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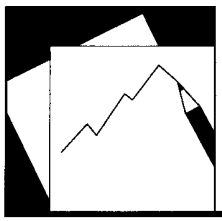

IMF Working Paper

Accounting for Reserves

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Accounting for Reserves[1]

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Abstract

Views on the effectiveness of sterilized reserve intervention vary. Sterilized intervention is generally seen as ineffective in advanced countries while persistent intervention by some emerging markets is often cited as contributing to undervalued exchange rates and current account surpluses. This paper argues that capital controls reconcile these views. We find strong and highly robust evidence that sterilized intervention is fully offset by outflows of private money in countries without controls, while controls partially block this offset. For a country with extensive capital controls, every dollar in additional reserves increases the current account by some 50 cents. This is mainly offset by an opposite adjustment in the current account of the United States—the dominant reserve currency issuer with the deepest and most liquid bond markets—with a smaller diversion to other emerging markets.

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I. INTRODUCTION

Views on the effectiveness of sterilized reserve intervention on the exchange rate and external accounts vary in the academic literature and among policymakers (Sarno and Taylor, 2001; Neely, 2005; Neely, 2008).[2] On the one hand, sterilized intervention is regarded as generally ineffective in all but the very short-run in advanced economies.[3] On the other hand, persistent intervention by countries such as China is often cited as leading to an undervalued exchange rate and a massive current account surplus with global implications (Bernanke, 2005; Blanchard and Milesi-Ferretti, 2010).[4]

How can these two apparently opposite views be reconciled? This paper examines the role of capital controls in the effectiveness of sterilized reserve intervention. The hypothesis we explore is that, in the case of economies such as Japan with open capital accounts, any *sterilized* increase in reserves (i.e., an increase that has no immediate impact on domestic activity via monetary policy) will be offset by an equal and opposite outflow of private money.[5] In short, private holdings are perfect, or at least near-perfect, substitutes for reserves. By contrast, in a country with extensive capital controls this offsetting flow is fully or partially blocked. As a result, sterilized reserve accumulation leads to a higher current account in countries with capital controls. Throughout the analysis we treat official reserve accumulation as a policy variable although we do not prejudice the reasons for intervention including push factors such as loose monetary conditions in economies that are important exporters of capital.

As a corollary to this, we also investigate if we can find the counterpart to reserve accumulation in the current accounts of open economies. In other words, if intervention in countries with closed capital markets increases the current account, then the current account elsewhere must deteriorate (unless one believes in trade with Mars). In particular, we examine whether the counterpart to larger reserve accumulation in closed economies is a weaker current account in countries that issue reserve currencies (exorbitant privilege),

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[2]Unsterilized intervention, which implies a change in the monetary stance, is a different matter and can be effective even in the absence of capital controls.

[3]Intervention tends to be more effective when conducted as part of a coordinated action by major central banks. Since 1995, advanced economies have mostly avoided using intervention as a policy tool. Coordinated interventions of central banks in the major advanced economies have taken place in June 1998 to support the yen, in September 2000 to support the Euro and in March 2011 in the aftermath of the Japanese earthquake (Neely, 2011).

[4]See http://www.federalreserve.gov/boarddocs/speeches/2005/200503102/default.htm.

[5]Sterilized intervention should affect neither prices nor interest rates, but intervention could affect exchange rates through other channels such as portfolio balance, signaling and coordination channels (Sarno and Taylor, 2001; Neely, 2011). Our argument effectively assumes that these channels are muted in their effects on exchange rates and current accounts.

whether it is splayed across countries with more open capital account more-or-less evenly, or whether it disproportionately affects emerging markets with open capital accounts

The existing literature on the determinants of current accounts mostly does not consider official reserve flows and rather concentrates on factors that explain medium-term movements in current accounts (Chinn and Prasad, 2003; Gruber and Kamin, 2007; Chinn, Eichengreen and Ito, 2011). The limited empirical work that does take reserve accumulation into account as a factor driving current accounts includes Gagnon (2011, 2012) who suggests that one dollar sold in support of the domestic currency translates into an improvement of about 40 cents in the average country's current account. Reinhart, Ricci and Tressel (2010) also suggest that reserve accumulation be positively associated with the current account, mainly for countries with closed capital accounts.

Our empirical approach is based on the regression framework in Gagnon (2012) which models the current account as a linear function of a range of structural determinants as well as a variable representing reserve accumulation. We proceed to add a range of interaction terms between reserve accumulation and measures of capital controls to test our hypotheses. Anticipating our results, we find that for a country with a closed capital account every dollar in additional reserves increases the current account by some 50 cents—in other words, half of the intervention is offset through private capital flows. For a country with an open capital account, however, the impact is zero. We also find that the average effect across countries has fallen over time with the trend towards greater capital account liberalization. While we confirm Gagnon's (2012) estimate of 40 cents to the dollar for the period of 1980–2010, the estimate falls to 10 cents to the dollar for our baseline sample period of 1995–2010. Looking to the other side of the impact, we find that the current account offset is mainly to the United States, the main reserve currency issuer, with some diversion to other emerging markets also evident.

The next section of this paper discusses the empirical specification we use, followed by a description of the data in section III. Section IV discusses our results, and section V discusses our conclusions and their policy implications.

II. SPECIFICATION

We start our analysis from an accounting identity. Since the current account must always be financed it follows that:

$$current\ account + capital\ account = intervention \quad (1)$$

There are two ways in which foreign exchange intervention (i.e., purchases of reserves) could affect the current account. The first is through its impact on monetary policy and interest rates and hence domestic demand and activity; the second is the direct impact of reserve

accumulation on the exchange rate and the current account. In the interest of isolating the latter, we control for the response of monetary policy—an independent policy choice—in the regressions by including a series of controls in our regressions, including the change in activity.

The impact of sterilized reserve accumulation on the exchange rate and the current account depends on the degree to which it triggers other financing flows. If the capital account is completely open and reserves are perfect substitutes for some other assets, the incipient change in the current account and underlying portfolio allocation caused by sterilized intervention will be offset by an equal and opposite flow through the rest of the capital account, so the impact on the current account will be zero. Intuitively, since reserves largely comprise short-term debt instruments from a limited number of large countries with sufficiently liquid secondary markets for government securities (such as U.S. government bills), it seems likely that these would be highly substitutable with the same instruments held by the private sector for similar reasons.[6] By contrast, if a country has controls on capital inflows and outflows, intervention will trigger only a partial offset from the capital account.

These considerations suggest a specification of the following type:

$$CA_{it} = \alpha + \beta\ intervention_{it} + \gamma\ intervention \times controls_{it} + \theta controls_{it} + \vartheta X_{it} + \varepsilon_{it} \quad (2)$$

where subscripts i and t represent county i and year t, $controls_{it}$ is an index that is zero when a capital account is fully open and 1 if fully closed, and X_{it} is a vector of explanatory variables. Under our hypothesis that intervention is fully offset by other financing flows when the capital account is open, but only partially offset if the capital account is closed, $\beta=0$ and γ is positive and less than one.

In estimating this regression, we are not making any assuming as regards the reasons for intervention. Intervention could be occurring in a floating exchange rate regime, when it is a discretionary policy choice, or a fixed exchange rate regime when it is induced by market pressures and the exchange rate regime. Equation 2 implies that, in the case of an open capital account ($controls_{it} = 0$), assuming the coefficient β is truly zero or very close to it, an exchange rate peg can be maintained only by varying monetary policy, and hence X_{it}, in response to change in circumstances. By contrast, when capital controls are present ($controls_{it} > 0$) sterilized intervention can be used to achieve a given peg. Intuitively, intervention can be sterilized as offsetting private sector flows can be partly or fully avoided. In many ways, equation 2 is thus simply a restatement of the impossible trinity—a country cannot have an open capital account, a fixed exchange rate, and an independent monetary policy.

[6]The private sector holds these securities for similar reasons—as a good short-term store of value.

Assuming that the countries in equation 2 cover most of the world, there is a further complication. As the global current account should sum to zero, if intervention raises the current account in some countries, it must have an equal and opposite impact on current accounts elsewhere. We therefore augment equation 2 by adding four possible offsets. First, the current account could fall in countries supplying reserve assets. The logic here is simple. By artificially increasing demand for reserve assets, intervention makes it easier for reserve currency issuers to run a current account deficit. By a similar token, it might be the case that current accounts fall only in the major reserve currency issuer, the US. Alternatively, the offset could be to emerging markets with open capital markets, on the basis that if advanced economy investors have a certain demand for emerging market assets then an inability to buy assets in one market could induce them to switch to other emerging markets. Finally, if assets across all countries with open capital markets are highly substitutable, then the current account offset could be splayed relatively equally across such countries. The *Diversion* terms are discussed in detail in the subsequent section and defined in the Appendix. Accordingly, we augment equation (2) with variables (*Diversion* terms) that measure net inflows of money to countries as a result of global official reserve accumulation.

$$CA_{it} = \alpha + \beta\, intervention_{it} + \gamma\, intervention \times controls_{it} + \theta controls_{it} + \sigma diversion + \vartheta X_{it} + \varepsilon_{it} \quad (3)$$

In each case we allocate these inflows across countries while taking the main result of this paper seriously and assuming that a share of official outflows—depending on the degree of capital account openness—returns to the domestic economy through private sector inflows. In defining these variables, we assume γ=1, implying that the sum of the freely estimated coefficients on our *Diversion* terms should be (approximately) equal to our actual estimate of γ.[7] The regression analysis would confirm this contention if the diversion variables we include in the model are correctly defined in that they distribute inflows across countries in precisely the way that it occurred in reality.

Finally, equation (2) is clearly a reduced form and it is necessary to consider any possible biases in the estimated coefficients. There are at least two possible sources for endogeneity. First, causality may go both ways; while our hypothesis postulates a causal link

[7]To see this, let us assume for simplicity that only country A accumulates reserves and the resulting inflows entirely end up in country B. Assuming further that β=0, it must be the case according to equation (3) that

$$Diversion^{*} = intervention \times capital\ controls \times \gamma$$

However, since we define

$$Diversion = intervention \times capital\ controls$$

Given that the coefficient on, by simple accounting (increase in financial account equals fall in current account), would have to be equal to 1, the coefficient on *Diversion* has to be equal to our estimate of γ.

going from reserve accumulation to the current account, reserve purchases may, in turn, similarly react to undesired changes in the current account. Indeed, policymakers may decide to accumulate reserves to depreciate their exchange rate when their current accounts fall to levels that are sub-optimal from a policy perspective. However, to the extent that one views foreign exchange intervention purely as a policy variable, reverse causality is only an issue in a statistical sense. In other words, as a practical matter, we believe that uncovering the partial correlation between the two variables is fully sufficient for the purposes of this study.

