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The External Balance Assessment Methodology: 2018 Update

by Luis Cubeddu, 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

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Abstract

The assessment of external positions and exchange rates is a key mandate of the IMF. This paper presents the updated External Balance Assessment (EBA) framework—a key input in the conduct of multilaterally-consistent external sector assessments of 49 advanced and emerging market economies—following the two rounds of refinements adopted since the framework was introduced in 2012 (as described in Phillips et al., 2013). It also presents new complementary tools for shedding light on the role of structural factors in explaining external imbalances and assessing potential biases in the measurement of external positions. Remaining challenges and areas of future work are also discussed.

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I. INTRODUCTION

The assessment of external positions and exchange rates is a key mandate of the IMF. Often, current account imbalances can be appropriate, even necessary. For example, countries whose populations are aging rapidly may need to accumulate external savings (by running current account surpluses) that they can draw from when their workers retire. On the flip slide, young and rapidly growing economies with ample investment opportunities benefit from foreign funding and can afford to run current account deficits provided they can repay them out of future income. However, there are times when these external imbalances reflect macroeconomic and financial vulnerabilities. Countries that accumulate external liabilities on too large a scale may become vulnerable to sudden stops in capital flows and financial crises, with negative effects that extend beyond their borders. History offers important examples—the Great Depression and the Global Financial Crisis—when these imbalances led to deep and protracted disruptions at the global level. The IMF plays a role in alerting the global community of potential balance of payments stresses and in providing policy advice to reduce such risks.

So how does the IMF conduct external assessments? Although staff have conducted external assessments since the IMF's inception, it was not until the early 1990s that assessments became informed by a multilaterally-consistent, model-based, framework. This framework has naturally evolved over time, building on insights gained from experience, feedback from stakeholders and experts, improvements in data availability, and methodological innovations. Initially, assessments were based on the framework of the Consultative Group on Exchange Rates (CGER), which focused on exchange rates of key advanced economies, evolving over time to include a wider country coverage and a broader range of measures and drivers of a country's external position.

The External Balance Assessment (EBA) framework, which built on its CGER predecessor, was launched in 2012 with the development of new current account and real effective exchange rate (REER) models.[2] The key innovations of the EBA framework included: (i) expanding the set of policy variables that affect external balances; and (ii) defining the concept of "norms" as the level of the current account or real exchange rate consistent not only with fundamentals but also with policies at their "desired" levels. These innovations improved the identification of the role of macroeconomic policies in driving excess external imbalances, better informing staff's overall policy advice. In addition, the EBA framework included a richer model-based approach for removing cyclical and temporary factors from the current account balance in order to assess a country's underlying external balance. The framework continued to rely on the external sustainability approach for assessments in cases where risks arising from a large net debtor position were relevant.

The first refinements to the 2012 EBA models were introduced in 2015. In addition to data updates, these mainly entailed: (i) revisions to the modeling of demographic factors to capture their nonlinear effects on the current account; and (ii) introducing another REER model to understand persistent differences in the *level* of the real exchange rate across countries.[3]

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[2] See Phillips et al. (2013) for detailed discussion of the original EBA methodology.

[3] For additional details see 2015 External Sector Report Annex (IMF, 2015).

In 2018, additional refinements were implemented. These focused primarily on the current account model and were aimed at strengthening the modeling of some key fundamentals (demographics and institutional quality), macroeconomic policies (foreign exchange intervention and credit excesses), and country-specific features (role of financial centers). REER models remained generally unchanged, although some aspects were refined to ensure comparability and consistency with the changes to the current account model. In addition, complementary tools were developed to provide further insights into the potential role of structural factors in driving external imbalances, as well as to better understand and estimate possible measurement biases in current account statistics.[4]

It is worth stressing that while the EBA models provide key numerical inputs for the identification of external imbalances, in some cases they may not capture all relevant country characteristics and potential policy distortions. As such, external assessments naturally need to be complemented by country-specific knowledge and insights. To integrate country-specific judgement in an objective, rigorous and evenhanded manner, a process was created for arriving at multilaterally-consistency external assessments for a subset of the largest 30 economies, representing about 90 percent of global GDP (see discussion in the next section). These assessments are not only presented in the individual annual Article IV consultations but also in the annual External Sector Report (ESR), which discusses the risks from the configuration of global excess imbalances and policies to address them in a manner supportive of global growth.

This paper presents the latest generation of the EBA models, reflecting the refinements conducted in 2015 and 2018. It borrows heavily from Phillips et al. (2013) as well as from other IMF Board documents that describe earlier methodological changes. The paper is organized as follows: Section II provides an overview of the Fund's external sector assessment framework and the combined role that models and judgment play in arriving at multilaterally-consistent assessments. Sections III and IV present the latest vintage of the EBA current account and REER models, respectively. Section V describes the process used to arrive at the norms and gaps for current account and the real exchange rates; and Section VI discusses different methods to estimate exchange rate semi-elasticities that help to map current account gaps into real exchange rate gaps. The External Sustainability approach is explained in Section VII; while Section VIII describes the complementary tools to shed light on the potential role of structural policies and on possible measurement biases in external sector statistics. Section IX concludes with a brief discussion on remaining challenges and areas for further work.

II. THE EXTERNAL SECTOR ASSESSMENT FRAMEWORK

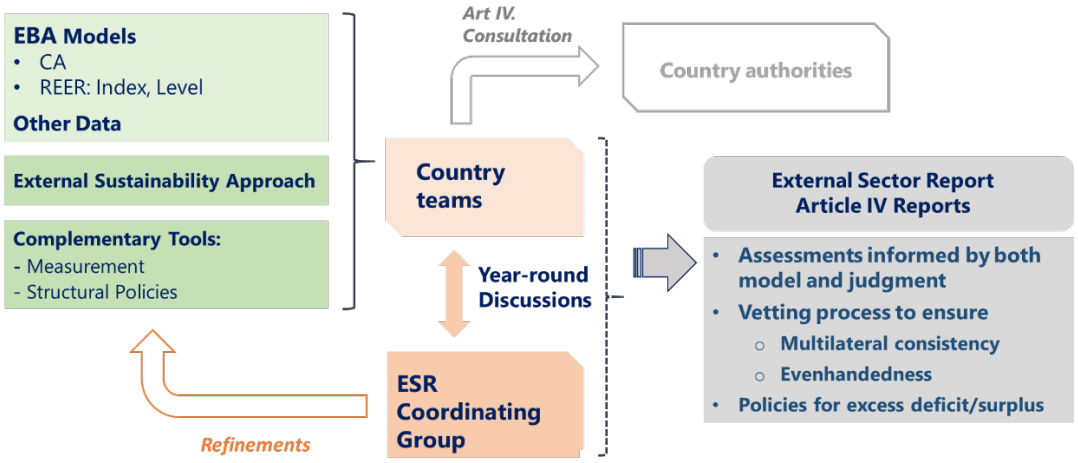
There are good reasons for countries to run current account surpluses and deficits at certain points in time; for example, to smooth out the effect of temporary shocks or to allow capital to flow from countries where it is more abundant to countries where it is scarcer. Thus, the main challenge when conducting external assessments is to determine how much of an external surplus (or deficit) is appropriate and how much is an "excess surplus (or deficit)" relative to a given country's fundamentals and desired policies over the medium term. Because there are many complex drivers of

[4] See also Technical Supplement of the 2018 External Sector Report (IMF, 2018).

current account balances and exchange rates, no single model is likely to give the right answer in identifying excess imbalances for every country.

Recognizing the natural shortcomings of numerical inputs, the introduction of the EBA models was accompanied by a process for the conduct of external assessments (see Figure 1), under which numerical inputs from the various EBA models are combined with analytically-grounded, country-specific judgment. This judgement often involves considering multiple external sector and competitiveness indicators (e.g. evolution of real unit labor costs, export and import performance), as well as results of the External Sustainability approach in cases where the dominant source of concern is the size and composition of its international investment position (IIP). Year-round discussions take place between country teams and an interdepartmental External Sector Coordinating Group, who is responsible for vetting country team assessments and ensuring that the final assessments for the largest 30 economies covered in the External Sector Report are multilaterally consistent. These assessments provide an important input for arriving at policy recommendations at both the bilateral and multilateral level so that all countries—with either excess surpluses or deficits—address these imbalances in a manner that does not compromise stability and growth at both the country and global level.

Figure 1. The IMF's Current External Assessment Framework



III. THE EBA CURRENT ACCOUNT MODEL

The EBA current account model builds on the extensive literature on the macroeconomic determinants of saving and investment decisions.[5] The current version of the model is guided by the same principles as the original EBA methodology (Phillips et al., 2013), including by specifying most regressors as deviations from the GDP-weighted global average.[6] This implies that, for instance, population aging will affect a country's current account balance only to the extent that this country is

[5] See, for example, Chinn and Prasad (2003), Chinn and Ito (2007), Gruber and Kamin (2007), Lee et al. (2008), Bussière et al. (2010), and most recently, Gagnon (2017), and Coutinho et al. (2018).

[6] The global average refers to the GDP-weighted average of the 49 countries in the EBA sample, which represent over 90 percent of global GDP. Details on the treatment of multilateral consistency can be found in Section V.

aging faster or slower than the world average. Similarly, the fiscal balance affects the current account only to the extent that other countries maintain different fiscal balances. This approach ensures multilateral consistency and allows for a decomposition of the effect of a certain policy variable on a given country's current account into its domestic and foreign component. Current account determinants are selected based on their conceptual underpinning and on whether the estimated coefficients are consistent with the theoretical priors, although for policy variables there is generally a higher bar since coefficients are also required to be statistically significant.

A. Sample and Estimation Method

The 2018 version of the current account model is estimated for a sample of 49 countries using annual data for the 1986-2016 period.[7] The estimated 2018 model not only includes longer time series but also data revisions, including the migration of external statistics data to the IMF's Balance of Payments Manual, 6th edition (BPM6) and new demographic estimates and projections (2017 Revision of UN World Population Prospects).

The current account model is estimated using a pooled Generalized Least Squares (GLS) method with a panel-wide AR(1) correction due to the autocorrelation of the current account data. Country fixed effects are not included since they do not provide an economic explanation of observed current account balances and may simply pick up policy distortions that have persistent effects. Similarly, the model does not include the lagged current account, despite its statistical significance (see Lee et al., 2008, and Calderón et al., 2002), since this would not explain the desirability of current account persistence. These two econometric choices inevitably penalize model fit when compared to other studies but are necessary for a normative interpretation of the results. Finally, to deal with endogeneity and reverse causality issues, some policy variables (fiscal policy and foreign exchange intervention) are instrumented.[8] Other country fundamentals (net foreign asset position, productivity, global financial conditions) and policies (health spending) are lagged. Further details on the treatment of the different determinants are provided below.

B. Regression Model and Results

This subsection describes the regressors included in the current account model, provides the theoretical justification for their inclusion, and discusses their estimated impact on the current account. The dependent variable is the CA-to-GDP ratio. The determinants are grouped into cyclical factors; fundamentals (macroeconomic and structural); and policy variables. Regression estimates are

[7] Annex IV provides a list of the EBA countries. The euro area is not included in the EBA models, but the current account assessment of the Euro Area is conducted by computing the GDP-weighted averages of the CA norms and gaps of the common currency area's 11 largest members, corrected for intra-European balances. The original version of the EBA model was estimated for the period 1986-2010, and with each refinement the sample period was extended an additional three years.

[8] The instrumentation is done for identification purposes only (i.e. properly estimating the coefficient of the policy variables). However, when calculating policy gaps, the model is evaluated at the actual value of policy variables.

presented in Table 1, while Table 2 compares these estimates to earlier versions of the model. Annex I includes a qualitative description of the refinements introduced since 2013, and the text, highlights situations when the size and statistical significance of the coefficient vary substantially across versions.[9] Meanwhile, Annexes II and III describe the data sources and definitions of the variables included in the regression models.

Cyclical Factors

Temporary and cyclical factors can substantially impact current account fluctuations. Thus, their estimated effects need to be stripped from the actual current account balance to derive a 'cyclically-adjusted' measure—i.e., that would prevail over the medium term—that can be compared to the medium-term current account norm (see also Section V). These transitory factors include:

Output gap. Current account levels tend to reflect the state of the business cycle, as weak domestic demand—reflected in negative output gaps—leads to higher saving and lower investment. The output gap, measured in percent of potential GDP, is used as a regressor to capture this. As most other variables in EBA, the output gap is measured in relative terms with respect to the world average to account for differential effects when business cycles are not synchronized. The estimated coefficient indicates that an increase in the relative output gap of 1 percent reduces the current account balance by about 0.35 percentage points of GDP.

Commodity terms-of-trade gap (interacted). Short-term fluctuations of terms of trade, especially of commodities, are expected to affect the current account as the associated temporary income gains (losses) are normally matched by higher saving (dissaving). The commodity terms-of-trade are measured as the ratio of a geometric weighted-average price of 43 commodity export categories to the equivalent geometric weighted-average price of commodity imports, each relative to manufactured goods prices in advanced economies (see further details in Annex III). The model includes the deviations of this index from its trend—to capture the temporary component—interacted with trade openness. The estimated coefficient suggests that a 10 percent temporary terms-of-trade improvement is associated with a 0.8 percentage points of GDP increase in the current account balance for a country with an openness degree of 50 percent of GDP.[10]

Macroeconomic Fundamentals

The 2018 EBA specification preserves many of the macroeconomic fundamentals included in earlier versions of the model (see Phillips et al., 2013) as well as in the CGER's macro-balance approach (see Lee et al., 2008). These include:

Net foreign assets (lagged). In general, countries with larger Net Foreign Asset (NFA) positions tend to exhibit higher current account balances. As in the CGER and earlier EBA specifications, the lagged

[9] An online appendix presents actual and fitted values for all EBA models and countries in the sample, including details on the contribution of each regressor (see link).

[10] See Ostry (1988) for a model linking terms of trade, exchange rates and the trade balance.

NFA-to-GDP ratio is included to account for its effect on the net income balance. Such effect partly captures measurement issues associated to the treatment of (nominal) interest income and retained earnings on portfolio equity positions (see Section VIII for more details). The estimated coefficient of 0.023, somewhat higher than in the earlier EBA versions, suggests that empirically, higher NFA and income balances are not fully offset by a lower trade balance.[11] The linear relationship between the NFA and the current account does not hold at large negative NFA levels, as large debtor countries need to adjust their stock positions by running higher current account balances. To account for this non-linear effect, the model also includes a dummy variable for countries with an NFA position below -60 percent of GDP (interacted with the NFA-to-GDP ratio itself). The associated coefficient is negative, as expected.

Output per worker (lagged). Richer countries, with already higher capital-labor ratios, are expected to export capital to poorer countries by running higher-than-otherwise current account balances, while the opposite would be expected for poorer economies (see Chinn and Prasad, 2003; Lee et al., 2008). To measure this effect, and given constraints on reliable capital-labor ratio data, a country's GDP per working age population (in PPP terms) is compared to the average of the top three economies (Germany, Japan and the United States), which are taken as the frontier. The variable is also interacted with the capital account openness policy variable (see below for more discussion) as the flow of capital from richer to poorer countries depends on the degree of capital mobility. Results suggest that a 10 percent increase in relative output per worker would increase the current account balance by about 0.64 percent of GDP in fully open economies.

Expected real GDP growth (5 years ahead). This variable is a determinant of both investment and savings. Higher expected output growth is likely to lead to higher investment, in anticipation of higher returns to capital, as well as higher consumption and lower saving to the extent that households engage in consumption smoothing. Both effects operate in the same direction (of higher growth leading to lower current account balances). Real GDP growth 5 years ahead from the World Economic Outlook (WEO) is used to proxy for expected growth. Results indicate that an increase of 1 percentage point in expected real growth lowers the current account by about 0.3 percent of GDP.

Reserve currency status. Countries that issue reserve currencies, especially the United States, tend to benefit from what is called an "exorbitant privilege". This broadly refers to the effect of the global demand for safe assets on the reserve currency issuer's funding costs, which tends to tilt consumption towards the present, and leads to higher investment. Global demand for reserve assets also tends to appreciate the currency of reserve issuers. These effects unambiguously weaken reserve currency issuers' current accounts. To capture this effect, as in earlier model versions, a measure of the share of a country's currency in world reserve holdings is included. The estimated coefficient suggests that for each 10 percentage points of global reserves held in its currency, a country's current account balance is weakened by about 0.3 percent of GDP.

[11] This higher coefficient, partly resulting from the exclusion of the financial center dummy variable, is consistent with the view that the NFA coefficient partly captures biases in the measurement of the current account.

Structural Fundamentals

Demographics. The current demographic specification, compared to earlier versions, focuses on disentangling *static* effects (associated with the age composition of a country's population) from *dynamic* effects (associated with longevity or old age survival risk). Generally, countries with a relatively high share of young or a high share of elderly tend to dissave, while countries with a higher proportion of prime-aged savers will tend to save more. The age-composition effect is captured through the inclusion of three variables: *population growth (which partly proxies the share of young), the old-age dependency ratio (OAD), and the share of prime-aged savers as a proportion of the total working age population*. The sign of the estimated coefficients aligns with economic priors. The *dynamic* effect is captured by the *life expectancy of a current prime-aged saver as well as its interaction with future (20 years ahead) OAD*. The intuition, based on the findings of a life-cycle model, is that countries save more when prime-aged savers expect to live longer (or have longer retirement periods), and more so when they cannot rely on future generations for old-age support. The estimated life expectancy term and its positive interaction with future OAD capture the non-linearities observed in the reduced-form relationship between life expectancy and the current account balance. Annex V and Dao and Jones (2018) provide further details on the current demographic specification.[12]

Institutional quality. In line with the vast literature that points to the quality of institutions as a key determinant of a country's ability to finance current account deficits, the model includes an institutional quality proxy based on information compiled by the International Country Risk Guide (ICRG).[13] Compared to the earlier versions of the model, the current indicator uses a broader range of institutional, social and political risk attributes that are considered important in saving and investment decisions.[14] Results indicate that a country at the 75th percentile of the institutional quality distribution would have, all else equal, a 0.5 percentage points of GDP lower current account balance compared to the median country.

