External Balance Assessment (EBA):

Technical Background of the Pilot Methodology

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The External Balance Assessment (EBA) methodology is being developed by the IMF's Research Department as a successor to the CGER methodology for assessing current accounts and exchange rates.[1] *A pilot version of EBA was implemented in Spring 2012, with results used to inform the Pilot External Sector Report; that report also includes a general overview of EBA. This more technical background note provides an extended description of the pilot EBA methodology, and is being made available to solicit comments and suggestions for future refinement of the EBA methodology.*

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[1] The EBA methodology is a project of the IMF's Research Department, under the general direction of Olivier Blanchard and Jonathan D. Ostry. The EBA Team comprises Steve Phillips (head), Luis Catão (lead on current account analysis), Luca Ricci (lead on real exchange rate analysis), Mitali Das (lead on external sustainability analysis), D. Filiz Unsal, Jungjin Lee, Marola Castillo, John Kowalski, and Mauricio Vargas.

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I. Introduction

The External Balance Assessment (EBA) methodology is being developed by the IMF's Research Department as a successor to the CGER exercise. EBA revamps its predecessor, building upon the base of CGER.

EBA comprises three methods, each based on its corresponding CGER predecessor.[2] Thus the first two EBA methods are panel regression-based analyses of the current account and real exchange rate, while the third method is model-free and focused on sustainability analysis. EBA however brings important differences relative to CGER, particularly in the two regression-based methods.

The most fundamental innovation is that EBA makes a sharper distinction between positive (descriptive) understanding of current accounts and real exchange rates and making normative evaluations. Along the way, EBA takes into account a much broader set of factors than CGER—notably including policies, cyclical conditions, and global capital market conditions—that may influence the current account and real exchange rate.

This is done by distinguishing two stages of the regression-based methods:

- The first stage is positive (descriptive), and focused on *understanding* current account and real exchange rate developments, via the estimation of panel regressions.

- The second stage provides estimates that are more suitable for a *normative evaluation* of current accounts and real exchange rates. The second stage thus goes further, drawing on information from the regression results to estimate the contributions of several "policy gaps" to current accounts and real exchange rates.

This technical background note sets out the pilot version of EBA was implemented during Spring 2012. As the EBA methodology is under ongoing development, this note is being shared to solicit comments and suggestions for future refinement.

The note is organized as follows. Section II sets out the basic framework for the empirical analysis of current accounts and real exchange rates. Sections III and IV explain the positive analysis of current account balances and real exchange rates, respectively, based on panel regressions. Section V explains the second stage: the shift from positive analysis to normative evaluation, combining the regression results with benchmark policy settings to

[2] For full details of CGER, see IMF Occasional Paper 261, *Exchange Rate Assessments: CGER Methodologies, 2008*.

estimate the contributions of "policy gaps" to current accounts and real exchange rates, and to EBA "total gaps." Section VI describes the EBA External Sustainability approach to assessing current accounts. Finally, Section VII briefly discusses some key issues in using EBA results to make assessments, including aspects of the relevance and reliability of each of the three EBA methods.

II. EBA Framework for CA and REER Analysis

EBA builds on two well-known relationships. The first expresses the current account as the gap between aggregate saving and investment (the so-called "IS" relation), where:

$$S(NFA, Y, r, X_s) - I(Y, r, REER, X_I) = CA(Y, REER, Y^{wo}, X_{CA}) \qquad (1)$$

where we have in brackets the labels of the respective arguments of the saving and investment functions to be defined just below.

The second equation comes from the balance-of-payments (BOP) identity:

$$CA(Y, REER, Y^{wo}, X_{CA}) + CF(r - r^{wo}, X_{CF}) = \Delta R \qquad (2)$$

where (with the superscript "wo" denoting the counterpart foreign or world variables)[3]:

Y = the domestic output gap;

REER = the real effective exchange rate;

NFA = net foreign assets (measured at the beginning of the period);

R = foreign exchange reserves;

CF = balance on the financial account;

$X's$ = all the factors that may influence saving, investment, net exports and the current account, capital flows. In particular:

X_s = the consumption/saving shifters, which include income per capita, demographics, expected income (shifts in permanent income), social insurance, and the budget balance;

[3] It is worth noting that in equation (2), ΔR is taken as exogenous (policy determined) for now, and so is not written as a function of any other variable.

X_I = the investment shifters, which include income per capita, expected income/output, governance, and the relative price of capital which varies with the REER;

X_{CA} = the export/import shifters, which include the world commodity price-based terms of trade (itself a function of the respective country's commodity shares in exports and imports), and the country's oil export balance.

X_{CF} = capital account shifters, which include indicators of global risk aversion (proxied by the VIX/VOX indices, as discussed later), and share of the country's currency in the world total stock of international reserves.

If monetary policy follows either a Taylor-type or a peg rule, it can be shown that we can re-write the domestic interest rate *r* as function of the domestic and foreign output gaps. In this case, the model delivers the following reduced form equations for the current account and for the real effective exchange rate:

$$CA = CA(Y_{gap}, Y_{gap}^{wo}, X_I, X_S, X_{CA}, X_{CF}, \Delta R) \quad (3)$$

$$REER = REER(Y_{gap}, Y_{gap}^{wo}, X_I, X_S, X_{CA}, X_{CF}, \Delta R) \quad (4)$$

Equations (3) and (4) constitute the analytical backbone of the empirical analyses described in the following two sections.

III. Positive Analysis: The EBA Current Account Panel Regression

Current account regression specification

The backbone of the EBA CA regression-based exercise is the estimation of the general equation (3).

A number of empirical proxies for each of the variables discussed above were considered and investigated. Those that survived the specification search are discussed below (and also in an annex glossary of variables, with a detailed description of how each was constructed) along with the associated estimation results.

Importantly, most of these variables are actually measured as a country's deviation, in a given year, from the relevant "world" counterpart (in that same year).[4] Thus a movement in

[4] This treatment does not apply to variables that by their nature are already measured "relative" to other countries (e.g., net foreign assets)

the fiscal balance, e.g., is hypothesized to affect the CA only to the extent that other countries' fiscal balances do not move by the same amount. For the sake of brevity, however, we refer to such a regressor simply as "the fiscal balance," keeping in mind that it is actually a deviation from the "world" fiscal balance. Since in all regressions the individual country's current account is scaled by GDP, the "world" fiscal balance is computed as a GDP-weighted average of individual countries' fiscal balance.

Considering each country's characteristics relative to a GDP-weighted world counterpart has another important implication. It is also a way of recognizing the role of a country's economic size in governing how much its CA/gdp ratio will respond to a given domestic shock. For example, developments in a very small economy can influence its own CA while having nearly zero effect on other countries' CA. For a very large economy, however, any movement in its CA would require moving the CA of the rest of the world to a notable degree, and thus face more "pushback." Thus a given domestic shock would be expected to move a large economy's CA by less than the same shock would move a small economy's CA. The regression weighting scheme allows for this difference—not by estimating separate coefficients for countries of different size, but by differently measuring their shocks relative to the global average.

