PIIE PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS

WORKING PAPER

21-4 Fiscal and Exchange Rate Policies Drive Trade Imbalances

New Estimates

Joseph E. Gagnon and Madi Sarsenbayev

March 2021

ABSTRACT

A 2017 analysis found that fiscal balances and foreign exchange intervention are the most important observable factors behind differences in current account balances across countries and over time (Gagnon 2017). This paper updates that analysis with three more years (2016–18) and roughly 40 percent more observations. The original findings are found to be robust to alternative estimation techniques, auxiliary variables, and sample restrictions. New analysis of net international investment positions (which largely reflect cumulated current account balances) finds even stronger evidence for the dominant role of official reserve positions in explaining differences across countries. An increase in a country's official reserve position causes essentially a dollar-for-dollar increase in its net investment position.

JEL Codes: F32, F41, F42

Keywords: current account balance; fiscal balance; foreign exchange intervention

Note: We thank Daniel Beltran and Menzie Chinn for helpful comments. All errors and opinions are our own and do not necessarily reflect the views of the Peterson Institute or other members of its research staff.

Joseph E. Gagnon is senior fellow at the Peterson Institute for International Economics. He served at the US Federal Reserve as visiting associate director, Division of Monetary Affairs (2008–09); associate director, Division of International Finance (1999–2008); and senior economist (1987–90 and 1991–97). He also served at the US Treasury Department (1994–95 and 1997–99) and taught at the Haas School of Business, University of California, Berkeley (1990–91). He is coauthor of *Currency Conflict and Trade Policy: A New Strategy for the United States* (2017) and author of *Flexible Exchange Rates for a Stable World Economy* (2011).

Madi Sarsenbayev is research fellow at the Peterson Institute for International Economics. He joined the Institute as a research analyst in 2018 and was 2019–20 Eranda Rothschild Foundation junior fellow. Previously, he worked in various roles in government-linked companies in Kazakhstan.

INTRODUCTION

Since the Pittsburgh Summit of September 2009, leaders of the Group of Twenty (G20) 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 in the euro area and some Asian economies they have grown. Deficits in the United States and the United Kingdom are roughly the same as 10 years ago.

These imbalances are pushing the net debt of deficit countries gradually toward unsustainable levels. The US net international investment position reached an unprecedented −68 percent of GDP in the third quarter of 2020.[3] Only the smallest and poorest countries have sustained such a large net debt in modern times without experiencing a sharp reversal in their trade deficits (Bergsten and Gagnon 2017, 60).

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 G20 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). More 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 2013, 2017; Bayoumi and Saborowski 2014; Bayoumi, Gagnon, and Saborowski 2015; Chinn 2017; Cubeddu et al. 2019).

This paper updates and extends the data used in a 2017 analysis and presents revised estimates of the model in that paper (Gagnon 2017). The updated data are described in the appendix and are available at www.piie.com. The new regressions run through 2018 instead of 2015, include improved data for some countries with sovereign wealth funds (SWFs), and treat members of the euro area as separate economies.

1 These quotes are from the Leaders Statement at the Pittsburgh Summit. Most subsequent summits have issued statements with similar language. See the G20 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 This figure excludes monetary gold stocks, which are not a claim on foreign countries. Data are from the US Bureau of Economic Analysis.

REGRESSION SPECIFICATION

Equations 1 and 2 present the baseline specifications, in which Greek letters denote parameters to be estimated, countries are denoted by subscript i, and years by subscript t.

$$\frac{CAB_{it}}{GDP_{it}} = \alpha_1\left(\frac{FISCAL_{it}}{GDP_{it}}\right) + \alpha_2\left(\frac{FISCAL_{it}\times MOB_{it-1}}{GDP_{it}}\right) + \beta_1\left(\frac{NOF_{it}}{GDP_{it}}\right) + \beta_2\left(\frac{NOF_{it}\times MOB_{it-1}}{GDP_{it}}\right) + \gamma\ SPILL_{it} + \delta_1\left(\frac{NOS_{it-1}}{GDP_{it-1}}\right) + \delta_2\left(\frac{NOS_{it-1}\times MOB_{it-1}}{GDP_{it-1}}\right) + \mu_1 AUX_{it} + \mu_2(AUX_{it}\times MOB_{it-1}) + \theta_t \times t \quad (1)$$

$$\frac{NPF_{it}}{GDP_{it}} = \alpha_1\left(\frac{FISCAL_{it}}{GDP_{it}}\right) + \alpha_2\left(\frac{FISCAL_{it}\times MOB_{it-1}}{GDP_{it}}\right) + (\beta_1 - 1)\left(\frac{NOF_{it}}{GDP_{it}}\right) + \beta_2\left(\frac{NOF_{it}\times MOB_{it-1}}{GDP_{it}}\right) + \gamma\ SPILL_{it} + \delta_1\left(\frac{NOS_{it-1}}{GDP_{it-1}}\right) + \delta_2\left(\frac{NOS_{it-1}\times MOB_{it-1}}{GDP_{it-1}}\right) + \mu_1 AUX_{it} + \mu_2(AUX_{it}\times MOB_{it-1}) + \theta_t \times t \quad (2)$$

CAB and NPF are the current account balance and net private financial flows. FISCAL is the cyclically adjusted fiscal balance. NOF is net official flows, defined by the acquisition and disposition of assets and liabilities denominated in foreign currency by public sector institutions in the reporting country.[4] NOS is the net stock of these official financial assets and liabilities. SPILL is a measure of spillovers of NOF in other countries, and is described below. MOB is the Chinn and Ito (2006) index 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] The auxiliary variables (AUX) include lagged MOB, lagged net private financial stocks (NPS) relative to GDP, net energy exports relative to GDP (ENERGY), the lagged real GDP growth rate over the previous five years (GROWTH), lagged purchasing power parity–adjusted GDP per capita relative to the United States (RELGDP), and the 10-year forward change in the old age dependency ratio (AGING).[6] 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 β_1 represents the effect of NOF on the current account, and the coefficient β_2 allows for a differential effect depending on the level of capital mobility. The coefficient δ_1 represents the effect of lagged net official asset stocks on the current account, while the coefficient δ_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 equating the current account with the financial account: CAB = NOF + NPF + errors and omissions. Factors that influence NPF also influence CAB. NOF has a direct effect on CAB (coefficient of 1) in addition to its indirect effect via NPF (presumed to be negative). All other variables affect CAB only to the extent that they also affect NPF.

4 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 also count as official financial flows.

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

6 MOB is based on legal restrictions and thus might be considered a policy variable. But our sense is that differences in MOB across countries and over time reflect slow-moving institutional considerations and not easily adjustable policies to influence output or the trade balance.

Any increase in NOF must be associated with some combination of an increase in CAB and a reduction in NPF that jointly equal the change in NOF. When NOF has no effect on CAB (i.e., $\beta_1 = 0$), it must cause a one-for-one reduction of NPF. 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 β_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 the effects of measurement error.[7] The bias from measurement error in the other explanatory variables is expected to be generally toward zero in both regressions, but there is added information from each regression that makes it desirable to focus on the average of the coefficients across equations 1 and 2.

Equations 1 and 2 include interactions between most explanatory variables and the MOB term. The interaction terms are included because the effect of many variables could vary with capital mobility. For example, net official flows are expected to have a greater effect on the current account when private financial flows are more restricted (MOB is low). In other words, if NPF cannot respond to NOF, then CAB must move more. On the other hand, 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 (MOB is high).

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, 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. Earlier papers show 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 (Gagnon 2012, 2013).

Instrumental variable 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 CAB and/or NPF. Valid instruments must reflect exogenous motives for reserve accumulation.

The first instrument used in this paper 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

7 In a univariate regression, measurement error always creates a bias toward zero. In a multivariate regression, it is possible that some coefficients are biased away from zero, but bias toward zero is more likely. The NOF coefficient from the CAB regression is lower than that implied by the NPF regression, as would be expected from bias toward zero.

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

as well as development loans. Both are likely to reflect longer-term savings and investment motives and, conditional on the control 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 affects 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 the testing of alternative assumptions about spillovers. In the earlier analysis (Gagnon 2017), spillover variables were constructed based on the sum of NOF across all countries in each year. This global NOF was then allocated across countries according to different criteria such as openness to capital flows, financial integration, and per capita income. The results showed that allocating global NOF according to the share of a country's assets in global foreign exchange reserves leads to the most robustly significant coefficient.

For this analysis, the spillover term applies weights of 62 percent for the United States, 26 percent for the euro area,[10] small weights for a few other advanced economies, and zero for all other economies.[11] These weights are multiplied by global NOF and divided by each country's GDP. No interaction term is included because countries issuing reserve currencies within the sample all have high levels of MOB. If all of the spillover of NOF shows up in the CABs of the reserve-issuing countries, we would expect a coefficient of −1 on SPILL.[12]

ESTIMATION RESULTS

The regressions cover up to 33 years (1986–2018) for 138 countries.[13] Many countries are missing observations, especially near the beginning of the sample. The regressions exclude countries with GDP of less than US$5 billion in 2018 as well as the war-torn countries of Afghanistan, Iraq, Libya, and Syria.[14] In addition, some countries lacked the necessary data even in recent years. (A complete list

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 each equation through the net energy exports term. Net energy exports are strongly correlated with the current account only in countries that actively save energy revenues abroad (Gagnon et al. 2017).

10 Euro area weights are allocated to member countries in proportion to GDP.

11 These weights are based on the IMF's Currency Composition of Foreign Exchange Reserves (COFER) data in 2010, with unallocated reserves split among Australia, Canada, Korea, and Sweden. 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 for dollars, euros, and yen since the data begin in 1995.

12 In Gagnon (2017), SPILL is normalized by world GDP. However, the current formulation fits better and has more intuitive appeal.

13 Euro area members are included separately, as are members of other currency unions. In Gagnon (2017) the euro area was treated as a single country.

14 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.

of countries in our sample and a detailed description of the data are provided in the appendix.) The coefficient standard errors are robust to heteroskedastic and first-order autocorrelated residuals. Significance levels are denoted by one asterisk (5 percent) and two asterisks (1 percent).

Baseline Regression and First-Stage Diagnostics

Table 1A displays the regression used to cyclically adjust fiscal balances. Both the level and the change of the output gap have significant positive effects on the fiscal balance (FIS_UNADJ). The cyclically adjusted fiscal balance (FISCAL) is the residual from this regression. Note that the adjustment does not remove persistent differences in fiscal balances across countries because it does not include separate intercepts (fixed effects) for each country.

The first-stage regression results (table 1B) reveal that the instruments are statistically significant. All the other variables in equation 1 are included in the first-stage regressions but not shown here. The instruments generally show the expected positive signs in the first-stage regression. The Sanderson-Windmeijer F-test statistics take values significantly larger than 10; the null hypothesis that these instruments are irrelevant is thus comfortably rejected. Similarly, the Stock-Wright LM S statistic comfortably exceeds all critical values for robust second-stage inference. At the same time, the values of the first-stage R^2s are around 0.65, and the partial R^2s are around 0.4, and thus do not signal overfitting.

The second-stage results (table 1C) show that most coefficients are similar across equations 1 and 2 (columns 1 and 2). However, there are notable differences (more than two standard errors) for the fiscal balance and projected aging, and roughly two standard errors for NOF, SPILL, and ENERGY (the difference for the latter is quite small). These differences arise from the presence of errors and omissions that break the identity between CAB and NOF + NPF. The effects of measurement error can be minimized by focusing on an average of the coefficients in equations 1 and 2, shown in column 3, which is our baseline model. The coefficient standard errors in column 3 are averages of those from the CAB and NPF regressions.[15] The R^2 statistic in column 3 is from the CAB regression in column 1 because we are interested in explaining current accounts and we wish to be comparable to other studies.

The coefficients on the noninteracted variables reflect the effect of each variable on the current account when MOB = 0 (mobility is low). The coefficients on the interacted variables reflect any additional effect as MOB increases. The sum of the two coefficients reflects the effect of a given variable when MOB = 1.