Exhaustible oil and natural gas resources. Exporters of natural resources are expected to save a portion of their export income for inter-generational equity reasons thus leading to, other things equal, higher current account balances. The fraction of natural resource exports that is saved often depends on the temporariness of this source of income (that is, countries would save more, the more temporary this income is). Thus, the model includes a variable that combines the size of the oil and

[12] Earlier versions of the model accounted for nonlinear effects through the aging speed variable (defined as the change in OAD, 20 years ahead) and its interactions. However, the specification had the shortcoming of confounding different forces in one indicator—changes in longevity, cumulative fertility changes, and variations in cohort sizes—and obfuscating the interpretation of associated results.

[13] See Chinn and Ito (2007), Gruber and Kamin (2007), Legg et al. (2007), Cheung et al. (2013), and Alfaro et al. (2008).

[14] Earlier versions of the model considered only five sub-indicators, including socio-economic conditions, investment profile, corruption, religious tensions, democratic accountability. The 2018 refinements extended these to include other institutional attributes such as government stability, law and order, and bureaucratic quality.

natural gas balance, in percent of GDP, and a measure of its degree of temporariness based on the ratio of current extraction to proven reserves (see Annex VI for additional details).[15] The estimated coefficient implies that a 1 percent of GDP increase in the "temporariness-adjusted" energy balance increases the current account balance by about 0.31 percent of GDP. This coefficient applies to 10 out of the 49 economies in the sample, where the net oil and gas balance is positive.

Policy Variables

Fiscal policy (instrumented). The relationship between fiscal policy and the current account has been extensively documented in the literature.[16] An increase in government spending leads to higher domestic demand and, for a given level of output, to a lower current account balance. The magnitude of such effect depends, among other things, on the extent of private sector offset. If Ricardian equivalence holds, private consumption would tend to offset the change in government spending in anticipation of future changes in taxes (necessary to satisfy the government's intertemporal budget constraint), in which case the effect on the current account would tend to be only partial. On the other hand, fiscal policy may also have supply-side effects that can be expansionary (via public investment) or contractionary (if fiscal policy entails changing distortionary taxes). Like in earlier versions, the fiscal policy variable is measured by the cyclically-adjusted general government overall balance. In addition, to overcome endogeneity issues, this measure of fiscal policy is instrumented using *lags* for relevant global factors (world real GDP growth, world output gap, world cyclically-adjusted fiscal balance, and global risk aversion, which is proxied by the U.S. corporate credit spread), as well as country-specific features (lagged GDP per capita, lagged output gap, the exchange rate regime, and a democracy index ranking). The estimated coefficient of 0.33 is comparable to those found in the literature that considers both advanced and emerging economies (Coutinho et al. 2018, Phillips et al. 2013, Lee et al., 2008).

Health spending (lagged). The generosity of the social safety net can have important bearings on aggregate saving due to precautionary motives. While there is no unique way of measuring the degree of social safety net provision, the level of public health spending relative to GDP provides a good empirical proxy, with consistent data for the estimation period and cross-country sample.[17] The health spending variable is included in the model with a lag to deal with potential endogeneity issues. The estimated coefficient indicates that an increase in public health expenditures of 1 percent of GDP reduces the current account by an average of about 0.4 percentage points of GDP.

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[15] Data constraints limit extending this variable to other exhaustible resources (e.g. metals). For oil and gas exporters where the social returns to domestic investment exceed the returns on foreign assets, consideration could be given to reducing the contribution of resource temporariness to the norm. See Araujo et al. (2016).

[16] There is a vast literature on "twin deficits", or the relationship between fiscal and current account deficits. See also Gagnon (2017) for a recent exploration of the effect of fiscal policy on the current account, and Abbas et al. (2011) for estimates using a variety of econometric methods and country coverage.

[17] The health spending variable is highly and positively correlated with broader measures of social safety net spending and coverage drawn from the World Bank's Aspire database, including the average real per capita transfers from social protection and social insurance programs as well as the share of population participating in these programs. Data limitations preclude the inclusion of these alternative proxies in the regression.

Foreign exchange intervention (interacted and instrumented). Interventions in the foreign exchange rate market can have important effects on the exchange rate and, thus, the current account, although these would depend on the degree of capital mobility, as documented in the extensive literature on the subject. To capture this, the EBA model includes as a regressor the FXI-to-GDP ratio, interacted with the Quinn index of capital controls (see below). FXI is proxied by the transaction-based change in reserves, as recorded in balance of payments (BOP) statistics—or, in a few cases where BOP data are not available, the change in the stock of reserves—plus comparable operations in derivatives markets.[18] This broad measure of FXI builds on the notion that on- and off-balance sheet foreign exchange operations have similar effects on exchange rates and current accounts (see IMF, 2014; and Nedeljkovic and Saborowski, 2017). FXI is also instrumented to address endogeneity issues.[19] The estimated effect of FXI under the refined model is larger than in earlier versions, and more in line with theoretical predictions and recent empirical studies (e.g., Bayoumi et al, 2015; Gagnon, 2017). Specifically, the results indicate that a 1 percent of GDP in FX purchases leads to a 0.19 percent of GDP improvement in the current account for a country in the 75th percentile of the distribution of capital controls index (compared to 0.11 under the earlier EBA specification) and 0.38 for a country at the 90th percentile (compared to 0.22).

Financial excesses. A large body of research shows that the current account deteriorates and the REER appreciates in countries that experience credit booms, with the opposite occurring during credit busts.[20] To capture the role of financial excesses, an updated credit gap measure that draws on recent advances in the literature and the Bank for International Settlements (BIS) methodology (Drehmann et al., 2011) is employed. Specifically, a one-sided Hodrick-Prescott (HP) filter is applied to the credit-to-GDP ratio, using a large penalty parameter that takes into account that financial cycles have a longer duration than the real business cycles.[21] Results imply that a 10 percent of GDP increase in credit

[18] The inclusion of derivatives in the FXI proxy is a refinement relative to the earlier model versions, necessary to account for the increased use of these instruments. Derivatives include aggregate short and long positions in forwards and futures in foreign currencies vis-à-vis the domestic currency (including the forward leg of currency swaps), and financial instruments denominated in foreign currency but settled by other means (for example, in domestic currency), as reported in the *International Reserves and Foreign Currency Liquidity Template*.

[19] Informed by recent relevant studies—like, Adler et al. (2015), Daude et al. (2016), and Bayoumi et al. (2015)—, the instruments in the first-stage regression include: (a) a measure of global accumulation of reserves, capturing what is known in the reserve accumulation literature as the "keeping-up with-the-Joneses" effect, or the desire of countries to maintain FX liquidity (for precautionary motives) at par with peer emerging market countries (excluding own reserve accumulation for each country); (b) a measure of reserve adequacy linked to M2, which is defined as (M2-reserves)/GDP relative to the average emerging market group; and (c) an emerging market and developing economy dummy to capture the tendency of emerging markets and developing economies to accumulate reserves as part of their export-led growth strategies.

[20] See Dell'Ariccia et al. (2012); Mendoza and Terrones (2012); and Gourinchas et al. (2001).

[21] The BIS uses a penalty parameter (that is, "lambda") of 400,000 for quarterly data. Following Ravn and Uhlig (2002) who suggest dividing the quarterly value by 4^4 to obtain its annual frequency counterpart, a penalty parameter of 1,600 is used. This is higher than the value of 100 typically employed in the HP-filter for real business cycle analysis. In a few countries with data limitations (China, Czech Republic and Russia), a two-sided HP filter was applied to estimate the credit gap in the initial years of the sample.

relative to its trend (or credit gap) would be associated with a 1 percent of GDP deterioration in the current account. The estimated coefficient is highly significant, suggesting that the "financial cycle" has an independent effect on the current account, above and beyond the business cycle proxied by the output gap and other fundamentals and policies. Earlier versions of the model proxied credit excesses as deviations of a country's credit-to-GDP ratio from its historical mean. Among other shortcomings, the previous proxy did not always adequately isolate the financial cycle nor recognize the existence of low-frequency drivers. This often led to large and permanent deviations of credit from its historical average, which were not necessarily related to financial excesses.

Capital controls (interacted). The measure of the degree of capital mobility is based on the Quinn index of capital controls (ranging from 0 in the case of full mobility to 1 in the case of no mobility).[22] As in earlier versions, the capital control index is not included as an independent regressor but, instead, interacted with other fundamental variables (income per capita, and global risk aversion) and policy variables (FXI) consistent with the notion that differences in fundamentals translate into current account imbalances only to the extent that capital mobility allows it. The capital controls regressor is not significant when included independently.

- ***Output per worker (lagged).*** The theoretical prediction that capital would flow from richer to poorer countries applies only to the extent that capital is mobile across countries. The interacted term between output per worker and capital account openness (defined as 1 minus the capital control index) captures this. Its estimated coefficient is statistically significant, with the expected positive sign and similar in magnitude to earlier model versions. The implied effect of a 10 percent increase of output per worker is about 0.6 percent in a country with fully open capital account, and 0.5 percent in a country at the 75th percentile of the capital controls index.
- ***Global risk aversion (lagged).*** Heightened global risk aversion tends to lead to increased precautionary savings and lower investment in most economies, except in reserve currency countries, although the impact depends on each country's degree of capital account openness. To capture this effect, the VXO index—the model's global risk aversion proxy, which is expressed in terms of deviations from its historical average—is interacted with capital account openness.[23] Results suggest that a 10 percent increase in global risk aversion would lead to a 0.17 percent of GDP increase in the current account balance of a non-reserve currency country with an average degree of capital account openness. To capture the offsetting safe-haven effect, the VXO is also interacted with a combination of capital account openness and the share of a country's currency in world reserves. The corresponding estimated coefficient is small, however, both in quantitative and statistical significance terms.[24]

[22] The capital controls variable is an update of the Quinn index (see Quinn, 1997; and Quinn and Toyoda, 2008).

[23] The VXO is an index of implied U.S. stock market volatility created by the Chicago Board Options Exchange (CBOE), and is based on the narrower S&P 100 index. It is very similar to the VIX (which is based on the S&P 500 index). The VXO is available since 1986, while the VIX is available since 1993.

[24] In earlier versions of the EBA current account model, the impact of this interacted term was larger and more significant, such that reserve currency countries would exhibit lower current accounts during periods of

C. Model Fit and Robustness

The goodness of fit of the current model is generally in line with similar reduced form approaches, and somewhat stronger relative to earlier versions of the model.[25] The model is also generally robust to different specifications or proxies of key variables, including institutions, credit excesses, demographics and foreign exchange intervention.

Institutional quality

The appropriateness of the ICRG as an indicator of institutional quality was assessed and compared against another widely-used institutional proxy, the Worldwide Governance Indicators (WGI). The latter are compiled by staff from the World Bank, the Natural Resource Governance Institute, and the Brookings Institution, and are based on multiple surveys of companies, citizens and experts. Since reliable WGI data are only available starting in 2002, alternative ways of merging both indicators were considered, including: (i) having both the WGI and ICRG proxies covering different periods (i.e. WGI from 2002 onwards and ICRG prior to 2002, with zero values elsewhere); and (ii) using the WGI proxy from 2002 and extending the series backwards using the average country-specific relationship between the ICRG and WGI for 2002-16. As shown in Table 3, the results of the baseline model, which are based on the broader set of ICRG indicators, are similar to the two alternative versions combining the ICRG and WGI—the model fit and statistical significance of coefficients generally coincide. The selection of the ICRG as the institutional proxy reflected both its wider cross-country and time-series coverage as well as its broader range of relevant institutional indicators.

Financial excesses

Alternative ways to proxy for this variable were considered. These included: (i) computing the credit gap with a larger penalty parameter in the Hodrick-Prescott filter (25,000 instead of 1,600); (ii) using the earlier specification where the credit gap is defined as the credit-to-GDP relative to each country's historical mean; and (iii) using the change in the credit-to-GDP ratio, with different lags, as a predictor of financial instability and external imbalances (see Jordá et al., 2011). The results of robustness analysis (see Table 4) show that while a larger HP filter penalty would not alter the fit of the model, it would come at the expense of increasing the volatility of the cyclical component of credit and lowering the estimated parameter. Meanwhile, reverting to the earlier demeaned credit specification would significantly reduce the model's fit (the RMSE increases to 3.3 percent). When including both the demeaned and the detrended measures, the coefficient on demeaned credit turns small and statistically insignificant while the detrended coefficient is unchanged. Finally, when using the change in the credit-to-GDP ratio (both current year and one-year lagged) to proxy for financial excesses, the fit of the model is similar relative to the baseline specification and the coefficients are significant and

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heightened global risk aversion. This change could reflect the fact that the VXO (similar to the VIX) has been less important as a driver of capital flows since 2010.

[25] Specifically, the R-squared is unchanged relative to the original 2012 model which comprised a substantially smaller sample (although 10 percent higher relative to the 2015 version), while the root mean squared error is 6 percent smaller. For a detailed discussion of the implications of the 2018 refinements on country-specific results see Technical Supplement of the 2018 External Sector Report (IMF, 2018).

in the right direction, confirming economic priors that sustained periods of high credit growth have a negative impact on the current account.[26] The one-sided HP filter credit gap specification was ultimately selected given its superior fit, and its ability to measure the impact that sustained financial imbalances can have on the current account.[27]

Demographics

Additional robustness exercises were also performed for the *demographic block* (see Table 5). First, the life expectancy variable was replaced by the aging speed variable, used in earlier EBA versions and other modeling work (Lane and Milesi-Ferretti, 2001). The results show that the estimated coefficients on aging speed, as well as that of all other demographic variables (old-age dependency ratio, population growth and the share of prime-aged savers), turn statistically insignificant (Column 2). This is not surprising since the aging speed variable confounds different forces in one indicator and is highly correlated with the prime-aged saver share variable. In addition, alternative specifications for the nonlinear effects of life expectancy (captured through the interaction of life expectancy with future OAD) were considered. While the coefficient on the squared life expectancy term is significant on its own (column 3), it becomes insignificant when the interaction term between life expectancy and future OAD is also included (column 4). Not only does the coefficient of interaction between life expectancy and future OAD remain significant, but also those of other regressors, suggesting nonlinear effects are best captured by this new theoretically-based interaction term.

Foreign Exchange Intervention

Sensitivity analysis was conducted to explore the implications of each aspect of the refinements (i.e., broadening the definition of FXI to encompass derivatives and implementing a simpler instrumentation to prevent overfitting). When the effect of FXI is not instrumented, the estimated coefficient is still statistically significant but considerably smaller, indicating that endogeneity leads to a downward bias (see Table 6, column 3) as it would be expected when FXI responds predominantly to capital flow shocks (as opposed to current account variations). Results, however, varied depending on the definition of FXI. A narrow FXI definition—that only encompasses spot interventions—delivers a somewhat larger coefficient, possibly indicating that spot and derivative operations often offset each other (column 4). Irrespective of the latter and given the growing importance of off balance sheet FXI operations, a broader measure of FXI is necessary to properly capture the role of these policies in driving external imbalances.

[26] When both the demeaned and first-differenced credit-to-GDP are included in the regression, the coefficient on demeaned credit also becomes statistically insignificant (see the last column of Table 4).

[27] In the European Commission model (Coutinho et al., 2018), sustained financial excesses are measured using the three-year cumulative credit-to-GDP changes. While the Hodrick-Prescott filter has some shortcomings (see Hamilton, 2018), the derived credit gap measure remains a strong predictor of financial crises (see Drehmann and Yetman, 2018).

IV. EBA REAL EXCHANGE RATE MODELS

This section presents the two EBA real effective exchange rate (REER) models: the REER-Index and REER-Level regressions. The latest version of the models builds on past IMF work, including Phillips et al. (2013) and Mano et al. (2018), as well as the ample literature on the subject.[28] As explained throughout the section, the two REER models build on the EBA current account model yet capture distinct aspects of the data. Figure 2 summarizes the regression specification across the EBA models.

The REER-Index model focuses on the country-specific determinants of movements in REER *indices.*[29] A main limitation of index data, which typically are normalized to a value of a 100 in the base year, is that they do not provide information on how a country's exchange rate level compares relative to other countries at any point in time. Therefore, the estimation requires the use of country fixed effects, which implies that the model residuals of each country average zero over the sample period. Thus, this specification does not allow for persistent deviations of the exchange rate from the level "consistent with fundamentals and desired policies".

In contrast, the *REER-Level* model aims at understanding differences in real exchange rate *levels* across countries, shedding light on possible persistent deviations from equilibrium levels across countries. The model was introduced in 2015 and builds on the work by Bergstrand (1991), who established a positive cross-country correlation between REER levels and GDP per capita, the so called "Penn effect". This relationship reflects not only supply-side factors—productivity differentials (the Balassa-Samuelson effect) and relative factor endowments (the Kravis-Lipsey-Bhagwati effect)—but also demand-side factors—non-homothetic preferences that reflect differences in consumption smoothing patterns across countries.