Estimation

The estimation uses pooled GLS with a panel-wide AR1 correction. Because current account data display strong autocorrelation, it is important to take account of this in the estimation. One other way of doing so would be to introduce a lagged current account in the regression. However, in pooled data this would amount to adding a quasi-fixed effect to the estimates and open up a key interpretative/normative issue related to having the current account in a given year being explained by the previous year's current account. With such a specification, the lagged CA regressor could end up picking up the effects of sustained distortions that are otherwise not captured by the regression (rather than serve its intended purpose of picking up dynamics and gradual adjustment).Therefore we instead use pooled GLS with a panel-wide AR1 correction to deal with autocorrelation.

Country sample and sample period

The set of countries covered is guided by balancing two considerations: capturing a large share of the global economy and avoiding having too much heterogeneity in the regression samples. Country selection focused on countries that have sizeable access to global capital markets and data of sufficient good quality and availability; countries with very low per capita income levels or small geographical area are mostly excluded from the sample. (Note that in practice these criteria are often interrelated.) A further consideration was to exclude countries for which oil exports are a highly dominant share of the economy (e.g., Saudi Arabia, Venezuela). It was judged that assessments of such cases require special considerations that would be too challenging to include in the EBA panel regression.

The balance is struck at a set of 50 economies (listed in an annex to this note), mainly advanced and emerging market economies, which together encompass about 90 percent of global GDP.

The regression is run on annual data for the period 1986-2010. The purpose of using annual data, rather than data that has been pre-averaged into 4- or 5-year blocks, is to uncover cyclical sources of current account behavior. In turn, this allows making a cyclical adjustment of the current account, and for the subsequent analysis to focus on the latest observed current account.[5] (For the pilot EBA exercise conducted in Spring 2012, the analysis centered on actual 2011 current account outcomes.)

Current account regression results

The estimated coefficients are shown in Table 1. They have the expected signs (with one exception discussed below) and nearly all are statistically significant.

Among the more "traditional" current account regressors, the lagged level of net foreign assets (NFA), the relative level of per capita income, the rate of income (GDP) growth, the net oil trade balance, aging speed, and a financial center dummy are clearly significant statistically. These variables all featured in the CGER methodology regression (or some of its variants) in some way, though the EBA regression involves refinements to several of these regressors.

- One refinement is to allow for an evident non-linearity in the (positive) relationship between the CA and NFA. That relationship flattens out when NFA is in the low end of the range; accordingly, an interaction term is used to allow a different slope when NFA is below negative 60 percent of GDP (a threshold suggested by the work of Catao and Milesi-Ferretti (2012), in the context of analyzing crisis probabilities).

- Also, with the EBA regression's inclusion of a cyclical terms of trade regressor (see below), it was noticed that there was no robust relationship between the oil trade balance and the overall CA balance for most countries in the sample. Accordingly the regression takes account of the oil balance only for outlying cases, when and where it

[5] In contrast, the approach taken in CGER was to focus assessments on the current account expected to hold 5 years into the future, which would be likely free of cyclical influences. The CGER analysis therefore relied on country desk projections of the current account; it did not directly speak to the recently observed level of the current account nor provide a quantification of current cyclical influences.

exceeds +10 percent of GDP.[6] Countries in that situation do tend to have sizable CA surpluses, presumably because they have substantial wealth in the form of exhaustible oil resources, and choose to save a portion of current oil income flows in light of that exhaustability.

- Another refinement in the EBA regression is that the rate of economic growth is considered on a forward-looking basis, as expectations of future growth rather than the record of past growth.

- Regarding demographic variables, the "aging speed" regressor (not used in CGER) is clearly statistically significant; faster projected aging is associated with a stronger current account.[7] On the other hand, the CGER's demographic variables, population growth and the old age dependency ratio, are not significant statistically, but do enter with the expected signs.

- As in CGER, a single dummy variable is entered for a small set of economies that are relatively small but have "financial center" characteristics. These are the Netherlands, Singapore, and Switzerland (and also Belgium, but only in the first part of the sample period). The use of a financial center dummy follows tradition and serves the purpose of avoiding potential bias in estimates of other regression coefficients, but otherwise does not advance the understanding or assessment of the CAs of such economies, which remains problematic.[8]

The EBA CA regression also includes a number of regressors that were not part of the CGER regression, including several that are cyclical in nature:

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[6] In recent years, this criterion is met only by Russia and Norway within the 50 country sample. It turned out that these 2 outlying countries alone were responsible for an apparent relationship between net oil exports and the CA; in their absence, the relationship disappeared. As a rough way to take account of the substantial difference of oil endowments of Russia and Norway, the oil balance data for Russia is adjusted (which amounts to making a relative adjustment for Norway also) by the ratio between the two countries' levels of oil reserves (each considered relative to current production).

[7] The aging speed concept has been previously used in CA analysis, including Lane (2010) and Lane and Milesi-Ferretti (2011).

[8] Other than by use of crude dummies, empirical research over the years has not quantitatively explained the tendency of such countries to have substantially higher CA balances than other countries – though there are a number of plausible hypotheses for this pattern. Mismeasurement of the CA is another possible explanation.

- The relative output gap—which proxies for the role of temporary demand shocks—enters with the expected negative sign.

- The commodity terms of trade (TOT), measured so as to capture only its cyclical element, and interacted with trade openness, enters with the expected positive sign.

- Another addition to the traditional CA regression is global capital market conditions, or global risk aversion, which is proxied by the VOX/VIX index.[9] As hypothesized, this shows up as a significant determinant of current account balances, but one that does not affect all economies equally: for non-reserve currency countries, a rise (fall) in the global risk aversion is associated with a rise (fall) in the current account. The VIX is interacted with the share of a country's own currency in world reserves—a proxy to capture differing degrees of flight to safety effects. Moreover, the VIX is interacted with the degree of openness of the capital account: the greater is openness (the fewer are capital controls), the greater the effect of the VIX on the current account.

Another regressor is the share of a country's own currency in the total stock of world reserves—a proxy for the so-called "exorbitant privilege" of reserve currency countries such as the U.S. in potentially financing their current accounts by issuing widely accepted money liabilities. When this variable is entered separately in the regression, its coefficient does not have the expected negative sign, but is near zero and is not statistically significant. (It is retained as a regressor as a control and for consistency with its use as an interaction variable in the VIX regressor.)

The EBA current account regression also includes terms to capture the effects of four types of policies:

- Fiscal policy here is measured as a cyclically-adjusted balance, and is instrumented. The coefficient on this fiscal balance is positive and statistically significant. The estimate of about + 0.4 suggests that Ricardian equivalence does not hold, so the fiscal stance can significantly affect the current account.

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[9] The VIX index is calculated by taking the weighted average of the implied volatility of a sub-set of call and put options on the SP index with an average time to expiration of 30 days. High readings of the index relative to average are oversold (excessive market bearishness) and low readings are overbought (excess of bullishness). From 2003, the Chicago Board Options Exchange (CBOE) changed the way the VIX is calculated, but the old VIX index (now called VOX) is still available, so that a consistent historical series is available starting in 1985.

- The level of public health spending, in relation to GDP, serves as a proxy for social protection. Consistent with the hypothesis that such protection tends to reduce the need for precautionary saving, the estimated coefficient is negative (and is statistically significant).