In the baseline results, the fiscal balance has a significant positive effect when MOB = 0, and this effect increases with MOB. When MOB = 1, the current account rises by $0.38 for each $1 rise in the fiscal balance. Each $1 rise in NOF increases the current account by $0.66 when MOB = 0, but this declines to $0.33 when MOB = 1. The SPILL coefficient is negative and significant.

15 Using average standard errors is valid on the assumptions of perfect correlation between the two coefficients and equality of their standard errors. 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.

Table 1A
Baseline regression

Cyclical adjustment of fiscal balance	
Variable	*FIS_UNADJ*
Change in GAP	0.19** 0.03
GAP	0.09** 0.02
Constant	−2.20** 0.09
R^2	0.03
Observations	3,159

Table 1B
Baseline regression

First-stage regressions		
Instruments	*NOF*	*NOFxMOB*
NROF	0.86** 0.05	−0.07** 0.02
NROF x MOB	0.11 0.09	1.06** 0.07
CRISIS	0.57* 0.29	−0.03 0.10
CRISIS x MOB	0.32 0.53	1.08** 0.39
Exogenous variables not shown		
R^2	0.63	0.68
Observations	3,159	3,159
Shea's partial R^2	0.36	0.42
Sanderson-Windmeijer F-test	233.34	290.88
(p-value)	0.00	0.00
Stock-Wright LM S statistic	52.46	52.46
(p-value)	0.00	0.00

* $p < 0.05$, ** $p < 0.01$
Note: Numbers reported in blue are standard errors. The coefficient on NOF in the NPF column of table 1C is the estimated coefficient plus 1, reflecting the implied impact of NOF on CAB as opposed to the effect on the dependent variable, NPF, based on the balance of payments identity. The baseline column in table 1C is the average of CAB and NPF columns. R^2 in the baseline column is from the CAB regression. See glossary for explanation of terms.
Source: Authors' calculations based on equations 1 and 2 using data described in the appendix.

Table 1C
Baseline regression

Second-stage regressions			
Variable	*CAB*	*NPF*	*Baseline*
Policy			
FISCAL	0.28** 0.09	0.10 0.07	0.19* 0.08
FISCAL x MOB	0.05 0.12	0.32** 0.10	0.19 0.11
NOF	0.53** 0.17	0.79** 0.12	0.66** 0.15
NOF x MOB	−0.31 0.19	−0.36* 0.15	−0.34* 0.17
SPILL	−0.88** 0.19	−0.49* 0.21	−0.69** 0.20
NOS	0.03** 0.01	0.03** 0.01	0.03** 0.01
NOS x MOB	−0.01 0.01	−0.02 0.01	−0.01 0.01
Auxiliary			
NPS	0.03** 0.01	0.02 0.01	0.03** 0.01
NPS x MOB	−0.02 0.01	−0.01 0.01	−0.02 0.01
MOB	−2.62 1.49	−4.27** 1.45	−3.44* 1.47
MOB x MOB	2.62* 1.28	4.06** 1.37	3.34* 1.33
ENERGY	0.15** 0.02	0.11** 0.02	0.13** 0.02
ENERGY x MOB	−0.06 0.04	−0.06 0.03	−0.06 0.04
GROWTH	0.03 0.09	−0.06 0.08	−0.01 0.09
GROWTH x MOB	−0.62** 0.14	−0.56** 0.13	−0.59** 0.13
RELGDP	2.37 1.51	0.42 1.60	1.40 1.55
RELGDP x MOB	2.35 1.84	2.06 1.87	2.20 1.86
AGING	0.39** 0.11	0.10 0.10	0.24* 0.10
AGING x MOB	−0.20 0.13	0.09 0.13	−0.05 0.13
R^2	0.53	0.32	0.53
Observations	3,159	3,159	3,159

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, global NOF averaged about 3 percent of US GDP, and the implied spillover to the US current account averaged about −1.2 percent of US GDP. Lagged net official financial stocks have a significant positive effect when MOB = 0, which diminishes slightly as MOB increases. Lagged net private financial stocks have essentially the same effect as lagged NOS when MOB = 0, but this effect diminishes a bit more as MOB increases than the effect of NOS does.

Capital mobility has a significant negative effect on the current account starting from a position of low capital mobility, but this effect diminishes to nearly zero as MOB rises toward its maximum value of 1. Net energy exports have a modest positive effect with low mobility, but this effect diminishes with higher MOB. Lagged five-year growth has little effect when MOB is low but becomes significantly negative when MOB is high (see table 2). When MOB = 1, an increase of lagged growth of 1 percentage point reduces CAB by 0.6 percent of GDP. Relative per capita GDP has an insignificant positive effect on CAB that increases with MOB and becomes strongly significant when MOB = 1 (see table 2). Projected aging has a significant but modest positive effect that does not change much with MOB. 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 0.2 percent of GDP.

Robustness to Estimation Technique

Table 2 displays results using different estimation techniques. Each column displays the average of results from equations 1 and 2. Instead of displaying coefficients on the interaction terms, which denote the additional effect of mobility, we display the sums of the noninteracted and interacted coefficients, which denote the overall effect of a given variable when MOB = 1. The noninteracted coefficient by itself denotes the effect when MOB = 0. R^2 statistics in this and subsequent tables are based on the CAB regressions (equation 1). Column 1 repeats the baseline regression.

Column 2 replaces the baseline instruments with a full set of country dummies after dropping a few countries that had fewer than five observations with available data.[16] 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 2. The estimated value when MOB = 0 is moderately larger than in the baseline results, and the implied value when MOB = 1 is slightly larger. Except for a moderate reduction in the FISCAL coefficient under low mobility, most other coefficients are not much affected.

16 We also tried a third set of instruments: a lagged crisis dummy, official borrowing, and a variable that equals net energy exports when they are in surplus and the fiscal balance is in surplus and zero otherwise. The latter two instruments might be viewed as more exogenous to the exchange rate than nonreserve flows. They would also capture saving of oil revenues by countries that report such savings as reserves (Russia and Saudi Arabia). This set of instruments had no noticeable effect on any coefficient.

Table 2
Robustness to estimation technique

Variable	Baseline	Alternative instruments	No instruments (OLS)	Autoregressive residual	Weighted by GDP	Robust regression	Country effects
Policy							
FISCAL (MOB = 0)	0.19* 0.08	0.11 0.09	0.24** 0.07	0.27** 0.08	0.04 0.05	0.08 0.04	0.13 0.09
FISCAL (MOB = 1)	0.38** 0.06	0.32** 0.08	0.42** 0.06	0.38** 0.06	0.44** 0.05	0.34** 0.03	0.37** 0.06
NOF (MOB = 0)	0.66** 0.15	0.86** 0.12	0.56** 0.08	0.56** 0.13	0.71** 0.10	0.72** 0.08	0.58** 0.15
NOF (MOB = 1)	0.33** 0.07	0.43** 0.11	0.26** 0.04	0.26** 0.08	0.36** 0.08	0.26** 0.05	0.28** 0.06
SPILL	−0.69** 0.20	−0.59** 0.20	−0.74** 0.20	−0.59** 0.21	−0.10 0.24	−0.65** 0.15	−0.70** 0.18
NOS (MOB = 0)	0.03** 0.01	0.03** 0.01	0.03** 0.01	0.01 0.01	0.02 0.01	0.02** 0.00	0.01 0.01
NOS (MOB = 1)	0.02** 0.01	0.02* 0.01	0.02** 0.01	0.02* 0.01	0.02* 0.01	0.03** 0.00	0.02* 0.01
Auxiliary							
NPS (MOB = 0)	0.03** 0.01	0.03* 0.01	0.03** 0.01	−0.00 0.01	0.05** 0.01	0.04** 0.00	0.00 0.01
NPS (MOB = 1)	0.01 0.01	0.01 0.01	0.01 0.01	0.00 0.00	0.04** 0.00	0.03** 0.00	0.01 0.01
MOB (MOB = 0)	−3.44* 1.47	−3.84** 1.47	−3.26* 1.46	−2.54 2.03	6.07** 1.45	1.31 1.15	−0.55 1.53
MOB (MOB = 1)	−0.10 1.00	−0.38 0.96	−0.02 1.01	0.62 1.37	0.33 1.15	0.27 0.59	3.92** 1.28
ENERGY (MOB = 0)	0.13** 0.02	0.13** 0.02	0.14** 0.02	0.18** 0.04	0.19** 0.02	0.17** 0.01	0.35** 0.05
ENERGY (MOB = 1)	0.07** 0.02	0.08** 0.02	0.07** 0.02	0.14** 0.04	−0.06* 0.03	0.08** 0.01	0.28** 0.05
GROWTH (MOB = 0)	−0.01 0.09	−0.06 0.08	0.00 0.09	−0.00 0.12	0.10 0.06	−0.05 0.05	−0.05 0.09
GROWTH (MOB = 1)	−0.61** 0.08	−0.59** 0.08	−0.61** 0.08	−0.49** 0.11	−0.74** 0.10	−0.53** 0.05	−0.74** 0.09
RELGDP (MOB = 0)	1.40 1.55	0.72 1.43	1.75 1.46	2.41 2.86	−3.08** 1.11	−0.76 0.97	10.20** 2.63
RELGDP (MOB = 1)	3.60** 0.83	3.46** 0.81	3.70** 0.84	3.18** 1.17	3.65** 0.96	2.80** 0.45	5.51** 1.87
AGING (MOB = 0)	0.24* 0.10	0.17 0.11	0.28** 0.10	0.28 0.18	0.44** 0.11	0.11 0.08	0.26 0.14
AGING (MOB = 1)	0.19** 0.06	0.18** 0.06	0.20** 0.06	0.29** 0.11	0.14** 0.05	0.21** 0.05	0.07 0.08
R^2	0.53	0.51	0.54	0.34	0.61	0.68	0.70
Observations	3,159	3,154	3,159	3,159	3,126	3,159	3,159

* $p < 0.05$, ** $p < 0.01$

Note: Numbers reported in blue are standard errors. Coefficients and standard errors are averages of respective coefficients and standard errors from CAB and NPF regressions. Reported R^2 numbers are from CAB regressions. See glossary for explanation of terms.

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

Column 3 is the ordinary least squares (OLS) version of this regression, which does not have any instrumental variables. 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 4 is a regression allowing for a first-order autoregressive residual. The estimated autoregressive coefficient is 0.60. This regression command cannot use instrumental variables, so the fitted values of NOF/GDP and NOF × MOB/GDP from the first-stage regressions shown in table 1B were used.[17] Compared to the baseline model, most coefficients are reasonably similar. The most statistically significant differences are for the effects of net official stocks, net private stocks, and net energy exports when MOB = 1.

Column 5 is a regression weighted by each country's share of world nominal GDP. In this regression the United States is dropped because it accounts for an outsized share of world GDP. The fiscal effect is somewhat smaller with low mobility but little changed at high mobility. The effects of NOF and NOS are broadly similar. The SPILL coefficient is small and insignificant, reflecting the fact that the United States is no longer in the regression. The effect of NPS is slightly larger. The effect of MOB is reversed in this regression, starting out large and positive but shrinking to zero when MOB = 1. The effect of ENERGY under high mobility is significantly lower than in the baseline and it is small but significantly less than zero. The negative effect of growth is somewhat larger with high mobility. RELGDP has a small negative effect with low mobility but it becomes strongly positive (and similar to baseline) with high mobility. The effect of projected aging is larger with low mobility but little changed at high mobility.

Column 6 is based on a robust regression that aims to reduce the influence of outliers in the data.[18] These regressions use the same fitted values of the instrumented variables that are used in column 4 with the same adjustment of the standard errors. The main differences from the baseline results are a somewhat smaller fiscal effect with low MOB and a smaller direct effect of MOB.

