Government-directed, or official, financial flows (dominated by purchases of foreign exchange reserves) have exploded over the past 15 years and are now running at more than $1 trillion per year. Current account imbalances also reached record levels in recent years and they remain a major source of tension in international economic policy, despite a partial retrenchment since 2007. Advanced economies see emerging ones as frustrating needed current account adjustment via reserve accumulation aimed at holding down the values of their currencies. Emerging economies see their advanced brethren as trying to export their way out of recession via loose monetary policies that tend to weaken their currencies. Hence the much publicized talk of currency wars. This paper explores the first of these two arguments: Are official flows frustrating current account adjustment? Of particular interest is the extent to which official flows have a greater impact on current accounts in the presence of capital controls or other barriers to capital mobility. In addition, we explore whether there is a longer lasting impact of official flows on current accounts through the portfolio balance channel.

**Background and Motivation**

**Current Accounts and Official Flows**

We define official financial flows as the acquisition and disposition of assets and liabilities denominated in foreign currencies by public-sector institutions. The dominant form of official

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1 Bayoumi and Saborowski are at the International Monetary Fund; Gagnon is at the Peterson Institute for International Economics. They thank Kent Troutman for expert research assistance. The views expressed here do not necessarily reflect those of the International Monetary Fund or the Peterson Institute.

2 We assume that monetary policy fully offsets, or “sterilizes,” any potential inflationary effects of accumulation of
flows is purchases of foreign exchange reserves. However, public-sector borrowing in foreign currency counts as a negative official flow. Foreign asset purchases by sovereign wealth funds (SWFs) also count as official financial flows. Although SWF data are not included in standard databases for some countries, we construct official flows and stocks for a limited number of countries using various sources of data as detailed in the appendix to this paper. We exclude countries with significant SWFs for which data do not allow the construction of comprehensive official flows.

According to the balance of payments (BOP) accounts, in the absence of statistical errors and omissions, a country’s current account must equal its financial account. A current account surplus implies net lending abroad (positive financial flows) whereas a current account deficit implies net borrowing from abroad (negative financial flows). The financial account, in turn, is the sum of net official financial flows and net private financial flows. These relationships are defined in equation 1.

\[
\text{Current Account} = \text{Net Official Flows} + \text{Net Private Flows}
\]

As shown in figure 1, net official flows grew rapidly in the years before the global financial crisis and have fluctuated around $1 trillion per year since then. The solid line in figure 2 displays the sum of all the positive current account balances in each year (in percent of world GDP), which is a measure of global current account imbalances. The figure shows that these imbalances reached record levels late last decade.

The dashed line in figure 2 is net official flows, and the dotted line is net private flows,

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3 There are also some transfers of assets and forgiveness of loans that are not included in the financial account, but these are tiny for most countries.

4 The countries included in this sum vary from year to year according to whether their current accounts moved between deficits and surpluses.
for the same countries whose combined current account surplus is displayed in the solid line. Thus, the dashed and dotted lines sum up to the solid line, except for a relatively small statistical error. The rise in current account imbalances since 2000 is clearly associated with an increase in net official flows of a strikingly similar magnitude, whereas net private flows declined slightly and appear unrelated to the combined current account surplus.

The focus of this paper is on establishing whether this close correlation reflects a causal relationship running from official flows to current accounts, although causality need not run in only one direction. There are two ways in which purchases of official reserves could drive the current account. The first is through their impact on monetary policy and interest rates and hence domestic demand and activity; this is unsterilized intervention. The second is the impact of reserve accumulation on the exchange rate and the current account even when intervention is sterilized. In this paper, we focus on the latter effect.

**The Case of No Private Flows**

In the absence of private financial flows, equation 1 implies that a country’s current account balance must equal its net official financial flows. In this case, an increase in net official flows increases the current account via depreciation of the exchange rate regardless of whether the official flow is fully sterilized or not. A net official financial outflow implies a transfer of capital from the home country to the rest of the world. The reduction in the domestic capital stock raises the marginal product of capital at home and the increase in the foreign capital stock lowers the marginal product abroad. This bids up domestic rates of return and pushes down foreign rates of return.\(^5\) In a world without private financial flows, interest rates and other rates of return on financial assets and the underlying capital stock can remain different across countries for

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\(^5\) The effect on domestic rates of return happens immediately in the case of sterilized intervention, but it may be delayed in the case of unsterilized intervention until inflation stabilizes. We are concerned with real, or inflation-adjusted, rates of return.
extended periods of time.

*Private Flows and Arbitrage*

When private investors are allowed to send capital across borders, they will tend to arbitrage these different rates of return. Starting from a position of equal rates of return across countries, a net outflow of official capital that is fully sterilized creates an arbitrage opportunity through incipient differences in rates of return. Private investors will take advantage of this opportunity and send capital in the opposite direction, from the rest of the world to the home country. Thus, positive net official flows will give rise to negative net private financial flows. The standard benchmark with fully open private financial markets is uncovered interest rate parity (UIRP), according to which private financial flows keep expected exchange-rate-adjusted rates of return equal across countries. Under UIRP, sterilized official flows have no effect on the current account because they are fully offset by private financial flows.

So far, we have shown that there is a one-to-one relationship between net official flows and the current account when private financial markets are closed. In the opposite extreme of efficient financial markets with perfect capital mobility, sterilized official flows have no effect on the current account because they are fully offset by private flows. Next, we consider intermediate cases in which capital mobility is imperfect, implying that the UIRP relationship breaks down, allowing official flows to have an effect on current accounts.

*Capital Controls*

Capital controls are one potential source of imperfect capital mobility. However, the implications for the link between official flows and the current account depend on the nature of

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6 As in the case above, these effects are delayed when intervention is not sterilized.
7 Sterilized official flows may have an effect if they are viewed as signals about future monetary policy. For example, a purchase of foreign assets may signal a future easing of monetary policy. However, if policy is not eased, the effect will be short-lived, and if policy is eased it will be similar to unsterilized intervention.
the capital control. We consider two broad types of controls: taxes and quantity controls.