- Capital controls have a positive coefficient in the CA regression, as expected. The point estimate suggests that a rise in the index from 0 controls to "full" controls (when the capital control index is at its maximum value of 1) would boost the current account balance by about 3 percent of GDP.

- The instrumented ratio of changes in international reserves (measured as a share of GDP), interacted with the index of capital controls, enters with a positive coefficient of about 0.4 .[10] The hypothesis is that the extent to which current account balances can be affected by reserve intervention policies depends on the presence of capital controls. Indeed, entering reserve accumulation alone, without taking account of capital controls, yielded a coefficient that was negligible economically and statistically insignificant. To mitigate endogeneity problems, the change in reserves (scaled by GDP) is instrumented with its own lag and VIX.

The EBA approach to CA assessment avoids a role for country dummy variables in determining CA gaps. Thus a fixed effects specification is not used, on the principle that country dummies would not provide an economic explanation of observed CAs and might pick up the uncaptured effects of sustained distortions on the CA. That said, the pilot version of the EBA regression does include dummies for each of three countries that had large average residuals over the sample period (Germany, Malaysia, and Sweden – dummy coefficients not reported). However, the contributions of these dummies are subsequently "backed out" of the fitted CA values for those countries, so as to count them later as part of estimated CA gaps, along with the regression residual. Thus the dummies enter only in EBA's estimation phase, and only out of a concern to avoid potential bias in the estimation of other coefficients.

Fit of the CA regression

Regarding regression fit, the adjusted R-squared is 0.61 and the root mean squared error (RMSE) is about 3.2 percent of GDP. The "typical" error value—measured as the median absolute value of the residual in a recent year—is smaller, about 2 percent of GDP. The higher RMSE value of course reflects the greater weight it gives to outlying cases. Indeed,

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[10] Other recent work also links the CA with reserve accumulation via panel regressions, albeit with different specifications: Gagnon (2011, 2012) and Bayoumi and Saborowski (forthcoming).

the size of the residuals found here and the challenge of fitting CA data can be viewed in the perspective the very large dispersion of current accounts that is observed within the "modern era" of our sample period (e.g., with current accounts ranging from deficits of 15 percent of GDP or more (Greece, Peru) to surpluses of 18 percent of GDP or more (Russia, Singapore). One notable pattern is that it is difficult for the regression to fully explain the wide swings in current accounts in some countries that have gone through severe boom and bust episodes in credit and asset markets.[11]

Monetary and financial factors not explicitly reflected in the CA regression

The EBA regression does not include a regressor measuring monetary policy or interest rates. As discussed earlier, this omission is justified in theory if monetary policy tends to follow Taylor-type rules, in which case monetary policy rules can be solved for the level of the output gap to which these rules react. (A further consideration is that exploratory attempts to include the domestic-foreign interest rate differential proved to yield a very unstable coefficient across specifications and time periods.)

A more problematic issue is that the EBA CA regression (as well as CGER) lacks regressors capturing domestic financial conditions or frictions, or distortions from inadequate financial regulatory responses. Developments on those fronts have the potential to importantly drive overshooting (or undershooting) of credit and asset prices associated with large swings in private sector spending and current accounts. More generally, aside from lagged NFA and (indirectly) the expected growth indicator, there is no other explanatory variable that captures wealth effects that can importantly drive consumption, and hence the saving ratio and the current account. This was a limitation of the CGER CA regression; it remains a limitation in the pilot EBA, one that reflects several difficulties. First, good proxies for domestic financial frictions, wealth effects and the appropriateness of financial regulation are difficult to obtain, particularly for EBA's broad cross-country panel regression sample. Second, the data that are systematically available tend to be for crude indicators (such as credit/GDP); even if a correlation between these and the CA can be found, potential endogeneity and omitted variable problems would make the attendant coefficient very difficult to interpret. For example, an association between credit growth acceleration and deterioration of the CA might in one episode be driven by an unmeasured relaxation of financial regulation, or it might be that both developments were consequences of a boom in domestic demand driven

[11] Comparisons to the fit of the CGER's CA regression are not straightforward, primarily because CGER had the advantages of working with smoothed (4-year averaged) data and its use of the lagged CA as a regressor, among other differences. Comparisons made in annual data and excluding the lagged CA indicate that the EBA's richer set of CA determinants adds roughly 10 to 15 points to the R-squared, relative to some more CGER-like specifications.

by non-financial factors. Even if empirical relationships with clear causal interpretations could be found, a third difficulty in introducing financial variables would come up in the assessment stage: normative policy benchmarks for these variables would be difficult to agree on, requiring the use of informed judgment for each country case.[12]

In the absence of such financial variables in the regression, financial effects are likely to go into the regression residual, making residuals particularly large in magnitude for some countries and periods. This highlights the importance of applying informed judgment in interpreting the regression residual, gauging the extent to which it reflects distortions not captured by the model.

Other hypotheses explored to date

Beyond the variables in the pilot EBA CA specification, a number of other hypotheses have been explored to date. These include the following, which however turned out to be insignificant statistically and/or economically, or otherwise inferior to alternatives:

- One area of investigation involved variables pertaining to governance and the quality of institutions. The well-known "Polity" index (either Mark I or II) is one that produced economically insignificant results. The World Bank "Doing Business" data is another (and its use was at any rate constrained by its time series limitations, as it is essentially a cross-sectional index available for recent years).

- Another variable explored was the Djankov et al. (2005) "de jure" social protection index. This was statistically significant (and with the right sign) but the index suffered from data limitations for the purpose at hand. It was outdated (based on 2002 cross country information) and did not cover all countries in the EBA sample.

- Another variable tried without success was the composition of net foreign liabilities (in particular the share of FDI in gross liabilities, given evidence that financing of current account deficits through FDI tends to make them be more sustainable).

- Trend (HP-filtered) GDP growth was tried but turned out to be dominated by the forward looking expected growth variable.

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[12] While the above problems limited what could be done within the EBA framework, other types of analysis can shed light on current account behavior during financial boom episodes. For example, Chinn, Eichengreen and Ito (2011) first use a standard CA panel regression to identify the 2006-08 period as one of excess (unexplainable) current account imbalances, and then undertake a separate "forensic" analysis of those excess imbalances to investigate the role of asset market booms in that period. Aizenman and Jinjarak (2009) link real estate appreciation with current account deficits.

- In addition, variables that control for the composition of government spending, alternative proxies of global risk aversion (such as the US corporate spread and the US treasury bond real interest rate), and (historical) terms of trade volatility were also tried and proved to unsuccessful in helping explaining the current account and (in some cases) in yielding signs consistent with well-accepted theoretical priors.

IV. Positive Analysis: The EBA Real Exchange Rate Panel Regression

This section discusses the REER panel regression of equation (4) from Section II. As noted earlier, EBA's two regression-based approaches are developed in parallel; essential to the theoretical framework that underlies both is that most factors that would influence the current account also influence the real exchange rate. For example, a factor that pushed down the saving rate of a country, and thereby boosted its domestic demand, would result in both a decline in the current account balance and an appreciation of the real exchange rate.