The issue of simultaneous determination is a potentially more serious one: To the extent that both the current account and the reserve accumulation react to exchange rate pressures driven by exogenous shocks, the coefficient on reserves estimated with bias. Gagnon (2012) considers a variety of shocks that might institute such bias and comes to the conclusion that it will likely be small. We take the issue seriously in this paper and test the robustness of our results to a variety of specification changes. In addition to instrumental variables we argue that, to the extent that shocks are likely to average out over long periods of time, the use of multi-year averages in the regressions is likely to go far in resolving the issue. As regards the results of this paper, we show that they are very robust to instrumentation and to various multi-year averages.

III. DATA AND VARIABLE DEFINITIONS

The sample period for the analysis is 1995-2010.[8] The benchmark model specification closely follows Gagnon (2012), both in terms of variable definitions and in terms of their sources. All variables used in the analysis are defined in the Appendix. The dependent variable in all our regressions is the current account. The basic macroeconomic variables included as regressors are official reserves, the fiscal balance, lagged net foreign assets (NFA), net energy exports, the change in the elderly ratio, growth, population growth, and the percentage deviation of PPP GDP per capita from the US.

The main explanatory variable of interest is official reserves flows which includes flows in reserve assets (a net measure) as well as net other external assets of the government and the monetary authorities.[9] This is in line with Gagnon (2012), although his benchmark

[8]The sample period is limited by our restriction that, for comparability purposes, only observations for which we have data on all three major measures of capital account restrictions are included in the benchmark sample. The sample period is thus shorter than the one used in Gagnon (2012). However, we also estimate our model on the longer time span, data coverage permitting, for robustness purposes. Importantly, the shorter time period has the effect of shrinking the coefficient on the official reserves level term in explaining the current account. The major driver of this change is the fall in the average degree of capital account restrictiveness as more and more countries go down the path of liberalization. The baseline analysis uses annual data on efficiency grounds but we illustrate the robustness of our results to using multi-year averages.

[9]Our results are qualitatively robust to the exclusion of net other assets from the official reserves term.

definition of official reserves also includes a measure of sovereign wealth fund (SWF) assets—which we do not include due to a variety of data and specification issues[10]—as well as a correction term in our extended specifications which we intend to capture separately in the *Diversion* variables discussed below.[11]

We use three measures of capital account restrictiveness in the analysis, which, while correlated, differ significantly for some countries (Tables 1 and 2). These include the overall Schindler index of capital account restrictiveness (and two sub-indices, the Schindler index measuring controls on inflows and on outflows), the Chinn-Ito index of financial openness and the Quinn measure of capital account openness.[12] Rather than taking a stand on which measures are better, we experiment with all three measures in the analysis.

The Schindler indices take the value 0 in the absence of controls and the value 1 in the case of a fully controlled capital account. We recode the Chinn-Ito and Quinn measure to achieve an equivalent interpretation. The three measures are used in our regressions as level terms along with their interactions with official reserves; finally, they are also used to construct additional variables, namely measures of *Diversion* of financial flows that result from official reserves purchases. To maintain comparability across regressions, we restrict the sample to periods over which all three measures of capital controls are available, which has the additional advantage of weeding out countries were the information on capital controls appears to be too partial to allow construction of some measures.

We design a variety of *Diversion* terms which allocate the consolidated capital outflows following the official purchases of country X as inflows to countries Y and Z. We impose the main finding of this study, namely that official reserves on balance only lead to net capital outflows to the extent that official sector outflows do not return as private money,

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[10]We do not include SWF net asset flows as there continue to be severe measurement issues: first, we only have stock data available for most sovereign wealth funds (Gagnon allocates the stock as a flow across years according to the magnitude of current account deficits in the respective countries) which is especially problematic when using shorter multi-year averages as we do in this paper; second, there are issues of double counting in countries in which it is unclear whether SWF assets are included in reserve assets or not.

[11]We do not include the correction term because we are interested in including it (in various forms) in the regression separately in the second part of our analysis. Not including the correction term has no significant impact on the basic result Gagnon (2012) presents, not even on the magnitudes of the coefficients. The correction term used in Gagnon's paper sums up net global reserve accumulation and assumes allocates the counterpart to industrial economies according to their currency's share in global reserve holdings. The correction term is defined as *Diversion Industrials* in the Appendix and will be used separately in the second part of our analysis.

[12]The original Schindler (2009) index includes data for the period of 1995–2005. In this paper, we use an updated version of the index, the Fund staff's narrow de-jure restrictiveness index–which comprises data for the period 1995–2010 and, contrary to the original index, includes a limited qualitative assessment of controls. For the period of availability of the original index, the correlation between the two indices is 92 percent.

and that the share of money that returns is determined by the degree of capital account openness. In other words, using the Schindler measure of capital account openness as an example, and assuming that γ=1, each *Diversion* term fulfills the following condition (see the Appendix for definitions):

$$\sum_{i=1}^{N} Diversion_i = \sum_{i=1}^{N} intervention_i \times Capital\ controls_i \quad (4)$$

As a first hypothesis we assume that all resulting inflows end up in the United States, the dominant reserve currency issuer which has the largest and most liquid global financial markets (*Diversion to US*); as a second option we allocate all inflows to industrial economies (other than the US) according to their currencies' share in international reserve holdings (*Diversion Industrials*); another alternative is that countries across the globe (other than the United States) receive inflows according to their share in global GDP and their degree of capital account openness (e.g. *Diversion by GDP and openness*); finally, we test the possibility that inflows go only to EMs, according to their share in global EM GDP and openness (e.g. *Diversion by EM GDP and openness*).[13] A caveat of this analysis is that the components of each diversion measure could well be correlated with other push and pull factors that could be driving financial flows and current account developments

IV. ESTIMATION RESULTS

The analysis in this section is divided into three parts. In the first part, we estimate the average effect of reserve accumulation on current accounts across time. The second part analyzes the role of capital account restrictiveness in determining whether or not reserve accumulation can be effectively used as a policy tool to control a country's current account. The final part aims to identify the counterparts of reserve accumulation, namely the main recipients of the financial flows resulting from global intervention.

The dependent variable across all regressions in this paper is the current account. The set of variables included in the model as controls includes the fiscal balance and lagged net foreign assets, among others, and does not change across regressions. Most of these basic controls are highly significant throughout specifications, and their coefficient estimates make economic sense both in terms of sign and magnitude. The key explanatory variable is the accumulation of official reserves while indicators of capital account restrictiveness as well as interaction and *Diversion* terms are added selectively to the basic specification.

[13]As an example, country A's value on the variable *Diversion by GDP and Schindler* would be calculated as country A's global GDP share multiplied by its openness (1-Schindler) which, in turn, is multiplied by the overall (net) magnitude of diverted flows from reserve accumulators across the globe (i.e. the sum, across countries, of the product of reserve accumulation and the Schindler index). For each country, the diversion measure is then multiplied by a constant that ensures that the sum, across countries, of values on *Diversion by GDP and Schindler* is equal to the overall magnitude of diverted flows.

We analyze all relevant issues using panel regressions. Our baseline regressions are un-weighted across countries, but as a robustness check, we also report regressions that downplay the influence of noisy data by weighting all observations by a country's global GDP share. The latter approach is also taken in Gagnon (2011). The un-weighted approach is the natural one since we are interested in the robustness of the result, while the weighted specification puts much more focus on some specific countries (these issues are explore further below). In each of the three parts of the analysis we first discuss the results based on the un-weighted data and then based on weighted data.

A. The average effect of intervention on current accounts has fallen side by side with the trend towards more open capital accounts

The objective of this first part of the analysis is to determine the average effect of reserve accumulation on the intervening country's current account. As a first stab at the data, we estimate the model in equation 2 without the interaction term between intervention and capital controls (with the restriction $\gamma=0$). As in Gagnon (2012), we find official reserves to be highly significant in explaining changes in the current account. Our baseline regression 1 in Table 3 suggests that an increase of $100 in official reserves purchases leads to a $10 dollar improvement in the current account. The magnitude of the coefficient is less than a third of that found in Gagnon's paper for the equivalent (weighted and time averaged) specification.

This apparent inconsistency is easily resolved, however: the sample period used in the present paper is substantially shorter, and adding the missing fifteen years of data for 1980–1994 leads to a coefficient estimate that is in line with his findings (Table 3, regression 2). Why does the coefficient on reserves drop so much when shortening the sample period by fifteen years? In fact, the finding is precisely in line with the basic hypothesis of this paper. To the extent that official reserve accumulation is an effective policy tool only when countries are sufficiently closed, the larger number of countries with liberalized capital accounts in the latter part of the sample must imply that a longer sample period will lead to smaller coefficients on the reserves term (Figure 1).

The weighted data tell a very similar story to the un-weighted data (Table 3, regressions 7 and 10). For the shorter sample since 1995 the coefficient is 0.11, still around one-third of the Gagnon result, while for the sample from 1980 the coefficient of 0.33 is very similar to the one he reports. We conclude that reserve accumulation is indeed an important determinant of current accounts in intervening countries as argued forcefully in Gagnon (2012). However, the average magnitude of this effect diminished over a period that was characterized by a trend towards greater capital account liberalization in the countries included in our sample.

B. In open economies reserve accumulation is a powerless policy tool while closed economies improve their current accounts by 50 cents for every dollar spent

The objective in this second part of the analysis is to test whether the effectiveness of reserve accumulation as a means of controlling the current account indeed depends on capital account restrictiveness. Regressions 1–5 in Table 4 once again estimate equation 2 but this time around allow the interaction term between capital controls and reserve accumulation, γ, to be freely determined by the data. We add one capital account restrictiveness indicator at a time to the basic set of control variables along with an interaction term between the indicator and the official reserves variable. According to the basic hypothesis of this paper, we would expect a positive sign on the coefficient of the interaction term while we are agnostic with regard to the coefficient on the restrictiveness indicator itself.

The analysis finds the interaction terms in all regressions to be highly significant. The coefficient estimates vary in a relatively narrow range, from a high of 0.66 (Schindler inflows) to a low of 0.38 (Quinn). In all five regressions the hypothesis that the coefficient on the interaction term is 0.5 cannot be rejected at standard significance levels (Table 4). Furthermore, the coefficient on the change in reserves, discussed above, is smaller and never significant—once the interaction term between intervention and capital controls is included intervention itself ceases to matter. This implies that in an economy with extensive capital controls $100 of official reserve accumulation improves the current account of the intervening country by about $50, with half of the reserves-related outflows returning to the economy through private sector inflows. In a fully open economy, by contrast, reserve accumulation is fully offset, rendering it ineffective.

Results using weighted regressions produce a very similar story, as can be seen in Table 5. The coefficients on the interaction term are again all highly significant and are even more clustered, varying from 0.56 (Quinn) to 0.65 (overall Schindler). This increase in the coefficients on the interaction between intervention and capital controls, however, comes with larger negative terms on the simple intervention term. These terms, which are generally on the order of -0.1, are often significant. Such a negative coefficient is difficult to explain (it implies that intervention is counterproductive in the face of open capital markets). In all cases, the hypothesis that the coefficient on the interaction term is equal to 0.5 cannot be rejected at standard significance levels.