- An across-the-board withholding tax on interest, dividends, and profits earned by foreigners creates a fixed wedge between domestic and foreign rates of return. If the withholding tax rate stays constant, and UIRP would otherwise hold, then official flows have no effect on the current account because private flows adjust to maintain the fixed differential in the rates of return.

- Quantity controls place limits on the volume of private financial flows. Binding quotas on inward and outward private financial flows imply that, ceteris paribus, a change in net official flows must be exactly matched by a change in the current account. In the extreme, as quotas approach zero, private cross-border financial flows are eliminated.

If financial markets are segmented, so that arbitrage is limited between foreign direct investment, portfolio equity, portfolio debt, bank debt, and other forms of capital, then it is possible that net official flows can have an effect between zero and one when quotas bind on some but not all financial instruments. As quotas become binding on more financial instruments, the effect of official flows on the current account should increase.

Menzie Chinn and Hiro Ito (2006), Dennis Quinn (1997), and Martin Schindler (2009) created indexes of the number of legal constraints on capital flows across different forms of capital for many countries and years. Figure 3 plots median values of these measures in each year, where measures are normalized to be bounded between zero and one with higher values denoting fewer controls. Two of these measures show a trend increase in financial openness, which should imply a declining effect of net official flows on the current account for the median country. Notably, the Quinn measure finds that more than half of all countries had removed all financial controls.

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8 For example, China limits the value of domestic equity that can be held by foreigners through its qualified foreign institutional investor scheme and forbids most forms of foreign investment in domestically issued debt instruments. It also imposes quotas on various classes of outward investment.
quantitative controls on financial flows by 2009, yielding the highest possible median value of 1. The Chinn-Ito measure displays substantial liberalization over time, but significant controls remained as of 2011. The Schindler measure starts in 1995 and shows little trend between 1995 and 2011 for the median country.

**Institutional Quality**

There are strong reasons to believe that legal controls on financial flows are not the only factor influencing the mobility of capital. Private investors may not send capital freely into countries with few or no controls if they have reason to doubt the safety of their investments. Potential concerns include the quality of financial supervision and regulation, the ability to obtain redress of fraud and negligence in the court system, the stability of the economic environment, and the risk of expropriation or discriminatory treatment by host governments.

The World Bank’s Worldwide Governance Indicators (WGI) are a widely used source of indicators of institutional quality. The PRS Group’s International Country Risk Guide (ICRG) provides measures of political, economic and financial risk by country. We experimented with the full set of measures and many of them are highly correlated. The paper focuses on three: the WGI rule of law and regulatory quality indexes and the ICRG financial risk index.

Figure 4 displays the median values of these three indicators. The median financial risk index (the dotted line) increased sharply after 1990, representing a marked decline in perceived financial risks at that time. There is little trend in this measure since the early 1990s. The solid line shows that the median value of the regulatory quality index has increased somewhat since its inception in 1995, but this increase is small relative to the overall scale of the index (0-100). The rule of law index (the dashed line) has declined somewhat over time, but this change is also

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9 The WGI indicators include voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

10 The ICRG comprises measures of political risk, economic risk, and financial risk as well as a composite indicator.
small relative to the scale of the index.

**Financial Market Measures**

Financial market outcomes provide alternative proxies for capital mobility. We use size indicators, both of cross-border financial transactions and of the domestic financial system. Intuitively, the magnitude of cross-border financial flows may be seen as the direct outcome of capital mobility. Alternatively, a country with a large domestic financial system may be viewed by investors as closely integrated into the global financial system. We consider three financial market measures: (1) the ratio of gross private financial transactions to the sum of gross current and gross private financial transactions in the BOP accounts; (2) the ratio of gross private financial transactions in the BOP accounts to nominal GDP; and (3) the ratio of total bank assets to GDP. Box 1 presents a simple model of cross-border investment driven solely by diversification which implies that the effect of net official flows on the current account should be inversely related to the first of these measures.

 Box 1. Investment as Pure Diversification

The model is based on the idea that uncertainty about expected rates of return across countries is a potential impediment that could constrain private flows from offsetting the impact of official flows. In an extreme case, market participants may have no views on differences in expected returns across countries. Nevertheless, investors may wish to reduce the overall variance of their portfolio returns by diversifying across countries. Private financial flows will then occur purely to reap the benefits of diversification. Private investors at home (US) and in the rest of the world (ROW) send financial outflows that are fixed in terms of their respective domestic currencies. In addition, for simplicity, we assume that trade flows in the current account have unitary price
elasticities of demand. This implies that imports into each country are constant in terms of local currency.

\[ M: \text{US imports, fixed in $ terms} \]
\[ X: \text{US exports, fixed in € terms} \]
\[ PFO: \text{US outward private financial flow, fixed in $ terms} \]
\[ PFI: \text{US inward private financial flow, fixed in € terms} \]
\[ NOF: \text{US net official flow in $ (ROW assumed to be 0)} \]
\[ E: \text{Exchange rate, $/€} \]

**BOP identity:** \[ E \times X - M = PFO - E \times PFI + NOF \]

**Effect of NOF on current account:** \[ \Delta (E \times X - M) = \frac{X}{\Delta NOF} \frac{1}{(X + PFI)} \]

**Effect of NOF on net private flows:** \[ \Delta (PFO - E \times PFI) = \frac{-PFI}{\Delta NOF} \frac{1}{(X + PFI)} \]

The exchange rate is determined statically based on trade flows and financial flows according to the BOP identity. An increase in net official flows pushes down the value of the domestic currency against the foreign currency, implying a rise in \( E \). The effect on the current account is proportional to the ratio of exports to the sum of exports and private financial inflows. The effect on net private flows is -1 times the ratio of private financial inflows to the sum of exports and private financial inflows. In order to minimize the correlation between this ratio and the country’s net financial flows and to generalize it from the point of view of all countries, we compute our measure of capital mobility as:

\[ \text{CAPMOB: } \frac{PFO + E \times PFI}{(E \times X + M + PFO + E \times PFI)} \]

The solid line in figure 5 is the median value of the share of private financial transactions in total BOP transactions (excluding reserve accumulation). This measure has trended up over time, but it has given back some of its gains since 2007. The dashed line is the median value of
private financial BOP transactions relative to GDP. The gains over time are even more pronounced for this measure, reflecting the growing size of cross-border transactions in the world economy. The dotted line is the median value of bank assets to GDP, which has also grown over time and has retrenched by less since its peak than the BOP-based measures.