The REER-level variable is constructed in two steps, combining cross-sectional information from PPP exchange rates as well as information across time contained in REER indices. In the first step, REER level cross-country data from the World Bank International Comparison Program (ICP) is used to compute price levels relative to the United States for the base year (2011). In the second step, the REER-level data is extended across the sample period (1990-2016), using REER indices re-scaled to their base year value. The rescaling of the index ensures that the basket of goods used to compute the REER level is comparable over time.[30] The data, however, present certain challenges. In particular, base-year ICP data could be subject to measurement uncertainty (see e.g., Deaton and Heston, 2010), with the potential of affecting the constructed REER level for the sample period (and to a lesser extent, the REER of its trading partners).

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[28] Seminal contributions include Dornbusch (1976), Edwards (1989), Edwards and Ostry (1992), Froot and Rogoff (1995), Obstfeld and Rogoff (1996) and Rogoff (1996), as well as more recent studies, Cashin, Céspedes, and Sahay (2004), Engel and West (2005), Engel, Mark, and West (2008), Christiansen et al. (2010), Ricci et al. (2013).

[29] REER indices, which are taken from the IMF's INS dataset, are normalized to 100 for 2011.

[30] In other words, a fixed consumption basket over time is assumed. For more details on the construction of the REER-level see Mano et al. (2018).

Figure 2. EBA Models: Summary of Explanatory Variables in Current Account and REER

EBA CA Model	REER-Index Model[FE]	REER-Level Model
Cyclical Factors Output gap (-) Terms of Trade[X] (+)	**Cyclical Factors** Output gap (+) Terms of Trade (+)	**Cyclical Factors** Terms of Trade (+)
Macroeconomic Fundamentals Output per worker[L] (+) Net foreign assets[L] (+) Expected growth (-) Reserve currency status (-)	**Macroeconomic Fundamentals** Output per worker[L] (+) Net foreign assets[L] (-) Expected growth (+) Reserve currency status (+/-)	**Macroeconomic Fundamentals** Output per worker[L] (+) Net foreign assets[L] (+) Expected growth (+) Reserve currency status (+/-) Capital/labor (+) Prod. Tradable/NonTrad (+)
Structural features Demographics (+/-) Institutional quality (-) Oil exporter (+)	**Structural features** Demographics (+) Trade openness[L] (-) Adm. prices in CPI (-) Financial home bias (+)	**Structural features** Demographics (+) Trade openness[L] (-) Adm. Prices in CPI (-) Institutional quality (+) VAT Revenue (+)
Policies Fiscal balance (+) Public health spending[L] (-) FXI[X] (+) Financial excesses (-) Capital controls[X] (+/-) ○ FXI, Global Risk Aversion[L], Reserve Currency[L]	**Policies** Monetary policy[X] (+) Public health spending[L] (+) FXI[X] (-) Financial excesses (+) Capital controls[X] (+/-) ○ MP, FXI, Global Risk Aversion[L], Reserve Currency[L]	**Policies** Monetary policy[X] (+) Public health spending[L] (+) FXI[X] (-) Financial excesses (+) Capital controls[X] (+/-) ○ MP, FXI, Global Risk Aversion[L], Reserve Currency[L]

Note: Lagged variables have an L superscript, while those interacted have an X superscript. Some policy variables (fiscal, FXI) are instrumented as well. The REER-Index model includes country fixed effects (FE).

A. Sample and Estimation Method

Reflecting current data constraints, the REER models are estimated for the period 1990-2016 and for a sample of 40 (39) countries in the index (level) regression, compared to the 49 included in the EBA current account regression. As with the current account model, most REER determinants are expressed as deviations from each country's trading partners weighted average, some regressors are lagged to address endogeneity concerns, and FXI is instrumented to deal with potential reverse causality issues. An increase (decrease) in the REER implies appreciation (depreciation). Both models are estimated with panel data methods that are compatible with a REER that is either stationary or nonstationary, but cointegrated with the regressors. Model results are reported in Table 7. This subsection discusses the determinants that are common across the two REER models, while the following two subsections present the variables that are specific to either the REER-Index or the REER-Level models, separately.

B. Common REER Determinants

Many of the common REER determinants are also common to the current account model, with *most* parameter estimates having the expected sign—the opposite to the coefficients reported in the EBA-

CA model—and similar statistical significance.[31] Both REER models include the same policy variables—health spending, foreign exchange intervention and financial excesses—all of which are common to the current account model. The key exception is the fiscal balance, which remains excluded from the REER models because its impact was either insignificant or counterintuitive. Instead, the REER models include a monetary policy variable, proxied by real interest rate differentials.

Cyclical factors

Commodity terms-of-trade. Commodity terms of trade is measured as the ratio of commodity export prices to commodity import prices. The coefficient has a positive sign, indicating that more favorable commodity terms of trade are associated with a more appreciated exchange rate, reflecting the income effect on domestic demand. An increase of 10 percent in the terms-of-trade appreciates the REER by 1.8 percent in the Index model, and by 0.6 percent in the Level model.

Macroeconomic Fundamentals

Net foreign assets (lagged). The relationship between the NFA-to-GDP ratio and the REER is ambiguous. Countries with negative NFA positions should be expected to run trade surpluses and would need an exchange rate depreciation to achieve this goal. This hypothesis implies that the coefficient on this variable should be positive, consistent with the results from the REER=level model, and Lane and Milesi-Ferretti (2004). This is contrary to the REER-index model, where the estimated coefficient is consistent with that of the current account regression.

Output per worker (lagged). Richer countries are expected to have higher non-tradable prices and more appreciated exchange rates reflecting the Balassa-Samuelson effect, whereby countries with higher labor productivity in the tradable goods sector have higher domestic wages and non-tradable goods prices, implying a more appreciated exchange rate. The estimated coefficients in both REER models support the Balassa-Samuelson hypothesis, and suggest that an increase in output per worker of 10 percent appreciates the exchange rate by about 2 percent in both models.

Expected real GDP growth (5 years ahead). The coefficient on this variable is positive, consistent with the negative sign in the current account model. Better growth prospects are associated with higher domestic demand and a more appreciated real exchange rate in both REER models. An increase in expected growth of 1 percent appreciates the REER by about 2 percent in both models.

Reserve currency status. As explained for the current account model, currencies with reserve status tend to be more appreciated than otherwise, reflecting their greater global demand. The full interpretation of this effect needs to take into account the interaction with capital account openness and global risk aversion (see below).

[31] In a few cases, the coefficient does not have the expected opposite sign, since the regressor can affect the REER (or relative prices) through a different channel than the current account.

Structural country features

Demographics (population growth). Consistent with Aloy and Gente (2009), higher population growth is related to a more appreciated currency. This effect is captured in both models, and it is consistent with the current account regression.

Trade openness (lagged). This variable is measured by the ratio of exports and imports to GDP. Trade liberalization generally lowers the domestic price of tradable goods, thus depreciating the real exchange rate. The variable is lagged to avoid the effect of contemporaneous exchange rate fluctuations on the indicator. As expected, the coefficient has a negative sign in both models. An increase in the openness indicator of 10 percentage points depreciates the REER by about 2 percent in the Index model and 3 percent in the Level model.

Share of administered prices in the CPI. Administered prices could in principle help to lower consumer prices thus depreciating the REER. The estimated coefficient corroborates this prior in both REER models. Specifically, a 1 percentage point increase in the share of administered prices depreciates the real exchange rate by about 2 percent in the REER-Index model and 3 percent in the REER-level model.

Policy Variables

Monetary policy (interacted). A higher real interest rate differential should be related to a REER appreciation, and this relationship should be stronger with greater capital account openness. The regression includes the real short-term interest rate (i.e. adjusted for the contemporaneous inflation differentials) to capture this effect, and the associated estimated coefficients in *both* REER models display the expected signs. For economies engaging in Quantitative Easing (QE), "shadow" real interest rates could be considered to capture the QE effect. For countries with a fully open capital account, an interest rate differential of 1 percent appreciates the REER in both models by about 0.6-0.7 percent. For a country at the 75th percentile of the capital controls index, these effects are about 0.4-0.5 percent.

Health spending (lagged). When the safety net is insufficient, households need to increase their precautionary saving, reducing domestic demand and leading to a more depreciated real exchange rate. The estimated coefficient for this variable is positive in both models: an increase in health spending of 1 percent of GDP appreciates the REER by 2 percent in the Index model and about 4 percent in the Level model. This is consistent with theory and the estimated coefficient in the current account model.

Foreign exchange intervention (interacted). FXI can affect the nominal and real exchange rate, and more so in countries with less open capital accounts. A proxy of FXI, with the same instrumentation as in the current account model, is included in both REER models. The results indicate that official reserve purchases lead to a real depreciation, with smaller effects in countries where capital is more mobile. With the new FXI measure—which includes operations with FX derivatives—the size of the estimated coefficient increases in both REER models with respect to their earlier versions. The results

indicate that a 1 percent of GDP in official foreign exchange purchases leads to a 0.6 real depreciation in the REER-Index model (and a 0.9 depreciation in the REER-Level model) for a country in the 75th percentile of the distribution of capital controls index. These effects double for a country at the 90th percentile.

Financial excesses. Consistent with the current account estimates and the relevant literature, the results show that credit booms—captured by private credit-to-GDP ratios above their long-term trends computed with filtering techniques—lead to a REER appreciation. However, the effect is statistically significant for the REER-index model only, where an increase in the credit gap of 10 percent of GDP appreciates the exchange rate by about 1 percent.

Capital controls (interacted). As in the current account model, the effect of capital controls is included indirectly through its interactions with global risk aversion and other policy variables (see above, FXI and monetary policy).

- ***Global risk aversion (lagged).*** Variations in risk aversion tend to affect capital flow movements and exchange rates, although often with a differentiated impact across countries, depending on their degree of capital account openness and safe-haven status. Increased risk aversion tends to weaken the currency of most countries (especially those more financially integrated) while strengthening reserve currencies. This result is visible in both REER models.

C. REER-Index Determinants

Since the REER-Index model is estimated with country fixed effects, some slow-moving variables, such as institutional quality and certain demographic indicators (e.g. population age composition and longevity risks), are not statistically significant and hence are excluded from the model. Additional variables specific only to the REER-Index model include:

Output gap. As expected, a higher output gap, reflecting stronger domestic demand relative to potential output, is associated with a more appreciated real exchange rate. A positive output gap of 1 percent appreciates the REER by about 0.4 percent in the Index model.

Financial home bias (lagged). This variable, proxied by the share of domestic debt owned by residents, captures the role that investor preference for domestic assets has on a country's REER. Since changes in the exchange rate can affect the indicator due to compositional effects (i.e. the share of foreign-held debt is more likely to be denominated in foreign currency), the variable enters the equation with a lag. As expected, an increase in the degree of home bias appreciates the exchange rate. The estimated coefficient is 0.2.

D. REER-Level Determinants

Since the REER-Level model measures differences in *relative price levels across countries*, proxies for supply-side differences in productivity (either in labor productivity or capital-labor ratios) and slow moving structural features (such as demographics, institutional quality, and indirect taxation) need to be considered. Additional variables specific to the REER-Level model include:

Capital-labor ratio (lagged). This variable captures the Bhagwati-Kravis-Lipsey effect, whereby countries with higher capital-to-labor ratios have higher non-tradable prices and a more appreciated REER, since the non-tradable sector tends to be more labor-intensive. Results suggest that a 10 percent higher capital-labor ratio is associated with a 1 percent real exchange rate appreciation.

Ratio of traded/non-traded sector productivity (lagged). This supply-side determinant captures the Balassa-Samuelson effect. The estimated coefficient is found to be positive, as expected: an increase in relative productivity of 10 percentage points appreciates the exchange rate by about 2 percent.

Demographics (old-age dependency ratio). Higher OAD ratios have been found to raise the demand for non-tradable old-age related services relative to tradable commodities, increasing the relative price of non-traded goods and thus leading to real exchange rate appreciation (Groneck and Kaufman, 2017). The estimated effect supports this hypothesis.

Institutional quality. Greater institutional risk—or the perception of such risk—is likely to be a disincentive to investment, leading to a higher current account balance and a more depreciated REER. A higher value for this indicator represents lower institutional risk, so the positive estimated coefficient is as expected, consistent with the current account model.

VAT revenue. Since indirect taxes create a wedge between domestic and foreign prices—which increases domestic consumer prices, thereby appreciating the REER— the share of VAT revenue in GDP is included in the REER-Level model. The estimated coefficient in the REER-Level model is found to have a positive sign (equivalent to about two-thirds), although it is not significant.

E. REER Model Fit and Robustness

In general, the fit of the REER models remains largely unchanged relative to earlier versions (See Tables 7 and 8). While the goodness of fit of the REER-level model (R-squared of 0.9) is stronger than that of the REER-Index model (R-squared of 0.58), these results are not directly comparable, as they refer to different models that aim at measuring different aspects of the data. In fact, to ensure that both models are not capturing a spurious relationship, several unit root and cointegration tests were conducted (Tables 9 and 10). All the tests reject the hypotheses of non-stationarity of the residuals and of no-cointegration among unit-root variables. In other words, the results indicate that our regressions—which use levels of non-stationary variables—capture a long-run equilibrating relationship, such that REER deviations from the values predicted by the independent variables are persistent but not permanent.

V. Constructing Current Account and Real Exchange Rate Norms And Gaps

Estimated EBA current account and REER models are used to establish *norms* and *gaps*, which are the main numerical inputs for IMF staff external sector assessments. Such norms (and the corresponding gaps) are not necessarily the fitted values of the estimated models: a normative view on the current

account or REER requires taking a view on the appropriate (or desirable) level for policy variables. This process is summarized in Figure 3 and is explained in detail below for the current account model. [32]

A. Gaps and Norms

The first step in the analysis is the EBA current account regression:

$$\frac{CA}{GDP} = \alpha + X^{cyc\prime}\beta^{cyc} + X'\beta + P'\gamma + e \qquad (1)$$

where, to lighten notation, country and time subscripts have been omitted and ***e*** is the zero-mean, normally distributed regression residual, which is assumed to follow an AR(1) process. The set of policy variables are summarized in the vector **P**, which includes: the fiscal balance, measures of capital controls, public health spending, reserve accumulation and financial excesses. All fundamentals (macroeconomic and structural) are summarized in the vector **X,** whereas the vector $\mathbf{X^{cyc}}$ includes the cyclical factors (output gap and terms of trade gap).

Using coefficient estimates (denoted with a hat) of policy, cyclical and fundamental variables, the *predicted* values for the current account balance in percent of GDP are given by:

$$\frac{\widehat{CA}}{GDP} = \hat{\alpha} + X^{cyc\prime}\widehat{\beta^{cyc}} + X'\hat{\beta} + P'\hat{\gamma} \qquad (2)$$

Let P* denote values of policy variables that are deemed desirable, which may or may not coincide with actual values P. Then, the predicted current account can be decomposed into three components: the cyclically-adjusted "CA norm", the cyclical component, and the policy gaps:

$$\frac{\widehat{CA}}{GDP} = \underbrace{\hat{\alpha} + X'\hat{\beta} + P^{*\prime}\hat{\gamma}}_{Cyclically-adjusted\ CA\ norm} + \underbrace{X^{cyc\prime}\widehat{\beta^{cyc}}}_{Cyclical\ component} + \underbrace{(P - P^{*})'\hat{\gamma}}_{Policy\ gap} \qquad (3)$$

The *cyclically-adjusted "CA norm"* is the current account balance implied by all underlying macroeconomic fundamentals at their actual values, assuming all policy variables are set at their medium-term desirable levels P* and excluding cyclical effects. Meanwhile, the *cyclical component* measures the contribution of the output gap and terms of trade to the predicted current account. Finally, the *policy gap* measures by how much deviations in policy variables from their desirable levels contribute to the overall deviation of the predicted current account balance from its norm. This implies that even when *actual and predicted* (cyclically-adjusted) current account balances coincide, the current account may not be consistent with the norm, as actual policies may not be at their desirable medium-term levels.