The importance of China the weighted regressions appears to partly explain the somewhat higher interactive coefficients. China has by far the largest GDP of all countries with extensive capital controls in recent years, and hence has a large role in the weighted regressions. Accordingly, excluding China from the analysis generally brings the coefficients in the weighted and un-weighted regressions closer together (Table 6).

Next, we investigate the issue of endogeneity. As a first approach, we rerun the un-weighted specification using instrumental variables, with the instruments being the current values of all of the control variables and the lagged values of the change in reserves, the capital control variable and their interaction. The results, shown in Tables 6 and 7, are very similar to those in the base regressions. In addition, we look at the results when using multi-year averages. Table 8 and Appendix Tables 1 to 3 report results for regressions that use multi-year averages of the data. With only 15 years of data, it is clear that the precision of our point estimates must suffer when using multi-year averages. However, the tables continue to report estimates on the interaction term that are generally significant and do not deviate much from the baseline effects—and certainly not in any systematic way—as the length of the averaging is increased. We conclude that endogeneity is not a serious issue for our estimates.

We already touched upon the fact that the magnitude of the coefficient on the official reserves term is very sensitive to changing the length of the sample period. The same cannot be said for the coefficient on the interaction terms. To the contrary, Table 9 illustrates that the coefficient is almost unaffected by changing the sample period.[14] In other words, even though countries by and large opened up over time—leading to a situation in which the average effectiveness of reserve intervention dropped across countries, the degree of capital account restrictiveness remains as crucial as it ever was.

We conclude that the main hypothesis of this paper is confirmed in that capital account restrictiveness is the decisive factor that determines whether reserve intervention is an effective policy tool in controlling the current account.[15] The results suggest that $1 of reserve accumulation in a fully closed economy leads to an improvement of 50 cents in the current account of the intervening economy while the remaining 50 cents return via private sector inflows. In open economies reserve accumulation is ineffective. Paired with the global trend towards greater capital account liberalization (Figure 1), this result implies that the impact of a given magnitude of global reserve accumulation on imbalances has been falling over time. Figure 2 illustrates this. In particular, according to our calculations, the global current account impact of reserve accumulation rose significantly slower between 2000 and

[14]Table 9 only includes results for the Chinn-Ito index and the Quinn index as data for Schindler only go back to 1995.

[15]While the analysis imposes a linear relationship on the interaction between reserve accumulation and capital account restrictiveness, it is possible that the relationship is indeed non-linear in nature. Appendix Table 7 tests this assertion by including two additional terms in the specifications tested so far: a squared capital account restrictiveness term and the interaction of this term with official reserves. Two issues complicate this analysis: first, capital account restrictiveness measures are not distributed evenly across the [0, 1] interval; second, the limited degrees of freedom make it more difficult to obtain precise estimates. However, the analysis indeed presents suggestive evidence in favor of the hypothesis that the effectiveness of reserve accumulation in controlling the current account increases more with a marginally more closed capital account the more open the capital account is in the first place.

2007 than reserve accumulation itself, and subsequently it fell (as a ratio to GDP) even as reserve accumulation stabilized (on the same basis).

C. The exorbitant privilege awarded to the United States is the main offset from global reserve accumulation but there also seems to be diversion to open emerging markets

We established that in closed economies only 50 cents in every dollar return to the intervening economy through private sector inflows. But where do the other 50 cents end up? At the risk of mining the data too much, we construct *Diversion* terms that are precisely meant to measure the counterparts to global reserve accumulation. Aggregate financial outflows resulting from net global reserve accumulation in any given year are given by equation 4; a positive value on a *Diversion* term for country i in year t thus reflects net positive global reserve accumulation in that year and that country i receives part of the resulting outflows from intervening economies as inflows. A precise definition of all *Diversion* terms we use is presented in the Appendix.

Our strategy is to test four competing hypotheses (see Figure 3): first, all the money flows to the US as a result of its exorbitant privilege (*Diversion to US*), second, the money goes to the largest reserve currency issuers other than the US (*Diversion Industrials*), third, the money is distributed across countries (other than the US) according to economic size and capital account openness (*Diversion by GDP and Controls*), and fourth, the money is distributed according to economic size and capital account openness but only flows to EMs (*Diversion by EM GDP and Controls*).[16]

In order to test the validity of these hypotheses, we initially augment equation 2 by each *Diversion* term in turn, as shown in equation 3. We start with each term individually in order to see which terms show the expected coefficients. The results, which are highly consistent across capital controls measures, are shown in equations 1–4 of Table 10 and Appendix Tables 4–6. The U.S. diversion term attracts a coefficient that is large, significantly different from zero, and easily accepts the adding-up restriction that the coefficient is equal and opposite to that on the interaction term between intervention and capital controls. The global GDP and emerging market terms also attract significant and correctly signed coefficients. The global GDP term, however, is very large and the adding-up restriction is only just satisfied, while the emerging market diversion term is smaller than the US term but more precisely estimated. Finally, the coefficient on non-U.S. reserve currencies is incorrectly signed.

[16]We note that, by construction, *Diversion Industrials* and *Diversion by GDP and Controls* are not mutually exclusive. The same holds for *Diversion by GDP and Controls* and *Diversion by EM GDP and Controls.*

Combining the three correctly signed terms in a single regression (not reported) results in coefficients and significance levels of similar magnitudes as in the individual regressions. As the adding up constraint is no longer satisfied it has to be imposed, a process that lowers the large but badly estimated coefficient on global GDP diversion and makes it insignificant. Once this term is dropped, the pattern that emerges is a larger coefficient on US diversion than emerging market diversion, suggesting a split of around two-thirds to one-third (Table 10 and Appendix Tables 4–6, regressions 5 and 6). In short, the main counterpart to reserve accumulation appears to be the United States, the economy with the most important reserve currency and most liquid and deep financial markets, but there is also diversion to financially open emerging markets.

This final exercise is a case where the results using weighted regressions are somewhat different from those using un-weighted ones. In particular, the coefficient on diversion to emerging markets is no longer significant, implying that the United States is the only offset to reserve accumulation by countries with closed capital markets (Table 10 and Appendix Tables 4–6, regressions 5 and 6). This suggests that reserve accumulation by larger emerging markets may be channeled more into the U.S. current account than accumulation by smaller countries, although we have no firm explanation as to why this might occur.

V. Conclusions and Policy Implications

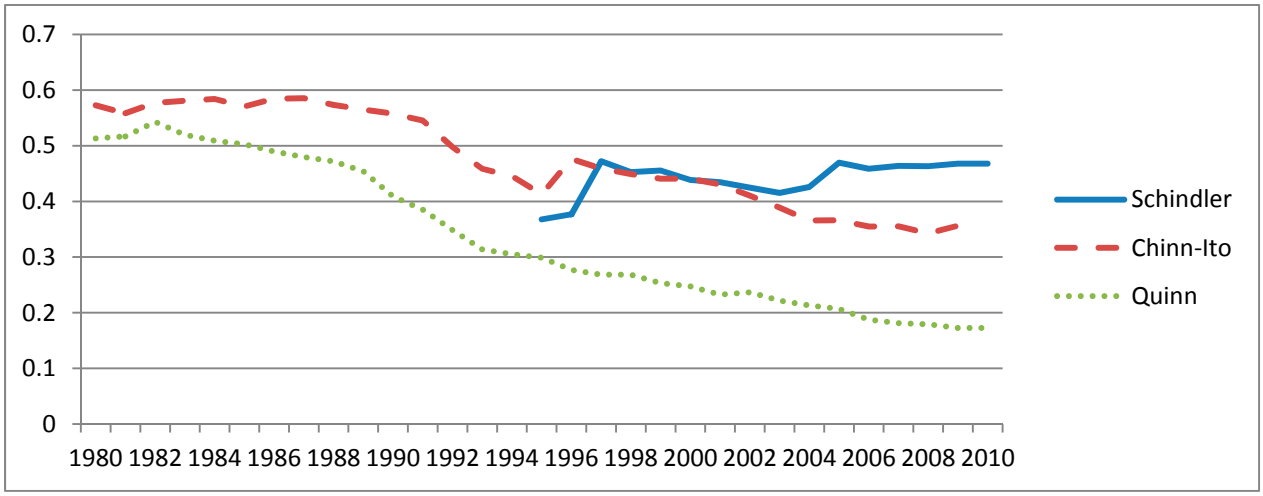
This paper has examined the impact of reserve intervention on the current account, with a particular emphasis on the role of capital controls. The results confirm our hypothesis that the level of capital controls is crucial to the impact of intervention on the current account. For a country with a closed capital account, the results suggest that every dollar of intervention moves the current account by 50 cents. The fact that 50 cents is undone by offsetting private sector flows is plausible given that capital controls can be circumvented and even countries with relatively closed capital accounts allow some capital inflows and outflows (such as foreign direct investment). By contrast, intervention in the absence of capital account restrictions seems to have no lasting impact on the current account.

The U.S. current account seems to provide a major offset to this reserve accumulation, but there is also evidence that intervention is diverted to open emerging markets. While this evidence is not definitive, it does suggest that reserve accumulation may have an element of beggar-thy-neighbor effects. This may help to explain why in recent years reserve accumulation has become fairly generalized across emerging markets.

The more positive message coming out of this paper is that the impact of reserve accumulation has been falling over time as countries have reduced their current account restrictions. Hence, even though intervention is rising, the size of the impact on the current account is dwindling (as a ratio to global GDP). Indeed, our calculations suggest that the impact of a given amount of reserve accumulation on imbalances has been falling over time.