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 seventh column removes the effects of persistent country differences by adding a full set of country fixed effects. The most notable changes from the baseline results are large increases in the effect of MOB and in the effect of RELGDP with low mobility and a moderate increase in the effect of ENERGY. As would be expected, the coefficients on variables that move only slowly over time

17 Because the first-stage regressions are conducted outside the second-stage regression framework, the standard error on the NOF coefficient is multiplied by the reciprocal of the first-stage R^2. The standard error on the sum of the NOF and NOF × MOB coefficients is multiplied by the reciprocal of the average of the first-stage R^2s.

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

but differ a lot across countries become smaller and less significant. In particular, the effects of NOS and NPS are close to zero. The coefficients on the other policy variables are not much changed.

Overall, the estimated effects of the policy variables on current account balances are broadly insensitive to these alternative statistical techniques.

Robustness to Auxiliary Variables and Country Classification

Table 3 presents the baseline results as well as some robustness checks for the effects of alternative variables and different country groupings. The auxiliary variables in the baseline are the same as in Gagnon (2017) except for the financial integration variable, which was not robustly significant and had measurement errors owing to missing values in the source data. Exclusion of this variable has little impact on the policy coefficients.

Column 2 tests for the importance of a suite of demographic variables used in the latest version of the IMF's External Balance Assessment (EBA) model (Cubeddu et al. 2019): (1) the population growth rate, (2) the old age dependency ratio, (3) the share of prime-aged savers in the working-age population, (4) life expectancy, and (5) the interaction of life expectancy with the projected future old age dependency ratio 15–25 years ahead.[19] These variables replace the projected aging variable in our model. We interact each of them with MOB. To save space, only the significant coefficients on these variables are shown in column 2. The new coefficients generally have the expected signs. Population growth reduces trade balances, as does the current old age dependency ratio; greater longevity increases the trade balance but this effect is reversed with very high capital mobility. The latter result is puzzling, but it should be noted that longevity increases the trade balance when the future old age dependency ratio and mobility are both high (the bottom row). The only notable effect on the remaining coefficients is a reversal of the direct effect of MOB, which is now significantly positive. Despite the fact that six of the ten new coefficients are statistically significant, the R^2 is little changed from baseline.

Column 3 adds the output gap to the baseline regression. As an endogenous variable, the output gap should be instrumented. However, the point here is merely to check if it might have any significant effect on the other coefficients. The output gap has the expected negative sign and is strongly significant; a cyclical boom sucks in imports and pushes trade into deficit. This result suggests that any endogenous effect from the current account—which would induce a positive correlation—is small relative to the exogenous component. Inclusion of the output gap has no noticeable effect on any of the baseline coefficients.

In regressions not shown in table 3, we explored the effects of income inequality on trade balances. A recent study suggests that rising income inequality may lead to falling trade balances (Kumhof et al. 2012). We add Gini indexes to the baseline regression, from the Standardized World Income Inequality Database.[20]

---

19 The age ratio is expressed in decimals instead of percentage points to enable full display of the coefficient.

20 The Gini index is a measure of inequality with a minimum value of 0, when all households have the same income, and a maximum value of 1, when all income is earned by just one household. Data are available at https://fsolt.org/swiid/.

Table 3
Robustness to auxiliary variables and country classification

Variable	Baseline	EBA demographics	Output gap	Policy variables	Auxiliary variables	Advanced economies	Developing economies
Policy							
FISCAL (MOB = 0)	0.19* 0.08	0.19* 0.08	0.16 0.08	0.28** 0.08			0.19* 0.09
FISCAL (MOB = 1)	0.38** 0.06	0.37** 0.06	0.37** 0.06	0.37** 0.06		0.30** 0.10	0.41** 0.09
NOF (MOB = 0)	0.66** 0.15	0.65** 0.15	0.66** 0.15	0.79** 0.15			0.65** 0.16
NOF (MOB = 1)	0.33** 0.07	0.32** 0.06	0.34** 0.07	0.43** 0.07		0.39** 0.09	0.27** 0.09
SPILL	−0.69** 0.20	−0.74** 0.20	−0.64** 0.20	−0.03 0.18		−0.82* 0.37	
NOS (MOB = 0)	0.03** 0.01	0.03** 0.01	0.03** 0.01	0.01 0.01			0.03** 0.01
NOS (MOB = 1)	0.02** 0.01	0.01* 0.01	0.02** 0.01	0.05** 0.01		0.02* 0.01	0.02 0.01
Auxiliary							
NPS (MOB = 0)	0.03** 0.01	0.03** 0.01	0.03** 0.01		0.03** 0.01		0.08** 0.01
NPS (MOB = 1)	0.01 0.01	0.01 0.01	0.01 0.01		0.02 0.01	0.02** 0.00	−0.01 0.01
MOB (MOB = 0)	−3.44* 1.47	14.62* 7.21	−3.62* 1.46		−1.67 1.54		−2.23 1.66
MOB (MOB = 1)	−0.10 1.00	18.48* 7.21	−0.08 1.00		1.01 0.98	−2.22** 0.73	−0.66 1.08
ENERGY (MOB = 0)	0.13** 0.02	0.14** 0.02	0.14** 0.02		0.14** 0.03		0.12** 0.02
ENERGY (MOB = 1)	0.07** 0.02	0.06* 0.02	0.08** 0.02		0.16** 0.03	−0.23** 0.05	0.22** 0.03
GROWTH (MOB = 0)	−0.01 0.09	−0.04 0.09	0.07 0.09		0.08 0.09		−0.00 0.09
GROWTH (MOB = 1)	−0.61** 0.08	−0.67** 0.09	−0.49** 0.09		−0.54** 0.09	−0.43** 0.14	−0.53** 0.11
RELGDP (MOB = 0)	1.40 1.55	3.27 2.02	1.92 1.55		5.80** 1.33		−0.67 2.22
RELGDP (MOB = 1)	3.60** 0.83	4.58** 0.92	3.71** 0.81		4.39** 0.83	6.59** 1.39	−0.03 1.57
AGING (MOB = 0)	0.24* 0.10		0.25* 0.10		0.33** 0.10		0.34** 0.13
AGING (MOB = 1)	0.19** 0.06		0.20** 0.06		0.15* 0.07	0.09 0.07	0.07 0.13
GAP			−0.14** 0.05				
POP_GRO (MOB = 0)		−0.66* 0.32					
AGE (MOB = 0)		−0.17** 0.07					

Variable	Baseline	EBA demographics	Output gap	Policy variables	Auxiliary variables	Advanced economies	Developing economies
AGE (MOB = 1)		−0.19** 0.04					
LIFE_EXP (MOB = 0)		0.29** 0.11					
LIFE_EXP (MOB = 1)		−0.36** 0.09					
LIFExFUT_AGE (MOB = 1)		0.49** 0.09					
R^2	0.53	0.55	0.54	0.40	0.37	0.55	0.54
Observations	3,159	3,159	3,159	3,159	3,159	930	2,229

* $p < 0.05$, ** $p < 0.01$

Note: Numbers reported in blue are standard errors. Coefficients and standard errors are averages of respective coefficients and standard errors from CAB and NPF regressions. Reported R^2 numbers are from CAB regressions. See glossary for explanation of terms.

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

In separate regressions, we added either the market income Gini index or the disposable income Gini index (the latter adjusts for taxes and transfers between governments and households). Both indexes have statistically significant coefficients, but no noticeable effect on any policy coefficient or the regression R^2. Contrary to the suggestion of Michael Kumhof and colleagues (2012), high inequality is associated with a positive trade balance when capital mobility is high. When mobility is low, inequality has either no effect (disposable income measure) or a negative effect (market income measure) on the trade balance.

Column 4 displays a regression on only the policy variables after dropping all auxiliary variables including year effects. The fiscal effect is slightly larger under low mobility and about the same under high mobility. The effect of NOF under low mobility is moderately higher and remains slightly higher under high mobility. The spillovers from NOF, however, appear to vanish. The effect of NOS declines under low mobility but is actually somewhat larger under high mobility. These four variables alone (with their interaction terms) explain 40 percent of the variance of imbalances as denoted by the regression R^2.

Column 5 displays a regression on the auxiliary variables without the policy variables or year effects.[21] The coefficients on the auxiliary variables are either similar in magnitude to those in the baseline regression or, in some cases, larger. Together they explain 37 percent of the variance of imbalances.

Column 6 displays a regression on only the advanced economies. There is little variation in MOB among these economies, so we drop the MOB-interacted terms. As the median value of MOB in this sample is 1, we display the results on the lines for MOB = 1. The only important differences from the baseline are in the auxiliary coefficients, including a more negative effect of MOB, a much larger positive effect of RELGDP, and a surprising negative, but modest, effect of ENERGY.

21 A regression on only year effects has an R^2 of 0.01.

By omitting the interaction terms, it is possible to calculate "standardized betas" that provide a comparison of the relative importance of the independent variables in explaining current accounts.[22] Based on the regression of column 6, standardized betas for the policy variables are FISCAL 0.19, NOF 0.33, SPILL −0.13, and NOS 0.11. Among nonpolicy variables the largest effects are from NPS and RELGDP, each of which has a standardized beta of 0.23.

Column 7 displays a regression on developing economies.[23] Again, the only important differences relative to baseline are for the auxiliary coefficients, including a larger effect of net private financial stocks when MOB is low, a slightly larger effect of ENERGY with high mobility, and no effect of RELGDP. The SPILL term was dropped because it is zero for these countries. Most coefficients (and all policy coefficients) are similar between advanced and developing economies. The two exceptions are the coefficients on ENERGY and RELGDP.[24]

Overall, the estimated policy effects on current account balances are not sensitive to alternative auxiliary variables and are relatively similar in advanced and developing economies.

Robustness to Mobility Measure and Sample

Table 4 explores the effects of different samples and measures of capital mobility on the results. Column 1 repeats the baseline results. Column 2 displays results using the baseline MOB variable (Chinn and Ito 2006) but limited to countries and years for which the updated Quinn (1997) measure of capital mobility is available.[25] Column 3 displays results using the Quinn measure in place of the Chinn-Ito measure. Column 4 displays results using the baseline MOB variable but limited to countries and years for which the Fernández et al. (2016) (FKRSU) measure of capital mobility is available. Column 5 displays results using the FKRSU measure of MOB based on inflow restrictions. The FKRSU data include both an overall measure and measures that focus on inflow restrictions and outflow restrictions; the inflow restrictions measure performs slightly better.[26]

22 The formula is sd(x)*coefficient(x)/sd(y), where sd(x) is the standard deviation of independent variable x and y is the dependent variable.

23 In a regression of developing economies that drops the interaction terms, the standardized betas are FISCAL 0.21, NOF 0.38, and NOS 0.17. SPILL is not defined for developing economies. The only other standardized beta greater in magnitude than 0.12 is for ENERGY at 0.29.

24 We explored whether the difference for RELGDP arises from nonlinearity given that advanced economies have higher income than most developing economies (oil exporters are an important exception). However, allowing for various nonlinear functions or breaks did not eliminate the differences between the two categories in this coefficient.

25 The IMF EBA model uses the Quinn measure of mobility. We use Quinn data available in Cubeddu et al. (2019) and normalize them to be comparable to the Chinn-Ito data, with 0 representing the lowest mobility and 1 the highest (fewest restrictions).

26 We also tried the difference between the inflow and outflow measure, on the hypothesis that inflow restrictions might increase the current account whereas outflow restrictions might reduce it. The difference measure had the lowest R^2 and some of the coefficients were poorly estimated. As with the Quinn data, we normalize the FKRSU data to be comparable to the Chinn-Ito data.