**Private Flows and Portfolio Balance**

In a world of risk-averse investors, UIRP need not hold even in the absence of legal controls and even with high-quality regulatory regimes. Volatile exchange rates are a particularly important source of risk. The portfolio balance theory holds that relative supplies of assets in different currencies will influence the exchange rates between these currencies through investors’ desire to maintain a specific balance of portfolio holdings. An increase in domestic-currency assets will depreciate the domestic exchange rate, setting up expectations of higher future returns relative to returns on foreign currency and thus inducing investors to hold the additional supply. The link between capital mobility and the portfolio balance channel is ambiguous. One the one hand, a lack of mobility may prohibit investors from balancing their portfolios, on the other hand, portfolio rebalancing may be inherently more important when investors face tight exposure limits in countries that are less closely integrated into the global financial system.

**Empirical Analysis**

**Prior Studies**

This paper follows in the footsteps of Chinn and Prasad (2003), Chinn and Ito (2008), Lee et al. (2008), and others who use a cross-country time-series approach to estimate the underlying determinants of current accounts. Bayoumi and Saborowski (2014), Gagnon (2012, 2013), and IMF (2012) augment the Chinn and Prasad framework to include reserve accumulation or net
official financial flows as a measure of a government’s exchange rate policy.\textsuperscript{11} All four studies find a significant effect of net official flows on the current account balance. However, Bayoumi and Saborowski and IMF find that the effect of official flows is significant only in countries with capital controls, whereas Gagnon finds a large effect of official flows that is not sensitive to measures of capital controls.\textsuperscript{12} Understanding the differences in data and specification that give rise to these conflicting results is a key objective of this paper.

\textit{The Basic Specification}

Equations 2 and 3 present the two basic specifications used in the analysis along with definitions of the variable names and a list of the auxiliary variables. Further information on the data is contained in the appendix. The regressions are run in a panel across 79 advanced and emerging-market countries.\textsuperscript{13} The sample runs up to 26 years, from 1986 through 2011. In principle, the maximum number of observations is 2054. However, owing to limitations on data availability, most regressions have between 800 and 1200 observations. In particular, a core group of regressions focuses on 1995-2010. The regressions allow for heteroskedastic errors with a first-order autoregressive error coefficient that is assumed to be identical across countries.\textsuperscript{14} Endogeneity is an important concern in our empirical setup and is addressed in more detail below, including through instrumental variables.

\begin{equation}
(CAX/GDP)_{it} = \alpha_1 (NOF/GDP)_{it} + \alpha_2 (NOF_H/GDP)_{it} \\
+ \beta_1 (NOA/GDP)_{it-1} + \beta_2 (NOA_H/GDP)_{it-1} + \gamma \text{ CAPMOB}_{it} \\
+ \text{Auxiliary Variables} + \text{Year Effects}
\end{equation}

\textsuperscript{11} Reinhart, Ricci, and Tressel (2010) find that reserve accumulation is positively associated with the current account, mainly for countries with capital controls. Aizenman, Jinjarak, and Marion (2013) also find a positive connection between reserve accumulation and current accounts.

\textsuperscript{12} All these studies tested for the role of capital controls by creating an interaction term that is the product of net official flows and a measure of legal restrictions on financial flows. The measures are displayed in figure 3.

\textsuperscript{13} A few regressions include low-income countries to check for robustness of our results.

\textsuperscript{14} We have done limited testing with country-specific autoregressive errors and found no notable effects on the coefficients of interest.
Equation 2 presents the current account as a function of net official flows and other control variables. The coefficient $\alpha_1$ represents the effect of net official flows on the current account and the coefficient $\alpha_2$ allows for a differential effect when capital mobility is above its median value. The coefficient $\beta_1$ represents the effect of lagged net official asset stocks on the current account and the coefficient $\beta_2$ allows for a differential effect with higher capital mobility. The coefficient $\gamma$ represents the direct effect of capital mobility on the current account, if any. The regressions include a standard set of controls for other potential determinants of the current account.\textsuperscript{15}

Equation 3 is a restatement of the link between official flows and the current account in equation 2 that takes advantage of the BOP identity: any effect of net official flows on the current account that is less than 1 must show up as a negative effect on net private flows. When net official flows have no effect on the current account ($\alpha_1=0$) then they must cause a one-for-

\textsuperscript{15} We do not include country fixed effects in most of our regressions because much of the identifying information comes from differences across countries. But we present a few regressions showing that most of our results are robust to including a full set of country effects.
one reduction of net private flows. Because of errors and omissions in the BOP data, these regressions are not identical. The bias from measurement error in net official flows in the estimate of $\alpha_1$ is downward in equation 2 and upward in equation 3, helping to put a range on its true value.

The dependent variable in equation 2 excludes investment income from the current account in order to remove the influence of steady-state differences in stocks of net foreign assets. Countries with higher net foreign assets tend to have higher current accounts. Because rates of return on foreign assets are close in magnitude to growth rates of GDP, net investment income is roughly equal to the size of current account surplus needed to keep the ratio of net foreign assets to GDP constant. Previous research has shown that the stock of net foreign assets is a robust and important regressor when the dependent variable is the total current account. By excluding net investment income from the dependent variable, we eliminate the need to include the stock of net foreign assets as a regressor. This allows us to use the stock of net official assets to estimate the lagged effect of net official flows on exchange rates and current accounts, working through the portfolio balance channel. We confirm in variants of the basic regressions (not shown) that the stock of net private foreign assets (constructed as the difference between net foreign assets and net official foreign assets) is no longer an important regressor after net investment income is excluded from the dependent variable.