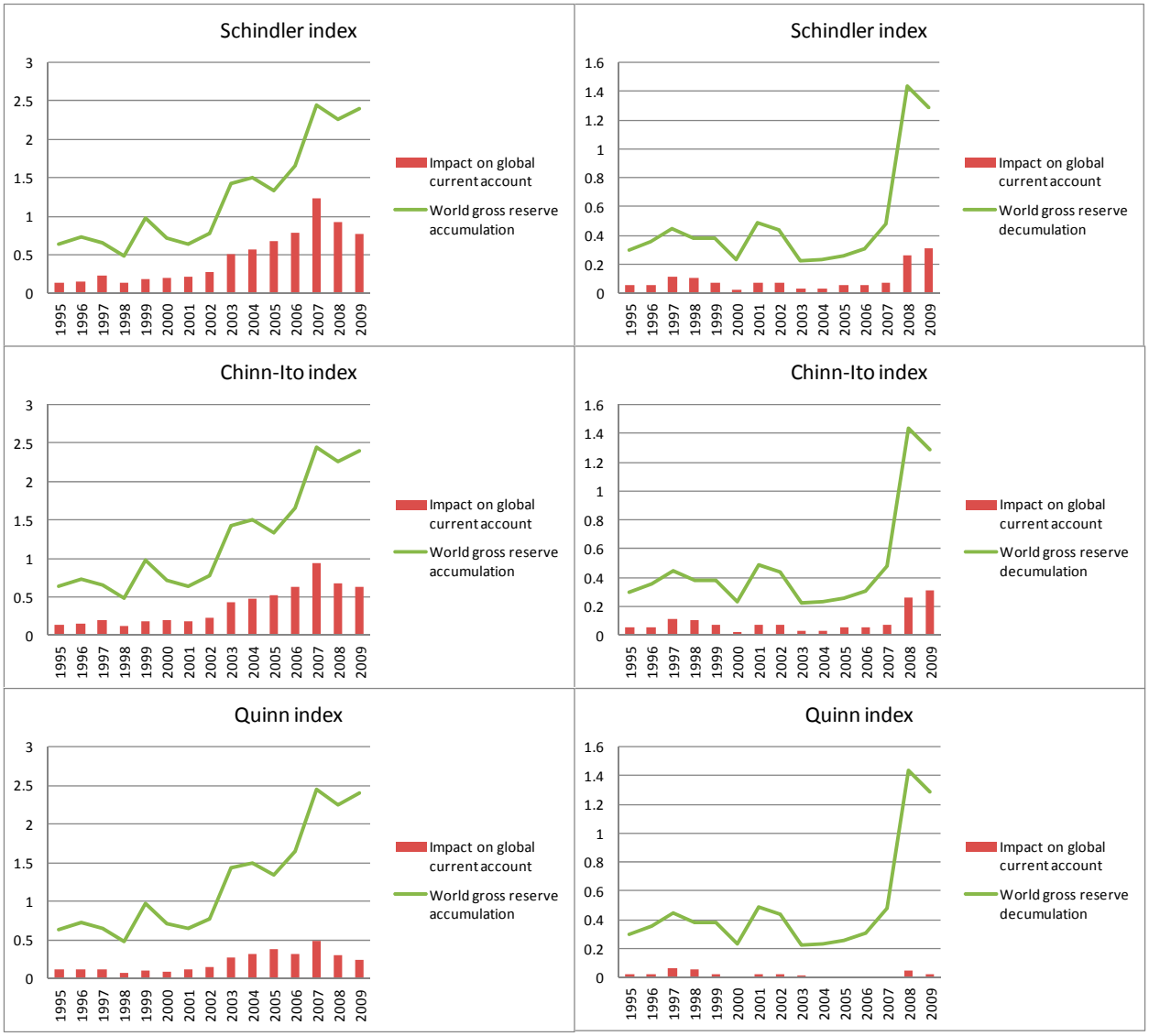
Given Chinese plans to further internationalize the renminbi, this erosion of the impact of reserve accumulation on the current account may well continue.

Figure 1. Capital Account Restrictiveness Measures Over Time



Source: Fund Staff Estimates.

Figure 2. Global Current Account Imbalances (Percent of Global GDP) Due to Reserve Accumulation (left) and Decumulation (right)*



Source: Fund Staff Estimates.

*We assume that $\beta = 0$ and compute global current account imbalances due to reserve accumulation by multiplying official reserves in each country with the estimated γ in the respective regression in Table 4 and sum up across countries. The sample is the same as the one used for the baseline regressions and thus reflects less than the whole world.

Table 1a. Capital Account Restrictiveness Measures: Summary Statistics

	Basic stats			Percentiles				
	Obs	Mean	Std. Dev.	1%	25%	50%	75%	99%
Schindler	975	0.4	0.3	0.0	0.1	0.3	0.7	1.0
Schindler inflow	975	0.4	0.3	0.0	0.2	0.3	0.6	1.0
Schindler outflow	975	0.4	0.4	0.0	0.0	0.3	0.8	1.0
Chinn-Ito	975	0.3	0.3	0.0	0.0	0.1	0.6	1.0
Quinn	975	0.2	0.3	0.0	0.0	0.1	0.4	0.9

Table 1b. Capital Account Restrictiveness Measures: Cross-Correlations

	Schindler	Schindler inflow	Schindler outflow	Chinn-Ito	Quinn
Schindler	1				
Schindler inflow	0.93	1			
Schindler outflow	0.96	0.80	1		
Chinn-Ito	0.79	0.72	0.77	1	
Quinn	0.83	0.77	0.80	0.85	1

Table 2. Capital Account Restrictiveness Measures for G20 (Latest)

	Schindler	Chinn-Ito	Quinn
Argentina	0.76	0.88	0.86
Australia	0.31	0.33	0.14
Brazil	0.48	0.67	0.43
Canada	0.01	0.13	0.00
China	0.84	1.00	0.57
France	0.01	0.21	0.00
Germany	0.01	0.58	0.00
India	0.84	0.96	0.57
Indonesia	0.31	0.58	0.43
Italy	0.01	0.13	0.00
Japan	0.01	0.46	0.00
South Korea	0.48	0.08	0.14
Mexico	0.31	0.83	0.43
Russian Federation	0.54	0.33	0.14
South Africa	0.84	0.71	0.57
Turkey	0.55	0.75	0.14
United Kingdom	0.01	0.08	0.00
United States	0.01	0.38	0.00

Source: Fund Staff Estimates.

Table 3. Gagnon (2012) Specification

	Reg 1	Reg 2	Reg 3	Reg 4	Reg 5	Reg 6	Reg 7	Reg 8	Reg 9	Reg 10	Reg 11	Reg 12
Sample	no weight 1995-2010	no weight 1980-2010	no weight 1995-2010	no weight 1995-2010	no weight 1995-2010	no weight 1995-2010	weight 1995-2010	weight 1980-2010	weight 1995-2010	weight 1995-2010	weight 1995-2010	weight 1995-2010
Multi-year averages	annual	annual	2-year	3-year	4-year	5-year	annual	annual	2-year	3-year	4-year	5-year
Official reserves, percent GDP	0.131**	0.387***	0.127	0.158*	0.067	0.244	0.098*	0.353***	0.006	0.152	-0.081	0.230
	0.052	0.068	0.089	0.089	0.095	0.149	0.056	0.076	0.085	0.106	0.107	0.155
Govt Balance, percent GDP	0.410***	0.383***	0.467***	0.455***	0.536***	0.536***	0.412***	0.306***	0.430***	0.445***	0.434***	0.617***
	0.054	0.049	0.073	0.081	0.093	0.11	0.055	0.036	0.069	0.067	0.091	0.084
NFA, percent GDP (lagged)	0.065***	0.039***	0.063***	0.057***	0.060***	0.052***	0.072***	0.059***	0.070***	0.064***	0.068***	0.061***
	0.005	0.004	0.006	0.006	0.009	0.009	0.005	0.004	0.006	0.006	0.009	0.010
Energy exports, percent GDP	0.164***	0.111***	0.160***	0.164***	0.141***	0.151***	0.189***	0.139***	0.179***	0.174***	0.172***	0.119***
	0.03	0.017	0.042	0.045	0.053	0.053	0.026	0.021	0.033	0.036	0.042	0.041
Change in elderly ratio	1.649**	1.288*	2.078*	3.048**	2.2	4.651***	3.965***	3.143***	4.386***	4.275***	4.844***	5.656***
	0.81	0.766	1.135	1.241	1.618	1.68	0.502	0.407	0.648	0.767	0.999	0.894
Real GDP, percent change	-0.308***	-0.104*	-0.284***	-0.234**	-0.308*	-0.008	-0.06	-0.136***	0.06	-0.014	0.191	-0.007
	0.075	0.059	0.11	0.119	0.16	0.198	0.087	0.043	0.121	0.099	0.188	0.173
Population, percent change	0.692***	0.498***	0.864***	0.835**	1.027**	1.221***	-0.559**	-0.345	-0.626*	-0.693*	-0.648	-0.440
	0.222	0.183	0.321	0.399	0.458	0.46	0.254	0.21	0.326	0.405	0.492	0.515
GDP pc, percent deviation from US	-0.906***	0.322*	-0.958***	-0.785**	-0.897**	-0.258	-1.950***	-1.063***	-2.014***	-1.735***	-1.905***	-1.664***
	0.213	0.191	0.309	0.336	0.415	0.444	0.204	0.17	0.276	0.273	0.38	0.338
Constant	0.708	1.107	0.997	-0.276	1.254	-1.485	-1.096	0.927	2.513***	0.8	2.938***	-0.057
	0.692	0.929	0.845	0.675	1.002	0.919	0.851	0.975	0.945	0.524	1.067	0.632
Adj R-squared	0.444	0.614	0.463	0.45	0.467	0.465	0.644	0.56	0.668	0.677	0.664	0.708
Obs	856	2038	419	315	224	186	856	2038	419	315	224	186

Robust Standard errors in parentheses
A full set of time dummies is included

* p<0.1, ** p<0.05, *** p<0.01

Source: Fund Staff Estimates.

Table 4. Adding Interaction Terms: Un-Weighted

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight
Official reserves, percent GDP	-0.059	-0.047	-0.044	0.032	0.033
	0.07	0.076	0.063	0.076	0.085
Govt Balance, percent GDP	0.424***	0.420***	0.424***	0.412***	0.413***
	0.051	0.052	0.05	0.05	0.052
NFA, percent GDP (lagged)	0.062***	0.064***	0.061***	0.060***	0.063***
	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.134***	0.130***	0.145***	0.144***	0.162***
	0.027	0.028	0.027	0.027	0.029
Change in elderly ratio	1.654**	1.699**	1.579**	1.920**	1.921**
	0.772	0.78	0.775	0.787	0.822
	-	-	-	-	-
Real GDP, percent change	0.346***	0.365***	0.323***	0.336***	0.333***
	0.069	0.07	0.069	0.066	0.072
Population, percent change	0.924***	0.893***	0.899***	0.943***	0.813***
	0.212	0.22	0.208	0.207	0.224
GDP pc, percent deviation from US	-0.086	-0.28	-0.088	0.405	-0.41
	0.258	0.255	0.249	0.286	0.268
Schindler	2.903***				
	0.589				
Interaction	0.571***				
	0.106				
Schindler inflow		2.426***			
		0.622			
Interaction		0.598***			
		0.122			
Schindler outflow			2.583***		
			0.497		
Interaction			0.477***		
			0.096		
Quinn				5.686***	
				0.918	
Interaction				0.482***	
				0.17	
Chinn-Ito					1.634**
					0.648
Interaction					0.363**
					0.162
Constant	0.49	0.589	0.497	0.315	0.487
	0.699	0.699	0.695	0.716	0.721
Adj R-squared	0.492	0.482	0.493	0.498	0.458
Obs	856	856	856	856	856
F-test of coeff. on interaction term = 0.5 (Prob > F)	0.223	0.174	0.887	0.910	0.442
Robust Standard errors in parentheses					
A full set of time dummies is included					
* p<0.1, ** p<0.05, *** p<0.01					

Source: Fund Staff Estimates.