Table 4
Robustness to mobility measure and sample

Variable	Baseline	Quinn sample	Quinn data	FKRSU sample	FKRSU data
Policy					
FISCAL (MOB = 0)	0.19* 0.08	0.11 0.06	0.10 0.12	0.33** 0.11	0.57** 0.15
FISCAL (MOB = 1)	0.38** 0.06	0.30** 0.06	0.29** 0.06	0.39** 0.07	0.21** 0.08
NOF (MOB = 0)	0.66** 0.15	0.48** 0.10	0.39* 0.18	0.62** 0.15	0.58** 0.20
NOF (MOB = 1)	0.33** 0.07	0.17* 0.09	0.25** 0.09	0.26** 0.06	0.24** 0.08
SPILL	−0.69** 0.20	−0.86** 0.17	−0.79** 0.17	−0.61** 0.22	−0.73** 0.24
NOS (MOB = 0)	0.03** 0.01	0.04** 0.01	0.06** 0.02	0.02 0.01	0.00 0.02
NOS (MOB = 1)	0.02** 0.01	0.01 0.01	0.02* 0.01	0.02** 0.01	0.03** 0.01
Auxiliary					
NPS (MOB = 0)	0.03** 0.01	0.04** 0.01	0.04** 0.01	0.00 0.01	0.01 0.01
NPS (MOB = 1)	0.01 0.01	0.03** 0.01	0.03** 0.01	0.01 0.01	0.01 0.01
MOB (MOB = 0)	−3.44* 1.47	−1.74 1.54	1.72 2.96	−4.37* 1.98	−5.67* 2.46
MOB (MOB = 1)	−0.10 1.00	−1.40 1.13	−4.27* 1.66	−1.72 1.19	−1.35 1.45
ENERGY (MOB = 0)	0.13** 0.02	0.20** 0.05	0.34** 0.09	0.11** 0.03	0.09* 0.04
ENERGY (MOB = 1)	0.07** 0.02	0.02 0.04	−0.06 0.04	0.10** 0.03	0.15** 0.03
GROWTH (MOB = 0)	−0.01 0.09	0.02 0.08	−0.06 0.12	−0.11 0.10	−0.19 0.12
GROWTH (MOB = 1)	−0.61** 0.08	−0.57** 0.09	−0.48** 0.08	−0.47** 0.09	−0.42** 0.10
RELGDP (MOB = 0)	1.40 1.55	−4.68** 1.30	−12.84** 2.24	−3.70 2.41	−2.35 1.73
RELGDP (MOB = 1)	3.60** 0.83	4.06** 0.80	4.79** 0.70	4.89** 0.90	5.28** 0.90
AGING (MOB = 0)	0.24* 0.10	0.33** 0.10	0.24 0.15	0.28* 0.14	0.35** 0.13
AGING (MOB = 1)	0.19** 0.06	0.08 0.05	0.11* 0.05	0.06 0.07	−0.04 0.07

Variable	Baseline	Quinn sample	Quinn data	FKRSU sample	FKRSU data
R^2	0.53	0.51	0.52	0.60	0.60
Observations	3,159	1,294	1,294	1,926	1,926

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

Note: The regression labeled "Quinn sample" is the baseline regression restricted to observations for which the Quinn capital mobility data are available. The regression labeled "Quinn data" replaces the Chinn-Ito mobility data with the Quinn mobility data. The regressions labeled "FKRSU sample" and "FKRSU data" are defined analogously. Numbers reported in blue are standard errors. Coefficients and standard errors are averages of respective coefficients and standard errors from CAB and NPF regressions. Reported R^2 numbers are from CAB regressions. See glossary for explanation of terms.

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

The differences in columns 2 and 4 compared to column 1 reflect the effects of different groups of countries and years. The Quinn measure of MOB is available for a long time span but for only 49 advanced and developing economies. The FKRSU measure is available for 100 economies but only since 1995. The Chinn-Ito measure (baseline MOB) has the broadest coverage in terms of countries and years.

Limiting the baseline regression to the Quinn sample (column 2) has few statistically significant effects on policy coefficients. There is a marginal reduction in the effect of NOF under high mobility.[27] There are also moderate, but not significant, reductions in the magnitudes of the FISCAL effects and the NOF effect under low mobility. The latter two may reflect the exclusion of many countries with either large sovereign wealth funds or large public external borrowing, which contribute to our ability to estimate significant policy effects. The coefficient on RELGDP is significantly reduced, but only when MOB is low. When MOB is high, the coefficient on NPS is significantly increased, while the coefficient on AGING is significantly decreased. Other changes are minor.

Limiting the baseline regression to the FKRSU sample (column 4) has no significant effect on any policy coefficient, but there is a moderate increase in the FISCAL coefficient under low mobility. The coefficients on NPS and RELGDP are significantly reduced when MOB is low. Other changes are minor.

Switching from the Chinn-Ito measure of MOB to the Quinn measure (comparing column 3 to column 2) has no significant effect on any policy coefficient, but there is a modest decrease in the NOF coefficient under low mobility and a modest increase in the NOS coefficient. The 2017 paper notes a tradeoff between these two coefficients that probably arises from collinearity as countries with large values of NOF tend to have large values of NOS (Gagnon 2017). Among auxiliary variables there are a few significant changes, including a decrease in the effect of MOB when MOB is high, an increase in the effect of ENERGY when MOB is low, and a large decrease in the effect of RELGDP when MOB is low.

27 We base significance levels on the difference in coefficient values divided by the average of the coefficient standard errors using a conventional t-statistic 5 percent critical value of 2.

Switching from the Chinn-Ito measure of MOB to the FKRSU inflow restrictions measure (comparing column 5 to column 4) moderately increases the FISCAL coefficient when MOB is low but significantly reduces the FISCAL effect when MOB is high. Other policy coefficients are not significantly affected, nor are coefficients on auxiliary variables, though the negative GROWTH effect is modestly larger under low mobility.

Overall, different measures of capital mobility do not have major effects on the policy coefficients with the exception of the FISCAL effect under high mobility with the FKRSU measure. The different samples for which these alternative measures are available do have a noticeable and marginally statistically significant effect on the NOF coefficient (with the Quinn sample) and a moderate but not significant effect on the FISCAL coefficient (with the FKRSU sample).

Comparison with Other Studies

Table 5 displays estimated policy coefficients at different mobility levels with results from Gagnon (2017), Chinn (2017), and the IMF EBA model (Cubeddu et al. 2019). The first row shows the FISCAL coefficients. In the baseline model of this paper, a $1 increase in the fiscal balance raises the current account $0.19 when MOB = 0 and $0.38 when MOB = 1. The median value of MOB in the baseline regression is 0.45, so the median estimated effect is roughly halfway between the low and high mobility estimates. In Gagnon (2017) these effects are $0.19 when MOB = 0 and $0.59 when MOB = 1. Chinn (2017, table 4) and the IMF do not allow for fiscal interactions with mobility. A $1 increase in the fiscal balance raises the current account $0.20 in Chinn's results and $0.33 in the IMF results. The Chinn result is close to the baseline result under low mobility and the IMF result is close to the baseline result under high mobility. The Chinn sample has more developing economies and early years in which MOB tends to be lower, whereas the IMF sample is focused on advanced economies and more recent years in which MOB tends to be higher, which may partly explain these moderate differences. The Gagnon (2017) estimate under high mobility is noticeably larger than the other estimates.

In the baseline model, a $1 increase in net official flows (NOF) raises the current account $0.66 when MOB = 0 and $0.33 when MOB = 1. In Gagnon (2017) these estimates are somewhat lower: $0.49 when MOB = 0 and $0.29 when MOB = 1. The IMF effects are $0.75 when MOB = 0 and $0.00 when MOB = 1 (Cubeddu et al. 2019). Because the median value of mobility in the IMF sample is very high, the median NOF effect is relatively low at $0.09. However, the IMF regression restricts the NOF coefficient to zero when MOB = 1. We are not able to test this restriction because we do not have the IMF's data. In our baseline model and data, this restriction is strongly rejected. However, as discussed above, the IMF sample excludes many countries with important variation in NOF that helps to identify this coefficient, including some with high mobility. In addition, the IMF NOF series is based only on changes in foreign exchange reserves and thus erroneously excludes official flows from the sovereign wealth funds of Chile, China, Malaysia, Norway, and Korea, which may lead to a downward bias in the estimated NOF effect.

Table 5
Comparison of policy effects across studies

	Baseline		Gagnon (2017)[a]		Chinn (2017)[b]	IMF (Cubeddu et al. 2019)[c]	
Mobility level	*Low*	*High*	*Low*	*High*		*Low*	*High*
Policy variable							
FISCAL	0.19	0.38	0.19	0.59	0.20	0.33	0.33
NOF	0.66	0.33	0.49	0.29	0.76	0.75	0.00
SPILL	−0.69	−0.69	−1.14	−1.14	n.a.	−0.03	−0.03
NOS	0.03	0.02	0.03	0.04	0.03	0.02	0.02
R^2	0.53		0.58		0.41	0.52	
Countries	138		111		157	49	
Years	1986–2018		1986–2015		1971–2015	1986–2016	
Observations	3,159		2,209		888	1,367	

n.a. = not applicable

a. SPILL is normalized by world GDP instead of country GDP.

b. There are no interaction or spillover terms. NOS effect is based on net foreign assets. Observations are nonoverlapping 5-year averages. Adjusted R^2 is shown.

c. NOF is based on foreign exchange reserves only. NOF enters only as interacted term with effect restricted to be 0 at high mobility. SPILL is the COFER share of allocated reserves. NOS effect is based on net foreign assets.

Note: See glossary for explanation of terms.

According to the Chinn results, $1 in NOF raises CAB $0.76 with no variation by mobility. In part, this higher coefficient reflects a sample with lower mobility. But it also reflects the fact that Chinn's regression is based on discrete five-year averages. Larger NOF coefficients have been found when the data are averaged over time (Gagnon 2012, 2013). This result may reflect that NOF influences CAB only slowly and over a long period of time, unlike most other variables in the regression. The inclusion of lagged NOS was meant to capture that effect, but it may not be the best way to do so. The next subsection explores this issue further.

The baseline model includes spillovers from NOF in the rest of the world, which are allocated to reserve-issuing countries in proportion to their share of official reserves (COFER). No MOB interaction is estimated since reserve-issuing countries all have high MOB. If all the spillover went to the reserve issuers in proportion to their COFER shares, we would expect a coefficient of −1. The baseline coefficient is −0.69. For the United States, this implies an average effect of −1.2 percent of GDP over the estimation sample. A coefficient of −1.14 on a version of SPILL was normalized by world GDP instead of country GDP (Gagnon 2017); for the United States, the average effect of SPILL in this sample was about

−2 percent of GDP. The IMF regression does not have a NOF spillover per se, but it does estimate a fixed effect of reserve accumulation on reserve-issuing countries in proportion to their COFER shares with a coefficient of −0.03. For the United States, this implies an average effect of −1.9 percent of GDP over the estimation sample. Chinn does not estimate any spillover effect.

In the baseline model, a $1 increase in net official stocks (NOS) raises CAB $0.03 when MOB = 0 and this declines only slightly as MOB increases. Gagnon (2017) finds the same $0.03 effect when MOB = 0, but it rises slightly to $0.04 when MOB = 1. In the Chinn (2017) and IMF (Cubeddu et al. 2019) analyses, there is no separate NOS variable, but there is a net foreign asset (NFA) variable that includes official stocks. Assuming that official and private financial stocks have similar effects (which is roughly true in the baseline model), a $1 increase in NOS raises CAB $0.02 in the IMF results and $0.03 in the Chinn results.

Cumulative Policy Effects

Gagnon (2012, 2013) and Chinn (2017) find larger effects of net official flows on the current account when data are averaged over several years. A potential explanation is that NOF has a diffuse effect over time, in part because it both responds to and influences volatile private financial flows. Lagged effects are a major argument for including the lagged stock of net official assets (NOS) in the baseline regression; this coefficient is statistically significant albeit not very large.

An alternative way to estimate the cumulative effect of NOF on CAB is to look at the relationship between cumulated net official flows and cumulated current account balances. Table 6 presents a regression of net foreign assets (as a percent of GDP) on cumulated versions of the variables in equation 1.[28] FISCAL is replaced by the gross general government debt as a percent of GDP (GGDEBT)[29]; NOF is dropped and NOS takes its place; SPILL is the COFER share times the sum of NOS across all countries as a percent of each country's GDP; MOB is the lagged 10-year average of annual MOB; ENERGY is the sum of 10 years' net energy exports divided by current GDP[30]; GROWTH is the lagged 10-year average real GDP growth rate; RELGDP is the lagged 10-year average value of annual RELGDP; and AGING is the age dependency ratio 10 years ahead minus 10 years ago.

