INTERNATIONAL MONETARY FUND

2022 Update of the External Balance Assessment Methodology

Cian Allen, Camila Casas, Giovanni Ganelli, Luciana Juvenal, Daniel Leigh, Pau Rabanal, Cyril Rebillard, Jair Rodriguez and João Tovar Jalles

WP/23/47

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.**
The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

2023
MAR

WORKING PAPER

© 2023 International Monetary Fund WP/23/47

IMF Working Paper
Research Department

2022 Update of the External Balance Assessment Methodology

Prepared by Cian Allen, Camila Casas, Giovanni Ganelli, Luciana Juvenal, Daniel Leigh, Pau Rabanal, Cyril Rebillard, Jair Rodriguez and João Tovar Jalles*

Authorized for distribution by Jaewoo Lee
March 2023

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

ABSTRACT: The assessment of external positions and exchange rates of member countries is a key mandate of the IMF. The External Balance Assessment (EBA) methodology has provided the framework for conducting external sector assessments by Fund staff since its introduction in 2012. This paper provides the latest version of the EBA methodology, updated in 2022 with additional refinements to the current account and real exchange rate regression models, as well as updated estimates for other components of the EBA methodology. The paper also includes an assessment of how estimated current account gaps based on EBA are associated with future external adjustment.

RECOMMENDED CITATION: Allen, Cian, Camila Casas, Giovanni Ganelli, Luciana Juvenal, Daniel Leigh, Pau Rabanal, Cyril Rebillard, Jair Rodriguez, and João Tovar Jalles, 2023, “2022 Update of the External Balance Assessment Methodology”, IMF Working Paper 23/47.

JEL Classification Numbers:	F21, F31, F32, F41, F42, G15, O16, O24
Keywords:	Current accounts; exchange rates; external sustainability; external sector assessments, global imbalances
Authors’ E-Mail Addresses:	callen@imf.org; ccasas@imf.org; gganelli@imf.org; ljuvenal@imf.org; dleigh@imf.org; prabanal@imf.org; crebillard@imf.org; jrodriguez@imf.org; jjalles@iseg.ulisboa.pt

* All authors were affiliated with the Research Department of the IMF at the time that the 2022 update to the EBA methodology was undertaken, except João Tovar Jalles (University of Lisbon) who was an external consultant. The team would like to thank Gita Gopinath, Pierre-Olivier Gourinchas and Antonio Spilimbergo for their guidance, and Rudolfs Bems, Martin Kaufman, Jaewoo Lee, Niamh Sheridan, Martin Sommer, Hui Tong and numerous IMF colleagues for their useful comments. The authors would like to thank Mariela Caycho, Deepali Gautam, Xiaohan Shao and Rongjin Zhang for their research assistance and Jane Haizel for her editorial assistance.

WORKING PAPERS

2022 Update of the External Balance Assessment Methodology

Prepared by Cian Allen, Camila Casas, Giovanni Ganelli, Luciana Juvenal, Daniel Leigh, Pau Rabanal, Cyril Rebillard, Jair Rodriguez and João Tovar Jalles

Contents

ANNEXES

Annex Figures

Annex Tables

I. Introduction

The assessment of external positions and exchange rates of member countries is a key mandate of the IMF. To support this mandate, Fund staff has strived to strengthen the framework that underpins the surveillance of the external sector and exchange rates over time. The External Balance Assessment (EBA) methodology has provided the framework for conducting external sector assessments by Fund staff since its introduction in 2012. The EBA framework built on the IMF's earlier Consultative Group on Exchange Rates (CGER) models, which had been introduced in the mid-nineties to inform Fund staff's exchange rate assessments for a number of advanced economies from a multilateral perspective, and which was later extended to incorporate a larger country sample (see Lee and others, 2008).

Like its CGER predecessor, the EBA methodology included three main components: (i) cross-country regression models to benchmark the current account (CA), (ii) similar regression models to benchmark the real effective exchange rate (REER), and (iii) the external sustainability (ES) approach, in cases where risks arising from a large net international debtor position can be relevant. The key innovations of the EBA methodology compared to CGER included: (i) the definition of CA and REER *norms* (or benchmarks) based on *desirable* (instead of actual) policy settings, (ii) expanding the number of indicators that help explain the behavior of the CA and REER, and (iii) including model-based cyclical adjustments with business and commodities cycles indicators (see Phillips and others 2013).