A key point is that the EBA REER regression-based approach relies on a panel regression of REER *indices*, which in turn requires using Fixed Effects (FE) estimation; i.e., a full set of country dummy variables. In that sense it is comparable to the CGER approach, which also used REER indices and FE estimation. However, significant differences from CGER arise from the inclusion of a wider set of determinants (including policy variables and short term factors), in line with the spirit of the new EBA analysis and the EBA CA regression-based approach.

Note that FE estimation forces each country's regression residuals to average to zero over the sample period, so that fitted values are heavily influenced by past REER levels. This implies that results are less reliable for countries with a short sample span or that have experienced large structural changes that are not well captured by the regression. A short sample span will make results very sensitive to the length and would generally tend to understate the extent of the gap.

A potential solution to these problems would be a regression analysis based on estimates of real exchange rate *levels*, rather than a time series of exchange rate indices that cannot be compared across countries. Work is ongoing to develop such a method, for use in future EBA analyses.

The real effective exchange rate measure

The real exchange rate is the Fund's standard REER index for each country, from the IMF's INS data. As an index, it has no meaningful cross-country variation, and FE estimation is required in order to avoid having the results depend upon the choice of index base year. An increase in the REER signifies a real *appreciation*.

Estimation method and sample

The estimation method entails fixed effect OLS coefficients and standard errors corrected for autocorrelation and heteroskedasticity. The choice is mainly due to the properties of OLS coefficient estimates, which are compatible with the data being either stationary or nonstationary (but cointegrated). Indeed, results of testing of stationarity were inconclusive. Inference, however, needs to be distinguished in the case of stationarity or nonstationarity. In the case of stationarity, standard errors are corrected via the Newey-West HAC method, which accounts for heteroskedasticity both within countries and across countries, as well as serial correlation within countries. In the case of nonstationarity, these standard errors are not reliable, and the relevance of variables is instead determined by the cointegration test (which indeed rejects the null of no cointegration for the specification presented; obviously, this test is relevant only if variables are nonstationary).

Due to data availability constraints, the REER regression sample is 1990-2010; the country sample (see annex) contains all but 8 of the 50 countries included in the current account regression.

Explanatory variables and summary regression results

Regression results are presented in Table 2. Note that regressors for each country are generally defined relative to the values of their trading partners, using the same weights as the INS system. Some variables are lagged for endogeneity but results are generally robust to an alternative 2SLS instrumental variable approach.

- **General government cyclically adjusted balance to GDP**. The coefficient is negative (in line with a positive sign in the CA regressions). The regression suggests that when the balance increases by 1 percentage point of GDP, the REER depreciates by 0.4%.

- **Health expenditure to GDP** (lagged) has a positive sign (consistent with a negative sign in the CA regressions). An increase in health expenditure by 1 percentage point of GDP is associated with a 2 percent appreciation.

- **Capital account controls** (lagged) have a negative coefficient. This is consistent with a positive sign in the CA regressions, and with the idea that this variable mainly captures the effect of capital controls on inflows (lower ability to borrow and run current accounts deficits, and a more depreciated exchange rate). [13]

[13] The capital controls data is an update of the Quinn dataset (Quinn, Dennis P. 1997, "The Correlates of Change in International Financial Regulation" *American Political Science Review*, Vol. 91,

(continued)

- The **output gap** has a positive coefficient (consistent with a negative sign in the CA regression). An increase in the output gap by 1 percentage point of GDP is associated with an appreciation somewhat above 1 percent.

- **VIX/VOX (indicator of global risk aversion), interacted with capital account openness** (lagged). The coefficient is generally negative for most countries (i.e. non reserve currency countries), associated with the need to generate a CA surplus when global risk aversion increases and access to credit becomes more difficult. The effect is stronger the more open the capital account is. For countries whose currency is a reserve currency the effect is in the opposite direction, and appreciates the currency. The VOX measure is demeaned so for the periods in mid-1990s and mid-2000s when global risk aversion was particularly low, these variables would indicate capital flowing from reserve currency countries to the others in the sample. (Entered as a separate regressor, the share of the own currency in global reserve holdings is insignificant; its inclusion mainly serves the purpose of allowing a proper analysis of the interaction term).

- **Financial home bias** (lagged) has positive sign. This variable is an indicator of the domestic preference for domestic assets. It is calculated as the share of domestic debt owned by residents. If a country has a preference for holding domestic assets, this tends to appreciate the REER. Given that other variables in the regression tend to capture international investor preference for the country assets (which would have the opposite effect on the exchange rate), this variable can be thought as the residual effect from a home bias. The variable is lagged, as changes in the exchange rate can affect the indicator purely from a composition effect (as the share of foreigners is more likely to be denominated in foreign currency).

- **Fertility** has a positive sign: the higher the fertility rate, the higher the share of inactive population, which is associated with lower net saving, and more appreciated real exchange rates. The work of Rose, Supaat, and Braude (2009) suggests that fertility is the best proxy for demographic factors in real exchange rate regressions.[14] This turned out to be the case also in our REER regression, which uses only fertility. The other three demographic variables used in the current account regressions were not as robust as fertility and did not always have correctly-signed coefficients.

September, pp. 531-551; and Quinn, Dennis P. and A. Maria Toyoda. 2008. "Does Capital Account Liberalization Lead to Economic Growth?" *Review of Financial Studies*, Vol. 21(3): pp. 1403-1449).

[14] Rose, Supaat, and Braude (2009) "Fertility and the Real Exchange Rate" *Canadian Journal of Economics*, Vol. 42, Issue 2, pp. 496-518, May 2009.

- **Commodity terms of trade** has a positive sign. The size of the coefficient is somewhat lower than existing CGER results and other standard literature based on samples until mid-2000s. This seems in part due to the richer model, which entails that other variables (such as the fiscal balance) capture part of the effect of commodity prices.

- **Trade openness** (lagged) has a negative sign. Average exports and imports to GDP is a proxy for trade liberalization, which lowers the domestic price of tradable goods, thus depreciating the CPI-based real exchange rate. As a change in the exchange rate affects differently the numerator and denominator of openness, this is indicator is lagged.

- **The share of administered prices** has a negative sign (as administered prices are generally imposed to lower prices). This variable is available only for a few transition economies (for the rest it is assumed to be 0), which experienced a significant reduction in the share of administered prices during the economic transition towards a market economy. A decrease in the share of administered prices by 1 percent is associated with a 1½ percent appreciation.

- **Forecast GDP growth** (5-year ahead) has a positive coefficient, consistent with the negative coefficient found in the CA regression (faster growth is associated with a weaker current account and a more appreciated real exchange rate).

- Finally, recognizing a significant structural break at the end of the apartheid in South Africa, we add a dummy for this country in the early years of the sample period, until 1994. This has very little effect on results, even for South Africa.

Regarding the fit of the REER regression, the root mean squared error is about 9.5 percent, which can be compared to an unconditional standard error of the REER (i.e. controlling only for fixed effects) of 18.5 percent. The corresponding figure from the CGER's REER regression was about 12 percent.