Table 5. Adding Interaction Terms: Weighted

	Reg 1 weight	Reg 2 weight excl. CHN	Reg 3 weight	Reg 4 weight excl. CHN	Reg 5 weight	Reg 6 weight excl. CHN	Reg 7 weight	Reg 8 weight excl. CHN	Reg 9 weight	Reg 10 weight excl. CHN
Official reserves, percent GDP	-0.166***	-0.158**	-0.143**	-0.138**	-0.150**	-0.137**	-0.031	-0.087	-0.087	-0.09
	0.062	0.063	0.062	0.064	0.061	0.059	0.055	0.053	0.055	0.057
Govt Balance, percent GDP	0.396***	0.405***	0.406***	0.414***	0.392***	0.403***	0.416***	0.425***	0.418***	0.425***
	0.052	0.052	0.051	0.051	0.053	0.052	0.05	0.049	0.049	0.049
NFA, percent GDP (lagged)	0.070***	0.071***	0.069***	0.070***	0.070***	0.071***	0.071***	0.071***	0.070***	0.071***
	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.186***	0.187***	0.192***	0.193***	0.183***	0.186***	0.187***	0.181***	0.194***	0.194***
	0.028	0.027	0.028	0.027	0.027	0.026	0.025	0.024	0.026	0.025
Change in elderly ratio	4.006***	4.021***	3.922***	3.944***	4.077***	4.094***	4.043***	4.010***	4.150***	4.139***
	0.486	0.488	0.491	0.494	0.486	0.486	0.507	0.515	0.498	0.497
Real GDP, percent change	-0.156*	-0.144*	-0.172**	-0.159*	-0.134	-0.132	-0.164**	-0.178**	-0.195**	-0.176**
	0.082	0.084	0.08	0.082	0.084	0.085	0.08	0.08	0.078	0.08
Population, percent change	-0.403*	-0.445*	-0.430*	-0.467*	-0.404	-0.448*	-0.478*	-0.509**	-0.398	-0.443*
	0.244	0.248	0.242	0.246	0.247	0.25	0.244	0.245	0.248	0.252
GDP pc, percent deviation from US	-2.128***	-2.264***	-2.213***	-2.347***	-1.989***	-2.148***	-1.779***	-1.756***	-1.988***	-2.211***
	0.235	0.24	0.254	0.257	0.214	0.221	0.305	0.304	0.279	0.288
Schindler	-2.026***	-1.760**								
	0.677	0.685								
Interaction	0.579***	0.506***								
	0.105	0.134								
Schindler inflow			-2.122***	-1.890***						
			0.672	0.681						
Interaction			0.570***	0.497***						
			0.107	0.14						
Schindler outflow					-1.402***	-1.162**				
					0.533	0.54				
Interaction					0.506***	0.401***				
					0.098	0.115				
Quinn							0.013	1.07		
							0.962	0.992		
Interaction							0.522***	0.616***		
							0.162	0.189		
Chinn-Ito									-0.713	-0.763
									0.686	0.697
Interaction									0.564***	0.486***
									0.115	0.151
Constant	-0.338	2.155**	-0.288	2.059**	-0.53	2.092**	-0.664	1.645**	-0.607	1.528*
	0.813	0.885	0.85	0.84	0.8	0.917	0.88	0.784	0.874	0.796
Adj R-squared	0.662	0.638	0.661	0.637	0.66	0.636	0.652	0.637	0.658	0.635
Obs	856	843	856	843	856	843	856	843	856	843
F-test of coeff. on inter. term = 0.5 (Prob > F)	0.132	0.336	0.260	0.237	0.356	0.854	0.670	0.794	0.330	0.241

Robust Standard errors in parentheses
A full set of time dummies is included
* p<0.1, ** p<0.05, *** p<0.01

Sources: Fund Staff Estimates.

Table 6. Adding Interaction Terms: Un-Weighted and Using Instrumental Variables

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight
	-	-	-	-	
Lagged official reserves, percent GDP	0.304***	0.301***	0.276***	0.244***	-0.199**
	0.08	0.078	0.076	0.066	0.081
Govt Balance, percent GDP	0.419***	0.416***	0.420***	0.412***	0.409***
	0.051	0.051	0.051	0.049	0.051
NFA, percent GDP (lagged)	0.063***	0.064***	0.062***	0.061***	0.064***
	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.138***	0.131***	0.150***	0.149***	0.170***
	0.028	0.029	0.028	0.028	0.03
Change in elderly ratio	1.984**	2.042***	1.862**	2.153***	2.193***
	0.772	0.778	0.774	0.792	0.818
	-	-	-	-	-
Real GDP, percent change	0.278***	0.296***	0.258***	0.264***	0.258***
	0.067	0.068	0.067	0.065	0.069
Population, percent change	0.878***	0.860***	0.837***	0.871***	0.733***
	0.218	0.226	0.213	0.208	0.221
GDP pc, percent deviation from US	-0.164	-0.356	-0.18	0.272	-0.490*
	0.265	0.263	0.258	0.281	0.271
Lagged Schindler	3.037***				
	0.615				
Lagged interaction	0.639***				
	0.154				
Lagged Schindler inflow		2.501***			
		0.654			
Lagged interaction		0.711***			
		0.158			
Lagged Schindler outflow			2.717***		
			0.508		
Lagged interaction			0.505***		
			0.136		
Lagged Quinn				5.671***	
				0.895	
Lagged interaction				0.597***	
				0.19	
Lagged Chinn-Ito					1.948***
					0.661
Lagged interaction					0.326**
					0.16
Constant	-0.198	0.072	-0.132	0.48	0.581
	0.676	0.683	0.671	0.699	0.711
Adj R-squared	0.487	0.479	0.486	0.496	0.45
Obs	853	853	853	853	853
Robust Standard errors in parentheses					
A full set of time dummies is included					
* p<0.1, ** p<0.05, *** p<0.01					

Source: Fund Staff Estimates.

Table 7. Adding Interaction Terms: Weighted And Using Instrumental Variables

	Reg 1 weight	Reg 2 weight	Reg 3 weight	Reg 4 weight	Reg 5 weight
Lagged official reserves, percent GDP	-0.223***	-0.181**	-0.231***	-0.061	-0.064
	0.079	0.083	0.074	0.078	0.085
Govt Balance, percent GDP	0.396***	0.404***	0.394***	0.413***	0.411***
	0.053	0.053	0.052	0.052	0.053
NFA, percent GDP (lagged)	0.071***	0.070***	0.072***	0.072***	0.072***
	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.183***	0.191***	0.178***	0.187***	0.193***
	0.028	0.029	0.027	0.026	0.026
Change in elderly ratio	4.140***	4.082***	4.171***	4.051***	4.104***
	0.488	0.497	0.483	0.515	0.501
Real GDP, percent change	-0.131*	-0.128	-0.132*	-0.129	-0.118
	0.079	0.078	0.079	0.083	0.08
Population, percent change	-0.423*	-0.444*	-0.427*	-0.512**	-0.498**
	0.243	0.247	0.241	0.247	0.247
GDP pc, percent deviation from US	-2.161***	-2.235***	-2.036***	-1.760***	-2.044***
	0.245	0.262	0.226	0.319	0.297
Lagged Schindler	-1.796***				
	0.694				
Lagged interaction	0.587***				
	0.116				
Lagged Schindler inflow		-1.873***			
		0.717			
Lagged interaction		0.532***			
		0.124			
Lagged Schindler outflow			-1.243**		
			0.535		
Lagged interaction			0.569***		
			0.107		
Lagged Quinn				0.44	
				0.975	
Lagged interaction				0.441**	
				0.174	
Lagged Chinn-Ito					-0.508
					0.824
Lagged interaction					0.359**
					0.148
Constant	1.931**	1.992**	-0.519	1.766*	1.744*
	0.883	0.887	0.781	0.903	0.918
Adj R-squared	0.66	0.656	0.661	0.649	0.647
Obs	853	853	853	853	853
Robust Standard errors in parentheses					
A full set of time dummies is included					
* p<0.1, ** p<0.05, *** p<0.01					

Source: Fund Staff Estimates.

Table 8. Adding Interaction Terms: Using Two-Year Averages

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 weight	Reg 5 weight	Reg 6 weight
Official reserves, percent GDP	-0.154	-0.002	-0.011	-0.267***	-0.146*	-0.183**
	0.108	0.119	0.128	0.086	0.076	0.074
Govt Balance, percent GDP	0.466***	0.459***	0.473***	0.393***	0.451***	0.456***
	0.067	0.068	0.069	0.069	0.06	0.06
NFA, percent GDP (lagged)	0.058***	0.057***	0.060***	0.068***	0.069***	0.069***
	0.005	0.006	0.006	0.006	0.006	0.006
Energy exports, percent GDP	0.116***	0.127***	0.157***	0.165***	0.161***	0.179***
	0.036	0.037	0.039	0.034	0.032	0.031
Change in elderly ratio	2.231**	2.521**	2.530**	4.175***	4.352***	4.484***
	1.051	1.074	1.154	0.655	0.655	0.64
Real GDP, percent change	-0.363***	-0.335***	-0.330***	-0.101	-0.147	-0.182*
	0.099	0.097	0.106	0.117	0.102	0.099
Population, percent change	1.125***	1.215***	1.059***	-0.475	-0.509	-0.397
	0.285	0.284	0.319	0.334	0.322	0.331
GDP pc, percent deviation from US	-0.015	0.556	-0.392	-1.878***	-1.616***	-2.005***
	0.371	0.413	0.392	0.318	0.408	0.376
Schindler	3.007***			-1.193		
	0.821			0.951		
Interaction	0.841***			0.594***		
	0.145			0.132		
Quinn		6.382***			1.011	
		1.227			1.326	
Interaction		0.608**			0.666***	
		0.237			0.233	
Chinn-Ito			1.870**			-0.432
			0.92			0.966
Interaction			0.490**			0.641***
			0.233			0.134
Constant	0.094	0.675	0.9	2.531***	1.858**	1.638**
	0.837	0.796	0.841	0.932	0.8	0.794
Adj R-squared	0.537	0.531	0.484	0.689	0.683	0.686
Obs	418	418	418	418	418	418
Robust Standard errors in parentheses						
A full set of time dummies is included						
* p<0.1, ** p<0.05, *** p<0.01						

Source: Fund Staff Estimates.