In order to minimize the effect of outliers, we weight the observations in most of our regressions by each country’s share of world GDP, but we also present some unweighted

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16 In order to be consistent with the BOP identity, net investment income is also subtracted from the dependent variable in equation 3.
17 The coefficient on net foreign assets in regressions of the total current account is typically in the range of 0.02 to 0.05, close to the average growth rate of GDP and typical real rates of return.
18 In deviations from a steady-state path, net foreign assets might be expected to have a negative effect on the current account through a wealth effect on consumption and imports. In practice, the coefficient on net foreign assets is usually positive and never significantly negative.
regressions to show robustness. Weighting by GDP is appropriate if a country’s ratio of current account to GDP is interpreted as an average of the current account ratios of individual economic agents. Larger countries have less noise and idiosyncratic movements in their data than smaller countries and thus deserve greater weight. However, just two countries—the United States and the euro area—account for nearly half of global GDP, so we run regressions on sub-samples with and without these two countries as a check on the effects of using GDP weights. Another reason to exclude the United States and the euro area is that these countries have essentially zero net official flows and are the two major issuers of foreign exchange reserves, so that their behavior might be very different from that of other countries. In the event, however, our results are not sensitive to including these two countries.

Comparing Measures of Capital Mobility

Tables 1 and 2 display estimates of equations 2 and 3 using each of the nine measures of capital mobility shown in figures 3 through 5. In order to compare goodness of fit across different measures, all regressions are run on the same set of observations that are common to all data. This limits the sample to 1995-2010. These regressions exclude the United States and the euro area, but adding these two countries has very little impact on the coefficients on net official flows and net official assets.

The auxiliary variables included in the regressions are relatively standard in the literature and are similar to the ones used in Bayoumi and Saborowski (2014) and Gagnon (2012, 2013). Except for relative PPP GDP per capita, the coefficients on the auxiliary variables all have the expected signs and are in the range found by previous studies. The unexpected negative effect of

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19 We treat the 11 original members of the euro area plus Greece (which joined in 2001) as a single country because they shared common monetary and exchange rate policies over essentially all of our core sample (1995-2010). We treat countries that joined in 2007 and later as independent countries throughout. Of course, the euro area is technically not a country, but that is a convenient term for the cross-section units of our analysis.
relative PPP GDP per capita is small and is not significant in some cases. An increase in relative GDP of 10 percentage points is estimated to reduce the current account by 0.0 to 0.4 percent of GDP.

Columns 1 and 2 of table 1 display results using the Chinn-Ito measure of capital mobility. Column 1 is based on a regression of the current account excluding investment income (equation 2) and column 2 is based on a regression of net private flows (equation 3). The estimated effect of net official flows on the current account when capital mobility is below median \( \alpha_1 \) is 0.29 in column 1 and 0.35 in column 2. The coefficient on NOF_H \( \alpha_2 \) captures the difference in the effect of net official flows between low-mobility and high-mobility situations. The effect of net official flows drops by more than half under high mobility. The overall effect of net official flows when mobility is above the median is the sum of these two coefficients, or 0.11 in column 1 and 0.16 in column 2.

The coefficients \( \alpha_1 \) and \( \alpha_2 \) reflect the immediate effect of net official flows on the current account. However, because official flows have permanent effects on the relative supplies of assets in different currencies, they are likely to have long-lasting effects on exchange rates and current accounts through the portfolio balance channel. These effects are captured in the coefficients on the lagged stocks of net official assets. In column 1, for countries with low capital mobility, a one percentage point higher lagged stock of net official assets increases the current account by 0.04 percent. Because stocks of official assets typically are larger than flows, this is an important effect. For example, a country with net official assets equal to 25 percent of GDP would have a current account that is higher by 1 percent of GDP than a country with 0 net official assets, even if net official flows were the same in both countries. Because we have

\[ \text{Note that the coefficient displayed in column 2 is one plus the regression coefficient in order to get an estimate of } \alpha_1 \text{ as implied by equation 3.} \]
excluded net investment income from the dependent variable, this effect must reflect a lasting
effect through the exchange rate rather than simply the earnings on official assets.

An interesting result is that the effect of lagged official assets increases in some
regressions when capital mobility is above the median. It appears that when capital mobility is
high, net official flows have a smaller immediate impact on the current account but a larger
lagged impact. This may occur because private flows are more available to smooth short-run
fluctuations in net official flows, but the greater volume of private flows increases the
importance of portfolio effects. When private flows are tightly restricted, agents have less ability
to maintain diversified portfolios and so accumulated stocks of official assets have less effect. A
competing hypothesis with the opposite implication could have been that investors have tighter
exposure limits in countries that are less integrated into the global financial system.

The final coefficient is that on the Chinn-Ito measure itself, which is very small and
insignificant. This is not surprising, as there is no a priori presumption that capital controls
should on average either increase or decrease the current account balance independently of
official financial flows.²¹

Turning to columns 3 and 4, we see that the effects of net official flows are very similar
with the Schindler measure. The effects of lagged official stocks are a touch larger in the low
mobility case and the increase under high mobility is a touch less than with the Chinn-Ito
measure, leaving the overall effect under high mobility the same as in columns 1 and 2. Again,
the direct effect of Schindler mobility on the current account is essentially zero.

Columns 5 and 6 display results using the Quinn measure of capital mobility. The effects

²¹ This presumption holds when controls are applied equally on outflows and inflows. Controls that are focused on
inflows would tend to increase current accounts and controls that are focused on outflows would tend to reduce
current accounts. Here we use the overall measures of capital controls. We note that for the coefficient of primary
interest, the effect of net official flows on current accounts, both inflow and outflow controls would be expected to
increase it.
of net official flows are again similar to those in the first four columns. The effects of official stocks are similar to those in the first two columns. The direct effect of Quinn mobility on the current account is significantly negative and moderately large. An increase in Quinn equal to the very large median increase over the entire sample (figure 3) is estimated to reduce a country’s current account by 2 percentage points of GDP.