28 NFA is also known as net international investment position.

29 Net government debt is less widely available and does not fit any better.

30 Countries with at least eight years of ENERGY data were included, with missing data prorated at the 8- or 9-year average.

Table 6
Cumulative policy effects: Cross-country regressions of 2018 net foreign assets

Variable	Baseline	No MOB interactions	Core variables	Advanced economy core variables	Developing economy core variables	Developing economy robust regression	2010 core variables	Cumulated current account balance
Policy								
GGDEBT	−0.50 0.66	−0.41 0.27	−0.49* 0.23	−0.39 0.35	−0.65* 0.27	−0.61** 0.17	−0.35 0.28	−0.63* 0.29
GGDEBT x MOB	0.22 0.79							
NOS	2.33** 0.45	1.10** 0.22	1.12** 0.18	1.02** 0.24	1.19** 0.24	0.98** 0.21	1.17** 0.15	0.85** 0.17
NOS x MOB	−1.58** 0.51							
SPILL	−1.65 0.90	−0.43 0.81						
Auxiliary								
MOB	−32.85 62.08	−24.20 14.61						
MOB x MOB	4.21 57.58							
ENERGY	−0.11 0.10	−0.03 0.06						
ENERGY x MOB	0.05 0.16							
GROWTH	4.89 4.10	−2.14 2.71						
GROWTH x MOB	−9.97 5.42							
RELGDP	155.07 120.27	46.57 25.50	37.59* 15.58	44.63 29.48	15.41 22.68	22.41 19.87	3.59 15.35	85.33** 16.29
RELGDP x MOB	−82.17 123.40							
AGING	−4.72 2.45	1.20 1.65						
AGING x MOB	7.42 4.34							
Constant	−22.08 37.13	−15.87 23.67	−24.31* 12.04	−26.73 38.98	−13.48 12.01	−14.33 9.47	−26.65* 11.27	-36.21* 15.59
R^2	0.73	0.69	0.69	0.59	0.71	0.52	0.38	0.61
Observations	125	125	142	37	105	103	139	142

* $p < 0.05$, ** $p < 0.01$

Note: Numbers reported in blue are standard errors. The United Arab Emirates is in the stock regression in column 1 but not in the annual flow regressions because net private financial flows (NPF) are missing. Conversely, Barbados, Cameroon, Democratic Republic of the Congo, Gabon, Guinea, Haiti, Mauritania, Mongolia, Papua New Guinea, Sudan, Taiwan, Tajikistan, Uzbekistan, and Venezuela are in the annual flow regressions but not in the stock regression in column 1 because one or more data series are not available in 2018. Owing to missing data in 2018 or earlier years, Chad, Luxembourg, Macao, Montenegro, Serbia, Turkmenistan, and the United Arab Emirates are in the stock regression in column 3 but not in the annual flow regressions, while Barbados, Mongolia, and Venezuela are in the annual flow regressions but not in the column 3 stock regression. Cumulated current account balance is based on all available data for each country up through 2018 and is calculated in dollar terms. See glossary for explanation of terms.

Source: Authors' calculations using data described in the appendix.

The first column of table 6 shows the analogue to equation 1, including a full set of MOB interaction terms. This is a pure cross-country regression in 2018, so no year effects are needed. Of the MOB interaction terms, only the NOS term is significant. The two NOS coefficients take on extreme and opposing values, raising the possibility of spurious correlations. When interaction terms are dropped (column 2), the NOS coefficient is more sensible and the equation R^2 is only modestly lower. Column 3 drops insignificant terms from column 2, keeping only GGDEBT, NOS, and RELGDP, which are now all statistically significant with the expected signs. Of these three variables, NOS is by far the most important in explaining NFA, with standardized betas of GGDEBT −0.16, NOS 0.68, and RELGDP 0.16. Column 4 focuses on advanced economies, column 5 on developing economies, and column 6 on developing economies using the robust regression (rreg) command in Stata, which minimizes the influence of outliers.[31] Column 7 uses data for 2010. In every regression, NOS is statistically significant at the 1 percent level and never significantly different from 1. A $1 increase in NOS raises NFA about $1. GGDEBT always has the expected negative effect but is only occasionally significant. A $1 increase in GGDEBT reduces NFA roughly $0.50 (column 3). RELGDP always has the expected positive effect but is rarely significant. A 10 percentage point increase in a country's per capita GDP relative to the United States increases its NFA by about 4 percent of GDP (column 3).

Column 8 presents a regression based on the cumulated current balance (as of 2018) instead of net foreign assets. Net foreign assets may deviate from the cumulation of past trade balances because of changes in asset valuations such as stock prices and exchange rates and because of data revisions and improvements in coverage. The difference between net foreign assets and cumulated trade balances is sometimes large (Curcuru, Thomas, and Warnock 2013). Column 8 shows that the effect of NOS on the cumulated trade balance is nearly as large as the effect on NFA, with a coefficient not significantly lower than 1. The effect of RELGDP is noticeably larger in this regression than in the others of table 6.

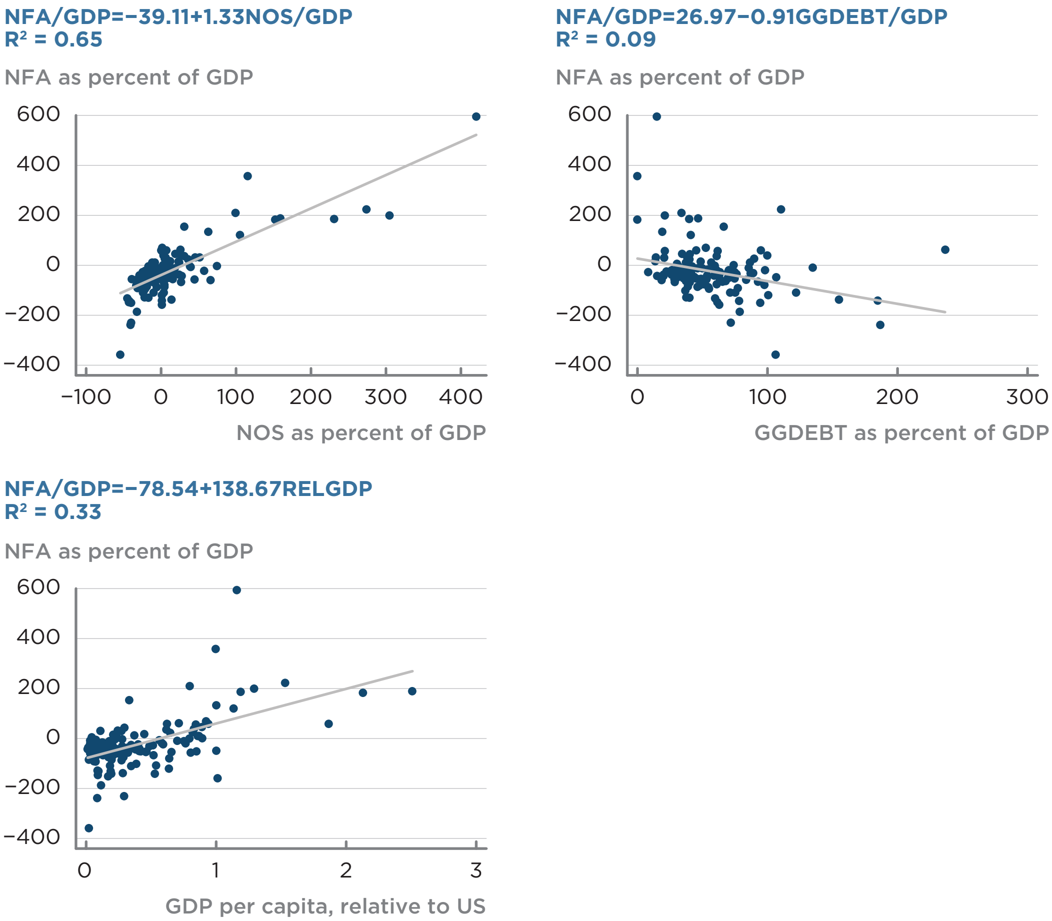
The constant term is negative, likely reflecting spillovers from countries with large positive NOS as well as some offset to the RELGDP effect, which is always positive by construction. Although the SPILL coefficients in columns 1 and 2 are not statistically significant, they are negative. The constant term drops significantly below zero when SPILL is dropped from the regression. The regression coefficients predict that a country with no GGDEBT, no NOS, and RELGDP equal to that of the United States (RELGDP = 1) would have NFA equal to about 13 percent of GDP (the RELGDP coefficient plus the constant term in column 3).

Figure 1 displays scatterplots of NFA against each of the independent variables in column 3. On its own, each variable is statistically significant in explaining differences in NFA, but NOS has by far the greatest explanatory power as shown by the regression R^2s. The outlier with NFA in 2018 at nearly 600 percent of GDP is Kuwait; Kuwait is not included in the regressions of columns 4 and 6 and this exclusion has little effect on the overall results.

31 The procedure dropped Kuwait and United Arab Emirates, countries with very large values of NFA/GDP and NOS/GDP, because they were deemed to be outliers based on Cook's D statistic.

Figure 1

Scatterplots of net foreign assets (NFA) and potential explanatory variables, 2018



Source: Authors' calculations based on data for the regression in column 3 of table 6. See glossary for explanation of terms.