Defining the cyclically-adjusted current account as:

$$\frac{CA^{cyc.adj.}}{GDP} = \frac{CA}{GDP} - X^{cyc\prime}\widehat{\beta^{cyc}}$$

and making use of equations (1) and (3), the following expression can be derived:

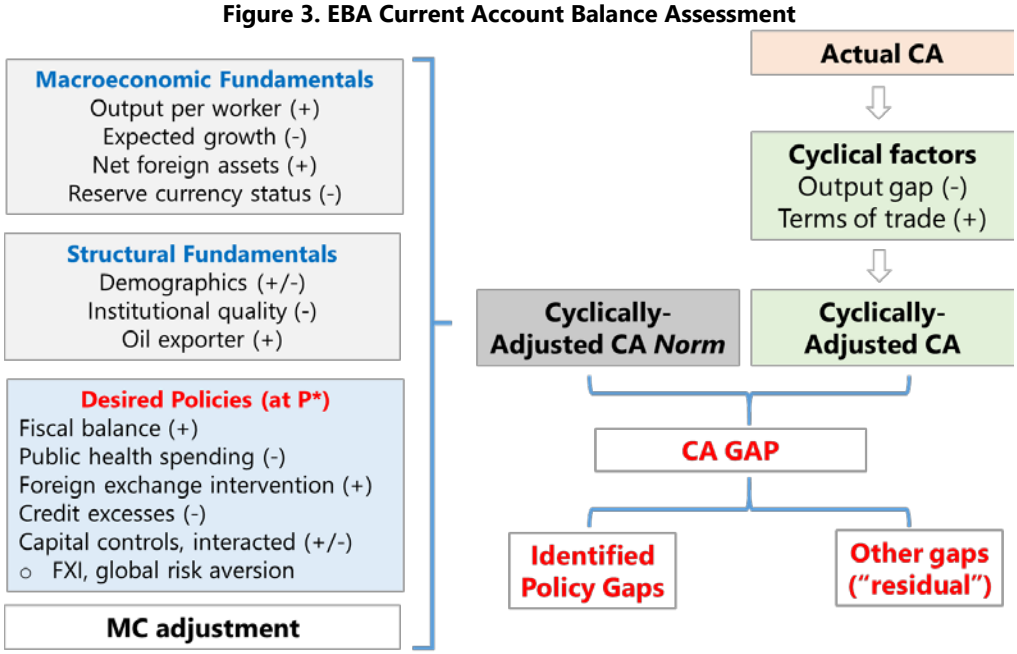
[32] The estimation of REER norms and gaps follows a similar procedure. One important difference is that, unlike the current account, the REER is not cyclically adjusted.

$$\frac{CA^{cyc.adj.}}{GDP} = \text{cyclically adjusted CA norm} + \text{total EBA gap}$$
$$= \text{cyclically adjusted CA norm} + \text{policy gaps} + \text{regression residual}$$

Thus, the *total EBA CA gap*, or difference between the cyclically-adjusted current account balance and its cyclically-adjusted norm, is equal to the sum of model-identified policy gaps and the residual. This last term captures other policy distortions or fundamentals that are not explicitly modeled and regression errors. It is worth noting that even when the overall current account gap is zero, such that the actual current account balance coincides with the norm, underlying policy distortions may still exist, although in such a way that the identified policy gaps are mutually offsetting or are offset by the residual.[33]

Since policy variables are specified as deviations from (GDP-weighted) world averages, overall policy gaps appear if a country's policy distortion is different from their corresponding world average. For example, if all countries are deemed to have a lower-than-desirable fiscal balance of the same magnitude, the contribution of the fiscal policy gap to the current account of each country would be zero. In other words, the estimated current account gap of each country not only reflects domestic policy distortions, but also responds to policy distortions in other countries, particularly of countries which have a large weight in the world average.

Figure 3. EBA Current Account Balance Assessment



[33] Structural polices, which are not explicitly modeled, might be contributing to the residuals. As discussed in Section VIII, while data limitations prevent a full inclusion in the EBA current account regression model, complementary analysis for a subset of countries and years could shed light on the role of these policies.

B. Benchmarks for Policy Variables (P*)

The estimation of current account and real exchange rate norms in the EBA exercise requires specifying normative policy benchmarks (P*) for appropriate levels of each of the policy variables in EBA: the fiscal balance, public health spending, capital controls, foreign exchange intervention, and monetary policy. Guidance on setting desired policies for financial excesses is also provided, recognizing that there are circumstances when the measured gap does not necessarily imply policy distortion needs to be addressed. The different policy benchmarks are guided by the following considerations:

- For *fiscal policy*, the P* corresponds to levels of the cyclically-adjusted fiscal balance (as a share of potential GDP) that staff deem desirable from a medium to long-term perspective, when output gaps are closed. As such, the fiscal P* should be anchored around metrics such as the debt-stabilizing primary balance, or long-term adjustment needs given the fiscal costs of aging. Desired fiscal policy settings can differ from what may be recommended for the current year, when cyclical considerations may be important.

- For *public health spending* (as a share of GDP), the P* is guided by benchmark estimates from a regression that includes (PPP-based) GDP per capita, a country's population structure (the current old-age dependency ratio) and income inequality (see Annex VII for details). However, staff can choose a different desired public health spending level to the extent that a clear justification is provided for large departures from the benchmark or actual spending levels.

- For *capital controls*, the benchmark level that is suggested as desirable for the medium term is either the cross-country average level of the controls index (0.16 in 2017, out of a potential 0 to 1 range), or a country's actual level, whichever is smaller. This asymmetric treatment reflects that, in general, an open capital account is desirable, but that full liberalization should be achieved at an appropriate pace.

- The desirable level of *foreign exchange intervention* (as a share of GDP) over the medium-term would normally be set to zero, as countries would be expected to reach a level of reserves (including comparable off balance-sheet FX positions) that is adequate from a precautionary viewpoint. Thus, no additional accumulation—beyond small amounts necessary to keep adequate FX coverage ratios unchanged—would be required. In exceptional circumstances, a nonzero desirable level could be set when reserves are significantly below the IMF's *Assessing Reserve Adequacy (ARA)* metric, implying that reserve accumulation may be necessary over an extended period of time. Deviations from the medium-term desirable level (that is, the policy gap P - P*) would not necessarily be interpreted as a policy distortion. In fact, FXI policy gaps may be appropriate if they are an adequate response to current conditions or they reflect the necessary, temporary, build-up of reserves to reach an adequate level of reserves over the medium-term.

- Regarding *monetary policy*, the desired short-term interest rate is the appropriate monetary policy stance that helps achieve output and inflation objectives (i.e. the country desk's estimate of the "neutral" real rate). In most cases, when inflation is close to the target, this will be equal to the actual value. If the current policy stance were judged by the country desk to be inconsistent with

that country's own inflation and output stabilization needs, a monetary policy gap would be identified (in terms of the interest rate differential regressor) and thus contribute to a country's overall REER gap.

- Finally, policies relevant for *financial excesses* deserve special consideration. These are now measured as credit gaps directly and hence imply that the P* of this policy variable, i.e. the desirable credit gap over the medium term, should be zero in most cases. However, adjustments can be considered if the credit gap estimate does not provide an accurate picture of financial imbalances. This might be warranted in countries that are experiencing financial deepening (where the gap measure may be overstating financial imbalances by understating the long-term trend). Adjustments can also be considered in countries experiencing a credit bust (where the credit-to-GDP ratio is either not expected to return to pre-crisis levels or will recover only over a protracted period).[34] It is also worth emphasizing that the presence of a credit policy gap does not necessarily mean that there is a policy distortion that needs to be addressed. Credit is an endogenous variable that may fluctuate for reasons other than inappropriate policy settings.

Finally, it is important to note that desirable policy settings are not aimed at targeting a specific level of the current account, but instead are aimed at meeting medium-term domestic objectives. For example, fiscal policy should aim at medium-term sustainability and intergenerational equity, public health expenditure should be guided by domestic welfare considerations (which aside from health outcomes should correct distortions from the lack of risk-sharing mechanisms), and credit policies (which can take the form of macroprudential policies) should avoid unsustainable credit booms and costly credit contractions.

C. Standard Errors of Estimated Norms

An important innovation introduced with the 2018 refinements entails presenting the standard errors associated with the estimated country-specific CA norms. Since the EBA CA norm for each country is a linear function of model regressors and coefficient estimates, the norm is subject to statistical uncertainty inherent in the estimates. The standard error of the CA norm is obtained as a linear combinations of the variance-covariance matrix of the estimated coefficients, assuming the regressors are fixed:

$$\left[\hat{V}(CA_{norm,t}^{cyc.adj.})\right]^{1/2} = \left[\hat{V}(X_t'\hat{\beta} + P_t^{*\prime}\hat{\gamma})\right]^{1/2} \qquad (4)$$

The resulting standard errors are reported alongside the estimated EBA CA norms and are meant to provide guidance to staff in setting the uncertainty ranges. In circumstances when uncertainty is judged to be higher than the estimated standard errors, staff may use larger uncertainty ranges with proper justification.

D. Multilateral consistency

Since the EBA country sample covers more than 90 percent of global GDP, multilateral consistency is an important aspect of EBA analysis. At the global level, current account balances should (at least in

[34] See also Technical Supplement of the 2018 External Sector Report (IMF, 2018).

theory) add up to zero. Similarly, REER gaps should average to zero. To a large degree such consistency is built into the design of the methodology, because most variables are expressed in terms of deviations from world averages, and hence their (GDP weighted) contributions effectively add up to zero. In practice, however, an additional small adjustment is necessary.

In the case of the current account, the need for an adjustment results from two factors. First, current account balances do not exactly sum up to zero over the EBA country sample, because of the existence of a global statistical discrepancy at the world level, and also because the EBA country sample does not cover the global economy (leaving aside a number of relatively large net commodity exporters). Second, a few variables do not enter the regression in deviations from world averages, and in some cases the effect is non-linear, so that their aggregate contribution does not necessarily add to zero (e.g. lagged NFA-to-GDP and global risk factor). In this context, multilateral consistency is ensured by adjusting (by a uniform amount, in terms of each country's own GDP) the components of the current account balance (following the decomposition presented in Section V.A), so that, over the whole EBA country sample: (ii) policy gaps add up to zero; and (ii) residuals add up to zero. Regarding the cyclical component, relative output gaps sum to zero (by construction), but commodity terms-of-trade gaps do not, reflecting the fact that the EBA sample includes more commodity importers than exporters. As a result, the EBA sample current account statistical discrepancy (about 0.4 percent of global GDP in 2017) is mostly attributed to the current account norms, except for the part resulting from cyclical commodity price changes (which is attributed to the cyclical component).

In the case of the REER models, the weighted average of residuals must annually add to zero for multilateral consistency. In addition to ensuring that each variable is defined relative to the trading-partner weighted average of the same variable, real exchange rates also need to be adjusted 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). This consistency adjustment is generally small (about 2¼ percent of the global residual in 2017).

VI. CURRENT ACCOUNT-REER ELASTICITIES

A key input of external sector assessments is the country-specific CA-REER elasticity, which allows one to translate an estimated CA gap into a consistent REER gap, and to compare results with those from the previously discussed REER models. Given that semi-elasticity estimates can vary across countries and over time depending on a country's structural features (such as the degree of trade openness, participation in global value chains and commodity dependence), its estimation is especially challenging. As such, several benchmark estimates are provided, which are based on a consistent methodology that borrows heavily from Lee et al. (2008). IMF country teams can use alternative estimates (including from more disaggregated data if available), and adjust for country-specific factors, where justified.

The semi-elasticity of the *CA/GDP* ratio with respect to *REER* is defined as:

$$\frac{\Delta(CA/GDP)}{\Delta\, REER/REER} = \overbrace{\eta^{TB}}^{goods\ and\ services\ trade} + \overbrace{\eta^{IB}}^{income\ account},$$

where $\eta^{TB} = \frac{\Delta(TB/GDP)}{\Delta REER/REER}$ and $\eta^{IB} = \frac{\Delta(IB/GDP)}{\Delta REER/REER}$ are the semi-elasticities of the *nominal* trade balance-to-GDP ratio and the income balance-to-GDP ratio, respectively. Assuming that the current account gap will be closed by an adjustment in the trade balance, the corresponding *REER* gap (in percentage terms) can be derived as:

$$REER^{gap} = \frac{CA^{gap}}{\eta^{TB}}, \qquad (5)$$

Two methodologies are used to estimate the semi-elasticity η^{TB}: (i) the original CGER approach, based on calibration methods, and (ii) the "CGER-inspired" approach, based on panel regressions for export and import equations.[35]

A. Original CGER Approach

The original CGER approach is based on Isard et al. (2001) and IMF (1998), and decomposes the parameter of interest into:

$$\eta^{TB} = \eta^X s^X - \eta^M s^M, \qquad (6)$$

where $\eta^X = \frac{\Delta(X/GDP)/(X/GDP)}{\Delta REER/REER}$ and $\eta^M = \frac{\Delta(M/GDP)/(M/GDP)}{\Delta REER/REER}$ are the elasticities of nominal exports/GDP and imports/GDP ratios with respect to the REER, and s^X and s^M are the nominal shares of exports and imports with respect to GDP. The original CGER relied on a macroeconomic model to calibrate η^X and η^M, which took values of 0.71 and 0.92, respectively, and which were assumed to be common across countries. The semi-elasticities of the *nominal* trade balance-to-GDP were obtained, for each country, by using the common calibrated values of η^X and η^M and the country-specific export and import shares (excluding oil), over the 2013-2023 period.[36] Hence, while the import and export elasticities are common to all countries, the semi-elasticity of the current account may change depending on each country's degree of openness.

[35] A more direct approach, where country-specific elasticities are derived from country-level regressions, could be considered in certain circumstances. Specifically, and following Rose and Yellen (1989), this would involve regressing a country's trade balance-to-GDP ratio against lagged terms of its trade balance, and current and lagged terms of the real exchange rate, its real GDP, and trading partners' real GDP. Estimation results would need to be interpreted with caution, however, given significant cross-country variation.

[36] Actual and staff forecast values (from WEO) for imports and exports ratios are used to smooth cyclical fluctuations in these shares.

B. CGER-Inspired Approach

The CGER-inspired approach builds on the original CGER method estimating the values of η^X and η^M used in equation (6) with updated data. Dynamic export (X) and import (M) equations are estimated using an unbalanced panel covering most EBA countries and quarterly data between 1980Q1 and 2017Q4:[37]

$$ln(X_{it}) = \sum_{j=1}^{n} \delta_j^X ln(X_{it-j}) + \sum_{j=0}^{m} \beta_j^X ln(REER_{it-j}) + \sum_{j=0}^{k} \gamma_j^X ln(RGDP_{it-j}^{TP}) + \varepsilon_{it}, \quad (7)$$

and

$$ln(M_{it}) = \sum_{j=1}^{n} \delta_j^M ln(M_{it-j}) + \sum_{j=0}^{m} \beta_j^M ln(REER_{it-j}) + \sum_{j=0}^{k} \gamma_j^M ln(RGDP_{it-j}) + \varepsilon_{it}, \quad (8)$$

where both specifications include time and country fixed effects. Equation (7) relates exports to real exchange rates and world demand (proxied by trading partners' real GDP). Similarly, imports are assumed to be a function of real exchange rates and domestic demand (proxied by domestic real GDP) in equation (8). Both equations allow for a rich dynamic lag structure (involving up to eight lags).[38] Using estimates from the panel regression, long-run export and import elasticities are obtained as follows:

$$\eta^X = \frac{\sum_{j=0}^{m} \beta_j^X}{1 - \sum_{j=1}^{n} \delta_j^X}, \text{ and } \eta^M = \frac{\sum_{j=0}^{m} \beta_j^M}{1 - \sum_{j=1}^{n} \delta_j^M}.$$

The panel estimation yields values of 0.11 and 0.57 for η^X and η^M, respectively. These volume elasticities are then used in equation (6), together with the country-specific openness ratios s^X and s^M to calculate each semi-elasticity η^{TB}. It is worth noting that in the CGER-inspired approach, the trade shares are computed based on aggregate imports and exports rather than their non-oil counterparts used in the original CGER approach. This more comprehensive measure of the trade balance was deemed appropriate for the updated elasticity estimates, including because of the increased substitutability between alternative sources of energy.[39]

C. Elasticity Estimates

Table 11 compares the updated estimated semi-elasticities with those in the original CGER approach. In general, the semi-elasticity estimates coming from the original CGER approach and the revised CGER-inspired approach are very similar—with a correlation of 0.9. It is important to note that the suggested elasticities coming from both approaches are computed using the same methodology for all countries, and do not necessarily correct for country-specific features (such as for commodity share of exports, value-added trade, capacity or other structural factors). As discussed earlier, however, IMF

[37] Data constraints prevent Tunisia's inclusion in the regression.

[38] These import and export equations follow the tradition of Houthakker and Magee (1969) but include the REER instead of a ratio of relative prices between domestic and foreign goods.

[39] Papageorgiou et al. (2017) find that the elasticity between clean and dirty energy inputs (mainly fossil fuels) is significantly greater than one.

country teams are encouraged to explore more granular data, and adjust for country-specific factors, when necessary and with proper justification.

VII. THE EXTERNAL SUSTAINABILITY APPROACH

The external sustainability (ES) approach seeks to determine the current account-to-GDP ratio that would stabilize the NFA-to-GDP position over the medium term at a benchmark or desired level, as opposed to identifying the current account or REER level consistent with fundamentals and desired policies—the approach discussed earlier. The ES approach remains along the lines of the framework described in the CGER (Lee et al., 2008) and the older EBA (Phillips et al., 2013) papers. It usefully complements estimates from the current account, REER-Index and REER-Level models, by focusing on sustainability considerations, which are central to external sector assessments in some cases.

Results from the ES approach provide useful insights when debtor or creditor positions are deemed excessively large, and where further widening of these positions is unwarranted. This is notably the case for countries where large debtor positions put external sustainability at risk. A key strength of the approach is that it requires a limited number of variables and assumptions, such as medium-term GDP growth, inflation, and rates of return on external assets and liabilities.[40] Unlike other EBA models, however, using the results of the ES approach to form a normative view on the current account depends heavily on having a normative view on the medium-term *desirable* NFA-to-GDP level. Such a normative level is generally difficult to determine, except in cases where there is a large negative NFA position, which unambiguously calls for a higher NFA.[41] Also, unlike the other EBA models, the ES approach does not provide information on specific policy gaps that shed light on how the actual current account or REER can be brought closer in line to its normative value.

A. Link Between Stock and Flow Positions

The ES approach hinges on the law of motion of the country's NFA position. Specifically, and leaving aside errors and omissions, the change of the NFA position between two consecutive periods can be expressed as a function of the current account balance (CA) and NFA valuation changes (VC):

$$NFA_t - NFA_{t-1} = CA_t + VC_t$$

Because the ES approach takes a forward-looking view—the CA level that would keep the NFA-to-GDP ratio constant—and valuation changes are unpredictable for the most part, it can be assumed that $VC_t = 0$.[42] Expressing the previous expression in terms of nominal GDP yields:

$$nfa_t - \frac{1}{(1+\pi_t)(1+g_t)} nfa_{t-1} = ca_t$$

[40] Real rates of return are only needed when focusing on the net exports and transfers balance, stabilizing the NFA-to-GDP position at a benchmark level.