Turning to the institutional measures of capital mobility, columns 7 and 8 display results using the financial risk index. Here the effect of net official flows is 0.18 to 0.24 in the low mobility situation with essentially no change when mobility is above the median. There is no effect of lagged official stocks in the low mobility case and a moderately large effect with high mobility. The financial risk index itself has essentially no effect on the current account. The two measures of institutional quality yield results similar to those in the first six columns. The institutional measure with the best regression fit (R²) is the regulatory quality index (columns 11 and 12). Here we find effects of net official flows of 0.30 to 0.35 with low mobility that fall significantly to 0.13 to 0.18 with high mobility. The lagged stock effect rises moderately from 0.03 to 0.04 with low mobility to 0.06 to 0.07 with high mobility. Regulatory quality has a significant negative direct effect on the current account, but this effect is rather small given the relatively small range of this variable.

Columns 1 through 6 of table 2 focus on financial market measures of capital mobility. Columns 1 and 2 use the BOP financial share measure discussed in Box 1. The results are remarkably similar to those in columns 5 and 6 of table 1 with the Quinn measure. The similarity extends even to the direct effect of the BOP financial share on the current account, which is significantly negative but not large given the small range of this variable.

The best fitting of all nine measures of capital mobility is the ratio of BOP financial flows
to GDP (columns 3 and 4). Here we find larger effects of net official flows (0.34 to 0.44) in the low mobility case but falling by more with mobility to about the same average level of 0.13 to 0.16 under high mobility as was true in columns 1 to 6 of table 1. The official stock effects with both low and high mobility are effectively identical to those with the Quinn measure. The direct effect of the BOP financial ratio to GDP is negative and fairly large but only borderline significant. A change in this measure equal to the trough-to-peak move of its median in figure 5 (20 percentage points of GDP) would reduce a country’s current account by about 3 percent of GDP.

The final mobility measure is the ratio of bank assets to GDP (columns 5 and 6). The results here are fairly similar to those for the financial risk index (columns 7 and 8 of table 1). These regressions have noticeably worse fit than those of the other financial market measures. It appears that domestic financial market size performs less well as a proxy for capital mobility than measures of the size of cross-border transactions.

The remaining columns of table 2 attempt to construct a better overall measure of capital mobility by extracting information common to the various indicators. Columns 7 and 8 display results based on the first principal component of all nine mobility measures. Columns 9 and 10 are based on the first principal component of the best measures within each sub-group. Columns 11 and 12 display a variant of the measure used in columns 9 and 10, substituting the financial share of BOP transactions for the ratio of BOP financial flows to GDP and the ICRG financial risk index for the regulatory quality index. This final measure is the overall best fitting measure among those constructed using one measure from each sub-group.

The results across all three principal component measures are broadly similar. Focusing

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22 Among the legal measures of capital controls, the best fitting measure is the Quinn index. The regulatory quality index is the best fitting among the institutional quality measures. And the best fitting financial market measure is the ratio of BOP financial flows to GDP.
on the best-fitting “alternate” measure, the effect of net official flows with low capital mobility is 0.35 to 0.48. This effect declines significantly to around 0.12 to 0.15 with high mobility. The effect of net official asset stocks is 0.06 with low mobility, and there is little further increase with high mobility. The direct effect of mobility on the current account is negative and significant and moderately large. An increase in capital mobility equal to half of the total range between the lowest value and the highest value in the sample would lower the current account by 2 percent of GDP.

**Robustness to Sample and Specification**

Table 3 displays regressions using the alternate principal components measure of capital mobility, which had the best fit in tables 1 and 2. Columns 1 and 2 are the same regressions as columns 11 and 12 of table 2 except that they are not restricted to the common sample for all nine mobility measures, which adds nearly 300 observations. The coefficients on net official flows are all very similar to those in table 2. The effects of the official asset stock are no longer statistically significant in the low mobility case but are significant and roughly the same as in table 2 in the high mobility case. The direct effect of mobility is roughly unchanged between columns 11 and 12 of table 2 and columns 1 and 2 of table 3. Extending the sample to include low-income countries (columns 3 and 4) adds 275 additional observations with remarkably little effect on any of the coefficients on interest. The only change of note is that the coefficient on official stocks in the high mobility case is a bit smaller and not statistically significant in the CAX regression.

Columns 5 and 6 add the United States and the euro area into the sample. This has essentially no effect on the estimated net official flow effects. It does increase the net official stock effect with low mobility a small amount. It also shrinks the negative direct effect of
mobility to near zero.

Compared to the results in columns 1 and 2, the unweighted regressions (columns 7 and 8) have very similar coefficients on net official flows, stocks, and mobility. The only noticeable difference is a slightly smaller net official flow effect in the CAX regression.

The final two columns display results with a full set of country fixed effects (using GDP weights and based on the main sample). Compared to columns 1 and 2, the biggest difference is that the official stock effects drop to moderate negative numbers with low mobility, but they rise to small positive numbers with high mobility. The direct effect of mobility shrinks slightly. The net official flow effects are little changed.

The regressions in table 3 were also run using two alternative controls for the stance of monetary policy that help to distinguish sterilized from unsterilized net official flows. The first control is the difference between the growth rate of nominal GDP and its lagged five-year moving average growth rate. The second control is the difference between the growth rate of domestic bank assets and its lagged five-year moving average growth rate. Loose monetary policy should cause an acceleration of nominal GDP and/or bank assets. Inclusion of either variable had no noticeable effect on any of the coefficients of interest. To save space, these results are not shown.

Table 4 presents a similar set of robustness checks on the underlying mobility measure with the best fit in tables 1 and 2, the ratio of gross BOP financial flows to GDP. This measure has great intuitive appeal as a practical measure of capital mobility because it reflects the size of cross-border financial transactions in each country. This measure also has the most availability across countries and years, allowing us to greatly increase the number of observations. Table 4 displays somewhat larger overall effects of net official flows than the previous tables along with
somewhat smaller effects of official stocks. The negative effect of capital mobility on the official flow effect remains large and significant. The direct effect of this mobility measure on the current account is not stable across specification, but is almost always negative and often significant.

Table 5 presents the same set of regressions using the Quinn measure of mobility. Broadly speaking, the results of table 5 lie between those of tables 3 and 4 in terms of the magnitude of the relevant coefficients.

