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17-15 Do Governments Drive Global Trade Imbalances?

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Abstract

This paper examines the extent to which government policies are responsible for the pattern of current account (trade) imbalances and, by implication, the extent to which such policies might be used to achieve the G-20 goal of reducing imbalances. Fiscal balances and foreign exchange intervention are the most important observable factors behind differences in current account balances across countries and over time. This finding is robust to alternative equation specifications, estimation techniques, and sample selections. The empirical results in this paper strongly suggest that G-20 countries (and others) have the necessary tools to achieve their stated goal of narrowing current account imbalances.

JEL Codes: F32, F41, F42
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INTRODUCTION

Since the Pittsburgh Summit of September 2009, the leaders of the G-20 nations have agreed to pursue "strong, sustainable, and balanced growth" including a commitment to "promote more balanced current accounts."[1] Global current account imbalances did narrow somewhat in the immediate aftermath of the global financial crisis of 2008, but they have remained broadly constant since about 2010 in relation to national economies.[2] Surpluses in China and some commodity exporters have narrowed, but surpluses in the euro area and some Asian economies have grown. Deficits in the United States and the United Kingdom are roughly the same as seven years ago.

At current levels, these imbalances will push the net debt of deficit countries gradually toward unprecedented and unsustainable levels (Bergsten and Gagnon 2017, 60). Moreover, the domestic political consequences of persistent trade deficits are already evident in both the United States and the United Kingdom, having contributed importantly to the election of Donald Trump and the outcome of the Brexit referendum (Bergsten and Gagnon 2017, 8). This paper examines the extent to which government policies are responsible for the pattern of imbalances and, by implication, the extent to which such policies might be used to achieve the G-20 goal of reducing imbalances.

There are two broad approaches to modeling current account balances. The first focuses on proximate causes, in which trade flows respond to exchange rates and aggregate demand or output (Goldstein and Khan 1985, Marquez 2002). However, exchange rates and output themselves respond endogenously to trade shocks. A second approach focuses on medium-term, relatively exogenous factors, such as demographics, natural resources, and policy stances (Chinn and Prasad 2003, Gruber and Kamin 2007). Recent studies build on the second approach by adding measures of a country's exchange rate policy based on its official purchases of foreign assets (Gagnon 2012; IMF 2012; Gagnon 2013; Bayoumi and Saborowski 2014; Bayoumi, Gagnon, and Saborowski 2015; and Gagnon et al. 2017).

This paper updates and extends the data in Gagnon et al. (2017) using publicly available sources.[3] It presents revised estimates of the model in that paper. The updated data are described in the data appendix and are available at www.piie.com. The new regressions run through 2015 instead of 2014 and now include observations for some countries with sovereign wealth funds (SWFs) that were not included in the previous study.

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1. These quotes are from the Leaders Statement at the Pittsburgh summit. Most subsequent summits have issued statements with similar language. See the G-20 Information Centre at www.g20.utoronto.ca.

2. The current account records all income received from foreigners and payments made to foreigners. It is dominated by trade in goods and services, but also includes income receipts on domestically owned factors of production (capital and labor) that are employed abroad and payments to foreign-owned factors of production at home. Unless specifically noted, the term trade balance is used as shorthand for current account balance.

3. Bayoumi, Gagnon, and Saborowski (2015) and Gagnon et al. (2017) rely on confidential IMF data that cannot be made available to the public.

REGRESSION SPECIFICATION

Equations 1 and 2 present the baseline specifications.[4]

$$\frac{\mathrm{CAX_{it}}}{\mathrm{GDP_{it}}} = \alpha_1\left(\frac{\mathrm{NOF_{it}}}{\mathrm{GDP_{it}}}\right) + \alpha_2\left(\frac{\mathrm{NOF_{it}}\times\mathrm{MOB_{it-1}}}{\mathrm{GDP_{it}}}\right) + \beta_1\left(\frac{\mathrm{NOA_{it-1}}}{\mathrm{GDP_{it-1}}}\right) + \beta_2\left(\frac{\mathrm{NOA_{it-1}}\times\mathrm{MOB_{it-1}}}{\mathrm{GDP_{it-1}}}\right) + \delta_1\mathrm{SPILL_{it}} +$$

$$\mu_1\mathrm{AUX_{it}} + \mu_2(\mathrm{AUX_{it}}\times\mathrm{MOB_{it-1}}) + \theta_t\mathrm{year_t} + u_{it} \quad (1)$$

$$\frac{\mathrm{NPFX_{it}}}{\mathrm{GDP_{it}}} = (\alpha_1 - 1)\left(\frac{\mathrm{NOF_{it}}}{\mathrm{GDP_{it}}}\right) + \alpha_2\left(\frac{\mathrm{NOF_{it}}\times\mathrm{MOB_{it-1}}}{\mathrm{GDP_{it}}}\right) + \beta_1\left(\frac{\mathrm{NOA_{it-1}}}{\mathrm{GDP_{it-1}}}\right) + \beta_2\left(\frac{\mathrm{NOA_{it-1}}\times\mathrm{MOB_{it-1}}}{\mathrm{GDP_{it-1}}}\right) +$$

$$\delta_1\mathrm{SPILL_{it}} + \mu_1\mathrm{AUX_{it}} + \mu_2(\mathrm{AUX_{it}}\times\mathrm{MOB_{it-1}}) + \theta_t\mathrm{year_t} + v_{it} \quad (2)$$

CAX and NPFX are the current account and net private financial flows, each excluding net investment income to remove the relatively predictable influence of income on asset stocks and thus focus more on trade in goods and services. NOF is net official flows, NOA is the stock of net official assets, and MOB is the Aizenman, Chinn, and Ito (2015) measure of legal restrictions on capital mobility, normalized to the unit interval [0-1], for which a higher value indicates fewer restrictions on private capital flows.[5] NOF is defined as the acquisition and disposition of assets and liabilities denominated in foreign currency by public-sector institutions in the reporting country.[6] The auxiliary variables (AUX) include MOB, financial integration (the share of gross private financial account transactions in total current account and financial account transactions), lagged purchasing power parity (PPP) GDP per capita relative to the United States, the 10-year forward change in the old-age dependency ratio, the lagged real GDP growth rate over the previous five years, net energy exports relative to GDP, and the cyclically adjusted fiscal balance relative to GDP.[7] Finally, the regressions include a full set of time effects or dummy variables for each year.

Equation 1 presents the current account as a function of NOF and other variables. The coefficient α_1 represents the effect of NOF on the current account, and the coefficient α_2 allows for a differential effect depending

4. One of the variables of interest in Gagnon et al. (2017) is a measure of unconventional monetary policy, or quantitative easing (QE), based on the cyclically adjusted change in the central bank's stock of domestic assets. Gagnon et al. had access to confidential data from the International Monetary Fund (IMF), but availability of this variable was limited, and its inclusion required a 16 percent reduction in the sample size. Based on current publicly available IMF data, including this variable would imply a 42 percent reduction in the sample size of this paper. Including QE and QE interacted with capital mobility in the baseline regressions of this paper (not shown) yields coefficients that are close to zero and not statistically significant. Thus, QE is not included in the following regressions.

5. MOB is lagged in all regressions, including in interaction terms, even when the interacted variable is not lagged.

6. The dominant form of official 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.

7. The adjusted fiscal balance is the residual from a regression of the fiscal balance on the level and growth rate of the output gap.

on the level of capital mobility. The coefficient β_1 represents the effect of lagged net official asset stocks on the current account, while the coefficient β_2 allows for a differential effect with higher capital mobility.

Equation 2 is a restatement of the link between the official flows and the current account in equation 1 that takes advantage of the balance of payments (BOP) identity:

CAX = NOF + NPFX + errors and omissions.

Any increase in NOF must be associated with some combination of an increase in CAX or a reduction in NPFX that jointly equal the change in NOF. When NOF has no effect on CAX (i.e., α_1=0), it must cause a one-for-one reduction of NPFX. Because of errors and omissions in the BOP data, these regressions are not identical. The bias from measurement error in NOF in the estimate of α_1 is downward in equation 1 and upward in equation 2, which helps to put a range on its true value, and makes the average of the coefficient estimates from the two equations a convenient statistic to reduce measurement error.

The specifications in equations 1 and 2 further include interactions between all of the auxiliary variables and the MOB term. The additional interaction terms are included because the effect of some of the auxiliary variables could vary with capital mobility. For example, demographic or fiscal influences on domestic interest rates may lead to higher capital flows, and thus larger current account imbalances, when capital markets are less restricted. Finally, SPILL, a measure of spillovers of aggregate global net official outflows on countries' current accounts, is included.

A key empirical issue is the potential endogeneity of official flows to shocks to current account balances and net private flows. On the one hand, endogenous movements are 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, saving resource revenues for future generations, borrowing for economic development, and achieving 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 NOF if current account (trade) shocks dominate, and a negative bias if private financial shocks dominate.

Instrumental variables regressions can address the potential endogeneity of NOF to shocks to current account balances and net private flows. The challenge is to isolate the variation in NOF that is not driven by shocks that simultaneously drive CAX and/or NPFX. Valid instruments must reflect exogenous motives for reserve accumulation. The first instrument is the incidence of a financial or currency crisis in the previous three years and the second is the portion of NOF that is not related to foreign exchange reserves.[8] The idea behind the former is that it captures a higher propensity to build up reserves for precautionary reasons following a crisis episode. The latter captures SWF-related asset flows as well as development loans. Both SWF flows and development loans are likely to reflect longer-term savings and investment motives and, conditional on the control

8. The set of instruments also includes their interaction with MOB since both NOF and its interaction with MOB need to be instrumented.

variables in the second stage, generally not to respond systematically to exchange rate shocks.[9] The results below explore the validity of these instruments and the robustness of the results.

The SPILL term explores how NOF impacts the current accounts of other countries. In principle, any effect of NOF on the current account of the country purchasing the assets must have an equal and opposite effect on current accounts in the rest of the world. The inclusion of a complete set of time effects in the regressions controls for spillovers of each country's policies on the assumption that they are distributed equally to all countries as shares of GDP. However, the framework allows testing alternative assumptions about spillovers. Gagnon et al. (2017) found that spillovers appeared to flow more toward countries with greater financial integration with the rest of the world. This paper employs an updated version of the financial integration variable that now has a more significant direct effect on the current account and only a small and insignificant role in allocating spillovers.[10] Instead, allocating spillovers according to a country's share in foreign exchange reserves generally works better. The new spillover term applies weights of 62 percent for the United States, 26 percent for the euro area, small weights for a few other advanced economies, and zero weights for all other economies.[11] These weights are multiplied by the sum of NOF across all countries divided by world GDP. No interaction term is included because countries issuing reserve currencies within the sample all have high levels of MOB.

ESTIMATION RESULTS

The regressions cover up to 31 years, 1985 through 2015, for 111 countries. Many countries are missing observations, especially near the beginning of the sample. The regressions exclude countries with GDP of less than US$1 billion in 2015 as well as the war-torn countries of Afghanistan, Iraq, and Syria.[12] The euro area is included as a single country beginning in 1999; individual members are not included before they joined the union. A detailed description of the data is contained in the data appendix. The coefficient standard errors are robust to heteroskedastic and first-order autocorrelated errors. Significance levels are denoted by one asterisk (5 percent) and two asterisks (1 percent).

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9. Changes in energy prices alter revenues to be allocated to SWFs in some countries, but this effect is controlled for on the right-hand side of the equation through the net energy exports term. Gagnon et al. (2017) show that net energy exports are strongly correlated with the current account only in countries that actively save energy revenues abroad.

10. In Gagnon et al. (2017), the financial integration variable was affected by gaps in certain categories of financial flows for some countries that had to be set to zero to avoid excessive missing observations. That problem is reduced in the latest data vintage.

11. These weights are based on the IMF's Currency Composition of Foreign Exchange Reserves (COFER) data in 2010. The stock shares fluctuate over time, mainly reflecting valuation adjustments as exchange rates change, and not necessarily any change in annual flow shares. The 2010 values are near the midpoints of the stock shares since 1985.

12. Kuwait in 1991 is also excluded from the regression because this outlier has a substantial effect on the results. In 1991 after the Gulf War, Kuwait drew down its SWF assets by nearly $40 billion (174 percent of trend GDP) to rebuild the country. This event strongly supports the conclusion that NOF affects the current account, but the difference in scale from other observations raises concerns about nonlinear effects that would be difficult to address.

Baseline Regression and First-Stage Diagnostics

The first-stage regression results (table 1a) reveal that the two instruments are significant for both NOF and NOF interacted with MOB.[13] (The noninteracted instruments are significant for the noninteracted NOF, and the interacted instruments are significant for the interacted NOF.) The instruments show the expected positive signs in the first-stage regression, and the F-test statistic takes values significantly larger than 10; the null hypothesis that these instruments are irrelevant is thus comfortably rejected. Similarly, the Angrist-Pischke first-stage chi-squared statistic rejects the null that the NOF term is unidentified. At the same time, the values of the first-stage R^2s are around 0.6, and the partial R^2s are around 0.4, and thus do not signal overfitting.

The second-stage results (table 1b) show that the coefficient on the original SPILL term has the expected negative sign, but it is much smaller than in Gagnon et al. (2017) and not statistically significant.[14] The new SPILL term is significant. The remaining coefficients are not much affected by the choice of SPILL term. Some of the coefficients differ noticeably according to the dependent variable (CAX or NPFX), but many do not. As in the previous study, the effects of measurement error can be minimized by focusing on an average of the coefficients in equations 1 and 2.

Table 2 presents the baseline results as well as some robustness checks for the effects of alternative variables. The table displays averages of the coefficients and standard errors in the CAX and NPFX regressions.[15] The R^2s refer only to the CAX regression because the focus of this paper—and that of all other studies—is on explaining current account balances, not private financial flows. The first column is the baseline result, which is based on the last two columns in table 1b.

In the baseline regression, financial integration has a significant negative effect on the current account in countries with low capital mobility, but this effect diminishes with higher values of MOB. Projected aging has a moderate positive effect that increases slightly with MOB. For a country with MOB=1, a projected increase in the ratio of elderly to working-age population of 1 percentage point over the next 10 years raises the current account about 0.5 percent of GDP. Net energy exports have a modest positive effect with low mobility, but this effect diminishes with higher MOB. The fiscal balance has little effect when MOB=0. But when MOB=1, the current account rises by $0.68 for each $1 rise in the fiscal balance. When MOB=0, the current account rises by $0.55 for each $1 rise in NOF, but this declines to $0.34 when MOB=1. The lagged stock of net official assets has a marginally significant negative effect when MOB=0, but this vanishes as MOB increases. As noted above, the SPILL term is negative and significant. The country most affected by SPILL is the United States because the dollar represents about 62 percent of global foreign exchange reserves. Over the regression sample,

13. The first-stage regressions are not affected by the choice of the dependent variable, CAX or NPFX.

14. A SPILL term constructed by interacting MOB with global NOF divided by global GDP is not significant either.

15. Using average standard errors is valid on the assumption of perfect correlation between the two coefficients. To the extent that coefficients are less than perfectly correlated, the true standard error would be smaller. Thus, the significance levels in this paper are conservative.

global NOF averaged about 1 percent of global GDP, and the implied spillover to the US current account was about –2 percent of US GDP.

Robustness to Auxiliary Variables

The auxiliary variables are chosen based on availability and robustness in previous research. In Gagnon et al. (2017), projected aging was not significant in either level or interacted form, and relative per capita GDP and lagged growth were significant only in interacted form. (Moreover, the relative GDP coefficient had the wrong sign.) In the baseline regression of this paper (column 1 of table 2), only projected aging has a significant coefficient (at the 5 percent level with the correct sign). Results not shown explore adding the level of the old age ratio, the level of the youth ratio, the growth rate of a centered 11-year moving average of real GDP, and different measures of trade barriers.[16] None of these has a significant coefficient, and their inclusion in the baseline regression has no noticeable effect on the policy coefficients (fiscal balance, NOF, NOA, and SPILL).

Chinn (2017) finds that relative per capita GDP has a significant effect when entered both in level and squared form. Column 2 of table 2 replicates Chinn's result by adding relative GDP squared in the baseline regression. Relative GDP has a positive effect on the current account (as expected), but this effect disappears in countries with very high capital mobility. Relative GDP squared has a negative effect, but this effect also disappears with high mobility. However, these results do not hold up when observations are weighted by GDP or when using a regression technique that is robust to outliers. (Weighted and robust regressions are discussed in the next section.) Because the coefficients on relative GDP squared are not robust to alternative estimation methodologies and because they have no meaningful effect on any of the policy coefficients in the baseline specification, relative GDP squared is excluded from further analysis.

Column 3 displays a regression on only the policy variables after dropping all auxiliary variables including the year effects. The fiscal coefficients are much larger than in the baseline, as is the effect of NOF under low mobility. The effect of NOF under high mobility and the effects of NOA and SPILL are not much affected. These four variables alone (with their interaction terms) are able to explain 36 percent of the variance of imbalances as denoted by the regression R^2.

A variable that is commonly included in the literature is the lagged stock of net foreign assets. This variable is important because net investment income on foreign assets is a component of the current account. This paper focuses on the current account excluding net investment income, suggesting that net foreign assets are not required. A component of net foreign assets, net official assets (NOA), is included in order to capture the lagged effect of past net official flows. Column 4 displays the results of adding the nonofficial part of net foreign assets, net private assets, to the baseline regression. This variable has a small and insignificant negative effect under low capital mobility, similar to that of net official assets. Adding this variable has a noticeable effect on the financial

16. The measures of trade barriers are the simple average and the trade-weighted average of tariff rates across goods categories. The coefficients on these variables are both economically and statistically insignificant. Data are from the World Bank's World Development Indicators database.

integration coefficients, but almost no effect on any other coefficient. Column 5 displays a regression of the total current account, including net investment income. Both net official assets and net private assets have a small positive effect on the total current account, as expected. The SPILL term becomes smaller in magnitude. The other policy coefficients are only modestly affected.

Robustness to Estimation Technique

Table 3 displays results using different estimation techniques. Column 1 repeats the baseline regression. Column 2 is the ordinary least squares (OLS) version of this regression. Most coefficients are similar to those in the first column, with a slightly larger fiscal coefficient. NOF enters directly into this regression without using first-stage instruments, and the NOF coefficients may be biased. The bias when NOF is responding endogenously to exchange rate pressures can go in either direction depending on whether the pressures arise from trade or from financial shocks. The OLS NOF coefficients are slightly smaller on balance, suggesting that financial shocks are a more important driver of intervention (NOF) than trade shocks.

Column 3 replaces the baseline instruments with a full set of country dummies after dropping a few countries that had less than five observations with available data. These instruments allow for idiosyncratic but persistent differences in desired reserve accumulation across countries. To the extent that current account shocks are persistent—and they are likely more persistent than financial shocks—the country dummy coefficients may have some correlation with current account shocks in the finite sample, giving rise to an upward bias on the NOF coefficient. Following this reasoning, one would expect the estimated effect of NOF on the current account to be larger in column 3. Although the estimated value when MOB=0 is smaller than in the baseline results, the interaction term becomes positive and quite large, implying a much larger overall estimate of the effect of NOF on the current account. The fiscal effect under high mobility, on the other hand, becomes smaller.

Column 4 is a regression weighted by each country's share of world nominal GDP. In this regression the euro area and the United States are dropped because they account for nearly half of world GDP and they have only negligible amounts of official flows. Many coefficients exhibit little change. Projected aging has a larger effect with low capital mobility but a smaller effect with high mobility. The fiscal effect is somewhat smaller. The effect of NOF is a bit smaller with low MOB but considerably larger with high MOB. The negative effect of lagged NOA is diminished in this regression. The SPILL coefficient is much larger in magnitude but no longer statistically significant.

Column 5 is based on a robust regression that aims to reduce the influence of outliers in the data.[17] These regressions use fitted values of the instrumented variables from separate first-stage regressions.[18] The main differ-

17. The regression uses the command "rreg" in Stata, which uses an iterative procedure to apply reduced weights to observations with particularly large residuals.

18. Because the first-stage regressions are conducted outside the second-stage regression framework, the coefficient standard errors on NOF and interacted NOF have been multiplied by the reciprocals of the respective first-stage R^2s.

ences from the baseline results are a somewhat smaller fiscal effect with high MOB, a somewhat larger negative effect of MOB on the NOF coefficient, and a considerably larger positive effect of MOB on the NOA coefficient.

It is standard in this line of research to exclude country fixed effects from the regression in order to use information from persistent differences across countries to identify causal factors behind persistent current account balances. The sixth and seventh columns remove the effects of persistent country differences by adding a full set of country fixed effects. The regression in column 6 adds fixed effects to the baseline regression; the regression in column 7 adds fixed effects to the weighted regression.[19]

Adding country fixed effects gives rise to changes from the baseline coefficients that are seemingly fragile, in that they depend on whether the observations are weighted or unweighted. One change that is robust is the large negative effect of lagged growth, which is a feature that characterized the results of Gagnon et al. (2017). Focusing on the coefficients of primary interest, the effect of NOF under low mobility declines a bit, but the interacted effect of NOF switches sign in the weighted version (and the robust version as well, not shown). The NOA effect is either a bit more or a bit less negative. The SPILL effect becomes insignificant in any version with country effects, probably because the US dummy is significantly negative.[20] Overall, the results with country fixed effects broadly support the conclusion that NOF, NOA, and the fiscal balance have empirically large effects on current accounts, even if these effects are not precisely measured.

Robustness to Regression Sample

Table 4 explores the effects of different samples on the results. Column 1 repeats the baseline results. Column 2 displays results limited to emerging and developing economies. In these economies, financial integration is associated with larger deficits for countries with low mobility, but this effect reverses for countries with high mobility. Relative income has the expected positive effect only in low mobility countries, but this switches to an unexpected negative effect when MOB is high. There is little difference from the baseline in the effects of NOF and NOA. SPILL is not identified in this regression because none of the emerging and developing economies had a reserve currency in this sample. Results for advanced economies (column 3) include implausibly large effects of NOF on the current account: $1.31 for each $1 of NOF with MOB=0 and $0.93 with MOB=1. One issue with the advanced economy sample is that MOB is uniformly high and there is little information with which to estimate the interaction effects. This means that the noninteracted coefficients are poorly estimated and one should focus mainly on the sum of the noninteracted and interacted coefficients.

The remaining columns of table 4 explore the implications of the exchange rate regime. The real exchange rate is a key element of the transmission from underlying shocks to the current account. The most obvious effect of exchange rate flexibility is on the speed of adjustment, which should not have a large effect on the estimates

19. Estimation with country random effects instead of fixed effects makes little difference to the coefficients. Adding country fixed effects to the robust regression yields results broadly similar to those of column 7.

20. The US fixed effect is –8.4 compared to a mean fixed effect of 2.6 in the unweighted regression. (The dependent variable is expressed in percentage points of GDP.)

because they are determined mainly by the long-run relationships. Flexible exchange rates are likely to allow a faster adjustment to shocks, but even under strictly fixed nominal exchange rates, real exchange rates can adjust through movements in relative prices. The excess demand pressures that drive such price movements may also have important effects on trade balances. Moreover, some shocks operate directly through spending decisions, for example in countries where the government borrows in foreign currency (a reduction in NOF) to buy imports (a reduction in CAX).

Columns 4 and 5 split the sample into relatively fixed and relatively flexible exchange rates based on the Aizenman, Chinn, and Ito (ACI 2015) measure of exchange rate volatility within each year. Columns 6 and 7 split the sample based on the Ilzetzki, Reinhart, and Rogoff (IRR 2017) fine classification. Although the coefficients are not identical across fixed and flexible rate regimes, many of the differences are rather small considering the extreme nature of the test. The capital mobility, financial integration, and projected aging coefficients are particularly sensitive to this sample split. Not surprisingly, the SPILL term is sensitive to this sample split. It is surprising, however, that the SPILL coefficient is more significant in the fixed regime as the economies that are primarily affected by SPILL—the United States and the euro area—are almost entirely in the flexible regime sample.[21]

This split should be particularly informative concerning simultaneity bias. Recall that any bias likely arises from countries that use NOF to stabilize their exchange rates. If the main shocks are to the current account, then the NOF coefficient will be biased upward (e.g. China 2007), but if the main shocks are to the financial account, then the NOF coefficient will be biased downward (e.g. Japan 2011). This bias should be greatest in countries with the most stable exchange rates. Thus, the coefficients in countries with flexible exchange rates ought to be relatively unbiased.

The results show that the bias seems to be downward, as the NOF and NOA coefficients broadly are smaller in the fixed rate regimes. NOF and NOA coefficients are moderately larger in the flexible regimes. But the differences are not huge, especially for low mobility countries.

DISCUSSION OF RESULTS

Explanatory Power of Policy Variables

As shown in table 2, the four policy variables jointly explain 36 percent of the variance of current account balances. The remaining six nonpolicy variables together have the same explanatory power. In regressions of the current account on a single variable at a time (including interaction with capital mobility) the highest R^2 (0.32) is associated with fiscal policy and the third highest (0.22) with net official flows. Net energy exports are associated with the second highest individual-variable R^2 (0.29). Relative per capita GDP is associated with a distant fourth-place R^2 of 0.12.

Gagnon et al. (2017) show that the connection between net energy exports and the current account is strongly linked to a government's decision to save the energy revenues through net official flows. Oil exporters

21. The euro area is in the ACI fixed regime in 2015 owing to low exchange rate volatility within that year.

with high NOFs tend to have current account surpluses, whereas oil exporters with low or negative NOFs tend to have low or negative current account balances. Thus, a considerable amount of the apparent explanatory power of net energy exports actually derives from the government's decision to save the revenues in foreign assets, that is NOF.

Taken together, two variables—the fiscal balance and NOF—provide the lion's share of the explanatory power of these regressions for current account balances.

Collinearity of Policy Variables

Within the baseline sample, the policy variables are positively correlated with each other: The correlation between NOF and lagged NOA is 0.32; between NOF and the adjusted fiscal balance, 0.51; and between lagged NOA and the fiscal balance, 0.25. When looking across alternative sets of regression coefficients, a decrease in the estimate of one of these coefficients is often associated with an increase in the estimate of another. For example, the interacted NOF coefficient in the robust regression (column 5 of table 3) is lower (more negative) than in the baseline regression but the interacted NOA coefficient is higher. Another example is the higher fiscal coefficient with the alternative instruments (column 3 of table 3) that is associated with a lower NOF coefficient relative to the baseline regression.

These collinearity effects are greatest between NOF and lagged NOA. They may arise in part from differences in the dynamic effects of NOF on the current account across observations. For example, a decision to build up reserves for precautionary purposes might have a lagged effect on the current account. In that case, the lagged NOA should play a role in explaining the current account. On the other hand, the automatic funneling of higher oil revenues into SWF assets has an apparently immediate effect in allowing the current account to rise and stay high. In that case, the NOF variable is what matters.

Interaction of Policy with Mobility

Capital mobility has the expected effect on all of the policy coefficients. The effect of fiscal policy is greater with open capital markets. A larger fiscal deficit, which raises domestic interest rates, will attract more private foreign capital (reducing the trade balance) when financial markets are open. Similarly, a fiscal surplus, which depresses domestic interest rates, will spur domestic residents to invest abroad (increasing the trade balance), and capital mobility enables them to do so.

The effect of net official flows is smaller with open capital markets. When private capital is not free to flow, any trade imbalance must be financed by official flows, implying a NOF coefficient near unity. However, as capital mobility increases, the private sector is able to arbitrage away some of the effects on domestic interest rates caused by official financial flows, and in so doing, reduces the impact of NOF on the exchange rate and trade balance.

The effect of the lagged stock of net official assets should be near zero when capital mobility is low. The finding of a negative coefficient on NOA is the main puzzle of these results. However, the size of this effect is

rather small and not robustly significant across specifications. As mobility increases, NOA is expected to have a positive effect. This positive effect reflects some combination of a lagged effect of past official flows and a portfolio balance effect in which the stock of official assets alters the availability of domestic and foreign currency assets in private portfolios. The central tendency of this effect is rather small, however.

An interesting and intuitive property of the baseline results, as well as most of the alternative regressions, is that the sum of the fiscal and NOF effects lies between 0.5 and 1. For example, in the baseline regression under the lowest capital mobility, the sum of these coefficients is 0.7, and under highest capital mobility the sum is 1.0. When a government runs a fiscal surplus and invests the surplus entirely in foreign assets, the current account rises by an amount nearly equal to the fiscal surplus, as is evident in countries such as Norway and Singapore.

Central Tendencies of Policy Coefficients

Although coefficient estimates vary somewhat across specification in tables 2 through 4, a broad conclusion is that the policy variables (NOF, NOA, fiscal balance) generally have a positive effect on the current account. The only exception to this conclusion is the small negative coefficient on NOA under low mobility.

Each of the regressions in table 3 plus the flexible regime regressions of table 4 have advantages and drawbacks relative to each other. Which is to be preferred depends on one's opinions concerning the different instruments (including no instruments), the information or noise in outliers, whether focusing on more flexible regimes reduces bias or introduces noise from a smaller sample, and whether the sacrifice of information from persistent cross-country differences is justified to prevent the results from being contaminated by spurious country-specific factors.

One approach is to examine the central tendencies of the coefficients across the seven regressions of table 3 plus the two flexible regime regressions of table 4. Table 5 displays the ranges of the estimated coefficients after eliminating the two highest and two lowest values of the nine total estimates. The reported values for high mobility (MOB=1) are the sums of the noninteracted and interacted coefficients. Note that the median value of MOB in the baseline sample is 0.45, with 7 percent of observations having MOB=0 and 25 percent having MOB=1. Thus, the effects of the policy variables for the median country are very nearly in the middle of the two sets of central tendencies.

For a country with the median level of MOB: A $1 increase in the fiscal balance would increase the current account about $0.25 to $0.40, a $1 increase in net official flows would increase the current account about $0.35 to $0.55, and a $1 increase in the lagged stock of net official assets would have a negligible effect. The spillover effect is not interacted with mobility but is instead related to a country's role in issuing a reserve currency. The lion's share of spillovers accrues to the United States, given its 62 percent share of reserves. A $1 increase in global NOF is estimated to reduce the US current account about $0.10 to $0.55.[22]

22. This calculation depends on the ratio of US to world GDP, which was about 24 percent in 2015. A central tendency based on eliminating the three highest and lowest coefficients would be about $0.25 to $0.45.

CONCLUSION

The historical evidence shows that both fiscal policy and foreign exchange intervention (net official flows and stocks) have important effects on current account balances. Fiscal surpluses and reserve accumulation tend to increase a country's current account balance. These findings are robust to alternative specifications, estimation techniques, and sample choices.

Because current accounts must balance out at the global level, factors that increase surpluses in some countries must increase deficits in other countries. Reserve accumulation has an especially large negative effect on the current account balances of reserve-issuing countries, mainly the United States and the euro area.

These empirical results strongly suggest that G-20 countries (and others) have the necessary tools to achieve their stated goal of narrowing current account imbalances. President Trump and some members of his administration have proposed using trade barriers to narrow the US current account (trade) deficit. The data show that trade barriers have very little effect on a country's trade balance. Fiscal policy and net official flows are the policies that matter for trade balances. Indeed, the relatively large US fiscal deficit in 2017 is a significant contributor to the US trade deficit. Increasing the fiscal deficit likely would cause the trade deficit to widen.

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Table 1a Baseline regressions: First-stage results (coefficients displayed only for instruments)

First stage for NOF	Original	Baseline
Nonreserve flows	0.89**	0.88**
Interacted with mobility	–0.03	–0.03
Lagged crisis dummy	0.80	0.80
Interacted with mobility	0.15	0.13
R-squared	0.58	0.58
Partial R-squared	0.35	0.35
F-test	122.14	120.61
(p-value)	(0.00)	(0.00)
AP Chi-sq test	231.77	228.77
(p-value)	(0.00)	(0.00)
First stage for NOF interaction	**Original**	**Baseline**
Nonreserve flows	0.01	0.01
Interacted with mobility	0.85**	0.85**
Lagged crisis dummy	–0.23	–0.22
Interacted with mobility	1.57*	1.58*
R-squared	0.59	0.59
Partial R-squared	0.38	0.38
F-test	55.21	54.57
(p-value)	(0.00)	(0.00)
AP Chi-sq test	419.66	412.91
(p-value)	(0.00)	(0.00)

* p<0.05, ** p<0.01

Note: Numbers reported in gray are standard errors.

Source: Author's calculations based on equations 1 and 2 using data described in the data appendix.

Table 1b Baseline regressions: Second-stage results

	Original		Baseline	
	CAX	NPFX	CAX	NPFX
Capital mobility (MOB)	-1.60 2.15	-6.44** 2.32	-1.93 2.16	-6.66** 2.32
Interacted with mobility	0.76 1.78	5.76** 1.92	0.86 1.78	5.80** 1.91
Financial integration	-9.76** 3.13	-5.67 3.64	-10.49** 2.47	-8.53* 3.40
Interacted with mobility	7.08 4.43	4.23 5.52	7.51 4.40	4.37 5.55
Relative PC GDP	1.40 1.73	1.68 1.99	1.26 1.72	1.45 2.01
Interacted with mobility	-1.19 2.53	-3.39 2.64	-0.51 2.56	-2.64 2.69
Projected aging	0.42* 0.17	0.29 0.17	0.42* 0.17	0.30 0.17
Interacted with mobility	0.04 0.21	0.20 0.22	0.04 0.21	0.18 0.22
5-year growth	-0.16 0.09	-0.15 0.10	-0.16 0.09	-0.15 0.10
Interacted with mobility	0.25 0.20	0.05 0.21	0.24 0.20	0.04 0.21
Net energy exports	0.31** 0.03	0.27** 0.03	0.31** 0.03	0.27** 0.03
Interacted with mobility	-0.21** 0.05	-0.19** 0.05	-0.21** 0.05	-0.19** 0.05
Adjusted fiscal balance	0.05 0.08	0.23* 0.09	0.06 0.08	0.24* 0.09
Interacted with mobility	0.63** 0.14	0.49** 0.17	0.60** 0.14	0.46** 0.17
Net offical flows (NOF)	0.66** 0.14	0.44** 0.14	0.66** 0.14	0.44** 0.14
Interacted with mobility	-0.43* 0.18	0.01 0.22	-0.43* 0.18	0.01 0.22
Net official assets (NOA)	-0.02* 0.01	-0.03** 0.01	-0.02* 0.01	-0.03** 0.01
Interacted with mobility	0.04** 0.01	0.02 0.01	0.04** 0.01	0.02 0.01
Spillovers (SPILL)	-0.58 1.87	-2.54 2.54	-4.10** 0.98	-3.54** 1.14
R-squared	0.50	0.33	0.50	0.33
Observations	2,220	2,220	2,220	2,220

* p<0.05, ** p<0.01

Note: Numbers reported in gray are standard errors.

Source: Author's calculations based on equations 1 and 2 using data described in the data appendix.

Table 2 Robustness to auxiliary variables

	Baseline	Relative PC GDP squared	Only policy variables	Net private assets	Current account balance
Capital mobility (MOB)	−4.30 2.24	−0.85 2.26		−5.29* 2.24	−3.83 2.03
Interacted with mobility	3.33 1.85	2.75 1.85		4.40* 1.88	3.82* 1.79
Financial integration	−9.51** 2.94	−10.50** 2.98		−4.63 7.18	0.09 6.72
Interacted with mobility	5.94 4.98	8.31 4.95		−0.14 8.91	−4.73 7.56
Relative PC GDP	1.36 1.87	15.87** 3.88		0.21 1.84	1.97 1.88
Interacted with mobility	−1.58 2.63	−19.91** 4.82		−0.28 2.58	−0.03 2.39
Relative PC GDP squared		−16.12** 4.65			
Interacted with mobility		18.55** 5.01			
Projected aging	0.36* 0.17	0.16 0.19		0.32 0.19	0.29 0.17
Interacted with mobility	0.11 0.22	0.29 0.23		0.20 0.23	0.04 0.21
5-year growth	−0.16 0.10	−0.08 0.10		−0.19* 0.09	−0.04 0.10
Interacted with mobility	0.14 0.21	−0.08 0.21		0.19 0.21	−0.24 0.18
Net energy exports	0.29** 0.03	0.28** 0.03		0.29** 0.03	0.11** 0.03
Interacted with mobility	−0.20** 0.05	−0.18** 0.05		−0.20** 0.05	0.01 0.04
Adjusted fiscal balance	0.15 0.09	0.19* 0.09	0.38** 0.11	0.19* 0.09	0.19 0.10
Interacted with mobility	0.53** 0.16	0.51** 0.16	0.35* 0.18	0.49** 0.16	0.40** 0.15
Net offical flows (NOF)	0.55** 0.14	0.49** 0.14	0.86** 0.14	0.53** 0.14	0.49** 0.14
Interacted with mobility	−0.21 0.20	−0.15 0.20	−0.52* 0.20	−0.19 0.20	−0.20 0.19
Net official assets (NOA)	−0.03* 0.01	−0.03* 0.01	−0.03** 0.01	−0.02* 0.01	0.03* 0.01
Interacted with mobility	0.03** 0.01	0.03** 0.01	0.05** 0.02	0.03* 0.01	0.01 0.01
Net private assets				−0.02 0.01	0.03* 0.01
Interacted with mobility				0.01 0.01	−0.02 0.02
Spillovers (SPILL)	−3.82** 1.06	−3.44** 1.00	−2.62** 0.82	−3.75** 1.08	−1.13 1.07
Country effects	no	no	no	no	no
Year effects	yes	yes	no	yes	yes
R-squared	0.50	0.52	0.36	0.51	0.58
Observations	2,220	2,220	2,220	2,173	2,209

* p<0.05, ** p<0.01

Note: Numbers reported in gray are standard errors. Reported R-squared is the R-squared of equation 1 (CAX).

Source: Author's calculations based on equations 1 and 2 using data described in the data appendix.

Table 3 Robustness to estimation technique

	Baseline	OLS	Alternative Instruments	Weighted	Robust	Country effects	Country effects (weighted)
Capital mobility (MOB)	−4.30 2.24	−4.58* 2.25	−4.47 2.31	1.32 1.91	2.63 1.55	2.68 2.09	4.30* 2.04
Interacted with mobility	3.33 1.85	3.56 1.83	3.77 1.96	0.60 1.43	0.07 1.33	5.14** 1.69	1.82 1.53
Financial integration	−9.51** 2.94	−10.21** 2.91	−11.25** 3.00	−5.98* 2.57	−8.15** 1.74	−4.44 5.73	−6.12 3.23
Interacted with mobility	5.94 4.98	6.28 5.00	10.86* 5.30	−3.98 3.34	5.43 2.81	−10.83 7.59	0.28 4.12
Relative PC GDP	1.36 1.87	1.70 1.84	2.88 1.98	−1.95 1.46	−0.26 1.28	27.17** 4.64	2.80 3.55
Interacted with mobility	−1.58 2.63	−1.80 2.62	−4.43 2.95	0.65 2.15	−2.11 1.55	−11.81** 3.22	−1.13 2.73
Projected aging	0.36* 0.17	0.42* 0.17	0.43* 0.18	0.60** 0.12	0.40** 0.12	0.37* 0.19	0.79** 0.17
Interacted with mobility	0.11 0.22	0.08 0.22	0.01 0.23	−0.45** 0.15	−0.30* 0.15	−0.24 0.21	−0.96** 0.19
5-year growth	−0.16 0.10	−0.13 0.10	−0.05 0.11	−0.09 0.08	−0.10 0.06	−0.05 0.11	−0.11 0.11
Interacted with mobility	0.14 0.21	0.13 0.22	−0.07 0.23	−0.22 0.19	−0.35** 0.11	−0.89** 0.19	−0.90** 0.19
Net energy exports	0.29** 0.03	0.30** 0.03	0.30** 0.03	0.35** 0.02	0.30** 0.01	0.59** 0.06	0.57** 0.06
Interacted with mobility	−0.20** 0.05	−0.22** 0.05	−0.21** 0.06	−0.41** 0.05	−0.15** 0.02	−0.09 0.07	−0.46** 0.08
Adjusted fiscal balance	0.15 0.09	0.23** 0.08	0.40** 0.11	0.12* 0.06	0.16** 0.05	0.18* 0.09	−0.02 0.08
Interacted with mobility	0.53** 0.16	0.47** 0.13	−0.01 0.18	0.23* 0.11	0.21* 0.08	0.35** 0.12	0.32** 0.11
Net offical flows (NOF)	0.55** 0.14	0.35** 0.08	0.09 0.15	0.48** 0.11	0.64** 0.12	0.49** 0.15	0.50** 0.11
Interacted with mobility	−0.21 0.20	−0.08 0.10	0.77** 0.25	0.14 0.19	−0.48** 0.17	−0.25 0.18	0.04 0.16
Net official assets (NOA)	−0.03* 0.01	−0.02 0.01	−0.01 0.01	−0.01 0.01	−0.03** 0.01	−0.04** 0.01	−0.02 0.01
Interacted with mobility	0.03** 0.01	0.02 0.02	0.01 0.01	0.04 0.02	0.10** 0.01	0.01 0.02	−0.01 0.02
Spillovers (SPILL)	−3.82** 1.06	−3.94** 1.09	3.98** 1.09	−8.59 9.04	−2.97* 1.28	−1.55 1.03	9.79 8.84
Country effects	no	no	no	no	no	yes	yes
Year effects	yes	yes	yes	yes	yes	yes	yes
R-squared	0.50	0.51	0.44	0.60	0.63	0.77	0.77
Observations	2,220	2,220	2,212	2,173	2,220	2,220	2,173

* p<0.05, ** p<0.01

Note: Numbers reported in gray are standard errors. Reported R-squared is the R-squared of equation 1 (CAX).

Source: Author's calculations based on equations 1 and 2 using data described in the data appendix.

Table 4 Robustness to regression sample

	Baseline	Emerging and developing	Advanced	ACI Fixed	ACI Flexible	IRR Fixed	IRR Flexible
Capital mobility (MOB)	−4.30 2.24	−2.78 2.39	−27.28* 12.76	−10.19** 3.21	1.33 2.89	−7.50* 3.80	2.07 2.38
Interacted with mobility	3.33 1.85	3.30 1.90	20.50** 6.09	3.74 2.65	6.43* 2.83	−0.32 3.22	6.62** 2.47
Financial integration	−9.51** 2.94	−15.60** 2.78	−3.12 21.87	−14.06** 3.24	6.76 11.16	−9.19* 3.65	−3.55 11.49
Interacted with mobility	5.94 4.98	31.29** 6.85	−10.39 22.09	22.82** 7.38	−20.23 12.31	31.28** 6.74	−12.79 12.88
Relative PC GDP	1.36 1.87	5.20* 2.54	−7.77 10.48	3.19 2.80	1.32 2.09	−0.82 3.55	3.45 1.99
Interacted with mobility	−1.58 2.63	−16.36** 4.39	14.95 10.96	−1.36 3.88	−5.09 2.94	3.19 4.82	−7.36** 2.61
Projected aging	0.36* 0.17	0.30 0.20	0.89 0.82	0.18 0.25	0.70** 0.25	−0.16 0.24	0.99** 0.24
Interacted with mobility	0.11 0.22	0.18 0.32	−0.56 0.83	0.74* 0.37	−0.47 0.28	0.95** 0.37	−0.87** 0.26
5-year growth	−0.16 0.10	−0.06 0.10	0.19 0.88	−0.13 0.14	−0.09 0.14	−0.01 0.15	−0.20 0.12
Interacted with mobility	0.14 0.21	−0.25 0.19	−0.56 1.05	0.21 0.27	−0.38 0.27	0.01 0.28	−0.58* 0.24
Net energy exports	0.29** 0.03	0.24** 0.03	1.06* 0.45	0.32** 0.03	0.24** 0.04	0.27** 0.04	0.23** 0.03
Interacted with mobility	−0.20** 0.05	0.08 0.06	−1.53** 0.48	−0.18** 0.06	−0.26* 0.10	−0.05 0.07	−0.24** 0.07
Adjusted fiscal balance	0.15 0.09	0.22* 0.09	−0.84 0.63	0.23 0.12	0.14 0.13	0.10 0.13	0.22* 0.10
Interacted with mobility	0.53** 0.16	0.35* 0.17	1.38* 0.68	0.35 0.20	0.51* 0.22	0.51* 0.22	0.13 0.17
Net offical flows (NOF)	0.55** 0.14	0.49** 0.14	1.31 0.67	0.48* 0.20	0.52** 0.18	0.70** 0.22	0.45** 0.15
Interacted with mobility	−0.21 0.20	−0.17 0.21	−0.38 0.74	−0.11 0.29	−0.03 0.26	−0.53 0.32	−0.05 0.23
Net official assets (NOA)	−0.03* 0.01	−0.02* 0.01	0.41** 0.11	−0.02* 0.01	−0.01 0.01	−0.02* 0.01	−0.03* 0.01
Interacted with mobility	0.03** 0.01	0.02 0.02	−0.43** 0.12	−0.01 0.02	0.04 0.02	−0.03 0.02	0.10** 0.02
Spillovers (SPILL)	−3.82** 1.06		−4.02** 1.40	−45.13 52.86	−0.67 1.10	−407.63 158.81	−1.61** 0.88
Country effects	no	no	no	no	no	no	no
Year effects	yes	yes	yes	yes	yes	yes	yes
R-squared	0.50	0.51	0.74	0.59	0.42	0.61	0.44
Observations	2,220	1,807	413	1,168	1,052	1,034	1,186

* p<0.05, ** p<0.01

Note: Numbers reported in gray are standard errors. Reported R-squared is the R-squared of equation 1 (CAX).

Source: Author's calculations based on equations 1 and 2 using data described in the data appendix.

Table 5 Central tendencies of policy coefficients

Fiscal balance, MOB=0	.14 – .22
NOF, MOB=0	.45 – .52
Lagged NOA, MOB=0	–0.03 – –0.01
Fiscal balance, MOB=1	.35 – .65
NOF, MOB=1	.27 – .54
Lagged NOA, MOB=1	.00 – .03
Spillover	–3.8 – –0.7

Note: Central tendencies are the ranges of coefficients from all regressions in table 3 plus the flexible regime regressions in table 4 after eliminating the two highest and two lowest values.

Source: Tables 3 and 4.

DATA APPENDIX

The principal sources of data used for the analysis in this paper are the International Monetary Fund's (IMF) Balance of Payments (BOP), International Financial Statistics (IFS), International Reserves (RES), and World Economic Outlook (WEO) databases; the World Bank's World Development Indicators (WDI) database; and the Lane and Milesi-Ferretti External Wealth of Nations (EWN) database.[23] A few series are taken from other sources as described below. All data are annual. Data were downloaded in October 2016, with the exception of the foreign exchange reserves (RES) data, which were updated in October 2017.

Net official assets are the sum of foreign exchange reserves and nonreserve official foreign assets minus official foreign liabilities. For advanced economies (as defined by the IMF) official foreign liabilities are assumed to be in local currency and are not subtracted from official foreign assets. Holdings and purchases of net official assets affect the exchange rate only to the extent that the government changes the net supply of foreign currency in the market.

The primary source for foreign exchange reserves is the "Reserve Assets, Other Reserve Assets, US Dollars" series in the BOP database. This series excludes gold, special drawing rights (SDRs), and accounts at the IMF. Missing observations are filled in with data from the same series in local currency converted by the end-of-period exchange rate or by subtracting gold, SDRs, and IMF accounts from total reserves where available.[24] Also used are the "Official Reserve Assets, Foreign Currency Reserves (converted to dollars from SDRs)" and "Total Reserves Excluding Gold, Foreign Exchange, US Dollars" data from the IFS database. Where no measure of reserves that focuses on foreign exchange was available, broader measures were sometimes used, namely the IFS series on "Total Reserves Excluding Gold" or "Official Reserve Assets."[25] Where data are available, long forward and futures positions are added to reserves and short positions are subtracted.[26] Forward and futures positions come from the RES database.

23. EWN data are available at http://www.imf.org/external/pubs/ft/wp/2006/data/update/wp0669.zip (accessed on December 12, 2017).

24. Exchange rates (annual average) are from the WEO as the primary source. They are generated by dividing current prices GDP in national currency by current prices GDP in dollars. The dollar-euro exchange rate from IFS is used for the euro area for 1999--2015. Missing data are filled in with data from IFS or EWN where available. The primary source for end-of-period exchange rates is IFS national currency per dollar. Missing data are filled in using the reciprocal of the IFS dollar per national currency figure or data from EWN where available. Remaining missing values are set equal to the annual average exchange rate. The WEO data for Liberia's exchange rate include errors. The average exchange rate for the period is replaced with end-of-period values for all years for Liberia.

25. Guatemalan reserve data before 2005 are backcast using reserve flows.

26. Forward positions for the United States, Japan, and the euro area are not included, because they are significant only for periods in which central bank currency swaps were active. The accounting treatment of these swaps does not appear consistent across central banks. Because the swaps involve exactly offsetting short and long positions, they do not affect the net positions of these institutions and are thus exclude from both reserves and nonreserve official assets. The swaps do not appear to have distorted the official data of other central banks.

Where available, nonreserve official foreign assets are the sum of "portfolio assets," "other assets," and "financial derivatives" held by the central bank or general government.[27, 28] For observations in which the central bank category was missing, the equivalent entry under "monetary authority" is used, if available. Nonreserve official liabilities are defined in a similar way (for nonadvanced economies). The highest levels of aggregation are used where available; where higher-level data are not available, aggregate data at lower levels are used.[29] When aggregating over lower-level categories, some of which are missing for some countries, missing values are assumed equal to zero. Net nonreserve official assets are the difference between gross assets and liabilities. Missing data for 2015 are filled in by adding 2015 nonreserve flows to 2014 stocks where available, but these values are not needed for the regressions.

Reporting of the nonreserve official categories of foreign assets and liabilities is missing or incomplete for many countries. External public debt data from WDI are used to replace nonreserve official liabilities with the value of WDI public and publicly guaranteed (PPG) debt for all countries with external public debt data, excluding South Africa and Azerbaijan. For a few countries, the BOP data start later than the WDI data, but appear to be more complete. To avoid a break in the series, the net nonreserve official assets are set as missing before the start of the BOP data. This affects Bahrain before 2007, Sudan before 2003, and Tanzania before 1992.

For Taiwan foreign exchange reserves are obtained from the central bank, and net nonreserve official assets are assumed to be zero.

For Yemen net nonreserve official assets are extrapolated from 2008 through 2015 using nonreserve flows. Macao does not report its fiscal reserve, which began in 2012, as part of its official assets. For the years 2012 through 2015, its net nonreserve assets are replaced with estimates of its fiscal reserve based on IMF Article IV reports. Macao's net nonreserve assets are set equal to zero for all years before 2012.

Information on sovereign wealth funds (SWFs) from various sources are used to fill in official assets of countries with such funds, since several countries have SWFs that are not included in the official BOP asset data. For the following countries, net nonreserve official assets are set equal to estimates of foreign assets held by SWFs from Stone and Truman (2016) for 2015 and the Sovereign Wealth Center (www.sovereignwealthcenter.com) for 2002, 2007, 2012, and 2014 (where available): Brunei, Kuwait, Malaysia, New Zealand, Oman, Qatar, and the United Arab Emirates (UAE).[30] Missing observations between 2002 and 2015 are interpolated. These

27. The financial derivatives categories are mostly empty. Where reported, they reflect the market value of the net position and not the notional value. For example, a futures contract on $1 billion (notional value) in foreign currency might have a net market value of only a few million dollars, reflecting the difference between the contract price and current market price. The forward positions mentioned in the previous paragraph refer to notional values.

28. Nonreserve official assets are small in the euro area and Japan except for the swap lines. These are set equal to zero. The central bank portion of nonreserve assets is set to zero in the United States for the same reason.

29. Nonreserve stocks for Barbados are backcast before 2008 and for Surinam before 2011 using nonreserve flows.

30. The Stone and Truman estimate for UAE in 2015 does not appear consistent with the Sovereign Wealth Center estimates before 2015. In any event, the UAE is not included in the regressions owing to missing data for net investment income (needed to construct CAX) and financial integration.

countries have no reported external public debt. The perpetual inventory method is used on Kuwait's nonreserve flows to fill in missing data back to 1985.

Algeria, Hong Kong, and Russia include assets of SWFs in reserves. Chile moved SWF assets out of reserves in 2006. Before 2006 nonreserve assets are zero.

Saudi Arabia moved SWF assets into reserves in 2005; reported nonreserve stocks and flows are zero from 2005 on. Reserve stock and flow data are used to construct a nonreserve stock in 2004 and the perpetual inventory method is used with nonreserve flows to fill in earlier dates.

Azerbaijan reports SWF assets in BOP data for 2007–08 only. Values for other years are constructed using the perpetual inventory method on BOP nonreserve official flows.

Nonreserve assets for Kazakhstan and Malaysia are constructed using the Stone and Truman (2016) and Sovereign Wealth Center estimates for 2000, 2002, 2007, 2012, 2014, and 2015 (where available). Missing observations between 2000 and 2015 are interpolated. Nonreserve liabilities are taken from WDI PPG external debt.

Net nonreserve assets for Botswana are constructed by adding the SWF estimates from Stone and Truman (2016) and the Sovereign Wealth Center to the BOP data from 2002, 2007, 2012, 2014, and 2015. Missing observations between 2002 and 2015 are interpolated.

Net nonreserve assets for Bahrain and Libya are constructed from the Stone and Truman (2016) estimates for 2015 and the perpetual inventory method on nonreserve flows.

China established an SWF in 2007. Estimates of its value in 2007, 2012, 2014, and 2015 are taken from Stone and Truman (2016) and the Sovereign Wealth Center, interpolating the missing values between 2007 and 2015. The People's Bank of China reports "other foreign assets" that are not included in the SWF (Setser and Pandey 2009). These are added to, and WDI PPG external debt is subtracted from, net nonreserve assets.

The Singapore Ministry of Finance at one time reported total financial assets of the Singapore government for March 2010 of SGD 650 billion.[31] Temasek's reported local assets of SGD 60 billion as of the same date (www.temasek.com.sg) are subtracted and the figures using the end-2009 exchange rate are converted to get an estimate of end-2009 net foreign assets. Reserves are subtracted to get net nonreserve assets in 2009 and the perpetual inventory method is used to construct net nonreserve assets in other years.[32]

The total assets of the Pension Fund Global are used as the estimate of net nonreserve official assets of Norway, based on data from Norges Bank.

31. This balance sheet is no longer available on the ministry's website, but I keep a paper copy.

32. The resulting estimate for Singapore's net official assets in 2015 ($571 billion) is consistent with Stone and Truman's (2016) estimate of Singapore's SWF holdings of $502 billion, considering that Singapore's SWF holdings include an undisclosed fraction of its foreign exchange reserves of $281 billion. Thus one would expect to find net official assets somewhere between $502 billion and $787 billion.

Reserve assets for Trinidad and Tobago are taken from the central bank website. The country set up an SWF in 2007. Estimates for 2007, 2012, 2014, and 2015 are taken from Stone and Truman (2016) and the Sovereign Wealth Center, interpolating missing values.

Net official flows are the sum of foreign exchange reserve flows and net nonreserve official flows. Consistent with the treatment of official assets, for advanced economies (as defined by the IMF), official foreign liability flows are assumed to be in local currency and are not subtracted from official foreign asset flows.

Financial flows are defined to include purchases and sales of assets, extension and repayment of loans, and reinvested income earned on assets. This definition of flows ensures that the current account equals the financial account in principle. Flows do not include changes in the market valuation of existing assets. However, to fill in missing observations, the approximation that flows equal the change in stocks or that stocks can be estimated over time from the cumulated flows is sometimes used. In its *External Sector Reports*, the IMF model of global current account balances uses the change in the stock of foreign exchange reserves as its estimate of net official flows. The IMF approach ignores the effects of nonreserve official flows.

The primary source for foreign exchange reserve flows is BOP "Financial Account, Reserve Assets, US Dollars." Where available, missing observations are replaced with data from BOP "Supplementary Items, Reserves and Related Assets, US Dollars," BOP "Financial Account, Reserve Assets with Fund Record, US Dollars," and IFS "Supplementary Items, Reserve Assets with Fund Record." Where data are available, changes in long forward and futures positions are added to reserve flows and changes in short positions are subtracted.[33] Forward and futures positions come from the RES database.

Nonreserve official flows are taken from "portfolio flows," "other flows," and "financial derivatives flow" for the central bank and general government, analogously to the nonreserve official stocks described above. Debt relief, as measured by BOP "Capital Account, Capital Transfers, Net," is removed from central bank and government flows.[34]

Coverage of nonreserve official flows is somewhat better than for nonreserve official stocks, including for countries with SWFs. Nevertheless, missing values of net nonreserve official flows are filled in with changes in net nonreserve official stocks where available.

Norway's net nonreserve official flows are assumed equal to the sum of government transfers into and earnings on the assets in the Pension Fund Global, as reported by the Norwegian Ministry of Finance in the annual budget.

Current account balances and *net investment income* are from BOP. Missing values are filled in with data from IFS or WEO.

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33. Changes in forward positions for the United States, Japan, and the euro area are not included because they are significant only for periods in which central bank currency swaps were active. See footnote 26.

34. Debt relief data for Liberia and Madagascar are missing from the capital account data. Net nonreserve flows are set equal to zero for Liberia in 2008–11 and for Madagascar in 2006.

Gross domestic product (GDP) (in US dollars, nominal local currency, and real local currency) is taken from WEO.

Output gap is the deviation of the logarithm of real GDP from the 11-year centered moving average of log real GDP. WEO projections are used to construct the moving average near the end of the sample.

Fiscal balances (defined as general government net lending/borrowing as a percentage of GDP) are from WEO. Missing values are filled in using WDI data.

The data for Brazil before 1996, Mexico before 1988, Nicaragua before 1991, and Peru before 1990 include errors. These observations are dropped. Data for Cameroon, Mali, Niger, Burkina Faso, and Zambia in 2006 and for São Tomé and Príncipe and Sierra Leone in 2007 are replaced by interpolation to account for debt forgiveness. Observations before 1995 are dropped for transition economies Azerbaijan, Belarus, and Russia.

Net international investment positions are the differences between a country's external financial assets and its liabilities. The primary source is EWN. Missing values are filled in using BOP data.

Net private assets are the difference between a country's net international investment position and net official assets.

Net energy exports are from WDI energy exports and imports as a share of merchandise trade times the value of merchandise trade. Some apparent errors for Bahrain, Kuwait, and the United Arab Emirates are replaced by interpolating between years with correct data. Data for Trinidad and Tobago are from the central bank website. Data for Angola, Gabon, and Libya are from the Gagnon et al. (2017) dataset, which is based on an earlier vintage of the WDI data.

Capital mobility is based on legal restrictions to private capital flows from Aizenman, Chinn, and Ito (2015) and is normalized to lie between 0 and 1, with higher values denoting greater openness.

Financial integration is constructed from BOP data. It is the sum of the absolute values of gross private financial flows relative to the sum of the absolute values of gross private financial and gross current account flows.

Relative per capita (PC) GDP is constructed from WEO data. It is a country's per capita nominal GDP divided by the US per capita nominal GDP of the same year.

Projected aging is the change in the ratio of the population over 64 to the population between 16 and 64 over the subsequent 10 years. Historical elderly ratios through 2015 are from WDI. Ratios for 2020 and 2025 are from the United Nations World Population Prospects database and are interpolated in order to create 10-year changes for 2006–15.

Crisis is a dummy that takes the value 1 if the respective country experienced a financial or currency crisis in the previous three years and is from Laeven and Valencia (2012). It is assumed no crises occur after 2011.

Exchange rate regimes are either flexible or fixed based on the values of an indicator of exchange rate flexibility. Observations with less than the median flexibility are classified as fixed and observations with more than the median flexibility are classified as flexible. There are two sets of regimes based on two underlying series. The first series is the Aizenman, Chinn, and Ito (2015) measure of exchange rate volatility within each year. The Aizenman, Chinn, and Ito data do not include data for the United States nor the euro area. The United States is assumed to have a flexible exchange rate in all years and the euro area is set equal to Germany. The second series is the Ilzetzki, Reinhart, and Rogoff (2017) fine classification. The fine classification associated with the number 15 (dual exchange market) is recoded as a fine classification equal to zero because dual exchange markets generally are associated with more tightly controlled exchange rates, but there are only seven observations with this classification and none of the results are noticeably affected by switching this category to the flexible regime.