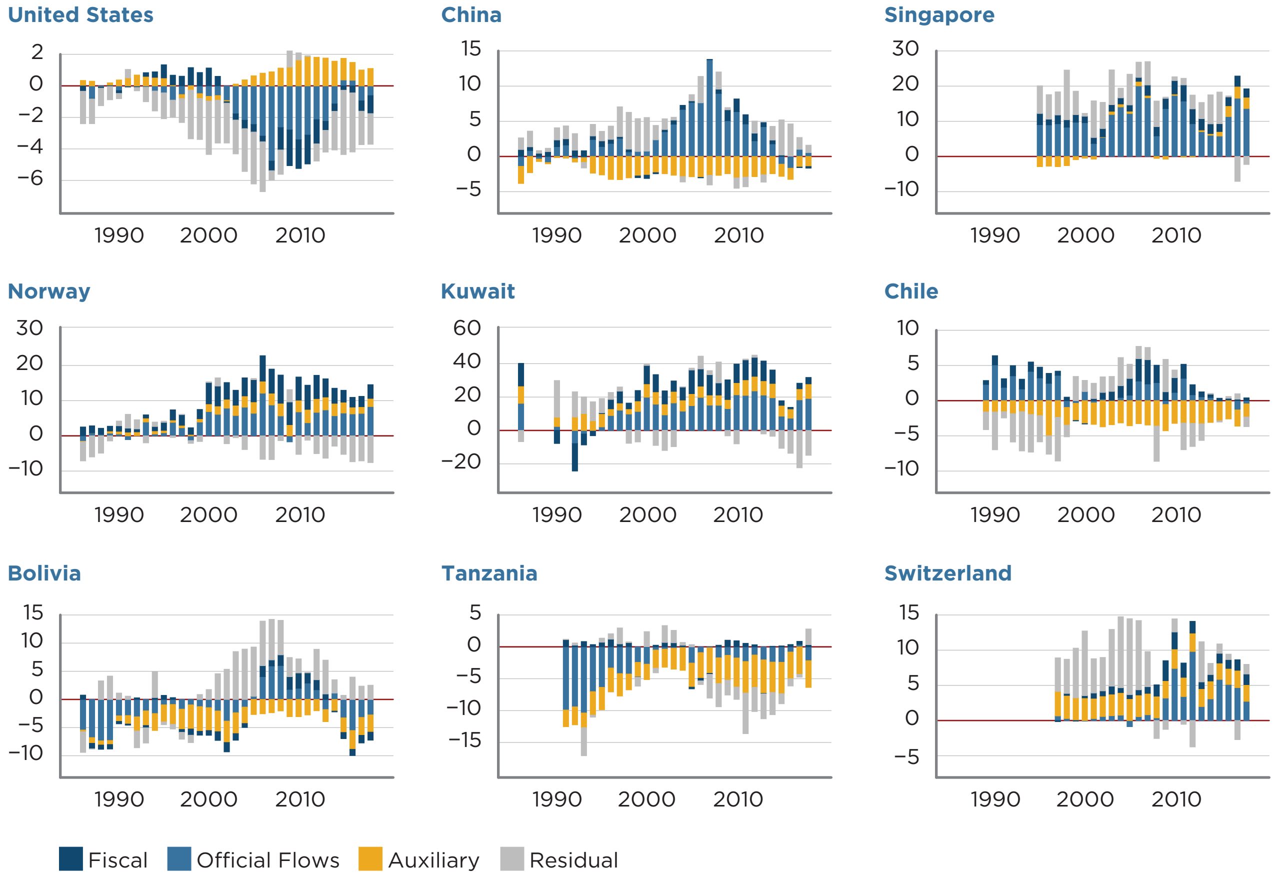
CASE STUDIES

Importance of Policy Variables

Figure 2 displays contributions to current account balances of selected countries constructed from the baseline regression of table 1C. Fiscal refers to the fiscal balance; official flows refers to the combined effects of NOF, SPILL, and NOS; auxiliary refers to the effects of the remaining variables; residual refers to any unexplained part of the current account. Year effects, which are small and equal for all countries, are not shown. The current account balance is the sum of the bars plus any year effect.[32] Fiscal effects are calculated based on the actual fiscal balance, not the cyclically adjusted balance; NOF effects are calculated based on the actual NOF, not the instrumented value.

32 Effects are calculated as differences from the global average effects of each variable or group of variables. The year effects equal the global current account discrepancy as a percent of global GDP.

Figure 2
Importance of policy contributions to current account balances in selected economies, 1986–2018 (percent of GDP)



Source: Authors' calculations based on the baseline coefficient estimates and data used in table 1.

Current account balances were small in the United States in the late 1980s and early 1990s. In the late 1990s, the current account moved into deficit despite a fiscal surplus. At first, the move into deficit was not explained well by the model, probably reflecting the safe haven status of the dollar during the Asian financial crisis and its aftermath. In the mid-2000s and early 2010s, official flows in foreign countries and the US fiscal deficit accounted for most or all of the deficit. An aging population and slower growth rate were pushing in the other direction, toward a modest surplus. Safe haven flows returned to importance in the late 2010s and official flows waned, as evidenced by the growing importance of the residual.

China also had small imbalances in the late 1980s and 1990s. In the late 1990s, rapid growth and energy imports offset modest positive contributions from official flows and an unexplained residual. Shortly after 2000, official flows soared and even exceeded the overall balance in 2007 before tapering off in the late 2000s and early 2010s. In recent years, China's balance has been relatively small, as slowing growth and declining oil prices shrank the auxiliary contribution while official flows became very small. Downward pressure on China's currency in 2015 and 2016 is apparent in the positive residuals in those years.

Singapore, Norway, and Kuwait are countries in which official flows and fiscal policy dominate the behavior of the current account balance. Singapore has a large funded social security system that is entirely invested abroad. Complete data on its official flows are not available before 1995, but since then official flows and the fiscal balance explain half or more of the large current account surplus in nearly every year. There is a significant positive residual in the late 1990s and early 2000s that has declined over time. Norway, despite having significant oil production since the 1970s, did not begin running a current account surplus until it started to save nearly all its oil revenues and invest them abroad in the mid-1990s, as shown by the fiscal and official flow contributions. Kuwait established the world's first sovereign wealth fund in 1953 and it ran a sizable current account surplus prior to the 1990 Iraqi invasion, as shown in the data for 1986. (Fiscal data are missing for 1987–89.) The 1991 Gulf War year is excluded from the regression because of the collapse in Kuwaiti GDP. The current account was near zero in 1992 as the government drew down foreign assets to pay for reconstruction. Over time, Kuwait returned to the prewar pattern of large trade surpluses supported by massive government saving in foreign assets.

Chile has saved much of its copper revenues, leading to positive contributions to the current account from the fiscal balance and official flows. Its rapid growth rate and youthful population make a negative contribution, while the residual has fluctuated from negative to positive and back.

Bolivia and Tanzania engaged in significant external official borrowing in the late 1980s and 1990s, and this was the dominant factor behind current account deficits in those years. Relatively poor and youthful populations and rapid economic growth make a persistent negative contribution to the balance. Government saving of natural gas revenues contributed to a notable swing into surplus for Bolivia in the late 2000s and early 2010s.

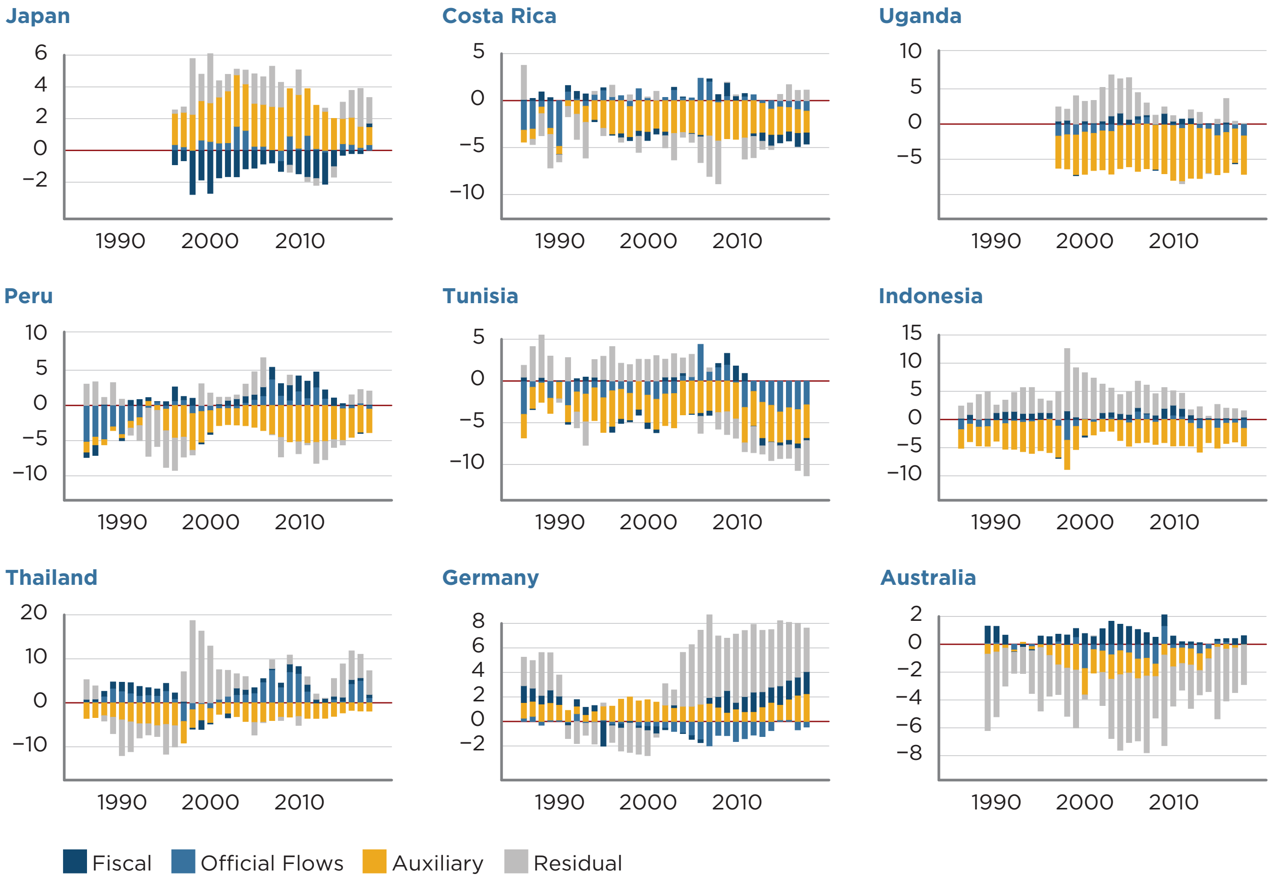
Switzerland presents an interesting story. Its current account moved into a substantial surplus in the 1990s (complete regression data are not available prior to 1997) as slow growth prospects encouraged Swiss companies to launch a wave of foreign investment. With the global financial crisis of 2008–09, Swiss outward investment slackened and foreign investors flooded in. This shift in net private capital flows caused the Swiss exchange rate to soar, threatening to shrink the country's large current account surplus. To prevent this deflationary shock, the Swiss National Bank purchased large amounts of foreign currencies. Along with an aging population and relatively large fiscal surpluses, these official flows have supported a large trade surplus while the residual has shrunk to a relatively small level that fluctuates around zero.

Auxiliary Variables and Residuals

Figure 3 presents current account contributions for selected countries that highlight the role of nonpolicy factors. Japan's moderate current account surplus is driven mainly by an aging population and slow growth, with a large fiscal deficit prior to 2015 providing some offset.

In Costa Rica and Uganda, fairly steady current account deficits are driven mainly by relatively poor and young populations and rapid growth. Costa Rica engaged in official external borrowing in the late 1980s. Uganda had a temporary unexplained narrowing of its deficit in the 2000s.

Figure 3
Importance of nonpolicy contributions to current account balances in selected economies, 1986–2018 (percent of GDP)



Source: Authors' calculations based on the baseline coefficient estimates and data used in table 1.

In Peru and Tunisia, auxiliary factors have also been consistently negative but less stable than in Costa Rica and Uganda. Policy factors initially made negative contributions that swung to positive in the late 2000s but have recently declined. Residuals have been in both directions but generally small.

Indonesia and Thailand display the effects of the Asian financial crisis of 1997, which caused a large increase in the residual as investors shunned assets in the affected countries. Thailand has had large positive contributions from official policy at various times since the mid-2000s.

Germany and Australia are two countries where the model does not work well and most of the current account imbalance is unexplained. For Germany, the current account was in a moderate surplus, only partly explained by auxiliary and fiscal factors prior to unification in 1990. In the 1990s, the current account was close to zero. After the formation of the euro area, Germany's surplus soared mainly because of factors not in the model, as the country invested heavily in peripheral euro area countries. Auxiliary and fiscal factors made small positive contributions, whereas the euro's role as a reserve currency was a small negative factor.

Australia has had a persistently large current account deficit, which is only partly explained by auxiliary factors and is partly offset by the country's fiscal surplus. These negative residuals likely arise from massive foreign investment to develop Australia's mineral resources.

CONCLUSION

The historical evidence shows that both fiscal policy and foreign exchange intervention (net official flows and stocks and their spillovers) have important effects on current account balances. Fiscal surpluses and purchases of official assets tend to increase a country's current account balance. Positive net official flows in other countries tend to reduce current account balances at home, especially when the home country issues a reserve currency. These findings are robust to alternative specifications, estimation techniques, and sample choices.

In regressions using annual data, these policy effects can explain about 40 percent of the variation of current accounts across countries and over time. Other variables, including those related to demographics, economic development, and energy exports, can explain a bit less than 40 percent of the variation. In regressions using cumulated current account balances in the form of net foreign assets as of 2018, roughly two-thirds of the variation across countries can be explained by cumulated official flows (net official stocks) with only small additional contributions from government debt and other factors.[33]

The difference in results between the annual flow regressions and the 2018 stock regressions is striking. It suggests that official flows are uniquely important in explaining differences across countries but other variables also have a role in explaining changes over time. One possible explanation is that the annual flow regression is particularly bad at capturing lags in the effects of official flows. To the extent that official flows respond to volatile private financial flows in an attempt to stabilize exchange rates, their estimated effect will be biased downward, as can be seen in a regression without instruments for official flows. Interestingly, an annual flow regression using instruments with only constant cross-country information (country effects) yields a noticeably larger estimated effect of official flows. We conclude that the annual flow regressions present a conservative estimate of the effects of official flows on current account balances.