**Simultaneity and Instrumental Variables**

A key empirical issue is the potential endogeneity of official flows with respect to shocks to current account balances and net private flows. Endogenous movements are most likely to arise from attempts to stabilize the exchange rate in the face of trade or financial market shocks. On the other hand, examples of exogenous movements in official flows include increasing holdings of foreign assets for precautionary reasons, to save resource revenues for future generations, to borrow for economic development, and to achieve economic growth through higher net exports. Gagnon (2012, 2013) shows that endogeneity through stabilization of the exchange rate leads to a positive bias of the coefficient on net official flows if current account shocks dominate and a negative bias if private financial shocks dominate. Conventional wisdom suggests that financial shocks are important; witness the complaints from central banks in emerging markets about private capital flows driven by monetary policy in advanced economies. Aizenman (2006) finds that current account balances are more stable in countries with larger stocks of official reserves, corroborating the view that official flows move to offset private flows and stabilize the current account. Thus, it is likely that the coefficient on net official flows is biased downward. However, Ghosh, Ostry, and Tsangarides (2012) find that motivations for official flows shift
over time and across countries, suggesting that the bias may not be constant over time and across countries.

Table 6 presents results of regressions in which net official flows are instrumented by a set of country fixed effects, the interaction of net energy exports with a dummy for the existence of an energy-based SWF, and the lagged ratio of gross official assets to imports of goods and services. The coefficients on the lagged asset-import ratio are allowed to vary across countries, but the results are not highly sensitive to forcing a common coefficient across countries. All the auxiliary variables plus NOA, NOA_H, and CAPMOB are also included in the first stage regression.

The first four columns of table 6 present results using the principal component measure of capital mobility that was used in table 3. Columns 1 and 2 contain results from a GDP-weighted regression excluding the United States and the euro area. Columns 3 and 4 contain results from an unweighted regression that includes the United States and the euro area. The effect of net official flows on the current account with low mobility is 0.25 to 0.75, considerably wider range with a higher upper bound than in previous regressions. The reduction in this effect with high capital mobility is comparable in magnitude and significance to the results in previous tables in the NPFX regressions but close to zero in the CAX regressions.

The effect of lagged official assets is small and sometimes negative with low mobility but it increases notably with high mobility to the low end of the range of previous regressions. The direct effect of capital mobility is close to that estimated for this principal component in most of

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23 Months of import cover is a common metric for adequacy of foreign exchange reserves.
24 Owing to software limitations, we ran the first stage regression separately and used the fitted values of net official flows in the final regression. This has no effect on the coefficients but it does invalidate their standard errors. We plan to run some robustness checks using standard instrumental variables regressions that do not allow for an autoregressive error structure.
25 All regressions in table 6 exclude low-income countries.
the regressions in table 3.

The middle four columns of table 6 present results using the ratio of BOP financial flows to GDP as a measure of capital mobility. Columns 5 and 6 refer to a GDP-weighted regression excluding the United States and the euro area, whereas columns 7 and 8 refer to an unweighted regression that includes the United States and the euro area. Owing to greater data availability of this mobility measure, there are about 100 more observations in these regressions than in those of the previous four columns. The effect of net official flows on the current account with low mobility is 0.49 to 0.70, somewhat higher than in the regressions without instruments (table 4). In contrast to other regressions in this paper, the reduction in the effect of net official flows with high capital mobility is small and insignificant. [This is a puzzling result which we plan to explore further.]

In columns 5 through 8, the effect of lagged official assets is small and generally not significant with low mobility. The increase in this effect with high mobility is small and generally not significant. The direct effect of capital mobility is smaller (less negative) than that estimated for the BOP/GDP ratio in table 2.

The last four columns of table 6 present results using the Quinn measure of capital controls. As before, columns 9 and 10 refer to a GDP-weighted regression excluding the United States and the euro area, whereas columns 11 and 12 refer to an unweighted regression that includes the United States and the euro area. The effect of net official flows on the current account with low mobility is 0.45 to 0.59, nearly as large as that found with the BOP ratio and somewhat higher than in the regressions without instruments (table 5). The reduction in the effect of net official flows with high capital mobility is comparable to results in earlier tables and is statistically significant in three of the four regressions. The effect of lagged official assets is
small and not significant with low mobility. The increase in this effect with high mobility is small to moderate and generally significant, especially in the unweighted regressions. Finally, the direct effect of capital mobility is somewhat smaller than that estimated for the Quinn measure in table 1.

**Illustration**

Table 7 presents the overall effects of net official flows, official stocks, and capital mobility for specific countries and years, based on the averages of the coefficients of columns 1 through 4 of table 6. All data are expressed as deviations from unweighted averages across countries in percent of GDP. The estimated contributions of each variable listed in the headers are the variable coefficient times the variable value for that country and year. The estimated contributions for the current account are the sums of the contributions of the other variables listed. Any difference between the current account data and estimated contributions reflects the effects of the auxiliary variables and the residual error.

The first row of table 7 shows that China’s current account excluding net investment income was more than 6 percentage points larger than that of the average country in 2007. China’s net official flows were 9 percentage points higher than those of the average country. Because China has low capital mobility, NOF_H = 0, which was 4 percentage points lower than that of the average country. China’s lagged stock of net official assets was more than 13 percentage points higher than that of the average country, but NOA_H = 0, which was far below average. Finally, China’s capital mobility was below average. China’s external policies as a group explain nearly all of its current account, of which most owes to China’s net official flows in 2007.

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26 To create table 7, CAPMOB was multiplied by 100 to be commensurate with other data expressed in percentage points.
The next section displays analogous results for Singapore, which had an even larger current account in 2007 but was characterized by high capital mobility. Singapore engages in massive net official flows and has an enormous stock of net official assets. Official flows, stocks, and capital mobility explain just over half of Singapore’s current account. Singapore’s fiscal surplus and rapid aging explain another 2 percentage points of its current account, still leaving a fairly large unexplained residual. For Singapore, the lagged official stocks have an important impact, explaining nearly as much of the current account as official flows.