[41] In such cases, however, there remains a significant degree of judgment in specifying the speed of adjustment.

[42] See Adler et al. (forthcoming) for a discussion on the presence of predictable components of valuation changes.

where x denotes the ratio of variable X to nominal GDP, π_t is the inflation rate and g_t is the real growth rate. Further decomposing the current account balance into net exports and transfers (nxt_t), and net interest payments (assuming the same real rate of return r_t on both lagged external assets and liabilities), the above equation can be written as:

$$nfa_t = nxt_t + \frac{1+r_t}{1+g_t} nfa_{t-1} \qquad (10)$$

This expression illustrates the risk of an unsustainable dynamics of the NFA-to-GDP ratio whenever $r_t > g_t$ on a sustained basis. In the steady-state, denoting variables without a time subscript, the current account balance (*ca*) and net exports and transfers balance (*nxt*) that stabilize the NFA-to-GDP ratio at a given nfa level are:

$$ca = \left(1 - \frac{1}{(1+\pi)(1+g)}\right) nfa$$

$$nxt = -\frac{r-g}{1+g} nfa \qquad (11)$$

Equation (11) sheds light on a few interesting features:

- For a debtor economy ($nfa < 0$), a lower growth rate requires a higher current account balance or a higher net exports and transfers balance to stabilize the NFA-to-GDP ratio at a benchmark level.
- Similarly, for a debtor economy, a higher rate of return on external assets and liabilities requires a higher net exports and transfers balance to stabilize the NFA-to-GDP ratio at a benchmark level.[43]

B. External Sustainability Approach in the EBA Framework

In practice, the implementation of the ES approach entails five steps:

1) *Choice of a benchmark or desired NFA-to-GDP level*. In most cases, the benchmark NFA level is set equal to the current or last year's level. However, for countries with large net debtor positions (and high sustainability risk), a benchmark NFA level consistent with a stronger external position is recommended, with the precise level informed by the averages of a particular regional or country group.

2) *Derivation of the current account balance that stabilizes the NFA position at its benchmark level*. This follows directly from equation (11), using medium-term inflation (π) and medium-term potential growth (*g)*.

3) *Staff forecast of the medium-term current account that would prevail under current policies and real effective exchange rates*. The medium-term current account is adjusted for the cycle (output gap and terms of trade) using the same methodology as in the EBA CA model.

[43] The above-described ES approach is deterministic in nature. Alternative probabilistic approaches (see, for example, Blanchard and Das, 2017) can shed light on the degree of uncertainty to external sustainability, which arises from both the size of gross asset and liability positions as well as from the volatility of returns on assets and liabilities. Implementation of such approaches (which typically have greater data requirements) can be considered, on a case-by-case basis, as an additional tool for external assessments of countries where external sustainability may be a concern (see, e.g., IMF, 2018b).

4) *Determination of the current account gap*. The CA gap is the difference between the staff forecasted medium-term current account that would prevail under current policies, and the current account balance that would stabilize the NFA position at its benchmark level.

5) *Calculation of the corresponding REER gap (*i.e., REER adjustment needed to close the above current account gap). This is derived from the current account gap using staff-assessed REER-CA semi-elasticities, for which benchmark values are estimated (see Section VI).

The current account balance that stabilizes the NFA position at its benchmark level should not be interpreted as a current account norm, since it is relevant only when external sustainability is a main concern. In these latter cases, results from the ES approach may take precedent to the EBA CA model results and guide the external sector assessments.[44]

VIII. COMPLEMENTARY TOOLS

As explained in Section II, the EBA models provide key numerical inputs for the assessment of external positions of 49 large economies, which in some cases need to be complemented by analytically-grounded judgment to account for country-specific circumstances that are not fully reflected in the EBA models. This relates to the interpretation of model residuals (i.e., the portion of the current account or REER gap that is not explained by the model's policy variables). Particularly important for external assessments is the ability to disentangle the part of model residuals that is due to policy distortions—and thus contribute to the external gap—from other residuals that likely reflect country characteristics not captured by model regressors or measurement issues—which should not count towards a country's external gap.

To understand what lies behind model residuals, and inform judgment, two additional analytical tools were developed. The first tool provides estimates of potential biases in the measurement of the current account, which helps inform outside-the-model adjustments to the underlying current account balance. The second tool explores the role of distortions in product and labor markets in driving current account imbalances, which supports staff's understanding of the unidentified portion of the current account gap for the subset of countries for which it is available. [45] In what follows, a brief summary of these tools and their implementation is provided. Additional details are included in forthcoming work.

A. Measurement Issues

Increasing international integration and growing activities of multinational corporations have blurred the boundaries between residents and non-residents, and the corresponding attribution of income across countries, raising questions about the appropriateness of some external accounts statistics. The

[44] More precisely, the ES approach can be used to adjust the current account norm (as derived from the EBA CA model) upwards, when the norm is significantly lower than the current account balance needed to stabilize the NFA position at its benchmark or desired level.

[45] Boz et al. (forthcoming) assessed the role of trade costs on current account imbalances. While effective export costs were found to be statistically significant, their impact on the current accounts was small. Data and conceptual complexities prevented their inclusion in the EBA models. See Ostry and Rose (1992) for an early contribution on this issue.

treatment of investment income is important as statistical definitions may depart from the relevant economic concept, leading to biases in the measured income balance of the current account and systematic valuation changes in the NIIP. These definitional issues relate to the fact that international statistical standards (BPM6) record *accrued nominal income arising from a transaction.* This *nominal* and *transaction-based* measure of investment income departs from a standard economic concept (accumulation of real net external wealth on an ultimate owner basis) in two key aspects:

- *Retained earnings on equity investments.* The statistical treatment of retained earnings is different for direct and portfolio investment and is not always attributed to the ultimate owner.[46] While for direct investment equity, both paid out dividends and retained earnings are recorded in the current account income balance, for portfolio equity only paid out dividends are recorded. Consequently, retained earnings are reflected in IIP valuation changes only. This treatment is consistent with the *BPM6* notion that retained earnings can be considered part of a formal agreement for remuneration on investment (and, hence, income) for the case of foreign direct investment equity (where a deliberate decision to retain earnings can be presumed) but not for portfolio equity. From an economic perspective, however, retained earnings can be considered income in both cases.
- *Inflation component in interest income.* Investment income is recorded in nominal terms. While this is consistent with the treatment of other forms of income in the balance of payments, it entails a departure from the economic notion of real income (and real accumulation of external wealth) as nominal interest income compensates for the expected erosion of the real value of the principal through inflation. The latter leads to systematic bias in NIIP valuation changes.[47]

Earlier versions of the EBA model did not fully address measurement issues consistently across countries. A financial center dummy was included in the model to capture measurement biases for a few economies that were particularly susceptible of being affected due to their large gross foreign investment positions. However, the underlying assumption in the financial center dummy—that biases have a similar direction (sign) and magnitude over time, and that they are present for only a few economies—was too restrictive. The sign and size of measurement biases vary with many factors, including with net equity and debt positions, inflation differentials, differences in dividend policies, etc., which may not be uniform across time and countries.[48]

The 2018 EBA refinements entailed removing the financial center dummy from the EBA model and introducing outside-of-model adjustors for measurement issues when:

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[46] See also Mancini and Stoffels (2012), Lane (2015 and 2017), Fischer et al. (2018), and Adler et al. (forthcoming).

[47] This issue is well recognized in national accounting—see, for example, Jump (1980), Vanoli (1999) and Hill and Hill (2003)—and has received recent attention also in the context of the recording of income on international assets, as discussed by Fletcher (forthcoming) as well as Mian and Saure (2017). The inflation content in the current account income balance was also previously studied by Freedman (1979).

[48] Other measurement issues may exist and could be important, as also discussed in Adler et al (forthcoming), but have not been firmly established in the literature, notably due to data limitations. This underscores the importance of further research and better data to advance our understanding of biases in the measurement of external positions.

- Empirical estimates of retained earnings and inflation measurement biases consistently point to sizable mismeasurement;
- There is evidence of systematic and persistent differences between a country's financial account and changes in its NFA position;
- Both of the above point in the same direction.

These criteria form the basis for the application of adjustors for measurement (see IMF, 2018; and Adler et al., forthcoming). The precise magnitude of the adjustment is determined on a case-by-case basis considering, among other things, the availability of data to accurately estimate these measurement biases and recognizing that the NFA-to-GDP coefficient in the EBA current account model already partially captures them (see earlier discussion in section III.B). Data limitations on stock-flow reconciliation and IIP currency exposures remain important constraints for a more granular and accurate estimate of measurement biases for many countries.

B. Structural Tools

The persistence of current account imbalances suggests that structural distortions are important for explaining the configuration of imbalances. Unfortunately, data limitations on both time and cross-country coverage prevent the inclusion of structural policies in the EBA regression models. Using data for a subset of EBA countries and years, a model-based tool was developed to inform policy discussions on the potential role product and labor market policies play on external imbalances (see Osorio-Buitron, forthcoming; and IMF, 2018).

Specifically, the analysis relies on a two-stage approach, whereby the estimated EBA CA residuals are regressed on structural variables for the group of countries j and years τ, for which data are available:

$$\hat{\mu}_{j\tau} = \alpha + \tilde{S}_{j\tau}\gamma + \varepsilon_{j\tau} \qquad (12)$$

where $\hat{\mu}_{j\tau}$ denotes the estimated EBA CA residual, and $\tilde{S}_{j\tau}$ is the vector of structural policies expressed as deviations from their GDP-weighted world average. $S_{j\tau}$ includes a measure of burdens in the *licenses and permits system* (LPS) and *employment protection laws* (EPL) for countries for which OECD data are available. For other country cases, the structural policy vector includes data from the World Economic Forum (WEF) on the number of *starting a business procedures* (SBP) and the degree of *cooperation in labor-employer relations* (CLER). While all publicly-available structural indicators were initially considered, the selected indicators used in the complementary tool generally met two criteria. Not only did their inclusion lead to robust empirical results, but also conceptually there also had to be a minimum degree of certainty of how the indicator would affect the current account.

In line with the related empirical literature, the results indicate that reducing burdens in LPS can lower the current account as investment by new firms rises and their additional demand for labor puts upward pressure on wages, reducing competitiveness. Meanwhile, reducing certain labor market

rigidities by easing EPLs can improve the current account as labor costs decline, boosting competitiveness (Table 9).[49]

This simple normative exercise assumes that desired policy settings—$S^*_{j\tau}$ — for product and labor market regulations correspond to the best-practice frontier. This assumption is not always justified, especially in the case of labor markets where desired policies could differ from the frontier. Hence, some flexibility in setting the desirable best-practice benchmarks can be considered, in practice. The tool identifies country-specific reforms that can *both* address domestic distortions and external imbalances and provides an estimate of the extent to which these reforms could explain the residual and address external imbalances: $(S_{j\tau} - S^*_{j\tau})\hat{\gamma}$.

IX. Concluding Remarks

This paper has presented the latest generation of EBA models. Recent methodological refinements represented a step forward in delivering a more reliable and conceptually-based assessment tool, but continued efforts will be needed to draw on latest advances in the academic literature and lessons learned in the implementation process. This search for "better" models should be viewed as a continuous and evolving process.

A key remaining challenge for the EBA models is that they still fall short of explaining a large portion of current account and real exchange rate gaps in some cases. These large residuals likely reflect a combination of structural distortions, measurement biases, and country fundamentals that are not explicitly modelled. Progress on modelling some of these aspects remains constrained by methodological challenges and data limitations. Thus, complementary tools to inform model residuals and support staff judgment will remain essential in arriving at external assessments, for as long as data limitations preclude their full inclusion in the regression models. Tackling these aspects more comprehensively and consistently within the EBA framework requires greater data collection efforts, especially on the areas of: (i) labor and product market policies and distortions; and (ii) external sector statistics on currency composition of cross-border positions and stock-flow reconciliation.

Lessons from latest trends in external imbalances also indicate that some new areas may warrant deeper exploration. For example, a better understanding is needed of: (i) the sectoral distribution of net saving and the role of corporates in driving the rise and persistence of current account surpluses in key advanced and some emerging economies; (ii) possible measurement biases related to the expansion of multinational activities; (iii) the risks from stock imbalances (due to their size and composition) and how they affect external assessments; and (iv) the interactions between aging and the design and sustainability of public pension systems.[50] In addition, further research is needed on the role of exchange rates as an adjustment mechanism, especially given the dominance of the U.S. dollar in both trade and finance and the changing trade landscape (e.g. increased intermediate goods

[49] These results confirm those of the existing empirical and theoretical literature. See Cacciatore et. al. (2016a, 2016b), Jaumotte and Sodsriwiboon (2010); Cheung et al. (2013); Culiuc and Kyobe (2017); and Kerdrain et al. (2010).

[50] See also Dao and Jones (2018) and Amaglobeli et al. (2019) for a study and discussion of the relationship between pension systems and savings.

trade and global value chains). As new insights are gained on these and other aspects, future refinements to incorporate them into the EBA framework will be considered.

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Table 1. EBA Current Account Regression, Dependent Variable CA/GDP

Cyclical Factors	
Output gap #	-0.356***
	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.161***
	(0.000)
Macroeconomic Fundamentals	
Net foreign asset (NFA) position (lagged)	0.023***
	(0.000)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.006
	(0.593)
Output per worker (lagged)	0.023
	(0.259)
Expected real GDP growth 5 years ahead #	-0.302***
	(0.004)
Reserve currency status	-0.030***
	(0.009)
Structural Fundamentals	
Demographic block	
Old-age dependency ratio (OAD) #	-0.069
	(0.109)
Population growth #	-0.692*
	(0.061)
Share of prime-aged savers #	0.138**
	(0.013)
Life expectancy #	-0.005***
	(0.000)
Interaction between life expectancy #, and future OAD	0.013***
	(0.005)
Institutional quality #	-0.047**
	(0.015)
Exhaustible resources of oil and natural gas	0.310***
	(0.000)
Policy Variables	
Fiscal policy #	0.329***
	(0.000)
Health spending (lagged) #	-0.399***
	(0.003)
Foreign exchange intervention (interacted with capital controls) #	0.754***
	(0.001)
Credit gap #	-0.104***
	(0.000)
Capital controls	
Output per worker (lagged, interacted with capital openness)	0.041*
	(0.051)
Global risk aversion (lagged, interacted with capital openness)	0.020
	(0.190)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.002
	(0.971)
Constant	-0.009***
	(0.002)
Observations	1,367
Number of countries	49
R-squared IV	0.524
R-squared Fit	0.550
Root MSE	0.031

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 2. EBA Current Account Regression Results, 2013 and 2015 Models

	2013 Model	2015 Model	
		Original Data	Updated Data
Cyclical Factors			
Output gap #	-0.400***	-0.385***	-0.392***
	(0.000)	(0.000)	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.230***	0.197***	0.139***
	(0.000)	(0.000)	(0.000)
Macroeconomic Fundamentals			
Net foreign asset (NFA) position (lagged)	0.016**	0.015**	0.014**
	(0.019)	(0.016)	(0.016)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.012	-0.009	0.005
	(0.378)	(0.493)	(0.673)
Output per worker (lagged)	0.007	0.033	0.025
	(0.730)	(0.143)	(0.229)
Expected real GDP growth 5 years ahead #	-0.471***	-0.425***	-0.272***
	(0.000)	(0.000)	(0.009)
Reserve currency status	-0.045***	-0.041***	-0.038***
	(0.000)	(0.000)	(0.001)
Financial center dummy	0.033***	0.027***	0.028***
	(0.000)	(0.000)	(0.000)
Structural Fundamentals			
Demographic block			
Old-age dependency ratio (OAD) #	-0.03	-0.057	-0.079
	(0.476)	(0.312)	(0.148)
Population growth #	-0.629	-0.565	-0.689*
	(0.107)	(0.168)	(0.075)
*Rel. dependency ratio * aging speed*		0.130***	0.101***
		(0.000)	(0.004)
*Rel. aging speed * dependency ratio*		0.088**	0.107***
		(0.039)	(0.009)
Aging speed #	0.156***		
	(0.000)		
Institutional quality (ICRG-5) #	-0.109***	-0.109***	-0.104***
	(0.000)	(0.000)	(0.000)
Exhaustible resources of oil and natural gas	0.615***	0.410***	0.398***
	(0.000)	(0.000)	(0.000)
Policy Variables			
Fiscal policy #	0.324***	0.470***	0.543***
	(0.001)	(0.000)	(0.000)
Health spending (lagged) #	-0.551***	-0.503***	-0.310**
	(0.000)	(0.000)	(0.022)
Foreign exchange intervention (interacted with capital controls) #	0.346**	0.449**	0.261
	(0.040)	(0.024)	(0.173)
Demeaned credit #	-0.026***	-0.021***	-0.038***
	(0.002)	(0.005)	(0.000)
Capital controls			
Output per worker (lagged, interacted with capital openness)	0.065***	0.046**	0.046**
	(0.003)	(0.043)	(0.032)
Global risk aversion (lagged, interacted with capital openness)	0.068***	0.040**	0.022
	(0.000)	(0.011)	(0.156)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	-0.136*	-0.093	-0.008
	(0.056)	(0.177)	(0.908)
Constant	-0.014***	-0.014***	-0.014***
	(0.000)	(0.000)	(0.000)
Observations	1080	1,197	1,340
Number of countries	49	49	49
R-squared IV	0.52	0.544	0.511
R-squared Fit	---	---	0.494
Root MSE	0.033	0.032	0.033