A number of variables that are present in the current account regression or have been employed in several empirical analyses of real exchange rates turned out to not be significant in our specification. In particular:

- Net foreign assets (NFA) would be expected to have a positive coefficient mainly because of the presumed steady state relationship (a country with a higher NFA can afford a lesser trade balance and a more appreciated REER). However, such a relationship may be in part captured by the cross-sectional dimension and so difficult to detect in fixed effects estimation.

- Accumulation of official reserves is hypothesized to drive a weaker exchange rate (and a stronger current account), particularly in the presence of capital controls.

However, an effect of reserve accumulation was not robustly detectable in the regression, after controlling for other determinants and seeking to account for the endogeneity of this variable. The coefficient was often of the correct sign (negative in countries with capital controls), but was generally unstable and insignificant, and so was excluded from the pilot REER regression. The difficulty of detecting a clear effect could reflect endogeneity problems (since a country might be most likely to accumulate reserves at a time when its currency is already strong, thus trying to "lean against the wind"). Another problem is that the cross-sectional (between country) variation of reserve accumulation is twice its time variation within countries, suggesting that countries that intervene tend to do so in a persistent manner. Again, this would make the effect difficult to detect under fixed effects estimation.

- GDP per capita turned out to not be significant. The Balassa-Samuelson effect posits that the real exchange rate should appreciate when productivity of tradables rises more than productivity of nontradables relative to trading partners. The traditional empirical support has been named "the Penn effect", as it is based on the Penn World Table database by regressing the price level on PPP GDP per capita. However, the Penn effect comes mainly from the cross-sectional dimension, as such real exchange rate data does contain level information and fixed effects are not included in the typical Penn regression. This would explain why GDP per capita is not significant in the Pilot EBA REER exercise, which includes fixed effects. It is worth noting that GDP per capita is not the best possible proxy for the Balassa-Samuelson effect, as it would increase with both the productivity of tradables and the one of nontradables. For the CGER's REER regressions, a likely more accurate proxy for the Balassa-Samuelson effect was constructed through the year 2004, with long and extensive efforts, based on estimates of the relative productivity of tradable versus nontradables relative to trading partners (IMF Occasional Paper 261; Ricci et al., 2012).[15] Such a proxy could in principle be reconstructed and updated for the EBA country sample. However, for our purpose of extending the pilot real exchange rate analysis to level (rather than index) REER data—an ongoing effort—the use of per capita GDP appears to be satisfactory and indeed works very well.

- Other variables such as the quality of institutions that may affect the savings-investment balance—but have mainly a cross-sectional dimension—also did not enter significantly, perhaps again because their effect is absorbed by the fixed effects.

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[15] Ricci, Luca Antonio, Gian Maria Milesi-Ferretti, and Jaewoo Lee (2012) "Real Exchange Rates and Fundamentals: A Cross-Country Perspective" forthcoming *Journal of Money Credit and Banking.*

We also investigated the possibility that the exchange rate regime would affect the real exchange rate, or the way in which the main determinants affect the exchange rate (i.e. via interaction terms). We used both de jure and de facto indicators of the regime and found no robust effect, apart from when interacted with the output gap or the terms of trade (countries with more flexible exchange rates have more positive effects from these two variables than countries with fixed exchange rate regimes).

A further point of investigation concerned the role of fiscal policy. The effect of a stronger fiscal balance on the real exchange rate turned out to be significant and negative, as expected (and consistent with an improvement of the external balance found in the current account regression). However, an improvement of the fiscal stance might also generate a positive confidence effect on the exchange rate. Such a confidence effect is more likely in countries with high debt, where the public finance position is weaker and fiscal balance improvements are more effective in bringing confidence back. Indeed, in a variant of the REER regression, we find that controlling for the level of indebtedness (as a way of controlling for the confidence effect) raises the magnitude of the coefficient of the fiscal balance, indicating a stronger negative effect.

V. Toward normative evaluation: estimation of policy gaps and total gaps

This section explains how the EBA methodology uses the results of the regressions, described in the previous two sections, as a tool to guide a normative evaluation of current account balances and real exchange rates.

For the purpose of exposition, this discussion below focuses on analysis of the current account. The EBA analysis of the real exchange rate proceeds in analogous manner. (The only notable difference is that the REER analysis does not explicitly measure the impact of reserve accumulation, as that policy variable did not feature robustly in the REER regression specification.)

As discussed above, the estimated current account equation includes a number of variables that are under policy control (fully or partially) in the near term: fiscal balances, capital controls, social spending, and reserve accumulation. The observed values of these policies, along with other variables, contribute to the regression-predicted values of the current account.

The EBA exercise, however, aims to go beyond decomposing observed current accounts into regression-explained and regression residual components. EBA seeks to gauge how far observed current account balances are being driven by deviations of policies from their desirable or appropriate levels.

It is easy to see how we can gauge the contribution of such "*policy gaps*" to the overall current account gap in the context of the estimated regression. Start from the fitted regression value (where country and time subscripts are omitted to lighten notation):

$$(\frac{\hat{CA}}{Y}) = \boldsymbol{\alpha} + \mathbf{X}'\boldsymbol{\beta} + \mathbf{P}'\boldsymbol{\gamma} \qquad (1)$$

where $\mathbf{X}$ is the vector of non-policy "structural" variables and $\mathbf{P}$ is the vector comprising the above policy variables measured by their actual values. Let $\mathbf{P}^*$ be the desirable values for those policy variables. Then simply add and subtract $\mathbf{P}^{*\prime}\boldsymbol{\gamma}$ from the right hand side of equation (1) to obtain:

$$(\frac{\hat{CA}}{Y}) = \underbrace{\boldsymbol{\alpha} + \mathbf{X}'\boldsymbol{\beta} + \mathbf{P}^{*\prime}\boldsymbol{\gamma}}_{\text{EBA's CA "norm" (i.e. EBA's predicted CA at P*)}} + \underbrace{(\mathbf{P} - \mathbf{P}^*)'\boldsymbol{\gamma}}_{\text{Contribution of policy gaps to deviations from CA norm}} \qquad (2)$$

That is, the fitted CA values from the regression can be decomposed into two parts:

- The first part is the EBA CA "norm," i.e., the CA value implied by the regression if all policies were at desirable P* levels (and all other regressor variables were at their actually observed levels).

- This second term represents the *contributions of policy gaps* to explain deviations of the actual current account balance from the EBA norm. These policy gap contributions are measured as the product of each of the estimated coefficients on the respective policy variables by the policy gap $(\mathbf{P} - \mathbf{P}^*)$.

Similarly, the actually observed current account for 2011 can be broken down into three parts, the last of which is the regression residual:

$$\frac{CA}{Y} = \frac{\hat{CA}}{Y} + \text{regression residual} = EBA \text{ norm} + (\mathbf{P} - \mathbf{P}^*)'\boldsymbol{\gamma} + \text{regression residual} \qquad (3)$$

The EBA estimated *Total Current Account Gap* is defined and measured as follows, in several equivalent ways:

$$\textbf{Total CA gap} = \frac{CA}{Y} - EBA \text{ norm} = \frac{CA}{Y} - \left[\frac{\hat{CA}}{Y} - (\mathbf{P} - \mathbf{P}^*)'\boldsymbol{\gamma}\right] \qquad (4)$$

$$= \textbf{Regression Residual} + (\mathbf{P} - \mathbf{P}^*)'\boldsymbol{\gamma}$$

Thus the Total CA Gap is the deviation of the observed CA from its EBA norm level; it is also equal to the sum of the CA regression residual and the *contributions of policy gaps* to the CA (which as noted are the product of each of the estimated coefficients on the respective policy variables and the policy gaps $(\mathbf{P}-\mathbf{P}^*)$).