The two largest countries, the United States and the euro area, had current accounts below the global average in 2007. These countries issue the world’s main reserve currencies and do not have significant net official flows or stocks. Because most countries did have positive net official flows and stocks in 2007, the data for these two countries are below the global averages. These are also high capital mobility countries. The table shows that just under half of the US current account is explained by its net official flows, stocks, and capital mobility, with most of the difference in a large residual. For the euro area, however, the model somewhat overpredicts the current account deficit, and the error is compounded by the auxiliary variables, which also predict a deficit. These results are consistent with Bayoumi and Saborowski (2014), who find that the effect of global reserve accumulation on the current account deficits of non-accumulating countries is almost exclusively focused on the United States.

The final two sections of the table examine countries that were intervening to support their currencies during periods of current account deficits. Hungary in 2006 had a current account 3.6 percentage points below average and net official flows nearly 9 percentage points

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27 Note that official flows and stocks in each country refer to assets and liabilities of the government of that country that are denominated in foreign currency. They do not include flows and stocks of assets and liabilities of the governments of foreign countries. Thus, Chinese government purchases of US assets are official flows for China but not for the United States, where they are counted as private inflows. For this reason, net official flows do not sum to zero around the world.
below average. The model exactly explains Hungary’s current account in terms of its official flows, stocks, and capital mobility. If Hungary had stopped intervening and allowed the forint to depreciate, it would not have had a current account deficit. The results are broadly comparable, but a bit weaker, for Romania in 2009.

**Comparison to Previous Studies**

We find larger effects of net official flows than Bayoumi and Saborowski (2014) and IMF (2013), but smaller than Gagnon (2013) and comparable to Gagnon (2012). Contrary to Gagnon (2012, 2013), we confirm the findings of Bayoumi and Saborowski (2014) and IMF (2013) that capital mobility has an important influence on the effect of net official flows on the current account. Unlike the latter studies, however, we find that net official flows do have important effects even when capital is highly mobile. A common finding in all of these studies is that capital mobility typically has a small to moderate negative direct effect on the current account. An important new finding in this study is the effect of lagged official flows as captured by the coefficient on the lagged stock of net official assets.

There appear to be several factors explaining the differences in results across studies. Most previous studies focus only on equation 2, in which the coefficient on net official flows suffers from the standard downward bias owing to measurement error. Including regressions of equation 3 balances out the results because measurement error introduces a bias in the opposite direction in equation 3. Basing the analysis on current accounts excluding net investment income allows us to identify a lagged effect of official flows operating through the lagged stock of net official assets.

Even after controlling for differences in capital mobility, coefficients are somewhat sensitive to which countries and years are included in the analysis. Many countries have very
low net official flows and stocks in all years, providing little information to identify an effect on
the current account when the sample is dominated by these countries. Some countries with large
current accounts and large SWF flows do not include their SWF flows in standard data;
including these countries in the sample with erroneous data on net official flows leads to biased
estimates. Small and poor countries sometimes have volatile data owing to idiosyncratic reasons
that are not well controlled by our auxiliary variables; weighting observations by GDP and
omitting low-income countries helps with this problem.

Endogeneity of net official flows to shocks to current accounts and private financial
flows leads to biased coefficient estimates, and the direction of bias varies across countries and
years. Instrumental variables may over-fit, leaving biases unadjusted, or they may under-fit,
creating new biases from measurement error and unstable coefficients in the second stage
regressions. We plan to do further exploration of instrumental variables regressions.

Conclusions
We find that net official flows have a large but plausible effect on current account balances. This
result is robust to an array of samples, specifications, and estimation techniques. The estimated
effects are somewhat larger with instrumental variables, reflecting possible downward bias in
regressions without instruments owing to an endogenous response of net official flows to private
financial flows.

We also find that the impact of net official flows is importantly affected by the extent of
international capital mobility. We explore various measures of capital mobility. Nearly all of
these measures show that the effect of net official flows on the current account declines as
mobility increases. These results are strongest with the measures of mobility that fit best and
they are highly robust to varying samples and specifications. For some measures of capital mobility, these results are robust to the use of instrumental variables, but for others they are not. This finding requires further exploration.

A further result is that there is an important effect of lagged net official flows, captured by the coefficient on the lagged stock of net official assets. We believe this effect operates through the portfolio balance channel. Persistent changes in the relative supplies of assets in different currencies have persistent effects on exchange rates and current account balances. This effect often, but not always, appears to increase with capital mobility, probably indicating that the portfolio channel is less important when private flows are tightly restricted. There is also some tradeoff across samples and specifications in the estimates of the net official flow and net official stock effects. When flow effects are estimated to be larger, stock effects typically are estimated to be smaller.

Finally, the direct effect of capital mobility on current accounts is often quite small, but is generally negative and sometimes significantly so. Opening of capital markets tends to favor borrowing over lending, other things equal.
Appendix: Data Sources and Definitions

Sources: IMF, Balance of Payments Statistics (BOP); IMF, International Financial Statistics (IFS); IMF, World Economic Outlook (WEO); The PRS Group International Country Risk Guide (ICRG); United Nations, World Population Prospects 2010 (UN); World Bank, World Development Indicators (WDI); World Bank, Worldwide Governance Indicators (WGI); Norway, Norges Bank; and Singapore, Ministry of Finance. Updated data on capital controls based on Quinn (1997), Chinn and Ito (2006), and Schindler (2009) were obtained from staff at the IMF.

CAX: The BOP current account balance minus BOP net investment income.

NOF: From the BOP data, NOF is the sum of reserves flows and net portfolio investment and other investment flows for central bank and general government except that portfolio and other liability flows are set at zero for advanced economies because they do not borrow significantly in foreign currency. For Norway we add flows by the Government Pension Fund Global based on data from Norges Bank because Norway does not include these flows in general government flows. We exclude from the sample all other countries that are known to have significant sovereign wealth funds (SWFs) whose flows are not reported in BOP official sectors (Bahrain, Brunei, Iran, Kuwait, Oman, Qatar, Saudi Arabia (before 2005), Trinidad and Tobago, and United Arab Emirates). For the United States and Mexico, we subtract the Federal Reserve swap flows in 2007-11. These dollar swaps represent matched purchases and forward sales of dollars and thus do not create any net change in currency positions of the official sector.