* significant at 10%; ** significant at 5%; *** significant at 1%
# sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 3. EBA Current Account Regression Results, Robustness on Institutions

	Baseline	Full ICRG through 2001, and WGI from 2002	WGI and ICRG average (WGI constant before 2002)	WGI from 2002; base pre 2002 on ICRG/WGI relation
Cyclical Factors				
Output gap #	-0.356***	-0.360***	-0.363***	-0.362***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.161***	0.150***	0.157***	0.155***
	(0.000)	(0.000)	(0.000)	(0.000)
Macroeconomic Fundamentals				
Net foreign asset (NFA) position (lagged)	0.023***	0.023***	0.022***	0.022***
	(0.000)	(0.000)	(0.000)	(0.000)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.006	-0.005	-0.005	-0.005
	(0.593)	(0.689)	(0.685)	(0.664)
Output per worker (lagged)	0.023	0.023	0.023	0.023
	(0.259)	(0.248)	(0.276)	(0.265)
Expected real GDP growth 5 years ahead #	-0.302***	-0.297***	-0.309***	-0.311***
	(0.004)	(0.004)	(0.003)	(0.003)
Reserve currency status	-0.030***	-0.031***	-0.032***	-0.032***
	(0.009)	(0.008)	(0.006)	(0.007)
Structural Fundamentals				
Demographic block				
Old-age dependency ratio (OAD) #	-0.069	-0.066	-0.071*	-0.072*
	(0.109)	(0.121)	(0.099)	(0.093)
Population growth #	-0.692*	-0.702*	-0.654*	-0.635*
	(0.061)	(0.058)	(0.077)	(0.083)
Share of prime-aged savers #	0.138**	0.136**	0.147***	0.147***
	(0.013)	(0.016)	(0.008)	(0.008)
Life expectancy #	-0.005***	-0.005***	-0.005***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Interaction between life expectancy #, and future OAD	0.013***	0.013***	0.013***	0.014***
	(0.005)	(0.004)	(0.004)	(0.003)
Institutional Quality				
Full ICRG #	**-0.047****			
	(0.015)			
Full ICRG through 2001, zero after #		**-0.059*****		
		(0.005)		
WGI after 2001, zero before 2002 #		**-0.033***		
		(0.052)		
WGI and ICRG average (WGI constant before 2002) #			**-0.045***	
			(0.077)	
WGI from 2002; base pre 2002 on ICRG/WGI relation #				**-0.038****
				(0.049)
Exhaustible resources of oil and natural gas	0.310***	0.305***	0.305***	0.302***
	(0.000)	(0.001)	(0.001)	(0.001)
Policy Variables				
Fiscal policy #	0.329***	0.375***	0.331***	0.331***
	(0.000)	(0.000)	(0.000)	(0.000)
Health spending (lagged) #	-0.399***	-0.380***	-0.377***	-0.369***
	(0.003)	(0.005)	(0.006)	(0.007)
Foreign exchange intervention (interacted with capital controls) #	0.754***	0.711***	0.744***	0.733***
	(0.001)	(0.001)	(0.002)	(0.002)
Credit gap #	-0.104***	-0.106***	-0.104***	-0.105***
	(0.000)	(0.000)	(0.000)	(0.000)
Capital controls				
Output per worker (lagged, interacted with capital openness)	0.041*	0.041**	0.043**	0.043**
	(0.051)	(0.044)	(0.039)	(0.040)
Global risk aversion (lagged, interacted with capital openness)	0.020	0.019	0.020	0.021
	(0.190)	(0.217)	(0.184)	(0.157)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.002	0.012	0.002	-0.001
	(0.971)	(0.856)	(0.975)	(0.983)
Constant	-0.009***	-0.010***	-0.009***	-0.009***
	(0.002)	(0.001)	(0.003)	(0.002)
Observations	1,367	1,367	1,367	1,367
Number of countries	49	49	49	49
R-squared IV	0.524	0.528	0.526	0.527
R-squared Fit	0.550	0.548	0.546	0.548
Root MSE	0.031	0.031	0.031	0.031

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 4. EBA Current Account Regression Results, Robustness on Credit

	Baseline	Higher Lambda	Demeaned Credit -to-GDP	Demeaned and Detrended Credit	Credit Growth	Demeaned Credit and Credit Growth
Cyclical Factors						
Output gap #	-0.356***	-0.363***	-0.381***	-0.355***	-0.353***	-0.350***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.161***	0.160***	0.162***	0.161***	0.159***	0.158***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Macroeconomic Fundamentals						
Net foreign asset (NFA) position (lagged)	0.023***	0.021***	0.018***	0.023***	0.022***	0.022***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.006	-0.007	-0.008	-0.005	-0.009	-0.007
	(0.593)	(0.587)	(0.498)	(0.672)	(0.472)	(0.563)
Output per worker (lagged)	0.023	0.019	0.016	0.022	0.033	0.032
	(0.259)	(0.339)	(0.434)	(0.280)	(0.101)	(0.111)
Expected real GDP growth 5 years ahead #	-0.302***	-0.313***	-0.376***	-0.300***	-0.284***	-0.283***
	(0.004)	(0.003)	(0.000)	(0.004)	(0.006)	(0.006)
Reserve currency status	-0.030***	-0.026**	-0.027**	-0.031***	-0.036***	-0.036***
	(0.009)	(0.026)	(0.022)	(0.009)	(0.002)	(0.002)
Structural Fundamentals						
Demographic block						
Old-age dependency ratio (OAD) #	-0.069	-0.057	-0.106**	-0.066	-0.089**	-0.087**
	(0.109)	(0.186)	(0.016)	(0.134)	(0.034)	(0.040)
Population growth #	-0.692*	-0.707*	-0.952**	-0.693*	-0.942***	-0.933***
	(0.061)	(0.055)	(0.011)	(0.060)	(0.009)	(0.009)
Share of prime-aged savers #	0.138**	0.135**	0.161***	0.136**	0.115**	0.116**
	(0.013)	(0.016)	(0.005)	(0.017)	(0.036)	(0.038)
Life expectancy #	-0.005***	-0.005***	-0.007***	-0.005***	-0.006***	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Interaction between life expectancy #, and future OAD	0.013***	0.013***	0.021***	0.013***	0.016***	0.016***
	(0.005)	(0.005)	(0.000)	(0.007)	(0.000)	(0.000)
Institutional quality #	-0.047**	-0.048**		-0.048**	-0.043**	-0.044**
	(0.015)	(0.013)		(0.014)	(0.021)	(0.019)
Exhaustible resources of oil and natural gas	0.310***	0.335***	0.318***	0.310***	0.290***	0.291***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Policy Variables						
Fiscal policy #	0.329***	0.336***	0.456***	0.333***	0.342***	0.352***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Health spending (lagged) #	-0.399***	-0.390***	-0.379***	-0.396***	-0.471***	-0.464***
	(0.003)	(0.004)	(0.006)	(0.003)	(0.000)	(0.000)
Foreign exchange intervention (interacted with capital controls) #	0.754***	0.752***	0.851***	0.760***	0.798***	0.817***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Credit gap (Lambda 1600) #	**-0.104*** **			**-0.105*** **		
	(0.000)			**(0.000)**		
Credit gap (Lambda 25000) #		**-0.092*** **				
		(0.000)				
Credit demeaned #			**-0.035*** **	**0.002**		**-0.000**
			(0.000)	**(0.794)**		**(0.995)**
Credit-to-GDP change, current #					**-0.107*** **	**-0.106*** **
					(0.000)	**(0.000)**
Credit-to-GDP change, lagged #					**-0.052*** **	**-0.056*** **
					(0.000)	**(0.000)**
Capital controls						
Output per worker (lagged, interacted with capital openness)	0.041*	0.041**	0.053**	0.042**	0.043**	0.044**
	(0.051)	(0.049)	(0.012)	(0.044)	(0.035)	(0.031)
Global risk aversion (lagged, interacted with capital openness)	0.020	0.020	0.016	0.019	0.014	0.013
	(0.190)	(0.179)	(0.300)	(0.205)	(0.344)	(0.380)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.002	0.003	0.005	0.004	0.002	0.004
	(0.971)	(0.967)	(0.946)	(0.955)	(0.975)	(0.947)
Constant	-0.009***	-0.009***	-0.015***	-0.009***	-0.013***	-0.013***
	(0.002)	(0.002)	(0.000)	(0.003)	(0.000)	(0.000)
Observations	1,367	1,367	1,367	1,367	1,367	1,367
Number of countries	49	49	49	49	49	49
R-squared IV	0.524	0.525	0.485	0.525	0.519	0.521
Root MSE	0.031	0.031	0.033	0.031	0.031	0.031

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 5. EBA Current Account Regression Results, Robustness on Demographics

	Baseline	Aging Speed instead of LE	LE squared	LE squared and LE interacted
Cyclical Factors				
Output gap #	-0.356***	-0.356***	-0.358***	-0.356***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.161***	0.166***	0.162***	0.161***
	(0.000)	(0.000)	(0.000)	(0.000)
Macroeconomic Fundamentals				
Net foreign asset (NFA) position (lagged)	0.023***	0.026***	0.025***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.006	-0.010	-0.010	-0.007
	(0.593)	(0.395)	(0.430)	(0.544)
Output per worker (lagged)	0.023	0.008	0.019	0.023
	(0.259)	(0.684)	(0.347)	(0.258)
Expected real GDP growth 5 years ahead #	-0.302***	-0.313***	-0.308***	-0.307***
	(0.004)	(0.003)	(0.003)	(0.003)
Reserve currency status	-0.030***	-0.028**	-0.027**	-0.032***
	(0.009)	(0.017)	(0.019)	(0.006)
Structural Fundamentals				
Demographic block				
Old-age dependency ratio (OAD) #	-0.069	-0.044	-0.054	-0.073*
	(0.109)	(0.298)	(0.200)	(0.093)
Population growth #	-0.692*	-0.450	-0.522	-0.697*
	(0.061)	(0.231)	(0.175)	(0.061)
Share of prime-aged savers #	0.138**	0.074	0.109**	0.148**
	(0.013)	(0.314)	(0.050)	(0.011)
Life expectancy #	-0.005***		-0.017*	0.004
	(0.000)		(0.051)	(0.803)
Interaction between life expectancy #, and future OAD	0.013***			0.017*
	(0.005)			(0.058)
Aging speed #		0.032		
		(0.451)		
Life expectancy squared #			0.0003*	-0.000
			(0.079)	(0.554)
Institutional quality #	-0.047**	-0.049**	-0.045**	-0.047**
	(0.015)	(0.012)	(0.019)	(0.016)
Exhaustible resources of oil and natural gas	0.310***	0.322***	0.301***	0.309***
	(0.000)	(0.000)	(0.001)	(0.001)
Policy Variables				
Fiscal policy #	0.329***	0.284***	0.310***	0.320***
	(0.000)	(0.001)	(0.000)	(0.000)
Health spending (lagged) #	-0.399***	-0.443***	-0.430***	-0.373***
	(0.003)	(0.001)	(0.001)	(0.007)
Foreign exchange intervention (interacted with capital controls) #	0.754***	0.749***	0.753***	0.735***
	(0.001)	(0.001)	(0.001)	(0.002)
Credit gap #	-0.104***	-0.106***	-0.106***	-0.103***
	(0.000)	(0.000)	(0.000)	(0.000)
Capital controls				
Output per worker (lagged, interacted with capital openness)	0.041*	0.049**	0.043**	0.041**
	(0.051)	(0.017)	(0.039)	(0.048)
Global risk aversion (lagged, interacted with capital openness)	0.020	0.023	0.021	0.020
	(0.190)	(0.128)	(0.158)	(0.184)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.002	-0.014	-0.007	0.001
	(0.971)	(0.831)	(0.917)	(0.986)
Constant	-0.009***	-0.005*	-0.008***	-0.009***
	(0.002)	(0.076)	(0.004)	(0.002)
Observations	1,367	1,367	1,367	1,367
Number of countries	49	49	49	49
R-squared IV	0.524	0.511	0.520	0.524
R-squared Fit	0.550	0.537	0.546	0.553
Root MSE	0.031	0.032	0.031	0.031

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 6. EBA Current Account Regression Results, Robustness on Foreign Exchange Intervention

	Baseline	No FXI refinements	No IV	Narrow FXI
Cyclical Factors				
Output gap #	-0.356***	-0.369***	-0.365***	-0.349***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity terms of trade gap (interacted with trade openness)	0.161***	0.143***	0.156***	0.155***
	(0.000)	(0.000)	(0.000)	(0.000)
Macroeconomic Fundamentals				
Net foreign asset (NFA) position (lagged)	0.023***	0.026***	0.025***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)
Net foreign asset (NFA) position times dummy if NFA/GDP < -60 percent (lagged)	-0.006	-0.007	-0.007	-0.006
	(0.593)	(0.582)	(0.569)	(0.612)
Output per worker (lagged)	0.023	0.023	0.022	0.025
	(0.259)	(0.270)	(0.252)	(0.221)
Expected real GDP growth 5 years ahead #	-0.302***	0.040*	0.041**	0.038*
	(0.004)	(0.059)	(0.041)	(0.066)
Reserve currency status	-0.030***	-0.032***	-0.031***	-0.030**
	(0.009)	(0.007)	(0.007)	(0.010)
Structural Fundamentals				
Demographic block				
Old-age dependency ratio (OAD) #	-0.069	-0.065	-0.066	-0.072*
	(0.109)	(0.123)	(0.116)	(0.095)
Population growth #	-0.692*	-0.754**	-0.764**	-0.665*
	(0.061)	(0.038)	(0.033)	(0.072)
Share of prime-aged savers #	0.138**	0.132**	0.139**	0.141**
	(0.013)	(0.016)	(0.010)	(0.011)
Life expectancy #	-0.005***	-0.005***	-0.005***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Interaction between life expectancy #, and future OAD	0.013***	0.012***	0.012***	0.013***
	(0.005)	(0.007)	(0.005)	(0.004)
Institutional quality #	-0.047**	-0.044**	-0.047**	-0.048**
	(0.015)	(0.026)	(0.012)	(0.013)
Exhaustible resources of oil and natural gas	0.310***	0.323***	0.307***	0.308***
	(0.000)	(0.000)	(0.000)	(0.001)
Policy Variables				
Fiscal policy #	0.329***	0.345***	0.335***	0.330***
	(0.000)	(0.000)	(0.000)	(0.000)
Health spending (lagged) #	-0.399***	-0.418***	-0.417***	-0.389***
	(0.003)	(0.002)	(0.001)	(0.004)
Foreign exchange intervention (interacted with capital controls) #	**0.754*** **			
	(0.001)			
Foreign exchange intervention (interacted with capital controls, narrow FXI definition and old IV) #		**0.195**		
		(0.295)		
Foreign exchange intervention (interacted with capital controls, No IV) #			**0.276*** **	
			(0.000)	
Foreign exchange intervention (interacted with capital controls, narrow FXI definition) #				**0.964*** **
				(0.001)
Credit gap #	-0.104***	-0.110***	-0.107***	-0.103***
	(0.000)	(0.000)	(0.000)	(0.000)
Capital controls				
Output per worker (lagged, interacted with capital openness)	0.041*	0.040*	0.041**	0.038*
	(0.051)	(0.059)	(0.041)	(0.066)
Global risk aversion (lagged, interacted with capital openness)	0.020	0.020	0.018	0.021
	(0.190)	(0.200)	(0.243)	(0.159)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.002	0.009	0.009	0.001
	(0.971)	(0.891)	(0.889)	(0.992)
Constant	-0.009***	-0.009***	-0.009***	-0.009***
	(0.002)	(0.003)	(0.002)	(0.002)
Observations	1,367	1,340	1,367	1,367
Number of countries	49	49	49	49
R-squared IV	0.524	0.528	0.534	0.526
R-squared Fit	0.550	0.554	0.555	0.549
Root MSE	0.031	0.031	0.031	0.031

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
sign means variable is included in differences from (GDP-weighted) world counterpart.
Capital account openness is calculated as one minus capital control index.

Table 7. EBA REER Models Regression Results

	Index	Level
Cyclical Factors		
Output gap †	0.392*	
	(0.055)	
Commodity terms of trade (log index)	0.184***	
	(0.000)	
Commodity terms of trade (log level, interacted with trade openness) †		0.064***
		(0.002)
Macroeconomic Fundamentals		
Net foreign assets (NFA) position (lagged)	-0.109***	0.056***
	(0.000)	(0.003)
Output per worker (log, lagged)	0.217***	0.171***
	(0.000)	(0.000)
Expected real GDP growth 5 years ahead †	2.012***	1.961**
	(0.003)	(0.048)
Reserve currency status	-0.068	-0.357***
	(0.267)	(0.000)
Financial home bias (lagged) †	0.193***	
	(0.000)	
Capital stock per employed person (lagged) †		0.110***
		(0.000)
Traded/Non-traded productivity (log, lagged) †		0.184***
		(0.000)
Structural Fundamentals		
Demographic block		
Old-age dependency ratio (OAD) †		0.362*
		(0.091)
Population growth †	2.003	2.570
	(0.337)	(0.253)
Institutional quality †		0.653***
		(0.000)
Trade openness (lagged) †	-0.208**	-0.336***
	(0.030)	(0.000)
VAT revenue, % of GDP †		0.662
		(0.256)
Share of administered prices in CPI †	-1.713***	-2.809***
	(0.000)	(0.000)
Policy Variables		
*Real interest rates * capital account openness †*	0.697***	0.585*
	(0.004)	(0.084)
Health spending (lagged) †	2.040**	4.196***
	(0.015)	(0.000)
Foreign exchange intervention (interacted with capital control) †	-2.479*	-3.561*
	(0.078)	(0.064)
Credit gap †	0.093*	0.032
	(0.062)	(0.655)
Capital controls		
Global risk aversion (lagged, interacted with capital openness)	-0.164**	-0.150
	(0.038)	(0.248)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.483	0.829
	(0.146)	(0.127)
Constant	4.482***	0.186***
	(0.000)	(0.000)
Observations	1,004	990
R-squared	0.548	0.895
RMSE	0.089	0.146
Number of Countries	40	39

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%

† sign means variable is included in differences from (trade weighted) world counterpart.