Table 9. Adding Interaction Terms: Extended Sample (1980–2010)

	Reg 1 no weight	Reg 2 no weight	Reg 3 weight	Reg 4 weight
Official reserves, percent GDP	-0.021	-0.004	0.014	-0.001
	0.075	0.08	0.057	0.059
Govt Balance, percent GDP	0.222***	0.224***	0.235***	0.261***
	0.036	0.037	0.034	0.033
NFA, percent GDP (lagged)	0.054***	0.054***	0.065***	0.064***
	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.177***	0.182***	0.161***	0.163***
	0.024	0.025	0.022	0.023
Change in elderly ratio	0.686	0.744	2.550***	2.939***
	0.581	0.59	0.413	0.392
	-	-	-	-
Real GDP, percent change	0.210***	0.207***	0.189***	0.186***
	0.048	0.047	0.047	0.047
			-	-
Population, percent change	0.408**	0.422**	0.682***	0.675***
	0.173	0.176	0.192	0.198
			-	-
GDP pc, percent deviation from US	0.254	-0.005	0.760***	1.152***
	0.192	0.177	0.259	0.206
Quinn	2.091***		2.058***	
	0.583		0.701	
Interaction	0.428**		0.565***	
	0.169		0.13	
Chinn-Ito		0.695		0.555
		0.433		0.424
Interaction		0.299**		0.467***
		0.145		0.105
Constant	0.946	1.262**	1.345*	1.620*
	0.622	0.604	0.797	0.871
Adj R-squared	0.368	0.356	0.522	0.514
Obs	1515	1515	1515	1515
Robust Standard errors in parentheses				
A full set of time dummies is included				
* p<0.1, ** p<0.05, *** p<0.01				

Source: Fund Staff Estimates.

Table 10. Adding Interaction Terms and Diversion Terms: Using Schindler

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight	Reg 6 no weight	Reg 7 weight	Reg 8 weight	Reg 9 weight	Reg 10 weight	Reg 11 weight	Reg 12 weight
Official reserves, percent GDP	-0.058	-0.051	-0.041	-0.032	-0.029	-0.042	-0.128*	-0.114*	-0.160**	-0.180***	-0.135*	-0.114**
	0.07	0.067	0.069	0.07	0.07	0.068	0.068	0.069	0.065	0.064	0.071	0.056
Govt Balance, percent GDP	0.415***	0.436***	0.433***	0.420***	0.410***	0.414***	0.307***	0.353***	0.337***	0.391***	0.305***	0.302***
	0.051	0.052	0.051	0.051	0.052	0.052	0.051	0.052	0.051	0.052	0.052	0.054
NFA, percent GDP (lagged)	0.062***	0.060***	0.063***	0.064***	0.064***	0.064***	0.069***	0.065***	0.069***	0.070***	0.069***	0.069***
	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.133***	0.135***	0.132***	0.128***	0.127***	0.127***	0.183***	0.201***	0.184***	0.189***	0.184***	0.184***
	0.027	0.027	0.027	0.027	0.027	0.027	0.029	0.029	0.028	0.028	0.029	0.029
Change in elderly ratio	1.535**	1.219	1.825**	1.509**	1.374*	1.434*	3.226***	3.759***	3.530***	4.016***	3.236***	3.184***
	0.772	0.765	0.781	0.761	0.76	0.76	0.462	0.433	0.467	0.487	0.461	0.465
Real GDP, percent change	-	-	-	-	-	-	-0.173**	-0.112	-0.154*	-0.165**	-0.178**	-0.169**
	0.349***	0.308***	0.351***	0.315***	0.317***	0.320***						
	0.069	0.069	0.069	0.07	0.07	0.07	0.082	0.081	0.081	0.082	0.082	0.081
Population, percent change	0.939***	0.939***	0.952***	0.902***	0.918***	0.912***	-0.25	-0.086	-0.376	-0.411*	-0.255	-0.253
	0.213	0.215	0.218	0.216	0.217	0.216	0.232	0.213	0.238	0.244	0.231	0.231
GDP pc, percent deviation from US	0.003	-0.326	-0.145	-0.423	-0.342	-0.363	-	-	-	-	-	-
							1.440***	1.945***	1.586***	2.046***	1.406***	1.399***
	0.263	0.259	0.258	0.287	0.29	0.29	0.255	0.215	0.24	0.241	0.263	0.263
Schindler	2.979***	2.813***	1.772**	1.888***	1.925***	1.916***	-0.988	-	-0.21	-	-0.931	-0.877
								1.690***		1.889***		
	0.593	0.578	0.751	0.704	0.705	0.705	0.683	0.565	0.793	0.684	0.694	0.671
Interaction	0.570***	0.576***	0.506***	0.520***	0.516***	0.552***	0.552***	0.596***	0.657***	0.610***	0.567***	0.525***
	0.107	0.107	0.11	0.107	0.107	0.099	0.102	0.105	0.108	0.112	0.109	0.071
Diversion USA	-				-	-	-				-	-
	0.748***				0.813***	0.418***	0.510***				0.506***	0.534***
	0.21				0.208	0.116	0.107				0.108	0.081
Diversion Industrials		0.786***						0.603***				
		0.137						0.082				
Diversion by GDP share and Schindler			-0.767**						0.819***			
			0.354						0.188			
Diversion by EM GDP share and Schindler				-0.140**	-0.146**	-0.134**				0.054	0.026	0.008
				0.059	0.059	0.056				0.055	0.054	0.046
Constant	0.564	-	1.375	0.448	0.527	0.559	-0.108	-1.022	-0.908	-0.316	-0.099	1.698*
		2.498***										
	0.698	0.876	1.348	0.695	0.693	0.717	0.807	0.805	0.82	0.815	0.809	0.956
Adj R-squared	0.494	0.507	0.495	0.496	0.499		0.679	0.69	0.672	0.662	0.679	
Obs	856	856	856	856	856	856	856	856	856	856	856	856
P-value H0: θ = σ					0.080						0.650	

A full set of time dummies is included
* p<0.1, ** p<0.05, *** p<0.01
Robust standard errors in parentheses
Regressions in columns in yellow entail the restriction that the coefficients on all interaction terms must sum to the negative of the coefficient on the interaction term.

Source: Fund Staff Estimates.

APPENDIX

Variable Definitions and Sources

Variable	Definition	Source
Official reserves	$-(reserve\ assets + net\ other\ assets\ of\ govt. and\ mon. auth.)$	IFS
Government Balance	$General\ government\ balance$	WEO
NFA, lagged	$IIP\ assets + IIP\ liabilities$	IFS; missing data filled in from Lane and Milesi-Ferretti (2007)
Energy exports	$Energy\ production - energy\ use$	WDI; energy data converted to USD using the price of Brent oil
Elderly ratio	$\frac{Persons\ aged\ 65\ and\ older}{Persons\ aged\ 16-64}$	WDI
Real GDP, percent change	Real GDP growth in percent annual rate	WEO
Population, percent change	Population growth in percent annual rate	WDI
GDP pc, percent deviation from US	Percent deviation of PPP GDP per capita from US PPP GDP per capita in that year	WEO

MEASURES OF CAPITAL ACCOUNT RESTRICTIVENESS

Variable	Definition	Source
Schindler	Schindler overall index ranging from 0 (open) to 1 (closed)	Schindler (2009), extended to 2010
Schindler inflow	Schindler inflow control index ranging from 0 (open) to 1 (closed)	Schindler (2009) , extended to 2010
Schindler outflow	Schindler outflow control index ranging from 0 (open) to 1 (closed)	Schindler (2009) , extended to 2010
Quinn	Quinn index, recoded to be ranging from 0 (open) to 1 (closed)	Updated data based on Quinn (1997) and Quinn and Toyoda (2008)
Chinn-Ito	Chinn-Ito index, recoded to be ranging from 0 (open) to 1 (closed)	Chinn and Ito (2008)

DIVERSION TERMS

For any given country i, each diversion measure defined below is subsequently multiplied by a constant which ensures that the sum of all diversion terms across countries is equal to, respectively, $\sum_{i=1}^{N} Schindler_i \times Official\ reserves_i$, $\sum_{i=1}^{N} Chinn - Ito_i \times Official\ reserves_i$ or $\sum_{i=1}^{N} Quinn_i \times Official\ reserves_i$.

All *Diversion* terms other than *Diversion to US* are set to zero for the US itself.

Variable	Definition	Source
Diversion industrials (Schindler)	$Share\ in\ global\ reserve\ holdings_{\ i} \times \sum_{i=1}^{N} Schindler_i \times Official\ reserves_i$	See above, for share in reserve holdings see Gagnon (2012)
Diversion industrials (Chinn-Ito)	$Share\ in\ global\ reserve\ holdings_{\ i} \times \sum_{i=1}^{N} Chinn - Ito_i \times Official\ reserves_i$	See above
Diversion industrials (Quinn)	$Share\ in\ global\ reserve\ holdings_{\ i} \times \sum_{i=1}^{N} Quinn_i \times Official\ reserves_i$	See above
Diversion to US (Schindler)	$\sum_{i=1}^{N} Schindler_i \times Reserve\ assets_i$ for the US and 0 otherwise	See above
Diversion to US (Chinn-Ito)	$\sum_{i=1}^{N} Chinn - Ito_i \times Reserve\ assets_i$ for the US and 0 otherwise	See above
Diversion to US (Quinn)	$\sum_{i=1}^{N} Quinn_i \times Reserve\ assets_i$ for the US and 0 otherwise	See above
Diversion by GDP and Schindler	$\frac{\mathbf{GDP_i}}{\sum_{\mathbf{i=1}}^{\mathbf{N}} \mathbf{GDP_i}} \times (\mathbf{1} - \mathbf{Schindler_i}) \times \sum_{\mathbf{i=1}}^{\mathbf{N}} \mathbf{Schindler_i} \times \mathbf{Official\ reserves_i}$	See above
Diversion by GDP and Chinn-Ito	$\frac{GDP_i}{\sum_{i=1}^{N} GDP_i} \times (1 - Chinn - Ito_i) \times \sum_{i=1}^{N} Chinn - Ito_i \times Official\ reserves_i$	See above
Diversion by GDP and Quinn	$\frac{GDP_i}{\sum_{i=1}^{N} GDP_i} \times (1 - Quinn_i) \times \sum_{i=1}^{N} Quinn_i \times Official\ reserves_i$	See above
Diversion by EM GDP and Schindler	EMs only: $\frac{GDP_i}{\sum_{i=1}^{N} GDP_i} \times (1 - Schindler_i) \times \sum_{i=1}^{N} Schindler_i \times Official\ reserves_i$	See above
Diversion by EM GDP and Chinn-Ito	EMs only: $\frac{GDP_i}{\sum_{i=1}^{N} GDP_i} \times (1 - Chinn - Ito_i) \times \sum_{i=1}^{N} Chinn - Ito_i \times Official\ reserves_i$	See above
Diversion by EM GDP and Quinn	EMs only: $\frac{GDP_i}{\sum_{i=1}^{N} GDP_i} \times (1 - Quinn_i) \times \sum_{i=1}^{N} Quinn_i \times Official\ reserves_i$	See above