NPFX: BOP net financial account flows minus BOP net investment income minus NOF.

NOA: IFS foreign exchange reserves minus WDI external public sector debt. Missing values of external public debt (mainly for advanced economies with little or no foreign-currency public debt) are set to zero. For Australia, NOA is adjusted for derivatives positions using data published by the Reserve Bank of Australia. For China, we add in some other official-sector assets following the suggestions of Setser and Pandey (2009), but the additions are small relative to the reported reserves. For Norway we add in assets of the SWF as reported by Norges Bank. For Singapore, we substitute year-end 2009 NOA with financial assets of the government of Singapore as of March 2010 from the Ministry of Finance. We use the perpetual inventory method to calculate NOA for other years based on NOF.

GDP: Nominal GDP in US dollars and in local currency, and real GDP are from WEO.

CAPMOB: Measures of capital mobility are based on the following data.

Chinn-Ito: Capital controls index based on Chinn and Ito (2006), updated, from IMF staff.

Schindler: Capital controls index based on Schindler (2009), updated, from IMF staff.

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28 The remaining recipients of these swap flows are all advanced economies, and their other official liabilities flows are set to zero in any case. For the United States, swap flows show up in the other central bank assets flows.
Quinn: Capital controls index based on Quinn (1997), updated, from IMF staff.

Financial Risk Index: ICRG

Rule of Law Index: WGI

Regulatory Quality Index: WGI

BOP Financial Share: The sum of BOP gross direct investment, portfolio investment, and other investment flows divided by the sum of the same gross financial flows plus gross current account flows.

BOP Financial/GDP Ratio: The sum of BOP gross direct investment, portfolio investment, and other investment flows divided by nominal GDP (WEO).

Bank Assets/GDP Ratio: Deposit money bank assets to GDP (WDI).

Relative PPP GDP Per Capita: WEO (relative to US level). We set this as missing before 1996 for European and central Asian transition economies.

Aging: 10-year forward change in ratio of elderly to working age population. Historical elderly ratios through 2010 are from WDI. Ratios for 2015 and 2020 are from UN and are interpolated and extrapolated in order to create 10-year changes for 2001-11.

Growth: 5-year moving average of growth rate of real GDP based on WEO. We corrected an error in Malta real GDP using IFS data. We set real GDP growth as missing for European and central Asian transition economies before 1996.

Energy: Difference between energy production and consumption in tons of oil equivalent (WDI), converted into dollars using Brent oil price (IFS) assuming 7.33 barrels per ton and divided by nominal GDP (WEO).

Fiscal: General government balance in percent of GDP (WEO) is cyclically adjusted as the residual in a panel regression of the fiscal balance on the GDP gap with no country or year effects. The GDP gap is created as the difference between log real GDP and its 11-year centered moving average using WEO forecasts for 2013-16. A missing value for South Africa in 2005 is interpolated.

Instruments:


GOA/IMP: Gross official assets (NOA plus external public debt) divided by imports of goods and services (BOP).
Scaling by trend GDP: When scaling data by GDP, we use the 11-year centered moving average of nominal GDP in US dollars (WEO), including forecast data through 2016.

Treatment of euro area: The 11 original members of the euro area (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain) plus Greece are treated as a single country by adding up data or creating nominal GDP-weighted averages where appropriate. The exception to this rule is euro-area foreign exchange reserves, which are taken from IFS data for the euro area with additions for Greece in 1999 and 2000 and subtractions for the late joiners in years after they joined (from 2007 onward). Before 1999, euro-area reserves are calculated as 74 percent of the sum of individual members’ reserves (based on the downward adjustment in January 1999) to exclude reserves in each others’ currencies. Late joiners are treated as separate countries throughout (Cyprus, Estonia, Latvia, Malta, Slovak Republic, and Slovenia).
References


International Monetary Fund.


Figure 1. Net Official Financial Flows (USD billions)

Note: Excludes countries with large unreported sovereign wealth funds.
Sources: IMF Balance of Payments, Norges Bank, and authors' calculations.

Figure 2. Net External Accounts of Countries with Current Account Surpluses (percent of world GDP)

Note: Excludes countries with large unreported sovereign wealth funds.
Sources: IMF Balance of Payments, Norges Bank, and authors' calculations.
Figure 3. Median Values of Capital Controls (Inverted)

Source: International Monetary Fund. Excludes low-income countries.

Figure 4. Median Values of Institutional Quality Measures

Source: International Monetary Fund. Excludes low-income countries.
Table 1. Common sample regressions with different measures of capital mobility, 1995-2010, annual, GDP weighted, excluding United States, euro area, and low-income countries.
Table 2. Common sample regressions with different measures of capital mobility, 1995-2010, annual, GDP weighted, excluding United States, euro area, and low-income countries.

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Robust standard errors below coefficients
* p<0.1, ** p<0.05, *** p<0.01

Table 3. Robustness with alternate principal component from table 2, 1986-2010, annual.
Table 4. Robustness with ratio of BOP financial flows to GDP, 1986-2011, annual.

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Robust standard errors below coefficients
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Table 5. Robustness with Quinn measure of capital controls, 1986-2011, annual.

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Robust standard errors below coefficients
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Table 6. Instrumental variables with different mobility measures and samples, 1986-2011.

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

Robust standard errors below coefficients
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<td>Estimated Contributions</td>
<td>-3.6</td>
<td>-8.1</td>
<td>-7.4</td>
<td>1.2</td>
<td>0.0</td>
<td>-0.4</td>
</tr>
<tr>
<td>Romania</td>
<td>2009</td>
<td>-4.1</td>
<td>-8.1</td>
<td>-8.2</td>
<td>-1.8</td>
<td>1.7</td>
<td>-2.3</td>
</tr>
<tr>
<td>Data</td>
<td>Estimated Contributions</td>
<td>-2.7</td>
<td>-4.2</td>
<td>1.3</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

$^1$CAPMOB data multiplied by 100.

Note: Contributions are based on average coefficients in first four columns of table 6.

Table 7. Data and estimated contributions to current account in percent of GDP, relative to world averages.