As an illustration of how to measure the policy contribution to the Total CA Gap, consider the case of the fiscal variable. As discussed in section 1, that variable enters the regression in the form of the cyclically adjusted fiscal balance with a combined coefficient $\gamma_{fiscal} = 0.4$ (see Table 1). So, the contribution of the fiscal "gap" to the overall current account balance of any given country in 2011 is estimated by 0.4 times the gap between the 2011 cyclically adjusted fiscal balance minus the desired P* medium-term fiscal balance. Consider a country that has an actual current account deficit of 2% of GDP in 2011 which is entirely explained by the fitted regression of Table 1, so the regression residual is zero. However, a perfect regression fit would not necessarily mean that "all is well" according to the EBA analysis. Say that country runs a cyclically-adjusted fiscal balance of -5% of GDP when its desirable long-term fiscal balance is zero. In other words, it has a fiscal gap of -5% in 2011. By equation (4), the EBA Total CA Gap will be the regression residual (0%) plus (-5%)*0.4, or -2% of GDP. So, the entire CA deficit of that country in 2011, and its entire Total CA Gap, is due to deviations of fiscal policy from its recommended position.

For the sake of simplicity, the above example did not refer to the fiscal policy of other countries. However, in these calculations of (P-P*) policy gaps, it is also important to take into account that – as noted earlier – a country's own policy needs to be measured relative to the policies of other countries. This is essential for logical consistency, and to ensure global consistency of the estimates.[16] Naturally, this need to consider "international relativities" arises also when analyzing the contributions of policy *gaps* to current accounts.

To see this, consider again the example of fiscal policy. It follows from the construction of this metric (i.e. measuring a country's P-P* relative to the foreign (world) counterpart, which we call P_{wo}-P^*_{wo}) that in a hypothetical situation in which *every country had the same size "own" fiscal policy gap, then the contribution of fiscal policy gaps to each country's CA would be zero*.[17] This example also relates to a point that happens to be critical in the present

[16] It can be formally shown that using foreign counterpart variables based on the their values weighed by the respective country share in world GDP ensures that this multilateral consistency constraint is essentially built in the estimates of the panel regressions in Table 1.

[17] While it is a common practice to denote starred variables as the foreign counterpart of the domestic variable under consideration, here we use P* as the *desirable* level of the variable, be it domestic or foreign. We use instead the subscript "wo" to denote the foreign (world) counterpart.

global conjuncture, in which many economies (including advanced countries that have a large weight in the global economy) now are judged to have sizeable negative fiscal gaps. Since what matters for their effect on the current account is the country-specific gap *relative to other economies*, the overall effect of such sizeable negative fiscal gaps on the respective country's current account will be dimmed accordingly. Another implication: in today's environment, even a country that now has a zero "own" fiscal policy gap will find that its CA is being influenced (upward) by the sizable negative fiscal policy gaps that prevail in the rest of the world.

In short, an estimated policy gap contribution to the CA of a given country can reflect not only that country's "own" policy gap (if any), but also the effects of policy gaps that may be present in other countries. The same also applies to a country's Total CA Gap.

Specifying benchmarks for policy variables

The EBA exercise thus requires specifying normative *policy benchmarks* for appropriate settings (levels) of each of four policy areas: the fiscal balance, capital controls, social spending (in this case public health spending/GDP), and FX market intervention (as proxied by changes in foreign exchange reserves).

For the pilot EBA exercise, policy benchmarks were defined as follows:

- For fiscal policy, we use recommended levels of the fiscal balance suggested by the country desks. (Importantly, these recommended settings would not necessarily be made also to the current year, since special considerations could apply to the current year. Typically the recommendations refer to a medium-term horizon, so that considerations of the business cycle and a possible counter-cyclical role of fiscal policy would not be relevant for the recommendations.)

- Regarding social protection—and more particularly public health spending—we obtain a benchmark from a regression of health/Y on countries' level of (PPP-based) GDP per capita (which alone explains 80 percent of the variation in health spending) as well as their demographics (the current old age dependency ratio).

- For capital controls, the benchmark is either the cross-country average level of the controls index (0.15 in 2010, out of a 0 to 1 range), or a country's actual level, whichever is the smaller.

- For the change in reserves, we presume for most countries that the observed change in 2011was appropriate. However, for those countries with levels of reserves that are

far in excess of the reserves metric "suggested adequacy range," we specify zero as the appropriate change in reserves.[18]

The final step: confirming multilateral consistency

Multilateral consistency is an important aspect of EBA analysis. To a large degree such consistency is built into the design of the methodology, but a final check and a small adjustment is necessary to confirm it.

In the case of the current account, perfect consistency would require that the sum of current accounts and current account gaps (say, expressed in U.S. dollars) of all countries would sum to zero. In practice, this is not a feasible objective because there is a global statistical discrepancy in the reported CA data. Moreover, the EBA country sample does not quite cover the global economy, though it does include the reported CA balances of countries representing just over 90 percent of global GDP.[19]

The feasible objective for consistency then becomes matching the sum of the CA of the EBA sample countries, and ensuring that the sum of any gaps for these countries is zero. As a final step in EBA analysis, the CA predicted values, and gaps, for each country are checked and adjusted as necessary (by a uniform amount, in terms of each country's own GDP) to ensure that objective. The necessary adjustment turns out to be small (e.g., about 0.2 % of GDP). This is because multilateral consistency is to a large degree "built in" to the regression specification, as each determinant of a country's current account is considered not simply as that country's own value, but relative to other countries' levels, with an appropriate weighting scheme.

In the case of the real exchange rate, for multilateral consistency, it is important to ensure that that the weighted average of residuals is zero in each year. To a large extent such consistency is achieved via careful construction of the variables, by relating each variable to the trading partner weighted average of the same variable. However, in principle this alone may not be sufficient to ensure full consistency.

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[18] For an overview of the reserves adequacy metric, see Appendix III of the Pilot External Sector Report (www.imf.org).

[19] For the 50-country EBA sample group, the sum of actual (that is, reported) current accounts in 2011 is about negative US$ 61 billion, the equivalent of about 0.1 percent of their combined GDP.

As in the CGER practice (see IMF Occasional Paper 167, chapter 7), for every year multilateral consistency is checked and ensured by adjusting each exchange rate residual by the global weighted average of residuals. For each year, the weights are given by the eigenvector associated with the unit eigenvalue of the trade weights matrix for that year. It turns out that the necessary consistency adjustment is very small, at less than 1 percent in the residuals, without or with policy gap contributions.

VI. EBA External Sustainability (ES) Approach

This section describes EBA's external sustainability (ES) approach, which remains essentially unchanged from that in CGER.[20] The ES approach is the only one among the three EBA approaches that is neither based on regression analysis nor on a model/set of hypotheses. Its simple structure is both a strength and a limitation of the approach.

The ES approach assesses the sustainability of a country's external debt by comparing the CA/GDP expected to prevail in the medium-term to the CA/GDP that would stabilize the external stock position (NFA/GDP) at a specified benchmark level. Unlike the other two EBA approaches, the ES approach does not seek to identify the adjustment required to bring the CA/GDP or RER to an "optimal" level. Nor does the ES approach identify a sustainable level of NFA/GDP.

In order to calculate the CA/GDP adjustment consistent with stabilizing NFA/GDP at a benchmark level, the ES approach requires only a few assumptions about a country's potential growth rate, inflation rate, rates of return on external assets and liabilities, and the benchmark level of NFA/GDP. For the pilot EBA exercise, the NFA/GDP benchmark is set at the latest observed (2010) level, for the majority of countries analyzed by EBA.[21] Although this benchmark has little normative content, it allows the ES to provide some perspective on whether the projected medium-term CA/GDP, at current RERs, are likely to lead to increase debtor or creditor positions relative to their current level.

The ES calculation is done in two steps. The first involves calculation of the CA/GDP level that would stabilize the NFA/GDP at the benchmark level. The second step calculates the

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[20] In ongoing work, a number of variants and extensions of the ES approach are being developed and considered for future implementation. For greater detail on the ES approach, see IMF Occasional Paper #261, *Exchange Rate Assessments: CGER Methodologies*.

[21] For a select group of economies with extremely high external liabilities (e.g., Greece, Hungary, Portugal, Spain), low external liabilities (e.g., South Africa) and exporters of non-renewable resources (e.g., Russia), the benchmark is modified on the basis of regional averages or other criteria.

CA/GDP gap as the WEO projected (2017) CA/GDP (assuming closed output gaps, current real exchange rates, and current policies—including those due to take effect between 2012 and 2017)—less the NFA benchmark-stabilizing CA/GDP. Where this gap is different from zero, the ES assessment is that the projected medium term CA/GDP will not stabilize the benchmark NFA/GDP position.

The ES gap is complementary to the gaps calculated in the CA and REER regression-based approaches, but not directly comparable. A key difference is that the ES does not attribute its CA gaps to the contributions of deviations from optimal policies (nor to any particular driver of the CA). Another difference is that the regression-based gaps focus on the current conjuncture (while controlling for cyclical influences, to the extent possible), whereas the ES approach is forward-looking (in this case, relative to 2017). In particular, the ES gap may be more informative about sustainability when countries have large net debtor positions, especially if these positions are projected to grow over the medium-term. The ES gap may also provide a complementary perspective where the regression approaches yield unsatisfactory empirical fits or face other particular country-specific challenges. Differences in the regression-based CA gap and the ES CA gap could arise from several factors, among others: (a) a plausibly non-optimal NFA/GDP benchmark; (b) discrepancies between current policies (assumed in ES) and the desirable mix of policies (assumed in CA); and, (c) an unsatisfactory regression fit (which increases the total CA gap). Nevertheless, the two types of CA gaps nearly always point in the same direction, even if their magnitudes differ.

VII. Interpreting EBA results: relevance and reliability

As will be clear from the previous sections, the three EBA approaches each have relative strengths and limitations. While each can act as a check on the others, each is known to perform better or worse in certain situations:

- ***The current account regression-based approach:*** This approach is often but not always the most informative and reliable of the three EBA approaches. Its limitations tend to be most apparent in analyzing countries with very important or dominant special sectors, such as large oil exporters and relatively small economies that are financial centers. For some countries, this approach yields very large regression residuals, and thus Total CA Gaps, which require careful further interpretation.

- ***The real exchange rate regression-based approach:*** This approach is especially useful where the first approach faces a particular difficulty. Its limitations are reduced reliability in countries with large productivity differentials or other large structural changes, as well as those with short data spans. This method forces gaps for each country to average to zero over time, and the resulting RER gaps may be understated as a consequence. A related problem is that RER gap estimates for the current year

can be very sensitive to the length of the prior sample period used to analyze a given country. The potential solution to these problems would be a regression analysis based on estimates of real exchange rate levels, rather than a time series of exchange rate indices that cannot be meaningfully compared across countries. Work is ongoing to develop such a method, for use in future EBA analyses.

- ***The external sustainability approach:*** As noted, this approach is most relevant and informative for countries with large NFA imbalances, and for which there is a clear view of what would be a more appropriate NFA level.

It is clear that EBA's two regression-based methods are the more ambitious, in terms of taking account of many factors in regressions, and then using those as a base for normative evaluation. As such, results of the first two methods in principle should be more meaningful than the less-ambitious ES exercise. However, despite a range of technical advances and refinements, the regression-based approaches of EBA cannot entirely overcome certain essential issues (issues that were also present in CGER). The underlying difficulty is that the positive empirical analysis still leaves one with an incomplete understanding of CA and RER levels and movements: there remains an unexplained, residual component, one that is often too large to completely ignore. In such a case, the challenge is to interpret the residual appropriately. Absent perfectly complete information from the standardized EBA regressions, additional information and judgment will be needed to complete a normative analysis, that is, an *assessment*. Essentially, a judgment must be made as to what is missing from the EBA regression's analysis of a given country, and whether the regression residual reflects the effects of distortions or of fundamentals on the CA and RER. In many cases, what is missing from the EBA analysis may be something well known to experienced analysts of a given country, even if it is not feasible to measure and include that factor in the panel regression. In light of the above, as well as the element of uncertainty that comes with any econometric analysis, it is suggested that EBA be seen as a tool that provides useful estimates to inform and guide assessments, rather than as a mechanical means of producing final assessments.

Table 1. EBA: Current Account Regression Results 1/

(Estimation Period: 1986-2010)

L. NFA/GDP	0.04	***
L. (NFA/GDP)*(dum=1 if NFA/GDP < -60%)	-0.03	**
Financial Center Dummy	0.04	***
L. Own per capita GDP/US per capita GDP (PPP)	0.04	***
Oil Trade Balance/GDP (if >10%)	0.5	***
Dependency Ratio	-0.03	
Population Growth	-0.4	
Aging Speed	0.1	***
Real GDP growth, 5-year ahead forecast	-0.4	***
L.Public Health Spending/GDP	-0.7	***
L.VOX*(1-Kcontrol)	0.06	***
L.VOX*(1-Kcontrol)*(currency's share in world reserves stock)	-0.2	***
Own currency's share in world reserve stock	0.003	
Output Gap	-0.4	***
Terms of Trade gap*Trade Openness	0.3	***
Cyclically Adjusted Fiscal Balance, instrumented	0.40	***
Capital Control Index ("Kcontrol")	0.03	***
Kcontrol*(Changes in Reserves)/GDP, instrumented	0.4	**
Constant	0.003	
Observations	1099	
R-Squared	0.61	
Number of countries	50	

1/ GLS estimates with panel heteroskedasticity corrected standard errors.
"L" stands for one-year lag of the respective variable.
* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 2. REER Fixed Effects Regression

VARIABLES	
Cydically adjusted fiscal balance to GDP (rel to TRD PRT)	-0.4*
Lagged health expenditure to GDP (rel to TRD PRT)	1.9**
Lagged capital account controls (quinn) (rel to TRD PRT)	-0.3***
output gap (rel to TRD PRT)	1.2***
Lagged VIX * Capital account openness	-0.2**
Lagged vox * capital account openness * share of own currency in global reserve	0.7**
Share of own currency in global reserves holdings	0.05
lagged financial home bias (shr dom. debt owned by residents, rel to TRD PRT)	0.2***
Fertility (rel to TRD PRT)	0.06**
Log commodity Terms Of Trade	0.2***
Lagged trade openness (exp+imp) to GDP (rel to TRD PRT)	-0.3***
Share of administered prices	-1.7***
5-year ahead WEO GDP growth forecast (rel to TRD PRT)	1.9**
Observations	826

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

Newey-West corrected standard errors

Annex 1. Glossary of Variables in Current Account Regression

- ***NFA/Y (*Net Foreign Assets to GDP ratio).** This enters directly, as in levels as well as interacted with a dummy that takes on the value of one if the NFA is below negative 60 percent of GDP.

- ***Financial Center Dummy.*** Dummy variable that equals 1 for the Netherlands, Singapore and Switzerland throughout the estimation period (and for Belgium also, but only through 2004).

- ***GDPpc/USGDPpc.*** Log of per capita GDP relative to that of the U.S.

- ***Oil Balance.*** Oil exports minus oil imports, as percentage of GDP. This enters only when the ratio exceeds 10 percent. (When the sample was restricted to exclude such cases, the oil balance did not show up as a robust determinant of current account balances.)

- ***Population Growth.***

- ***Old Age Dependency Ratio.*** Ratio of population aged over 65 divided by population between 30 and 65 years old.

- ***Aging Speed.*** Projected change in the dependency ratio (above), ratio 20 years out, relative to current level.

- ***5-year growth forecast.*** WEO projections of the rate of real GDP growth 5 years ahead. This is expected to measure underlying growth potential (at a time when the output gap is likely to be closed). (For each country, it is measured relative to the GDP-weighted world average growth rate forecast.)

- ***Public health spending/GDP.*** A proxy for social protection which tends to reduce private agents' need for precautionary saving.

- ***VOX, interpreted as a measure of global risk aversion.*** The VOX is an index of implied U.S. stock market volatility (very similar to the VIX, but available for a longer period). Annual average varies between 0.12 and 0.35 during the sample period. The VOX enters alone as well as interacted with the respective country's share of its own currency in reported reserves held by central banks worldwide (see below).

- ***Own currency share in world reserves.*** Share of the country's own currency in total stock of world reserves, as a proxy for the "exorbitant privilege." Varies somewhat over time. For example, it was 73 percent for the US in 1985, down to 61 percent in 2010. For a country like

Greece, it moves from zero in 1998 to 19 percent in 2001 (when it joined the euro), and so on. For Germany, the change between 1998 and 1999 is of course less dramatic (from 14 percent to 17 percent). This variable enters both alone and interacted with the VIX.

- ***Output gap***. For most countries and years, this reflects estimates from IMF country teams. For those countries and/or years for which such country team estimates are not available, HP filtered estimates of the output gap (based on data over 1980-2017, and using WEO projections for 2012-2017, are used). This variable is also measured relative to the weighted world GDP averaged output gap.

- ***Commodity Terms of Trade Gap, interacted with trade openness***. This regressor aims to capture the role of cyclical developments in commodity prices in influencing a country's overall terms of trade, by taking into account for each country the detailed structure of its own trade pattern in commodities and the importance of such trade in relation to its total trade. The regressor is constructed in several stages. It draws on a geometric average-based ratio of 43 world price indices of commodities relative to manufactured goods according to their share in the countries' export to imports. The index is constructed so that the numerator is the product of each commodity relative price to the power of the export value of the commodity divided by the average of exports and imports, and likewise for the denominator.[22] To produce a cyclical gap measure, the time series is first extended into the medium term (using commodity prices projected as part of the IMF's latest WEO round) and then filtered by the HP procedure for each country, so has a zero country-specific mean. Finally, the resulting gap series is interacted with a measure of the country's trade openness, the ratio of exports plus imports of goods and services in GDP.

- ***Cyclically-Adjusted Fiscal Balance, instrumented***. For most countries and years, the series is based on country team estimates of cyclical adjustment. Otherwise, it is computed as the residual of a regression of the fiscal balance on the output gap. Because of the potential

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[22] To illustrate, consider a country that exports no commodities. Then the numerator will be the product of each of the 43 commodity relative price indice to the power of zero which will equal one. Conversely, if a country has a balanced trade in one commodity (say a given foodstuff variety), with exports and imports of that commodity being 20% of its total average trade (=(exports+imports)/2). Then country's TOT will not be affected for global relative price of that commodity as the index will deliver $(Pfood/Pman)^{0.2}/(Pfood/Pman)^{0.2}=1$, irrespective of the value of Pfood/Pman. Finally, take a country that the same food commodity accounts for 20% of its exports and 20% of its imports but overall imports are twice as large exports. Then that TOT index will be $(Pfood/Pman)^{0.1}/(Pfood/Pman)^{0.2} = (Pfood/Pman)^{-0.1}$. Taking logs, it is straightforward to see that the country will experience a TOT deterioration of 1% when the price of that commodity rises by 10%.

endogeneity of the fiscal balance, the variable is instrumented with the lagged cyclically-adjusted global fiscal balance, a time trend, lagged world GDP growth, lagged domestic and world output gaps, US corporate credit spreads (worked marginally better than the VIX), FX regime, the polity index, and the average cross-sectional fiscal balance.

- ***Capital Controls***. Quinn index on overall capital controls on the private sector. It is scaled to vary from 0 (no controls) to 1 (full control).

- ***Changes in reserves, instrumented***. Change in central bank foreign exchange reserves during the year scaled by nominal GDP, both in US$ dollars. It was instrumented on the basis of annual regressions of this variable, for each country separately, on its lagged values and the VIX/VOX. For each country, this variable is measured relative to the GDP-weighted world average counterpart.

Annex 2. Countries in the EBA Regression Samples

Argentina	Korea
Australia	Malaysia
Austria	Mexico
Belgium	Morocco*
Brazil	Netherlands
Canada	New Zealand
Chile	Norway
China	Pakistan
Colombia	Peru
Costa Rica*	Philippines
Czech Republic	Poland
Denmark	Portugal
Egypt*	Russia
Finland	*Singapore*
France	South Africa
Germany	Spain
Greece	Sri Lanka*
Guatemala*	Sweden
Hungary	Switzerland
India	Thailand
Indonesia	Tunisia*
Ireland	Turkey
Israel*	United Kingdom
Italy	United States
Japan	Uruguay*

Notes:
Asterisks(*) denote countries included in current account regression but not included in REER regression for data availability reasons.
Singapore included in regression samples but not in other EBA analysis.