Dependent variable: REER (+=appreciation)

Capital account openness is calculated as one minus capital control index.

Table 8. EBA REER Models Regression Results, 2015 Models

	Index 2015		Level 2015	
	Original Data	Updated Data	Original Data	Updated Data
Cyclical Factors				
Output gap †				
Commodity terms of trade (log index)	0.092*	0.128***		
	(0.063)	(0.005)		
Commodity terms of trade (log level, interacted with trade openness) †			0.059***	0.063***
			(0.002)	(0.002)
Macroeconomic Fundamentals				
Net foreign assets (NFA) position (lagged)			0.105***	0.069***
			(0.000)	(0.000)
Output per worker (lagged)	0.698***	0.614***	0.164***	0.173***
	(0.000)	(0.000)	(0.000)	(0.000)
Expected real GDP growth 5 years ahead †	1.858***	2.663***	1.758*	1.924**
	(0.002)	(0.000)	(0.058)	(0.032)
Reserve currency status	0.036	0.056	-0.332***	-0.304***
	(0.539)	(0.346)	(0.000)	(0.000)
Financial home bias (lagged) †	0.370***	0.297***		
	(0.000)	(0.000)		
Capital stock per employed person (lagged) †	-0.493***	-0.373***	0.087***	0.094***
	(0.000)	(0.002)	(0.001)	(0.000)
Traded/Non-traded productivity (log, lagged) †			0.225***	0.217***
			(0.000)	(0.000)
Structural Fundamentals				
Demographic block				
Old-age dependency ratio (OAD) †			0.911***	0.720***
			(0.000)	(0.000)
Population growth †	0.859	-1.676	6.018***	4.910**
	(0.611)	(0.265)	(0.008)	(0.020)
Aging speed †			0.631**	0.480**
			(0.013)	(0.032)
Institutional quality †			0.423***	0.413***
			(0.000)	(0.000)
Trade openness (lagged) †	-0.305***	-0.207**	-0.314***	-0.306***
	(0.001)	(0.022)	(0.000)	(0.000)
VAT revenue, % of GDP †			1.195**	0.901*
			(0.024)	(0.087)
Share of administered prices in CPI †	-2.124***	-2.142***	-2.543***	-2.644***
	(0.000)	(0.000)	(0.000)	(0.000)
Policy Variables				
*Real interest rates * capital account openness †*	0.662***	0.878***	0.889**	0.665*
	(0.005)	(0.000)	(0.021)	(0.056)
Health spending (lagged) †	1.235	1.520**	1.742**	2.312***
	(0.105)	(0.048)	(0.032)	(0.001)
Foreign exchange intervention (interacted with capital control) †	-1.731***	-1.204**	-2.097*	-2.104
	(0.000)	(0.023)	(0.088)	(0.131)
Credit gap †	0.133***	0.121***	0.119***	0.055
	(0.000)	(0.000)	(0.006)	(0.147)
Capital Controls				
Global risk aversion (lagged, interacted with capital openness)	-0.260***	-0.220***	-0.318**	-0.188
	(0.001)	(0.005)	(0.017)	(0.152)
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.838**	0.701**	1.005*	0.805
	(0.020)	(0.036)	(0.097)	(0.147)
South Africa Apartheid (pre-1994)	0.305***	0.335***		
	(0.000)	(0.000)		
Constant	4.329***	4.351***	0.189***	0.177***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	882	998	876	989
R-squared	0.606	0.582	0.905	0.897
RMSE	0.083	0.085	0.140	0.144
Number of Countries	40	40	39	39

Standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
† sign means variable is included in differences from (trade weighted) world counterpart.
Dependent variable: REER (+=appreciation)
Capital account openness is calculated as one minus capital control index.

Table 9. Unit Root Tests

Variables	REER-Index model			REER-Level model		
	Fisher test 1/ H0: All panels **have unit root** *(Z-statistic)*	Hadri test 2/ H0: All panels **are stationary** *(Z-statistic)*	Unit root? *(diagnostic)*	Fisher test 1/ H0: All panels **have unit root** *(Z-statistic)*	Hadri test 2/ H0: All panels **are stationary** *(Z-statistic)*	Unit root? *(diagnostic)*
REER-Index	-2.29**	26.30***	inconclusive	.	.	.
REER-Level	.	.	.	-2.27**	26.31***	inconclusive
Commodity terms of trade (log index)	3.73	53.52***	yes	.	.	.
Commodity terms of trade (log level, rel. TRD PTR)	.	.	.	3.68	56.31***	yes
Output gap (rel. TRD PTR)	-5.76***	9.62***	inconclusive	.	.	.
VIX*capital account openness (lagged)	-5.18**	1.94**	inconclusive	-5.18***	1.95**	inconclusive
VIX*capital account openness * reserve currency status (lagged)	-4.16**	-3.77	no	-4.17***	-3.64	no
Reserve currency status	0.55	9.12***	yes	0.57	9.41***	yes
Financial home bias (lagged, rel. TRD PTR)	-1.75**	36.11***	inconclusive	.	.	.
Old age dependency ratio (rel. TRD PTR)	5.19		yes	5.18	44.62***	yes
Population growth (rel. TRD PTR)	-0.02	44.59***	yes	0.06	44.44***	yes
Output per worker (lagged, rel. top 3 economies)	3.60	50.50***	yes	4.24	49.41***	yes
Capital stock per employed person (lagged, rel. TRD PTR)	.	.	.	0.74	41.87***	yes
Traded/non-traded productivity (lagged, rel. TRD, PTR)	.	.	.	-1.30*	46.95***	inconclusive
Share of administered prices	-9.02***	-3.18	no	-3.22***	-1.37	no
VAT revenue (% GDP, rel. TRD PTR)	.	.	.	-7.25	29.47***	yes
Institutional quality (rel. TRD PTR)	.	.	.	-4.62***	28.71***	inconclusive
Trade openness (lag, rel. TRD PTR)	2.02	46.22***	yes	2.17	45.85***	yes
Expected real GDP growth 5 years ahead (rel. TRD PTR)	-5.04***	27.57***	inconclusive	-5.30***	27.58***	inconclusive
Net Foreign Assets(NFA) position (lagged)	1.66	44.34***	yes	2.44	44.35***	yes
Real interest rate *capital account openness (rel. TRD PTR)	-9.95***	13.00***	inconclusive	-10.70***	20.81***	inconclusive
Health spending (lagged, rel. TRD PTR)	-0.15	39.22***	yes	-0.49	38.79***	yes
FXI*capital controls (instrumented, rel. TRD PTR)	-3.56***	27.17***	inconclusive	-11.65***	6.64***	inconclusive
Credit gap (rel. TRD PTR)	2.53	30.09***	yes	2.80	29.55***	yes

* 10% significance; ** 5% significance; *** 1% significance

rel. TRD PTR denotes "relative to trading partners".

1/ Phillips-Perron test with no lags. Results are the same for the Dickey-Fuller tests.

2/ Requires balanced panel. Test run for 1996-2016 period, and exluding Pakistan in the case of FXI and monetary policy variables.

Table 10. Cointegration tests

Model residual panel unit root test 1/		
H0: All panels have unit roots		
Z-statistic	REER-Index residual	REER-Level residual
Fisher unit root	-3.20***	-4.10***
Cointegration pooled tests 2/		
H0: No cointegration		
t-statistic	REER-Index model	REER-level model
Dickey-Fuller	-5.35***	-3.52***
Modified Dickey-Fuller 3/	-6.43***	-3.33***
Augmented Dickey-Fuller (1 lag) 3/	-5.00***	-3.66***

1/ Based on fitted residuals

2/ Assumes the same cointegrating vector across countries.

The alternative hypothesis is that all panels are cointegrated.

Table 11. CA to REER Elasticities

	Original CGER 1/	CGER-inspired Approach 2/
Argentina	-0.13	-0.11
Australia	-0.20	-0.15
Austria	-0.45	-0.36
Belgium	-0.72	-0.58
Brazil	-0.10	-0.09
Canada	-0.27	-0.22
Chile	-0.28	-0.19
China	-0.23	-0.12
Colombia	-0.14	-0.13
Czech Republic	-0.44	-0.49
Denmark	-0.46	-0.34
Egypt	-0.14	-0.16
Finland	-0.31	-0.25
France	-0.27	-0.22
Germany	-0.38	-0.28
Greece	-0.28	-0.23
Hungary	-0.42	-0.59
India	-0.18	-0.16
Indonesia	-0.19	-0.14
Ireland	-0.92	-0.65
Israel	-0.25	-0.20
Italy	-0.25	-0.20
Japan	-0.14	-0.12
Korea	-0.25	-0.27
Malaysia	-0.46	-0.42
Mexico	-0.13	-0.27
Morocco	-0.29	-0.30
Netherlands	-0.74	-0.53
New Zealand	-0.25	-0.18
Norway	-0.35	-0.23
Pakistan	-0.11	-0.12
Peru	-0.23	-0.16
Philippines	-0.22	-0.23
Poland	-0.46	-0.35
Portugal	-0.36	-0.29
Russia	-0.27	-0.16
South Africa	-0.27	-0.20
Spain	-0.28	-0.22
Sweden	-0.36	-0.28
Switzerland	-0.53	-0.39
Thailand	-0.64	-0.41
Tunisia	-0.36	-0.37
Turkey	-0.22	-0.20
United Kingdom	-0.24	-0.20
United States	-0.12	-0.10

1/ Figures shown are those previously used in the CGER exercise, in most cases using a common elasticity assumption of 0.71 for exports and 0.92 for imports.
2/ Based on newly estimated common elasticities using quarterly data (1980Q1-2017Q4), adjusted by the size of exports and imports in GDP; 0.11 for exports and 0.57 for imports.

Table 12. Effect of Product and Labor Market Policies on EBA Current Account Model Residuals

	OECD	WEF
	(1)	(2)
PMRs: LPS (+ = more burdens)	0.0049**	
LMRs: EPL (+ = stricter regulations)	-0.0048**	
PMRs: SBP (+ = more procedures)		0.0242**
LMRs: CLER (+ = more cooperation)		0.0508***
Observations	374	533
R-squared	0.026	0.053
Number of countries	24	49

* significant at 10%; ** significant at 5%; *** significant at 1%

Source: OECD, WEF, and Staff Estimates

Annex I: Comparison of EBA Current Account Model Specifications Across Vintages

		2013 Model	2015 Model	2018 Model
Fundamentals	Demographics	Aging speed [1/]	Aging speed [1/] Aging speed * OADR (unscaled) OADR * Aging speed (unscaled)	Prime-age savers share Life expectancy Life expectancy * future OADR
	Institutions	ICRG-5 subindices	ICRG-5 subindices	ICRG-All 12 subindices
	Measurement	Financial center dummy [2/]	Financial center dummy [2/]	*Complementary tool* : estimates magnitude of retained earnings and inflation biases
Policies	Credit	Demeaned Credit-to-GDP	Demeaned Credit-to-GDP	Detrended Credit-to-GDP with HP filter
	FXI	Spot FX intervention	Spot FX intervention	Spot and derivate FX intervention Simplified instrumentation
	Structural			*Complementary tool* : estimates whether product and labor market distortions explain model residuals

Note: Table focuses only on variables whose specification has changed in 2013.

1/ Aging speed is defined as the 20 year ahead change in old age dependency ratio (OADR)

2/ Applied only to Switzerland and the Netherlands.

Annex II: Data Sources

	Variables	Sources
CURRENT ACCOUNT	**Current Account**	IMF WEO
	Net Foreign Assets (NFA) position	EWN: Lane, Milesi-Ferretti
	Output per worker, relative to top 3 economies	IMF WEO
	Output per worker (interacted with capital openness)	IMF WEO and Quinn Database
	Expected real GDP growth 5 years ahead	IMF WEO
	Output Gap	IMF WEO
	Commodity Terms of Trade Gap (interacted with trade openness)	IMF WEO and World Bank, World Integrated Trade Solution (WITS)
	Reserve Currency Status	IMF, COFER
	Global Financial Conditions (interacted with capital controls)	Haver, and Quinn Database
	Global Financial Conditions (interacted with capital controls and reserve currency)	Haver, IMF COFER, and Quinn Database
	Old-age dependency ratio (OAD)	UN, World Population Prospects, 2017 Revision
	Population Growth	UN World Population Prospects, 2017 Revision
	Share of prime-aged savers	UN World Population Prospects, 2017 Revision
	Life expectancy	UN World Population Prospects, 2017 Revision
	Life expectancy at prime age (interacted with future OAD)	UN World Population Prospects,2017 Revision
	Institutional quality	PRS Group, International Country Risk Guide (ICRG)
	Exhaustible resources of oil and natural gas	IMF WEO, World Bank WITS, and British Petroleum Statistical Review of World Energy
	Fiscal Policy	IMF WEO
	Health Spending	OECD and WDI. ADB, CEPAL, and IMF Fiscal Affairs Department database in some cases
	Foreign Exchange Intervention (interacted with capital controls)	IMF WEO; EWN: Lane, Milesi-Ferretti, IMF Data Template on International Reserves and Foreign Currency Liquidity, and Quinn Database
	Credit Gap	BIS Credit Statistics, and World Bank Global Financial Development Database

REER INDEX	**Real Effective Exchange Rate**	IMF, Information Notice System (INS)
	Share of administered prices	EBRD, Structural Change Indicators
	Financial home bias	BIS, Debt Securities Statistics
	Real interest rate differential (interacted with capital controls)	IMF, International Financial Statistics, IMF WEO, Haver, and Quinn Database
REER LEVEL	**Price Level**	World Bank, International Comparison Program, 2011
	Capital stock per employed person	Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013), "The Next Generation of the Penn World Table"
	Ratio of traded/non-traded sector productivity	Rui C. Mano and Marola Castillo (2015), "The Level of Productivity in Traded and Non-Traded Sectors for a Large Panel of Countries", and World Bank World Development Indicator (WDI) Database
	VAT revenue	OECD's Revenue Statistics Dataset, the Council of State Governments (USA) and the Bureau of Economic Analysis

Note: Dependent variables in each model are in bold.
ADB: Asian Development Bank; BIS: Bank for International Settlements; COFER: Currency Composition of Official Foreign Exchange Reserves EBRD: European Bank of Reconstruction and Development; EWN: External Wealth of Nations; OECD: Organization for Economic Cooperation and Development; WEO: World Economic Outlook.

Annex III: Variables Definition in the EBA Models

Most variables in the current account regression are defined and measured relative to the contemporaneous GDP-weighted "world" (sample) average level, while variables included in the REER regression are measured relative to the trade-weighted average of other economies' levels. Explicit mention is made to variables that do not enter in relative terms.

- ***NFA-to-GDP.*** This variable enters directly (not relative) in level terms and is also interacted with a dummy that takes on the value of one if the NFA position is below negative 60 percent of GDP. NFA data are an updated and extended version of the Lane and Milesi-Ferretti (2007) EWN dataset.

- ***Output per worker, relative to top 3 economies.*** Ratio of PPP GDP to working age population relative to average of Germany, Japan, and U.S., demeaned. The variable is also interacted with capital account openness.

- ***Oil and gas trade balance, adjusted for "temporariness."*** This variable enters only when the of the oil and gas balance is positive. It is defined as the net oil and gas external balance (five-year moving average, in percent of GDP) multiplied by a relative measure of temporariness, which is in turn defined as the ratio of current oil extraction to proven reserves published by the British Petroleum Statistical Review (i.e. the inverse of "years-till-exhaustion") relative to the same ratio for Norway in 2010. Higher values of the temporariness term indicate that the resource is expected to be exhausted sooner (Annex VI provides more details). The proven oil and gas reserves used in the EBA model, which are published in the annual British Petroleum Statistical Review of World Energy, are location based.

- ***Population growth.*** Annual growth rate of total population***.***

- ***Old age dependency ratio.*** Ratio of population aged over 65 divided by population between 30 and 64 years old.

- ***Share of prime-aged savers.*** Current share of prime savers (ages 45-64) as a proportion of the total working-age population (ages 30-64).

- ***Life expectancy.*** Life expectancy of a current prime-aged saver.

- ***Interaction between life expectancy and future Old age dependency ratio.*** Future old age dependency ratio is calculated as the average of the old age dependency ratio 15, 20 and 25 years ahead.

- ***5-year growth forecast.*** The IMF's WEO 5-years ahead rate of real GDP growth. This is a proxy for potential output growth, since over the medium-term cyclical factors are not expected to play a role.

- ***Public health spending/GDP.*** Public health expenditure is collected from various sources but relies on OECD data when available. The OECD definition includes "health expenditure and financing, current expenditure on health, government/compulsory schemes, all providers (as share of GDP)." The OECD follows System of Health Accounts (SHA) 2011 to determine the financing categories. While other data sources use similar definitions, there are differences in some cases. For example, the OECD only considers government and compulsory schemes as public expenditure, whereas WDI also includes external borrowing and NGO grants.

- ***Global risk aversion proxies, VXO.*** The VXO is an index of implied U.S. stock market volatility created by the Chicago Board Options Exchange (CBOE), and is based on the S&P 100. It is available since 1986. It measures the same concept as the VIX, which is based on S&P 500 and is available only since 1993. Annual average during the sample period is 0.2.

- ***Own currency share in world reserves.*** Share of the country's own currency in total stock of world reserves proxies for the "exorbitant privilege." This share in 2017 was highest for the US dollar (67 percent), followed by the euro (20 percent), the yen (4.7 percent), and sterling (4.4 percent). This variable enters both alone and interacted with the VIX and the capital account openness index.

- ***Output gap.*** Based on IMF staff estimates in WEO. For countries and/or years where such estimates are not available, HP filtered estimates of the output gap (based on WEO actual and projected data for 1980-2023) are used.

- ***Commodity terms of trade gap.*** 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 each country's commodity trade pattern structure and relative importance. The regressor is constructed in several stages. The commodity index is the ratio of a geometric weighted-average price of 43 commodity export categories to a geometric weighted-average price of 43 commodity imports, each relative to manufactured goods prices in advanced economies, where weights are given by each commodity's share in the countries' export or imports.[51] To produce a cyclical gap measure, the time series is first extended into the medium term (using the latest IMF commodity prices projections) and then filtered by the HP procedure for each country. Hence, this variable has a zero country-specific mean. In the case of the current account model, the resulting gap series is interacted with a measure of the country's trade openness.

[51] To illustrate, consider a country that exports no commodities. Then the numerator will be the product of each of the 43 commodity relative price indices 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 percent 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 percent of its exports and 20 percent 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 can be seen that the country will experience a TOT deterioration of 1 percent when the price of that commodity rises by 10 percent.

- ***Commodity terms of trade.*** This regressor, which is used in the REER-Index model, is defined as the ratio of the geometric weighted-average price of key commodity exports to the geometric weighted-average price of key commodity imports. The index is constructed using the prices of six commodity categories (food, fuels, agricultural raw materials, metals, gold, and beverages), measured against the advanced economies' manufacturing goods prices. These relative commodity prices for six categories are weighted by the time average of export and import shares of each commodity category in total trade (exports and imports of goods and services). In the REER-level model, the commodity terms of trade is constructed as in the CA model but the treatment of the variables is different. Instead of filtering the series as it is done in the CA model, the level of the terms of trade is normalized to its 2011 value.

- ***Cyclically-adjusted fiscal balance (instrumented).*** For most countries and years, the cyclically-adjusted overall general government fiscal balance is based on IMF staff's cyclical-adjustment estimates. Otherwise, it is computed as the residual of a country-specific regression of the overall fiscal balance on the output gap. Because of the potential endogeneity of the fiscal balance, the variable is instrumented with lagged global variables (world real GDP growth, world output gap, the world cyclically-adjusted fiscal balance, and global risk aversion which is proxied by lagged U.S. corporate credit spreads), as well as country-specific factors (GDP per capita, the exchange rate regime, and a democracy ranking).[52] Other country-specific controls include the lagged output gap, and the average cross-sectional fiscal balance (the first stage regression also controls for the independent current account regressors).

- ***Capital controls index.*** Capital controls are proxied using the Quinn index on overall capital controls on the private sector. The index is scaled and varies between 0 (no controls) and 1 (full controls). The 2017 capital controls mean across countries for 2017 was 0.16, with values ranging between 0 and 0.75.

- ***Foreign exchange intervention (instrumented).*** FXI is measured as the change in central bank foreign exchange reserves including off-balance sheet foreign exchange intervention during the year, scaled by nominal GDP in U.S. dollars. As explained in the main text, this variable is instrumented with the difference between M2/GDP and reserves/GDP, reserve accumulation and emerging market/developing economies indicator, all interacted with capital controls index, to account for various reserve accumulation motives (the first stage regression also controls for independent regressors of the respective current account or REER regression).

- ***Real interest rate.*** This variable is the difference between the nominal short-term interest rate and the annual inflation rate. The short-term interest rate is more widely and more consistently available than the policy rate, and the two indicators tend to comove very strongly given their similar maturities.

[52] The U.S. corporate credit spread is taken from the Moody's Corporate Bond Yield database, while the democracy ranking is taken from the Polity Index. The Polity Index is constructed by the Center for Systemic Peace and is based on an evaluation of the competitiveness and openness of elections, the degree of citizen political participation, and the extent of checks on executive authority.

- ***Private credit-to-GDP gap.*** The credit-to-GDP ratio is detrended using a one-sided Hodrick-Prescott filter to eliminate cross-country differences in the level of financial development and capture financial excesses more closely. The credit-to-GDP ratio is measured as total credit (bank and nonbank) provided to the non-financial private sector, excluding non-bank cross-border flows from the BIS. The World Bank Financial Development Database, which is used in some cases, has similar coverage (see IMF, 2018).

- ***Institutional quality.*** This variable includes 12 sub-indicators from the International Country Risk Guide (ICRG) dataset: government stability; internal conflict; external conflict; military in politics; law and order; ethnic tensions; bureaucracy quality; socioeconomic conditions; investment profile; corruption; religious tensions; and democratic accountability. The indicators are drawn from surveys of risk perceptions related to each of these 12 characteristics. The values are normalized to range between 0 and 1, with higher values signifying less risk.

- ***Trade openness.*** Average ratio of goods and services exports and imports to GDP.

- ***Financial home bias.*** This effect is measured by the share of domestic debt owned by residents, from the BIS database, using end-of-period quarterly figures (or the latest available).

- ***Real Effective Exchange Rate (REER) Levels.*** As explained in the main text, to convert the REER Index into levels, (the log of) the REER Index is rebased to the year 2011, and then the log of PPP relative prices is added. To construct the PPP relative price variable, the 2011 price level (GDP, expenditure based) of each country is rescaled such that the US price level equals 1.

- ***Capital Stock per employed person.*** The variable is obtained by dividing capital stock at constant 2005 national prices by total employed population.

- ***VAT revenue.*** VAT revenue as a percent of GDP.

- ***Ratio of Traded/Non-Traded Sector Productivity.*** Ratio is estimated using sectoral labor productivities at 2005 USD PPP from the Mano and Castillo (2015) dataset. Missing PPP data are obtained using fitted values from an OLS regression of sectoral USD log(PPP) on sectoral productivity at market rates. Where values for sectoral productivities are missing, the series are extended using changes in real labor productivities from the WDI's sectoral productivity database.

- ***Share of administered prices.*** This variable is only relevant and available for a few transition economies which experienced a significant reduction in the share of administered prices during their transition towards a market economy. For most other countries, a value of zero is assigned.

Annex IV: List of Countries in the EBA Models

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	South Africa
France	Spain
Germany	Sri Lanka*#
Greece	Sweden
Guatemala*#	Switzerland
Hungary	Thailand
India	Tunisia*#
Indonesia	Turkey
Ireland	United Kingdom
Israel*#	United States
Italy	Uruguay*#
Japan	

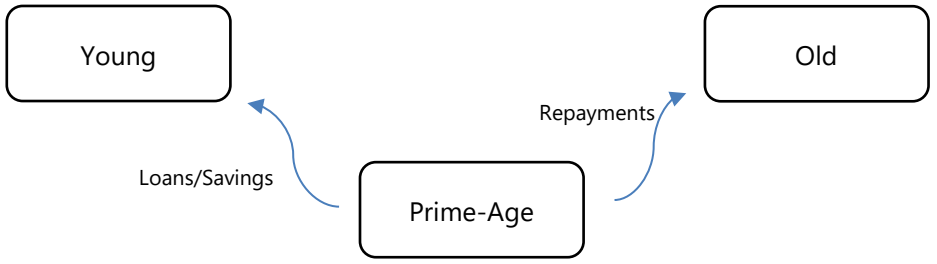
Notes: All countries are included in the current account model. Asterisks (*) denote countries not included in REER index regression, while sharps (#) denote countries not in REER levels regression for data availability reasons.

Annex V: The Demographic Block in the EBA Current Account Model

The updated demographic specification seeks to better disentangle the relationships between demographics, savings, and current account balances. To understand the relevant channels, staff developed a multi-country overlapping generations model embedding the key demographic forces as informed by the latest academic research (see Dao and Jones, 2018).[53]

The model. Structural models analyzing the macroeconomic consequences of the demographic transition focus on two key drivers of demographic trends: (i) the age composition of a country's population (the *static* effect) and (ii) the role of old-age survival risk (the *dynamic* effect), the latter being the key driver of household savings in quantitative models.[54] Building on these insights, the model features population growth (the combination of fertility and migration) and age-specific mortality. The model is extended to a two-country setting to study the implications of demographic change on capital flows and how these findings are affected by the introduction unfunded old-age transfer schemes.

Figure A.1. Baseline Model: Flow of Resources



Notes: The prime-age population receives an endowment. Out of that endowment, they consume, and save by lending to the young, repay old loans to the old.

Model predictions. The model has a number of predictions on the relationship between demographics and savings. The first key prediction is that countries with higher life expectancy have higher savings. Intuitively, the longer that workers expect to live and spend in retirement, the higher that accumulated savings must be to maintain a desired level of consumption. These predictions are shared by many recent papers studying the implications of demographic trends on aggregate savings and interest rates.[55] In an open economy setting, countries with higher longevity relative to the world average, and countries with a higher share of prime-aged savers relative to the world average export capital, because they save more relative to the rest of the world and invest those savings abroad.

The current demographic specification. Guided by the predictions of the model, direct measures for static and dynamic effects were used. Table A.1 compares the demographic variables under the current and earlier (2015) version of the model.

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[53] For example, Brooks (2003); Domeij and Floden (2006); Backus et al. (2014); Eugeni (2015); Bárány et al. (2018).

[54] See Auerbach and Kotlikoff (1987); Eggertsson et al. (2017); Lisack et al. (2017).

[55] See, for example, Gagnon, Johannsen, and Lopez-Salido 2016; Carvalho, Ferrero and Nechio 2016; Eggertsson, Mehrotra, and Robbins 2017; Jones 2018.

- The **static effect**, is captured by three variables: (i) the contemporaneous population growth rate (which proxies the share the young), (ii) the old age dependency ratio (ages 65+/30-64), and (iii) the share of prime savers (ages 45-64) as a proportion of the total working-age population (ages 30-64). The idea is to capture the relative differences in the age composition across countries that go beyond the youth and elderly dependency rations, recognizing that the 45-64 age cohort typically has the highest saving rates. The latter is the direct result of the life-cycle model and the hump-shaped earnings and savings profiles– so that a higher share of prime-age savers should imply a higher aggregate saving rate (see Lisack et al. 2017 for theoretical support; and Lane and Milesi-Ferretti, 2001 for empirical support).

- The **dynamic effect** is now captured by the life expectancy of a current prime-aged saver, such that countries with longer longevity and retirement spans save more, as predicted by the standard lifecycle hypothesis. An interaction term between life expectancy with future old-age dependency is also considered to capture the notion that workers save more not only because they expect to live longer, but also because they expect to rely less on future generations for old-age support.[56] The latter assumes the existence of unfunded old-age transfer scheme and limits on taxation, such that a projected increase in the future old-age dependency (say, driven by a cumulative decline in birth rates) would result in both a reduction in the future transfers under the system and an increase in the saving by the prime-aged cohort.[57]

Table A.1. Comparison of Demographics Specifications

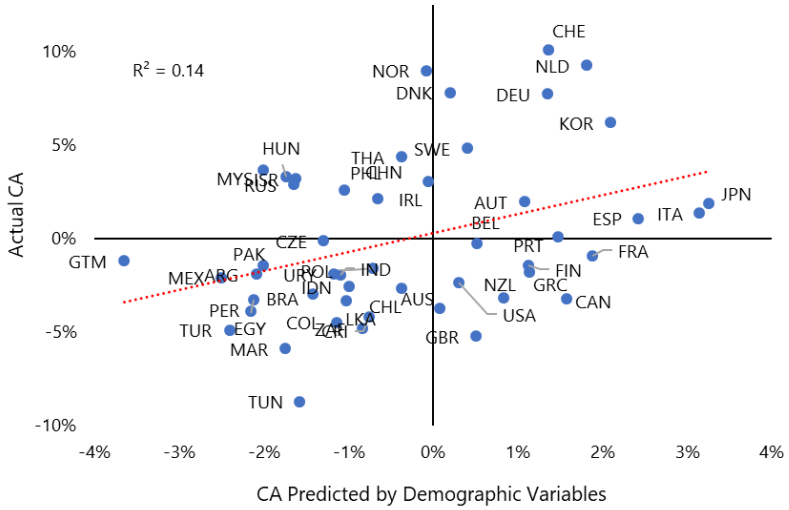
	2015 EBA	2018 EBA
Static Effects	• Old age dependency (OAD) ratio (ages 65+/30-64) • Population growth	• OAD (ages 65+/30-64) • Population growth • Current share of prime savers (ages 45-64) as a proportion of the total working-age population (ages 30-64)
Dynamic Effects	• Interaction of relative aging speed (20-year ahead change in OAD) with current OAD • Interaction of relative current OAD with aging speed.	• Life expectancy of a current prime-aged saver • Interaction of life expectancy with future old-age dependency.

[56] For a few EBA countries that are clear outliers in terms of low life expectancy and high adult mortality, consideration is being given to shifting down by 5 years the age-cohorts defining the working age population, prime-aged savers and old age dependency when computing the demographic contribution to their current account norms.

[57] The future old age dependency ratio is the moving average of the old age dependency ratio 15 to 25 years ahead.

Results and implications. The combined impact of the demographic variables is economically significant, and can explain about 15 percent of the cross-country variation in the current account over the last five years (Figure A.2).[58] Furthermore, across the sample, the revised demographic specification explains a larger fraction of the unexplained component of the current account, after accounting for the non-demographic regressors in the EBA model (see IMF, 2018).

Figure A.2. Actual CA and CA Levels Predicted by Demographic Variables
Average 2012-16, in percent of GDP



Notes: The horizontal axis denotes the current account level predicted by a regression model with only the current demographic variables (and an intercept). Values on both axis are averaged over the last 5 years in the sample for each country.

[58] This magnitude is consistent with the literature, where demographic forces generated by calibrated structural models explain between 13 and 27 percent of current account variation across major advanced economies, depending on the time period (see Domeij and Floden, 2006; see also Brooks, 2003; Backus et al. 2014).

Annex VI: Estimation of Exhaustible Resources in the EBA Models

An important aspect of the EBA model is the treatment of income from exhaustible resources. If this source of income is expected to be temporary, intergenerational equity considerations would suggest that a fraction of the related income should be saved for future generations. This fraction should increase with the temporariness of the resource.

The variable measuring income from exhaustible resources applies only to net exporters of oil and gas and captures: (i) the temporariness of the resource; and (ii) the extraction size (relative to GDP). The more temporary the resources revenues and the larger the extraction, the larger the positive effect on the current account balance. Temporary movements in oil and gas prices are controlled for by the detrended commodity terms of trade.

The oil and natural gas trade balance is defined as the *5-year moving average* of the net exports for oil and natural gas, relative to GDP, multiplied by a temporariness index for oil and gas. The variable is constructed as:

$$var_{i,t} = \sum_{k=\{oil,gas\}} \frac{1}{5} \sum_{s=t-4}^{t} \frac{X_{k,i,s}}{Y_{i,s}} \frac{temp_{k,i,t}}{temp_{oil,NOR,2010}}$$

where the first part captures the average oil and gas extraction size ($\frac{X_{k,i,s}}{Y_{i,s}}$), and the second part captures the temporariness of the resource, relative to this measure for Norway in 2010 ($\frac{temp_{k,i,t}}{temp_{oil,NOR,2010}}$). Values for "temp" are defined as the ratio of current extraction to proven reserves (or the inverse of "years-till-exhaustion" from the British Petroleum Statistical Review of World Energy), such that higher values for the temporariness term indicate that the resource is more temporary, i.e., are expected to be exhausted sooner.

Annex VII: Benchmark for Public Health Spending in the EBA Models

The level of public expenditure on health, as a share of GDP, is considered as a type of social protection policy that may influence the national saving rate. Such protection tends to reduce households' need for precautionary saving—the expected coefficient is thus negative in the current account regression with a higher public expenditure on health leading to a decline in the current account due to decrease in the national saving rate.

The desired level of public health spending to GDP (i.e. the P*) is based on a benchmark level of health spending that varies depending on country characteristics. Borrowing from Phillips et al. (2013), a cross-sectional regression is estimated for the average of the period 2005-2016, linking a country's public health spending (as a share of GDP) to structural determinants like income, demographics and inequality. Specifically:

- **Income:** Since countries with higher income per capita tend to spend more on health, the regression includes the log difference between countries' PPP-based GDP per capita (from WEO or Penn Tables) and the world average.
- **Demographics:** Since health spending increases with age, the regression includes the old age dependency ratio (65+/30-64).
- **Inequality:** To capture notion that governments in more unequal countries need to spend more on health (either because their health spending tends to be less efficient or higher share of poor impose a higher burden), the regression includes the gross income concept Gini coefficient (from the Standardized World Income Inequality Database for 2013).

Table A.2 shows the regression result of the current specification. All variables have the expected sign and are statistically significant, with the exception of the inequality proxy which lost significance following the data revisions and sample extension. The fitted values from this regression are indicative benchmarks, but, as in other policy variables, IMF staff may judge that a different desired policy level is warranted based on well justified country-specific considerations.

Table A.2.: Benchmark for Public Health Spending

Relative Income	0.018***
Old age dependency ratio	0.096***
Gini coefficient	0.0175
Constant	0.021*
Observations	49
R-squared	0.835

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1