Appendix Table 1. Adding Interaction Terms: Using Three-Year Averages

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 weight	Reg 5 weight	Reg 6 weight
Official reserves, percent GDP	-0.112	0.04	0.016	-0.149	-0.029	-0.067
	0.128	0.115	0.132	0.118	0.103	0.104
Govt Balance, percent GDP	0.474***	0.451***	0.463***	0.409***	0.459***	0.465***
	0.076	0.076	0.076	0.071	0.066	0.067
NFA, percent GDP (lagged)	0.056***	0.053***	0.056***	0.064***	0.065***	0.065***
	0.006	0.006	0.006	0.006	0.006	0.006
Energy exports, percent GDP	0.122***	0.124***	0.150***	0.157***	0.161***	0.172***
	0.04	0.041	0.043	0.038	0.035	0.035
Change in elderly ratio	2.880**	3.058***	3.063**	4.109***	4.329***	4.409***
	1.141	1.168	1.233	0.764	0.776	0.746
Real GDP, percent change	-0.353***	-0.323***	-0.313***	-0.154	-0.141	-0.184*
	0.103	0.106	0.112	0.109	0.102	0.104
Population, percent change	1.094***	1.218***	1.055***	-0.49	-0.579	-0.469
	0.354	0.363	0.393	0.422	0.407	0.416
GDP pc, percent deviation from US	-0.092	0.536	-0.328	-1.715***	-1.510***	-1.924***
	0.401	0.44	0.413	0.329	0.448	0.4
Schindler	2.839***			-1.371		
	0.917			1.139		
Interaction	0.688***			0.586***		
	0.207			0.177		
Quinn		5.435***			0.636	
		1.405			1.472	
Interaction		0.714***			0.558**	
		0.263			0.239	
Chinn-Ito			1.347			-0.855
			1.002			0.98
Interaction			0.603**			0.581***
			0.255			0.162
Constant	-1.024	-0.395	-0.32	1.142*	0.67	0.504
	0.673	0.636	0.672	0.602	0.543	0.56
Adj R-squared	0.513	0.516	0.472	0.695	0.685	0.686
Obs	314	314	314	314	314	314
Robust Standard errors in parentheses						
A full set of time dummies is included						
* p<0.1, ** p<0.05, *** p<0.01						

Source: Fund Staff Estimates.

Appendix Table 2. Adding Interaction Terms: Using Four-Year Averages

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 weight	Reg 5 weight	Reg 6 weight
Official reserves, percent GDP	-0.203*	-0.054	-0.094	-0.294***	-0.213**	-0.247**
	0.107	0.096	0.105	0.111	0.099	0.099
Govt Balance, percent GDP	0.546***	0.529***	0.547***	0.417***	0.484***	0.489***
	0.087	0.088	0.087	0.092	0.082	0.081
NFA, percent GDP (lagged)	0.055***	0.055***	0.058***	0.066***	0.066***	0.066***
	0.008	0.008	0.008	0.008	0.008	0.008
Energy exports, percent GDP	0.093**	0.101**	0.135***	0.156***	0.140***	0.169***
	0.046	0.047	0.051	0.045	0.04	0.039
Change in elderly ratio	2.610*	2.793*	2.751*	4.644***	4.702***	4.913***
	1.484	1.488	1.627	1.009	1.007	0.968
Real GDP, percent change	-0.438***	-0.407***	-0.406***	0.019	-0.123	-0.157
	0.138	0.138	0.15	0.194	0.162	0.163
Population, percent change	1.324***	1.417***	1.283***	-0.481	-0.479	-0.299
	0.383	0.391	0.449	0.519	0.488	0.51
GDP pc, percent deviation from US	0.07	0.665	-0.304	-1.743***	-1.307**	-1.945***
	0.495	0.541	0.518	0.442	0.52	0.475
Schindler	3.081***			-0.827		
	1.112			1.3		
Interaction	0.923***			0.520**		
	0.217			0.226		
Quinn		6.676***			2.011	
		1.685			1.835	
Interaction		0.705**			0.748**	
		0.311			0.294	
Chinn-Ito			1.847			-0.615
			1.237			1.271
Interaction			0.697**			0.758***
			0.275			0.191
Constant	0.045	0.646	0.987	2.862**	2.105**	1.799*
	0.992	0.937	0.974	1.103	0.979	0.97
Adj R-squared	0.545	0.544	0.495	0.676	0.682	0.683
Obs	224	224	224	224	224	224
Robust Standard errors in parentheses						
A full set of time dummies is included						
* p<0.1, ** p<0.05, *** p<0.01						

Source: Fund Staff Estimates.

Appendix Table 3. Adding Interaction Terms: Using Five-Year Averages

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 weight	Reg 5 weight	Reg 6 weight
Official reserves, percent GDP	-0.127	0.098	0.058	-0.118	0.096	-0.007
	0.173	0.181	0.193	0.168	0.176	0.164
Govt Balance, percent GDP	0.549***	0.532***	0.539***	0.573***	0.627***	0.635***
	0.102	0.103	0.104	0.095	0.085	0.085
NFA, percent GDP (lagged)	0.050***	0.047***	0.050***	0.061***	0.062***	0.062***
	0.008	0.009	0.009	0.009	0.009	0.009
Energy exports, percent GDP	0.092**	0.107**	0.135***	0.106***	0.111***	0.119***
	0.043	0.047	0.051	0.039	0.04	0.039
Change in elderly ratio	3.985***	4.386***	4.618***	5.226***	5.591***	5.723***
	1.475	1.535	1.646	0.829	0.873	0.83
Real GDP, percent change	-0.241	-0.162	-0.114	-0.237	-0.12	-0.195
	0.165	0.167	0.18	0.171	0.18	0.17
Population, percent change	1.452***	1.582***	1.447***	-0.255	-0.385	-0.23
	0.402	0.413	0.465	0.544	0.523	0.536
GDP pc, percent deviation from US	0.34	0.984*	0.192	-1.708***	-1.503***	-2.030***
	0.517	0.593	0.567	0.364	0.485	0.466
Schindler	2.495**			-1.207		
	1.182			1.299		
Interaction	0.982***			0.662***		
	0.244			0.237		
Quinn		5.507***			0.709	
		1.733			1.667	
Interaction		0.733*			0.391	
		0.404			0.406	
Chinn-Ito			1.408			-1.18
			1.3			1.191
Interaction			0.643*			0.570**
			0.362			0.242
Constant	-1.609*	-1.287	-1.369	0.73	0.064	-0.082
	0.84	0.81	0.866	0.667	0.632	0.637
Adj R-squared	0.542	0.531	0.484	0.723	0.708	0.713
Obs	186	186	186	186	186	186
Robust Standard errors in parentheses						
A full set of time dummies is included						
* p<0.1, ** p<0.05, *** p<0.01						

Source: Fund Staff Estimates.

Appendix Table 4. Adding Interaction Terms and Diversion Terms: Excluding the Level Term

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight	Reg 6 no weight	Reg 7 weight	Reg 8 weight	Reg 9 weight	Reg 10 weight	Reg 11 weight	Reg 12 weight
Govt Balance, percent GDP	0.419***	0.440***	0.436***	0.421***	0.412***	0.417***	0.304***	0.353***	0.337***	0.395***	0.305***	0.312***
	0.051	0.052	0.05	0.051	0.052	0.051	0.054	0.054	0.054	0.055	0.055	0.054
NFA, percent GDP (lagged)	0.062***	0.060***	0.063***	0.064***	0.064***	0.064***	0.069***	0.065***	0.069***	0.070***	0.069***	0.068***
	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.134***	0.135***	0.132***	0.128***	0.127***	0.127***	0.183***	0.201***	0.183***	0.187***	0.183***	0.183***
	0.027	0.027	0.027	0.027	0.027	0.027	0.028	0.029	0.028	0.028	0.029	0.029
Change in elderly ratio	1.560**	1.238	1.852**	1.516**	1.379*	1.453*	3.093***	3.659***	3.393***	3.869***	3.093***	3.172***
	0.774	0.766	0.782	0.761	0.76	0.761	0.46	0.431	0.468	0.489	0.46	0.469
	-	-	-	-	-	-						
Real GDP, percent change	0.356***	0.313***	0.356***	0.317***	0.319***	0.323***	-0.169**	-0.106	-0.147*	-0.151*	-0.168**	-0.186**
	0.067	0.068	0.067	0.069	0.069	0.069	0.084	0.083	0.083	0.085	0.085	0.08
Population, percent change	0.952***	0.950***	0.962***	0.908***	0.924***	0.919***	-0.254	-0.086	-0.388	-0.418*	-0.254	-0.257
	0.214	0.216	0.218	0.217	0.217	0.217	0.233	0.214	0.241	0.247	0.233	0.233
							-	-	-	-	-	
GDP pc, percent deviation from US	0.035	-0.301	-0.126	-0.422	-0.34	-0.364	1.401***	1.927***	1.562***	2.083***	1.405***	-1.424***
	0.265	0.262	0.259	0.287	0.29	0.29	0.26	0.221	0.244	0.249	0.267	0.258
								-		-		
Schindler	3.141***	2.952***	1.824**	1.927***	1.961***	1.969***	-0.82	1.565***	-0.023	1.807***	-0.828	-0.929
	0.611	0.596	0.76	0.709	0.711	0.71	0.671	0.559	0.779	0.68	0.686	0.67
Interaction	0.483***	0.500***	0.443***	0.472***	0.472***	0.491***	0.396***	0.459***	0.461***	0.380***	0.395***	0.435***
	0.081	0.081	0.084	0.083	0.083	0.079	0.075	0.078	0.085	0.082	0.076	0.061
	-				-	-	-				-	
Diversion USA	0.754***				0.818***	0.351***	0.528***				0.529***	-0.466***
	0.21				0.208	0.1	0.105				0.105	0.069
Diversion Industrials		0.791***						0.620***				
		0.137						0.081				
Diversion by GDP share and Schindler			-0.806**						0.828***			
			0.352						0.19			
Diversion by EM GDP share and Schindler				-0.146**	-0.152**	-0.140**				0.017	-0.003	0.031
				0.059	0.059	0.057				0.054	0.052	0.045
		-										
Constant	0.554	2.535***	1.49	0.441	0.521	0.472	-0.144	-1.081	0.669	-0.391	-0.145	1.624
	0.702	0.882	1.333	0.697	0.695	0.706	0.813	0.807	1.095	0.818	0.814	1.007
Adj R-squared	0.494	0.507	0.495	0.497	0.499		0.678	0.689	0.669	0.659	0.677	
Obs	856	856	856	856	856	856	856	856	856	856	856	856
P-value H0: θ = σ					0.039						0.346	
A full set of time dummies is included												
* p<0.1, ** p<0.05, *** p<0.01												
Robust standard errors in parentheses												
Regressions in columns in yellow entail the restriction that the coefficients on all interaction terms must sum to the negative of the coefficient on the interaction term.												

Source: Fund Staff Estimates.

Appendix Table 5. Adding Interaction Terms and Diversion Terms: Using Chinn-Ito Measure

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight	Reg 6 no weight	Reg 7 weight	Reg 8 weight	Reg 9 weight	Reg 10 weight	Reg 11 weight	Reg 12 weight
Official reserves, percent GDP	0.033	0.045	0.039	0.059	0.061	0.047	-0.057	-0.04	-0.058	-0.097*	-0.058	-0.071
	0.085	0.081	0.083	0.084	0.084	0.084	0.064	0.06	0.062	0.056	0.066	0.054
Govt Balance, percent GDP	0.406***	0.429***	0.418***	0.408***	0.399***	0.406***	0.317***	0.371***	0.317***	0.413***	0.317***	0.321***
	0.053	0.053	0.052	0.054	0.054	0.053	0.05	0.049	0.049	0.049	0.05	0.051
NFA, percent GDP (lagged)	0.063***	0.060***	0.063***	0.064***	0.064***	0.064***	0.070***	0.065***	0.069***	0.070***	0.070***	0.070***
	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Energy exports, percent GDP	0.162***	0.162***	0.161***	0.158***	0.157***	0.158***	0.194***	0.210***	0.192***	0.192***	0.194***	0.194***
	0.029	0.029	0.029	0.029	0.029	0.029	0.026	0.027	0.026	0.026	0.026	0.026
Change in elderly ratio	1.820**	1.502*	2.167**	1.741**	1.606**	1.724**	3.276***	3.901***	3.154***	4.159***	3.279***	3.334***
	0.824	0.81	0.841	0.803	0.805	0.804	0.479	0.45	0.463	0.5	0.478	0.476
Real GDP, percent change	-0.334***	-0.292***	-0.342***	-0.297***	-0.297***	-0.303***	-0.195**	-0.150**	-0.167**	-0.203***	-0.195**	-0.204***
	0.072	0.072	0.072	0.073	0.073	0.073	0.077	0.075	0.075	0.078	0.077	0.075
Population, percent change	0.822***	0.840***	0.838***	0.795***	0.805***	0.802***	-0.253	-0.073	-0.301	-0.402	-0.254	-0.254
	0.225	0.228	0.228	0.229	0.229	0.229	0.236	0.216	0.231	0.247	0.236	0.236
GDP pc, percent deviation from US	-0.353	-0.609**	-0.425	-0.757**	-0.711**	-0.719**	-1.340***	-1.653***	-1.238***	-1.897***	-1.333***	-1.340***
	0.272	0.267	0.268	0.297	0.299	0.298	0.274	0.267	0.27	0.286	0.284	0.282
Chinn-Ito	1.632**	1.790***	0.821	0.881	0.826	0.888	-0.257	-0.022	0.832	-0.645	-0.252	-0.288
	0.648	0.647	0.734	0.699	0.699	0.7	0.676	0.713	0.723	0.684	0.681	0.68
Interaction	0.364**	0.358**	0.322**	0.305*	0.303*	0.350**	0.547***	0.597***	0.653***	0.586***	0.549***	0.584***
	0.163	0.159	0.16	0.16	0.16	0.154	0.115	0.117	0.118	0.119	0.119	0.081
Diversion USA	-0.728***				-0.885***	-0.143	-0.654***				-0.652***	-0.619***
	0.223				0.233	0.179	0.123				0.126	0.085
Diversion Industrials		1.028***						0.779***				
		0.167						0.098				
Diversion by GDP share and Chinn-Ito			-1.039*						1.483***			
			0.577						0.242			
Diversion by EM GDP share and Chinn-Ito				-0.229**	-0.244***	-0.206**				0.094	0.008	0.036
				0.093	0.094	0.087				0.082	0.079	0.062
Constant	0.561	-2.034**	1.684	0.138	0.37	1.088	-0.217	-1.193	-0.88	-0.556	0.795	1.323
	0.721	0.902	1.477	0.865	0.881	0.695	0.859	0.86	0.829	0.875	0.599	0.835
Adj R-squared	0.459	0.475	0.46	0.463	0.464		0.678	0.688	0.68	0.658	0.677	
Obs	856	856	856	856	856	856	856	856	856	856	856	856
P-value H0: θ = σ					0.010						0.676	
A full set of time dummies is included												
* p<0.1, ** p<0.05, *** p<0.01												
Robust standard errors in parentheses												
Regressions in columns in yellow entail the restriction that the coefficients on all interaction terms must sum to the negative of the coefficient on the interaction term.												

Source: Fund Staff Estimates.

Appendix Table 6. Adding Interaction Terms and Diversion Terms: Using Quinn Measure

	Reg 1 no weight	Reg 2 no weight	Reg 3 no weight	Reg 4 no weight	Reg 5 no weight	Reg 6 no weight	Reg 7 weight	Reg 8 weight	Reg 9 weight	Reg 10 weight	Reg 11 weight	Reg 12 weight
Official reserves, percent GDP	0.032	0.042	0.033	0.04	0.041	0.033	-0.013	0.02	-0.013	-0.039	-0.012	-0.064
	0.076	0.073	0.076	0.076	0.077	0.076	0.063	0.061	0.061	0.055	0.065	0.051
Govt Balance, percent GDP	0.403***	0.429***	0.412***	0.409***	0.399***	0.406***	0.294***	0.364***	0.294***	0.411***	0.294***	0.316***
	0.05	0.051	0.05	0.05	0.051	0.05	0.052	0.051	0.052	0.051	0.053	0.052
NFA, percent GDP (lagged)	0.060***	0.057***	0.060***	0.061***	0.061***	0.061***	0.070***	0.065***	0.070***	0.071***	0.070***	0.070***
	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004	0.004
Energy exports, percent GDP	0.143***	0.143***	0.144***	0.142***	0.140***	0.141***	0.182***	0.198***	0.181***	0.188***	0.182***	0.186***
	0.027	0.027	0.026	0.027	0.027	0.027	0.026	0.027	0.025	0.025	0.026	0.026
Change in elderly ratio	1.783**	1.505*	1.925**	1.820**	1.656**	1.782**	2.866***	3.672***	2.650***	4.057***	2.863***	3.208***
	0.79	0.769	0.804	0.78	0.782	0.78	0.494	0.466	0.491	0.508	0.493	0.492
Real GDP, percent change	-0.338***	-0.291***	-0.337***	-0.319***	-0.318***	-0.324***	-0.148*	-0.097	-0.13	-0.172**	-0.148*	-0.191**
	0.066	0.067	0.067	0.067	0.067	0.068	0.081	0.08	0.08	0.08	0.081	0.078
Population, percent change	0.954***	0.977***	0.943***	0.924***	0.933***	0.929***	-0.301	-0.123	-0.312	-0.474*	-0.301	-0.315
	0.208	0.211	0.208	0.211	0.212	0.21	0.23	0.208	0.227	0.245	0.23	0.232
GDP pc, percent deviation from US	0.480*	0.16	0.404	0.192	0.245	0.238	-0.803***	-1.307***	-0.699**	-1.693***	-0.808**	-0.934***
	0.29	0.285	0.287	0.323	0.325	0.325	0.304	0.273	0.297	0.313	0.313	0.306
Quinn	5.694***	5.864***	5.654***	5.167***	5.104***	5.180***	1.319	1.423	2.744***	0.041	1.318	0.729
	0.919	0.914	1.09	1.005	1.005	1.009	0.913	0.945	0.983	0.96	0.913	0.892
Interaction	0.485***	0.480***	0.481***	0.464***	0.466***	0.502***	0.513***	0.518***	0.623***	0.546***	0.511***	0.693***
	0.17	0.168	0.172	0.171	0.171	0.167	0.163	0.166	0.159	0.163	0.167	0.123
Diversion USA	-1.289***				-1.415***	-0.349*	-1.159***				-1.161***	-0.879***
	0.329				0.347	0.199	0.182				0.188	0.114
Diversion Industrials		1.661***						1.236***				
		0.24						0.158				
Diversion by GDP share and Quinn			-0.05						2.678***			
			0.969						0.362			
Diversion by EM GDP share and Quinn				-0.181	-0.206	-0.154				0.116	-0.009	0.186*
				0.128	0.129	0.122				0.119	0.116	0.095
Constant	0.407	-0.389	-0.608	0.304	0.403	0.913	-0.201	-1.351	-0.947	-0.618	-0.204	1.514*
	0.716	0.726	1.463	0.711	0.71	0.656	0.887	0.882	0.861	0.884	0.889	0.841
Adj R-squared	0.499	0.516	0.497	0.498	0.5		0.676	0.684	0.679	0.652	0.676	
Obs	856	856	856	856	856	856	856	856	856	856	856	856
P-value H0: θ = σ					0.008						0.046	
A full set of time dummies is included												
* p<0.1, ** p<0.05, *** p<0.01												
Robust standard errors in parentheses												
Regressions in columns in yellow entail the restriction that the coefficients on all interaction terms must sum to the negative of the coefficient on the interaction term.												

Source: Fund Staff Estimates.

REFERENCES

Bernanke, B. 2005, "The Global Saving Glut and the U.S. Current Account Deficit," At the Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia.

Blanchard, O. and G. Milesi-Ferretti, 2010, "Global Imbalances: In Midstream?" CEPR Discussion Papers 7693 (London: Centre for Economic Policy Research).

Chinn, M., B. Eichengreen and H. Ito, 2011, "A Forensic Analysis of Global Imbalances," University of Madison, manuscript.

Chinn, M. and H. Ito, 2008, "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis,* 10, 3, pp. 309–22.

Chinn, M. and E. Prasad, 2003, "Medium-term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration," *Journal of International Economics*, 59, pp. 47–76.

Gagnon, J., 2011, "Current Account Imbalances Coming Back," Working Paper 11–1, Peterson Institute for International Economics.

Gagnon, J., 2012, "Global Imbalances and Foreign Asset Expansion by Developing Economy Central Banks," forthcoming in BIS Quarterly Review.

Gruber, J. and S. Kamin, 2007, "Explaining the Global Pattern of Current Account Imbalances," *Journal of International Money and Finance*, 26, pp. 500–22.

Neely, C., 2005, "An Analysis of Recent Studies of the Effect of Foreign Exchange Intervention," Review, Federal Reserve Bank of St. Louis, 87, 6, pp. 685–717.

Neely, C., 2008, "Central Bank Authorities' Beliefs about Foreign Exchange Intervention," *Journal of International Money and Finance*, 27, 1, pp. 1–25.

Neely, C., 2011, "A Foreign Exchange Intervention in an Era of Restraint," Review, Federal Reserve Bank of St. Louis, 93, 5, pp. 303–24.

Reinhart, D., L. Ricci and T. Tressel, 2010, "International Capital Flows and Development: Financial Openness Matters," IMF Working Paper 10/235, (Washington: International Monetary Fund).

Schindler, M., 2009, "Measuring Financial Integration: A New Data Set," *Staff Papers*, International Monetary Fund, 56, 1, pp. 222–38.

Quinn, D., 1997, "The Correlates of Change in International Financial Regulation," *American Political Science Review,* 91, pp.531–51.

Quinn, D. and A. Toyoda , 2008, "Does Capital Account Liberalization Lead to Economic Growth?" *Review of Financial Studies*, 21, 3, pp.1403–1449.

Sarno, L. and M. Taylor, 2001, "Is Official Exchange Rate Intervention Effective?" *Economica*, 26, 1, pp. 24–36.