Overall, we find that fiscal policy and exchange rate policy (measured by net official financial flows) are the most important factors behind trade imbalances. Factors related to demographics and economic development play a secondary but significant role in the directions predicted by economic theory. When trade balances and underlying factors are cumulated over time, the role of net official financial flows becomes especially dominant.

REFERENCES

Bayoumi, Tamim, and Christian Saborowski. 2014. Accounting for Reserves. *Journal of International Money and Finance* 41 (March): 1–29.

Bayoumi, Tamim, Joseph E. Gagnon, and Christian Saborowski. 2015. Official Financial Flows, Capital Mobility, and Global Imbalances. *Journal of International Money and Finance* 52 (April): 146–74.

33 On their own, debt can explain about 10 percent of the variation and per capita GDP about one-third.

Bergsten, C. Fred, and Joseph E. Gagnon. 2017. *Currency Conflict and Trade Policy: A New Strategy for the United States*. Washington: Peterson Institute for International Economics.

Chinn, Menzie. 2017. The Once and Future Global Imbalances? Interpreting the Post-Crisis Record. Paper presented at the Federal Reserve Bank of Kansas City's Jackson Hole conference, August.

Chinn, Menzie, and Hiro Ito. 2006. What Matters for Financial Development? Capital Controls, Institutions, and Interactions. *Journal of Development Economics* 81, no. 1: 163–92.

Chinn, Menzie, and Eswar Prasad. 2003. Medium-Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration. *Journal of International Economics* 59: 47–76.

Cubeddu, Luis, Signe Krogstrup, Gustavo Adler, Pau Rabanal, Mai Chi Dao, Swarnali Ahmed Hannan, Luciana Juvenal, Nan Li, Carolina Osorio Buitron, Cyril Rebillard, Daniel Garcia-Macia, Callum Jones, Jair Rodriguez, Kyun Suk Chang, Deepali Gautam, and Zijiao Wang. 2019. *The External Balance Assessment (EBA) Methodology: 2018 Update*. IMF Working Paper WP/19/65. Washington: International Monetary Fund.

Curcuru, Stephanie, Charles Thomas, and Francis Warnock. 2013. On Returns Differentials. International Finance Discussion Paper No. 1077. Washington: Board of Governors of the Federal Reserve System.

Fernández, Andrés, Michael Klein, Alessandro Rebucci, Martin Schindler, and Martín Uribe. 2016. Capital Control Measures: A New Dataset. *IMF Economic Review* 64: 548–74.

Gagnon, Joseph E. 2012. *Global Imbalances and Foreign Asset Expansion by Developing-Economy Central Banks*. PIIE Working Paper 12-5. Washington: Peterson Institute for International Economics.

Gagnon, Joseph E. 2013. *The Elephant Hiding in the Room: Currency Intervention and Trade Imbalances*. PIIE Working Paper 13-2. Washington: Peterson Institute for International Economics.

Gagnon, Joseph E. 2017. *Do Governments Drive Global Trade Imbalances?* PIIE Working Paper 17-15. Washington: Peterson Institute for International Economics.

Gagnon, Joseph E., Tamim Bayoumi, Juan Londono, Christian Saborowski, and Horacio Sapriza. 2017. Direct and Spillover Effects of Unconventional Monetary and Exchange Rate Policies. *Open Economies Review* 28, no. 2: 191–232.

Goldstein, Morris, and Mohsin Khan. 1985. Income and Price Effects in Foreign Trade. In *Handbook of International Economics*, vol. 2, ed. R. W. Jones and P. B. Kenen, 1041–105. Amsterdam: Elsevier.

Gruber, Joseph, and Steven Kamin. 2007. Explaining the Global Pattern of Current Account Imbalances. *Journal of International Money and Finance* 26, no. 4: 500–22.

Kumhof, Michael, Claire Lebarz, Romain Rancière, Alexander Richter, and Nathaniel Throckmorton. 2012. *Income Inequality and Current Account Imbalances*. IMF Working Paper WP/12/08. Washington: International Monetary Fund.

Laeven, Luc, and Fabian Valencia. 2018. *Systemic Banking Crises Revisited*. IMF Working Paper WP/18/206. Washington: International Monetary Fund.

Lane, Philip, and Gian Maria Milesi-Ferretti. 2018. The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis. *IMF Economic Review* 66: 189–222.

Marquez, Jaime. 2002. *Estimating Trade Elasticities*. Boston: Kluwer Academic Press.

Quinn, Dennis. 1997. The Correlates of Change in International Financial Regulation. *American Political Science Review* 91, no. 3: 531-51.

APPENDIX

DESCRIPTION OF DATA AND LIST OF COUNTRIES IN THE PAPER'S SAMPLE

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 Lane and Milesi-Ferretti's (2018) External Wealth of Nations (EWN) database. A few series are from other sources as described below. All data are annual. Data were downloaded in May–June 2020, with the exception of the WEO and EWN data, which were accessed in October 2020.

Regressions and figures exclude data for countries with 2018 GDP less than $5 billion. Also excluded are countries heavily affected by war or sanctions: Afghanistan, Iraq, Libya, and Syria.

Net official asset stocks (NOS) are the sum of foreign exchange reserves and nonreserve official foreign assets minus official foreign liabilities. 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 "International Liquidity, Total Reserves excluding Gold, US Dollars" series in the IFS database. Missing observations are filled in with data from the "FX Reserves minus gold" series in the EWN database. Based on data available in the RES database, long forward and futures positions are added to reserves, whereas short positions are subtracted.[34]

Nonreserve official foreign assets come from the BOP dataset and, where sovereign wealth funds (SWF) are not included in the official BOP asset data, from various other sources that provide information on assets held by SWFs. BOP data are used for the following countries: Argentina, Australia, Chile, Ecuador, Iraq, Kazakhstan, Korea, Kyrgyz Republic, Mexico, Panama, Nigeria, Sudan, Timor-Leste, and Venezuela. These countries' nonreserve official foreign assets are set equal to the sum of the central bank's or general government's holdings of "Equity and Investment Fund Shares" as well as "Debt Securities" in the "Portfolio Investment" asset category and "Debt Instruments" in the "Other Investment" asset category in the BOP database. SWF data downloaded primarily from national sources (accessed directly or via Macrobond) and the Sovereign Wealth Fund Institute (www.swfinstitute.org)[35] are used for the following countries: Azerbaijan, Bahrain, Botswana, Brunei Darussalam, China, Ghana, Kuwait, Libya,[36] Macao, New Zealand, Norway, Oman, Qatar, Singapore, Trinidad and Tobago, and the United Arab Emirates.

34 Forward positions for the United States, United Kingdom, Switzerland, and Denmark 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 excluded from both reserves and nonreserve official assets. The swaps do not appear to have distorted the official data of other central banks.

35 Other sources used are discussed below.

36 Information on assets held by Libya's SWF is from the International Forum of Sovereign Wealth Funds (IFSWF, www.ifswf.org). Since this information is not dated, SWF holdings are assumed to be reported as of the end of 2019.

Nonreserve official foreign assets are constructed for some countries and years using the perpetual inventory equation: NROAS = (1 + VALRATE) × NROAS(−1) + NROAF, where NROAS is the net stock of nonreserve official assets, VALRATE is the change in the value of nonreserve official assets in proportion to last year's asset stock, and NROAF is the nonreserve official asset flows (defined later). This equation can run both backward and forward from any year in which we have stock data. It requires flow data and an estimated valuation adjustment rate. We base VALRATE on countries with reliable stock and flow data for nonreserve official assets. VALRATE is fixed at its mean value of 0.014 before 2001 owing to limited and volatile data.

The main source for official foreign liabilities is the "External debt stocks, public and publicly guaranteed" series in the WDI database. For several countries, where WDI data are not available, information from the BOP dataset is used. A few countries have gaps or breaks (large jumps) in their series, which is why their official foreign liabilities are set as missing prior to the start of more consistent data. This affects Barbados before 2008, Namibia before 2000, Uruguay before 1990, and Vietnam before 1989. 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.

For Taiwan, data on nonreserve official foreign assets for the years 2007–19 are obtained from annual reports and detailed balance sheets of the central bank. Nonreserve assets were relatively small in 2007; they were extrapolated smoothly toward zero over the previous six years and assumed to be zero before that.

Macao does not report its fiscal reserve, which began in 2012, as part of its official assets. For the years 2012–19, its nonreserve official assets are replaced with estimates of its fiscal reserve based on IMF Article IV reports; for all years before 2012 its nonreserve official assets and flows are set equal to zero.

Algeria, Hong Kong, and Russia include assets of SWFs in reserves. Chile moved SWF assets out of reserves in 2006; before 2003 its nonreserve official assets are set at zero (there are small entries in the "Other Investment" asset category in 2003–05).

Saudi Arabia moved SWF assets into reserves in 2005; both nonreserve stocks and flows are set to zero from 2005 on. Data on the change in the reserve stock, the reserve flow, and an estimated valuation adjustment rate for reserves based on advanced economies in 2005 are used to construct a nonreserve stock in 2004 and the perpetual inventory method is used with NROAF to fill in earlier dates.

Azerbaijan's SWF asset holdings are missing for 2001, the year its SWF began operating. Therefore, its 2001 nonreserve official stocks are set equal to NROAF obtained from the BOP dataset. Nonreserve assets are assumed to be zero before 2001.

Nonreserve official foreign assets for Ecuador, Ghana, and Iraq are constructed using the perpetual inventory method on NROAF since 2006, 2011, and 2015, respectively. For Ecuador and Ghana, both nonreserve official assets and flows are set equal to zero before 2006 and 2011, respectively.

Because of data gaps, nonreserve assets and flows for Kazakhstan, Korea, New Zealand, Nigeria, Panama, and Trinidad and Tobago are set at zero for all years before 2000, 2003, 2002, 2005, 1995, and 2007, respectively.

For Kuwait, the perpetual inventory method is used on NROAF to fill in missing nonreserve stock data for all years before 2015. Nonreserve assets in the United Arab Emirates and Qatar are estimated in a similar fashion for 2000–11 and 2011–18, respectively, using 2012 and 2019 values as starting points. Their nonreserve stocks and flows are set as missing before 2000 and 2011, respectively. The same approach is applied to estimate Libya's nonreserve assets for 2007–18, with its missing 2019 NROAF observation replaced with the 2018 value and its nonreserve stock and flow data set equal to zero before 2007.

The Singapore Ministry of Finance reported the government's total financial assets for March 2010 of SGD 650 billion.[37] Temasek's reported local assets of SGD60 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 nonreserve assets in other years.

For Norway, the total assets of the Pension Fund Global are used as the estimate of the country's nonreserve official assets, based on data from Norges Bank.

Nonreserve official assets for Oman for the years 2012–15 are from the Sovereign Wealth Center (originally downloaded from www.sovereignwealthcenter.com, which has been discontinued).

Australia's missing nonreserve official asset and flow observations prior to 1989 are replaced with zeros.

Net official flows (NOF) are the sum of foreign exchange reserve flows and nonreserve official asset flows minus official liability 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 ensures that the current account equals the financial account in principle. Flows do not include changes in the market valuation of existing assets. The IMF uses the change in the stock of foreign exchange reserves as its estimate of net official flows (Cubeddu et al. 2019); this approach thus includes valuation adjustments and ignores the effects of nonreserve official flows.

The primary source for foreign exchange reserve flows is BOP "Supplementary Items, Reserve Assets (with Fund Record), US Dollars." Holdings of monetary gold, as reported by BOP "Financial Account, Reserve Assets, Monetary Gold, US Dollars," are subtracted from this series. Where data are available, changes in long forward and futures positions are added to reserve flows and changes in short positions are subtracted.[38] Forward and futures positions come from the RES database. For Taiwan, forward positions data are obtained from the central bank.