IMF staff introduced updates to the EBA models in 2015 and again in 2018 to incorporate the latest data and advances in the related literature, as well as feedback from stakeholders (see Cubeddu and others 2019; IMF 2018, IMF 2015). The 2015 EBA refinements included: (i) revisions to the modeling of demographic factors to capture their nonlinear effects on the current account; and (ii) introducing another REER model (the REER Level model) to understand persistent differences in the level of the real exchange rate across countries, to complement the analysis of exchange rates based on index data (the REER Index model). 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). 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.

This paper provides the latest version of the EBA methodology, updated in 2022 with additional refinements to the EBA CA and REER models for use in the 2022 *External Sector Report* (ESR). In addition to updating the dataset, the main refinements to the CA model included: (i) the refinement of variables included in the models; (ii) a Bayesian Model Averaging (BMA) procedure to exclude non-robust variables; (iii) an expanded sample of economies,[1] and (iv) complementary tools for assessing the

[1] The latest version of the EBA framework adds three economies to the sample (Bangladesh, Romania and Vietnam), increasing the panel size from 49 to 52 economies. These are among the world's largest 50 economies according to 2019 nominal GDP and play a significant role for global trade but were not previously included in the EBA sample. The sample for estimating the models continues to exclude outlier economies, such as financial centers or large oil exporters.

relationship between CA balances and pension system features, as well as an update of the labor and product market regulations analysis for a subsample of economies with the necessary data, and a new methodology for estimating measurement and accounting biases in the CA. The refinements to the EBA REER-Index and REER-Level models included, in addition to data updates and an expanded country sample: (i) the use of refined variables, as in the EBA CA model, and (ii) a BMA procedure to exclude non-robust variables from both REER models. This paper also provides revised estimates of the semi-elasticity between the CA and the REER, that take the reaction of both the trade balance and the income balance into account. Other elements of the framework, including the ES approach, remained unchanged.

This paper aims at providing, in a self-contained discussion the latest version of the EBA framework. Since the main building blocks of the EBA framework are similar to previous versions, explained in Phillips and others (2013), and Cubeddu and others (2019), some repetition exists. The main novelty of this paper is that it includes an assessment of the how much estimated current account gaps based on EBA are associated with future external adjustment. The main result is that EBA CA gaps are associated with future CA and REER movements in the expected way, although the speed of adjustment depends on country characteristics such as the initial CA balance and income level.

The paper is organized as follows. Section II provides an overview of the external sector assessment process at the IMF. Section III describes the CA model while Section IV describes the REER-Index and REER-Level models. Section V presents updated estimates of the CA-REER elasticities. Section VI explains the ES approach. Section VII explains complementary tools that help inform staff judgment in the areas of measurement, pensions and structural policies. Section VIII analyzes how estimated CA gaps are associated with future external adjustment. Section IX concludes.

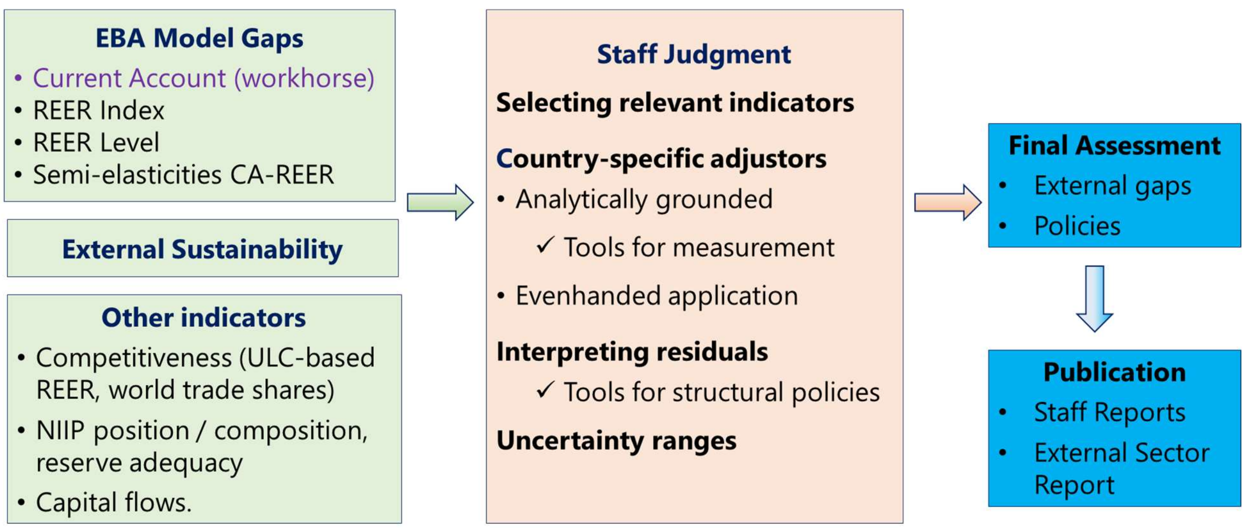
II. The External Sector Assessment Process: An Overview

Current account balances and exchange rates fluctuate over time in response to macroeconomic conditions and policies. There are good reasons for countries to run current account surpluses or deficits, such as to smooth out the effects of temporary shocks, to save and accumulate assets to cover retirement needs, or to allow capital to flow to where it is scarcer and can have a higher rate of return. Similarly, exchange rates may fluctuate in response to the macroeconomic environment. For instance, terms-of-trade shocks are expected to affect the exchange rate: one such example would be that of an energy importer facing an increase of energy prices and should allow its currency to depreciate to restore external balance. Exchange rates can also react to financial market indicators such as interest rate differentials, which would be reflecting different monetary policy stances with respect to a reference currency.

Because some fluctuations in current accounts and exchange rates are justifiable, the main challenge when conducting external sector surveillance consists in understanding how much of these fluctuations is appropriate, and how much can be considered excessive and driven by a country’s policy settings or other distortions. Moreover, the drivers of current account balances and exchange rates are complex, so no simple approach to identifying excessive imbalances is likely to give the right answer for every country. Therefore, the external sector assessment process for every country involves a combination of EBA model inputs and Fund staff judgment to arrive at a staff external sector assessment (Figure 1).[2]

The CA model is the workhorse for conducting external sector assessments.[3] As explained in Section III, this model provides an estimated CA gap by comparing an economy's CA balance (stripped of cyclical components) to its CA benchmark or norm. Because all borrowing must be matched by lending, the sum of all the world's current account deficits should be equal the sum of its surpluses - a principle called multilateral consistency. To ensure this, the CA gaps are adjusted so they add up to zero across the EBA sample (see Section III.E for details). The starting point for estimating the REER gap is transforming the CA gap into a REER gap using the CA-REER elasticity. However, the CA-implied REER gap may not fully capture currency fluctuations due, for instance, to lags between currency movements and CA adjustments. In such cases, the REER models can provide a useful benchmark for the overall assessment.

Figure 1. The IMF's External Sector Assessment Process



Staff judgement involves selecting the relevant indicators to reach an overall assessment. This implies deciding how much weight to give to the outcomes of the different models. It may also involve the use of other external sector indicators that complement the models' outputs. These may include competitiveness measures, such as alternative REER measures based on unit labor costs (ULC) and the evolution of a country's export shares in the world economy, and the ES approach and other external balance sheet

[2] The EBA methodology is applied to the 52 largest economies that are not commodity exporters or financial centers (see Section III). For the wider IMF membership, external sector assessments rely on the EBA-lite methodology (IMF, 2019), which was also refined in 2022.

[3] Although staff takes account of estimates provided by several models to arrive to an external assessment, generally greater weight is given to the current account model. One important reason is that the CA model focuses directly on the main variable of interest, while the REER models only shed light on a channel for external adjustment. In addition, CA balances are less volatile than exchange rates and therefore are a more appropriate indicator when thinking about the medium term, as in the EBA framework. Furthermore, as recognized in the academic literature, modeling exchange rates is not an easy task because they reflect not only the relative price of goods but also the relative price of assets.

indicators. Other relevant information, outside of the regression models, is included as country-specific adjustments, or *adjustors*. One such example has been how to account for the effects of the Covid-19 pandemic on the external sector (see IMF 2021, 2022). Other examples include one-off factors, such as the effect of droughts on agricultural exports, or large infrastructure projects on investment and imports. Yet other examples include adjustors that account for specific characteristics of a small number of countries that can determine their patterns of saving and/or investment but are not adequately captured by the model. In some countries, measurement issues affect the current account and Fund staff has developed methodologies to estimate their effects, as discussed below in Section VII.A. In other countries with significantly lower life expectancies, the contribution of the demographic block may be overstated and an adjustment to the norm is needed. Fund staff strives to ensure that these adjustors are applied evenhandedly, and that they are analytically grounded, through an internal vetting process involving several departments.

These numerical adjustors, if any, are added to the EBA model outputs to estimate staff CA and REER gaps and arrive at a bottom-line external sector assessment (Table 1). The uncertainty around these estimates is also presented. These assessments also include policy recommendations to address external imbalances at both the bilateral level (Article IV Staff Reports) and multilateral level (External Sector Report for the 30 largest economies) so that all countries—with either excess surpluses or deficits—address excess imbalances in a manner that does not compromise global stability and growth.

III. The EBA CA Model

The EBA current account (CA) model relates the CA balance, given by the difference between aggregate saving and investment, to several macroeconomic determinants documented in the literature.[4] These determinants are selected based on their conceptual underpinning and on whether the estimated coefficients are consistent with the theoretical priors, statistically significant and robustly associated with the CA balance.[5] The latest version of the model is guided by the same principles as the original EBA methodology, introduced by Phillips and others (2013).

[4] See, for example, Chinn and Prasad (2003), Chinn and Ito (2007, 2022), Gruber and Kamin (2007), Lee and others (2008), Bussière and others (2010), Phillips and others (2013), IMF (2015), Gagnon (2017), Coutinho and others (2018, 2022), Cubeddu and others (2019), Gagnon and Sarsenbayev (2021) and Herman and others (2021).

[5] Although the potential inclusion of CA determinants in the model is anchored on theoretical considerations, theory is not sufficiently explicit regarding which variables are robustly associated with the CA balance and should be included in the “true” equation (see Sala-i-Martin and others, 2004, for a related discussion in the context of growth regressions, and Ca’Zorzi and others, 2012, for an application to empirical models of current account imbalances). To select which variables are robustly associated with the CA balance, BMA was used. This approach analyzes all possible combinations of variables considered and calculates the probability that a variable belongs in the model (the posterior inclusion probability, PIP). A potential explanatory variable is considered to be robustly correlated with the dependent variable if the PIP is greater than 50 percent (see, for example, Hoeting and others, 1999, and Masanjala and Papageorgiou, 2008).

A. Model Specification

The EBA CA regression is given by:

$$CA_{it} = \alpha + C_{it}'\beta + F_{it}'\lambda + P_{it}'\gamma + e_{it} \qquad (1)$$

where CA_{it} denotes the CA balance-to-GDP ratio in country i and year t, C_{it} is a matrix of cyclical and temporary factors, F_{it} includes medium-term macroeconomic and structural fundamentals, P_{it} includes policy variables, and e_{it} is the zero-mean, normally distributed regression residual, which is assumed to follow an AR(1) process. Most variables in the model are measured relative to the GDP-weighted world average.[6] This implies that a determinant, for instance fiscal policy, will have an impact on the CA as long as it is more expansionary or contractionary than in the rest of the world. To address endogeneity and reverse causality issues, fiscal policy and foreign exchange intervention are instrumented, and health spending, the annual change in the real effective exchange rate and some fundamentals (net foreign asset position, productivity) are lagged. Further details on the CA determinants are provided in Section III.B. Table 2 lists the data sources for all variables included in the EBA framework.

The CA model is estimated for a sample of 52 countries using annual data for the 1986-2019 period. Table 3 provides a list of the EBA countries.[7] The 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.

B. Regression Results

This section presents the CA model estimation results and discusses the regressors included in the model, the theoretical justification for their inclusion, and their estimated impact on current account balances. The dependent variable is the CA-to-GDP ratio, and the determinants are grouped into temporary and cyclical factors; fundamentals (macroeconomic and structural); and policy variables. Table 4 presents the CA model estimation results. For ease of comparison, Table 5 reports estimates for previous CA model estimates, as presented in Phillips and others (2013), IMF (2015), and Cubeddu and others (2019). In addition, column (4) shows the results of estimating the previous version of the model (Cubeddu and others, 2019) but updating data and extending them to include the additional 2017-2019 years.

Temporary and Cyclical Factors

The EBA framework controls for the influence of temporary and cyclical factors. These are factors that can affect current account fluctuations, and that need to be stripped out to estimate a medium-term cyclically-adjusted balance that can be then compared with the medium-term CA norms (see Section

[6] The world average refers to the GDP-weighted average of the 52 countries in the EBA sample, which represent over 90 percent of global GDP.

[7] While the euro area aggregate is not included in the EBA regression models, the largest individual economies of the area are. 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.

III.E). Specifically, the CA model controls for the output gap, which indicates the state of the business cycle, for the commodity terms-of-trade gap to control for the commodity price cycle, and for the lagged annual change in the real effective exchange rate (REER) to control for the effects of sharp changes in exchange rates on the current account.

Output gap. The state of the domestic economy is usually reflected on current account balances. For instance, a weak domestic demand (reflected in a negative output gap) usually leads to higher saving and lower investment. The effect of the domestic business cycle is captured in the model with the ratio of the output gap to potential GDP. It enters the model 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 with trade openness. Short-term fluctuations of export and import prices, particularly those of commodities, are expected to affect the current account as the temporary increase (decrease) in income normally leads to higher (lower) saving. All else equal, the effect of terms-of-trade fluctuations on the current account balance is expected to increase with an economy's trade openness. To construct the terms-of-trade gap, band-pass filtering techniques are applied to individual commodity price series to isolate long-term trends and to obtain the corresponding gaps for each of the 42 categories considered (for instance, an oil price gap, a copper price gap, and so on). The filtering techniques used in the construction of the gaps allow for both short-term and longer "supercycles", characteristic of commodity prices. The terms-of-trade gap is obtained by aggregating all individual commodity price gaps using country-specific trade weights (see Annex I.A for further details on the construction of the refined terms-of-trade gap). The estimated coefficient suggests that a 1 percent terms-of-trade improvement in a country with an openness degree of 0.5 is associated with an increase in the current account balance of 0.15 percentage points of GDP.

Change in the REER (lagged). Some temporary movements in the REER can reflect short-term factors other than the effects of medium-term fundamentals and policies on a country's currency, such as market sentiment or risk-on and risk-off episodes. Including the lagged annual REER change (calculated with the annual log-change) as an additional control, as in Coutinho and others (2022), allows the model to strip out the influence of these temporary movements. Since the EBA CA model already controls for medium-term factors, the estimated coefficient on the REER term indicates that a 1 percent appreciation is associated with a 0.02 percentage points of GDP decrease in the current account balance holding such other factors constant.

Macroeconomic Fundamentals

Net foreign asset (NFA) position (lagged). In general, larger NFA positions are associated with higher current account balances. Moreover, as Kumhof and Laxton (2007) explain, in steady state, when an economy is on its balanced growth path, the CA balance-to-GDP ratio is a positive function of the NFA-to-GDP ratio, with a slope coefficient approximately equal to the nominal growth rate of GDP. As in earlier EBA specifications, the lagged NFA-to-GDP ratio is included to account for its effect on the net income balance. The estimated coefficient, 0.04, suggests that higher NFA positions are associated with higher

CA balances. Moreover, the empirical positive correlation between the CA and the NFA has been increasing over time, as suggested by the higher coefficient with respect to earlier EBA versions.[8]

Output per worker (lagged). Richer countries are expected to export capital to poorer countries, where capital is relatively scarce and the rates of return are higher. All else equal, this should be reflected in higher current account balances for the former and lower balances for the latter (see Chinn and Prasad, 2003; Lee and others, 2008). To measure this effect, 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. Results suggest that a 1 percent increase in relative output per worker is associated with an increase of about 0.03 percent of GDP in the current account balance.

Expected real GDP growth (5 years ahead). Expected output growth determines both investment and saving. If output is expected to grow, the anticipation of higher returns to capital can lead to higher investment. And even if the return rates are expected to remain unchanged, investment may increase due to the expected demand shift that would result from the economy's expanse. Moreover, consumption-smoothing households will reduce saving. Hence, higher growth expectations are likely to lead to lower current account balances through both channels. Expected growth is proxied with the 5-year-ahead projections of real GDP 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.

Structural Fundamentals

Demographics. The model's demographic block accounts for both the static and dynamic effects of a country's demographic features on its saving decisions (see Dao and Jones, 2018, IMF, 2018, and Cubeddu and others, 2019 for details on the demographic specification). The *static effect* captures the impact of the age composition of a country's population on saving: generally, countries with a relatively high share of young or elderly population tend to dissave, while countries with a higher proportion of prime-aged savers will tend to save more. This is captured with three variables, all measured in differences from the world average: population growth (to proxy for 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 *dynamic effect* captures the impact of longevity and is based on the findings of a life-cycle model: countries where prime-aged savers expect to live longer (or have longer retirement periods) will need to save more, particularly if future generations cannot provide old-age support. The dynamic effect is captured by the life expectancy of a current prime-aged saver (also in differences from world average) and its interaction with future (20 years ahead) OAD; by including the latter, the model captures the non-linearities observed in the reduced-form relationship between life expectancy and the current account balance. The sign of the estimated coefficients aligns with economic priors.

Institutional quality. The quality of institutions is considered 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) that includes a broad range of institutional,

[8] For an analysis of the measurement issues associated to the treatment of (nominal) interest income and retained earnings on portfolio equity positions included in the NFA, see Section VII.A and Annex III.

social, bureaucratic, and political risk attributes considered important in saving and investment decisions. Results indicate that a country at the 75th percentile of the institutional quality distribution can 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 reserves. Exporters of natural resources tend to save a portion of their exports to mitigate income volatility and to generate wealth for future generations, with the fraction of exports being saved often depending on the temporariness of this source of income (that is, the more temporary this income is, the higher the proportion saved). All else equal, this leads to higher current account balances. The model includes a variable that combines the size of the oil and 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. To calculate the former, exports of oil and gas are assessed as if their prices were at their long-term trend level, consistent with a zero-price gap as estimated for the terms-of-trade gaps of these two specific commodities. This helps to further insulate the oil and gas reserves variable from short and medium-term price fluctuations, thus enhancing its structural nature (see Annex I.B). The estimated coefficient implies that a 1 percent of GDP increase in the energy balance (once adjusted for its temporariness) increases the current account balance by about 0.3 percent of GDP. This term is relevant for 9 out of the 52 economies in the sample, for which the net oil and gas balance is positive.

Policy Variables

One key element of EBA is the distinction between the positive (descriptive) factors driving current account balances, and the normative evaluation of these balances. The inclusion of policy variables in the model allows for the use of the regression results in the subsequent normative assessments of potential policy distortions and their effect on current account balances. Policy regressors are all specified as deviations from the GDP-weighted global average. 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 components.

Fiscal policy (instrumented). The relationship between fiscal policy and the current account has been extensively documented in the literature. Fiscal policy can have demand effects if an increase in government spending leads to a higher domestic demand and a lower current account balance (given output). However, the effect on the current account could be only partial if private consumption contracts as a response to the fiscal expansion in anticipation of future taxes (necessary to satisfy the government's intertemporal budget constraint). Fiscal policy may also have supply-side effects that can be expansionary (through public investment) or contractionary (if distortionary taxes are levied). Estimating the relationship between fiscal policy and the current account can be challenging because fiscal policy decisions are often motivated by economic developments that also affect trade and currency movements. As in previous versions of the CA model, fiscal policy is measured with the cyclically-adjusted general government overall balance. This variable is instrumented to address the aforementioned endogeneity issue.[9] The estimated coefficient of 0.3 is comparable to those of previous versions of the model and others found in the literature that considers both advanced and emerging economies (e.g., Coutinho and others, 2018).

Health spending (lagged). The generosity of the social safety net can affect aggregate saving due to precautionary motives. In the EBA framework the degree of social safety net provision is proxied with the level of public health spending relative to GDP.[10] 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 0.3 percentage points of GDP.

Foreign exchange intervention interacted with capital controls (instrumented). Interventions in the foreign exchange market can have important effects on the exchange rate and, hence, on the current account. Moreover, as documented in the literature, these effects depend on the extent of capital mobility—FXI has a larger effect when capital mobility is low. To capture this, the EBA model includes the interaction between the FXI-to-GDP ratio and an index of capital controls.[11] FXI is proxied by the transaction-based change in reserves, as recorded in balance of payments (BOP) statistics plus comparable operations in derivatives markets.[12] Capital controls are measured with the Financial Account Restriction Index (FARI), constructed by Fund staff in the Monetary and Capital Markets (MCM) department based on information in the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) questionnaire responses. It is calculated as the percentage of authorities' affirmative answers to the AREAER categories related to regulations on capital account transactions (see Baba and others, forthcoming, for details on its construction). The interaction of FXI and capital controls is instrumented to address endogeneity issues.[13] The estimated effect of the FXI and capital controls interaction implies that a 1 percent of GDP in FX purchases leads to a 0.12 percent of GDP improvement in the current account for the median country of the FARI distribution.

Credit gap. There is a well-documented relationship between credit cycles and current account balances and exchange rates, beyond the effects of the business cycle. When countries experience credit booms, the current account tends to deteriorate and the REER to appreciate, with the opposite occurring during

[9] The (demeaned) fiscal balance is instrumented with relevant global factors (lags of world real GDP growth, world output gap, world cyclically-adjusted fiscal balance, and the U.S. corporate credit spread to proxy for global risk aversion) and with country-specific features (lagged GDP per capita, lagged output gap, lagged fiscal balance in differences from trade-weighted average across trading partners, the exchange rate regime, and a democracy index ranking).

[10] A key advantage of using health spending as a safety net proxy is the availability of consistent data across countries for the estimation period. Moreover, this variable is highly and positively correlated with alternative measures of social safety net spending and coverage drawn from the World Bank's Aspire database (such as the average real per capita transfers from social protection and social insurance programs or the share of population participating in these programs) for which data is limited.

[11] Capital controls are one potential source of imperfect capital mobility, but capital flows can be affected for other reasons. See Section III.D for an analysis of the robustness of the model to alternative measures of capital mobility.

[12] In the few cases where BOP data are not available, FXI is calculated with the change in the stock of reserves.

[13] The interaction of FXI and capital controls is instrumented with a measure of global accumulation of reserves (to capture the tendency of countries to maintain FX liquidity at par with peer emerging market countries, what is known in the literature as the "keeping-up-with-the-Joneses" effect); a measure of reserve adequacy linked to M2, defined as (M2-reserves)/GDP relative to the average emerging market group; and with an emerging market and developing economy dummy to capture the tendency of these economies to accumulate reserves as part of their export-led growth strategies. See Adler and others (2015), Bayoumi and others (2015) and Daude and others (2016).

credit busts (Dell'Ariccia and others, 2012; Mendoza and Terrones, 2012; Gourinchas and others, 2001). The model includes a credit gap measure (estimated following the methodology proposed by the Bank for International Settlements, BIS) to capture the role of financial excesses. Specifically, the model includes the difference between the credit-to-GDP ratio and its long-term trend, estimated with a one-sided Hodrick-Prescott (HP) filter with a large penalty parameter that takes into account that financial cycles have a longer duration than the real business cycles.[14,15] Results suggest that a 1 percent of GDP increase in the credit gap is associated with a 0.1 percent of GDP deterioration in the current account.

C. Comparing the CA Model Fit with Other Studies

The goodness of fit of the current model is generally in line with similar cross-country, reduced form regressions documented in the literature, either by IMF staff or by other authors. Table 6 shows that the model fit measured using the R-squared statistic is about 53 percent for the refined model, moderately better than the fit of the previous version of the CA model estimated with data up to 2019. Importantly, the refined model also reduces the fraction of the gap unexplained by the model (the part assigned to the unexplained residual—see Section III.E for details on the calculation of gaps). The absolute sum of residuals falls by about 10% with respect to the previous model—in practice this implies that a 1% of GDP gap with the previous model becomes a 0.9% of GDP gap with the refined model.

One way to increase model fit would be to include country fixed effects or the lagged CA balance. However, for the purposes of the EBA exercise, such factors are excluded despite the latter's statistical significance. