croatia	Croatia	Croatia
Cyprus ⁺	Cyprus	Cyprus ⁺	Cyprus ⁺	Cyprus
Czech Repub	Czech Repub	Czech Repub	Czech Repub	Czech Repub
Denmark	Denmark	Denmark	Denmark	Denmark
Estonia ⁺	Estonia ⁺	Estonia ⁺	Estonia ⁺	Estonia
Finland	Finland	Finland	Finland	Finland
France ⁺	France ⁺	France ⁺	France	France ⁺
Georgia	Georgia	Georgia	Georgia	Georgia
Germany ⁺	Germany ⁺	Germany ⁺	Germany ⁺	Germany
Greece	Greece	Greece	Greece	Greece
Hungary	Hungary	Hungary	Hungary	Hungary ⁺
Iceland	Iceland	Iceland	Iceland	Iceland
India	India	India	India	India
Indonesia	Indonesia	Indonesia	Indonesia	Indonesia
Iran	Iran	Iran	Iran	Iran ⁺
Ireland	Ireland ⁺	Ireland	Ireland	Ireland
Israel	Israel	Israel	Israel	Israel
Italy	Italy	Italy	Italy	Italy
Japan ⁺	Japan ⁺	Japan ⁺	Japan ⁺	Japan ⁺
Korea Rep	Korea Rep	Korea Rep	Korea Rep	Korea Rep
Latvia	Latvia ⁺	Latvia	Latvia ⁺	Latvia
Lithuania ⁺	Lithuania ⁺	Lithuania ⁺	Lithuania ⁺	Lithuania
Luxembourg	Luxembourg ⁺	Luxembourg	Luxembourg	Luxembourg
Macedonia	Macedonia	Macedonia	Macedonia	Macedonia
Malaysia	Malaysia	Malaysia	Malaysia	Malaysia
Malta	Malta	Malta	Malta	Malta
Mexico	Mexico	Mexico	Mexico	Mexico
Morocco	Morocco	Morocco	Morocco	Morocco
Netherlands ⁺	Netherlands ⁺	Netherlands ⁺	Netherlands ⁺	Netherlands ⁺
New Zealand	New Zealand	New Zealand	New Zealand	New Zealand

Norway ⁺	Norway	Norway ⁺	Norway ⁺	Norway ⁺
Peru	Peru	Peru	Peru	Peru
Philippines	Philippines	Philippines	Philippines	Philippines
Poland	Poland	Poland	Poland	Poland
Portugal	Portugal	Portugal	Portugal	Portugal
Romania	Romania	Romania	Romania	Romania
Russia	Russia	Russia	Russia	Russia
Slovakia	Slovakia	Slovakia	Slovakia	Slovakia
Slovenia	Slovenia	Slovenia	Slovenia	Slovenia
South Africa	South Africa	South Africa	South Africa	South Africa
Spain	Spain	Spain	Spain	Spain
Sweden	Sweden	Sweden	Sweden	Sweden
Switzerland ⁺	Switzerland ⁺	Switzerland ⁺	Switzerland ⁺	Switzerland ⁺
Thailand	Thailand	Thailand	Thailand	Thailand
Turkey	Turkey	Turkey	Turkey	Turkey
Ukraine	Ukraine	Ukraine	Ukraine	Ukraine
United Kingdom	United Kingdom	United Kingdom	United Kingdom	United Kingdom
United States	United States ⁺	United States	United States	United States
Uruguay	Uruguay	Uruguay	Uruguay	Uruguay

Note: Countries with procyclical currencies are denoted by * (and in red); countries with countercyclical currencies are denoted by + (and in blue).