37 This balance sheet is no longer available on the ministry's website, but one of the authors keeps a paper copy.

38 As in the case of NOS discussed above, changes in forward positions for the United States, United Kingdom, Switzerland, and Denmark are not included in NOF because they are significant only for periods in which central bank currency swaps were active.

Nonreserve official asset flows are from asset-side "portfolio flows" and "other flows" for the central bank and general government, analogously to the nonreserve official stocks described above. Official liability flows are based on liability-side "portfolio flows" and "other flows" for the central bank and general government, removing debt forgiveness flows, as measured by BOP "Capital Account, Capital Transfers, General Government, Debt Forgiveness, Credit, US Dollars." Nonreserve official flows (NROF) are computed by subtracting official liability flows from NROAF.

Missing NROAF values are filled in using the perpetual inventory method. Where data necessary to construct official liability flows are not available, net official flows are estimated by changes in official foreign liability (external debt) stocks, after adjusting them for debt forgiveness flows.

Singapore's NROAF are the sum of the "Financial Account, Other Investment, Other Equity, Net Acquisition of Financial Assets, Debt Instruments, General Government, US Dollars" series in the BOP dataset and official portfolio investment asset flows, as reported in Singapore's balance of payments downloaded from the Singapore Department of Statistics (www.singstat.gov.sg). Nonreserve asset flows are set as missing prior to 1995, when the portfolio flows begin.

NROAF for Bahrain, Botswana, China (which established an SWF in 2007), and Oman are extrapolated using the perpetual inventory method based on nonreserve official stocks from 2008, 2005, 2007, and 2013 onward, respectively. Those for prior years are set as missing.

Kazakhstan's NROAF are set equal to the assets in 2000, the starting year of its SWF. The same approach is adopted for Trinidad and Tobago in 2007, with its flows further extrapolated in subsequent years using nonreserve assets and the perpetual inventory method.

NROAF data for the United Arab Emirates for 2000–19 are obtained from the central bank via Macrobond.

Current account balances (CAB) are from BOP. Missing values are filled in with data from WEO.

Net private financial flows (NPF) are defined as the difference between the financial account balance and NOF. The financial account balance is from the BOP dataset, with missing values filled in using IFS data, and is adjusted for debt forgiveness flows. Data on the financial account balance for Taiwan are obtained from the central bank via Macrobond.

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

Output gap (GAP) is the deviation of the logarithm of real GDP from the 11-year centered moving average of log real GDP, where the forward years near the end of the sample are based on WEO projections.

Fiscal balances (FIS_UNADJ) (defined as general government net lending/borrowing) are from WEO. Missing values are filled in with data from WDI (except for India, where the WDI data looked incompatible with the WEO data).

Data for Cameroon, Central African Republic, Mali, and Niger in 2006 and for Sierra Leone in 2007 are replaced by interpolation to account for debt forgiveness. For Burkina Faso and Zambia 2006 values are replaced with WDI data.

The cyclically adjusted fiscal balance (FISCAL) is constructed as the residual from a regression of FIS_UNADJ on GAP and the change in GAP, shown in table 1A.

Net foreign assets (NFA) are the difference between a country's external financial assets and its liabilities. The source is EWN.

Net private financial stocks (NPS) are the difference between a country's NFA and NOS.

Net energy exports (ENERGY) are from WDI energy exports and imports as a share of merchandise trade times the value of merchandise trade divided by nominal GDP. Some apparent errors in certain years for Antigua and Barbuda, the Bahamas, Burundi, Dominican Republic, Seychelles, the United Arab Emirates, and Zimbabwe are set as missing. To interpolate missing values, net energy exports, expressed relative to world GDP (to avoid country-specific fluctuations in GDP), are regressed, using observations from 1999 to 2010, on country dummies and their interaction with US GDP deflator–adjusted energy prices. Fitted values from this regression are reexpressed relative to each country's GDP and are used to fill in missing observations, after dropping predicted values for 1999 and 2010 and for countries that have fewer than five observations for net energy exports. For 2010–19, missing observations are replaced in a similar fashion, but based on results from the regression run for a period from 2009 onward. Cyprus, Mauritania, Suriname, and Venezuela are excluded from these interpolations.

Remaining missing observations are replaced with an alternative series calculated based on the "Energy imports, net (% of energy use)" and "Energy use (kg of oil equivalent per capita)" series from WDI as well as population, oil price, and GDP series from WEO, except for Armenia, Belarus, Bulgaria, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Moldova, Mongolia, Myanmar, Russia, Slovak Republic, South Africa, Turkmenistan, Ukraine, the United Arab Emirates, and Yemen.

The alternative series is used as the primary source for Bahrain, Cameroon, Eritrea, Kuwait, and Paraguay, with missing observations filled in with interpolated values from the above regressions (except for Cameroon).

Energy consumption data for Taiwan are from the Republic of China (Taiwan) Ministry of Economic Affairs, with physical volumes multiplied by prices for various energy items reported in WEO.

Capital mobility (MOB) is the Chinn-Ito measure (http://web.pdx.edu/~ito/Chinn-Ito_website.htm) based on legal restrictions to private capital flows and is normalized to lie between 0 and 1, with higher values denoting greater openness. Alternative measures of mobility include the Quinn data, available on the webpage for Cubeddu et al. (2019) (www.imf.org/external/np/res/eba/data.htm), and the FKRSU data (available at www.columbia.edu/~mu2166/fkrsu/).

Relative PPP GDP per capita (RELGDP) is constructed from WEO data. It is a country's purchasing power parity (PPP)–adjusted GDP per capita divided by the US per capita GDP.

Projected aging (AGING) is the change in the ratio of the population aged 65 and older to the population between 15 and 64 over the subsequent 10 years. Data are from the United Nations World Population Prospects (WPP) 2019 database (https://population.un.org/wpp/) and are interpolated to create 10-year changes.

Population growth (POP_GRO) is the annual change in total population. Data come from the UN WPP 2019 database.

Old age dependency ratio (AGE) is the ratio of the population aged 65 and older to the population between 30 and 64. Data are from the UN WPP 2019 database.

Share of prime-aged savers in the working-age population is the ratio of the population aged 45–64 to the population aged 30–64. Data come from the UN WPP 2019 database.

Life expectancy (LIFE_EXP) is the average value of life expectancy at ages 45 and 50. Data are from the UN WPP 2019 database and are interpolated to create values for each year.

Interaction of life expectancy with the projected future old age dependency ratio (LIFE×FUT_AGE) interacts life expectancy with the average of the old age dependency ratio 15, 20, and 25 years ahead. The dependency ratio is expressed in decimals instead of percentage points to enable full display of the coefficient in table 3.

CRISIS is a dummy that takes the value 1 if a country experienced a financial or currency crisis in the previous three years. Data are from Laeven and Valencia (2018). It is assumed no crises occur after 2017.

APPENDIX

Appendix Table 1
List of countries included in the annual flow regressions

1	Albania	36	Egypt	71	Lebanon	106	Romania
2	Algeria	37	El Salvador	72	Lithuania*	107	Russia
3	Angola	38	Estonia*	73	Madagascar	108	Rwanda
4	Argentina	39	Ethiopia	74	Malawi	109	Saudi Arabia
5	Armenia	40	Fiji	75	Maldives	110	Senegal
6	Australia*	41	Finland*	76	Mali	111	Singapore*
7	Austria*	42	France*	77	Malta*	112	Slovak Republic*
8	Azerbaijan	43	Gabon	78	Mauritania	113	Slovenia*
9	Bahrain	44	Georgia	79	Mauritius	114	South Africa
10	Bangladesh	45	Germany*	80	Mexico	115	Spain*
11	Barbados	46	Ghana	81	Moldova	116	Sri Lanka
12	Belarus	47	Greece*	82	Mongolia	117	Sudan
13	Belgium*	48	Guatemala	83	Morocco	118	Sweden*
14	Benin	49	Guinea	84	Mozambique	119	Switzerland*
15	Bolivia	50	Haiti	85	Myanmar	120	Taiwan*
16	Bosnia and Herzegovina	51	Honduras	86	Namibia	121	Tajikistan
17	Botswana	52	Hong Kong*	87	Nepal	122	Tanzania
18	Brazil	53	Hungary	88	Netherlands*	123	Thailand
19	Bulgaria	54	Iceland*	89	New Zealand*	124	Togo
20	Burkina Faso	55	India	90	Nicaragua	125	Trinidad and Tobago
21	Cambodia	56	Indonesia	91	Niger	126	Tunisia
22	Cameroon	57	Ireland*	92	Nigeria	127	Turkey
23	Canada*	58	Iran	93	North Macedonia	128	Uganda
24	Chile	59	Israel*	94	Norway*	129	Ukraine
25	China	60	Italy*	95	Oman	130	United Kingdom*
26	Colombia	61	Jamaica	96	Pakistan	131	United States*
27	Costa Rica	62	Japan*	97	Panama	132	Uruguay
28	Côte d'Ivoire	63	Jordan	98	Papua New Guinea	133	Uzbekistan
29	Croatia	64	Kazakhstan	99	Paraguay	134	Venezuela
30	Cyprus*	65	Kenya	100	Peru	135	Vietnam
31	Czech Republic*	66	Korea*	101	Philippines	136	Yemen
32	Democratic Republic of the Congo	67	Kuwait	102	Poland	137	Zambia
33	Denmark*	68	Kyrgyz Republic	103	Portugal*	138	Zimbabwe
34	Dominican Republic	69	Laos	104	Qatar		
35	Ecuador	70	Latvia*	105	Republic of Congo		

* Denotes advanced economy based on latest IMF classification.

Note: Transition economies (IMF country codes above 900, except for China and Hungary) are excluded from the regression sample before 2001. Observations for Equatorial Guinea, Kuwait in 1991, Mauritius before 2011, and Nicaragua before 1991 are excluded as well owing to data errors, data gaps, and outliers.

GLOSSARY

AGING	10-year forward change in the old age dependency ratio (for table 6 only, old age dependency ratio 10 years ahead minus 10 years ago); the old age dependency ratio here is defined as the ratio of the population aged 65 and older to the population between 15 and 64
AGE	ratio of the population aged 65 and older to the population between 30 and 64
AUX	auxiliary variables
BOP	balance of payments
CAB	current account balance
COFER	Currency Composition of Official Foreign Exchange Reserves
EBA	External Balance Assessment
ENERGY	net energy exports (for table 6 only, sum of 10 years' net energy exports divided by current GDP)
FIS_UNADJ	fiscal balance
FISCAL	cyclically adjusted fiscal balance
FKRSU	Fernández, Klein, Rebucci, Schindler, and Uribe (2016)
GAP	output gap
GGDEBT	gross general government debt as a percent of GDP
GROWTH	lagged real GDP growth rate over the previous five years (for table 6 only, lagged 10-year average real GDP growth rate)
LIFE_EXP	life expectancy
MOB	international capital mobility (for table 6 only, lagged 10-year average of annual MOB)
NFA	net foreign assets
NOF	net official financial flows
NOS	net stock of official financial assets and liabilities, including foreign exchange reserves
NPF	net private financial flows
NPS	net private financial stocks
NROAF	nonreserve official asset flows
NROAS	net stock of nonreserve official assets
OLS	ordinary least squares
POP_GRO	population growth rate
RELGDP	purchasing power parity–adjusted GDP per capita relative to the United States (for table 6 only, lagged 10-year average value of annual RELGDP)

SPILL	spillovers of NOF in other countries, defined as the sum of NOF in all countries times the COFER share of a country's assets in official foreign exchange reserves divided by a country's GDP (for table 6 only, a country's COFER share times the sum of NOS across all countries as a percent of its GDP).
SWF	sovereign wealth funds
VALRATE	change in the value of nonreserve official assets in proportion to last year's asset stock

PIIE PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS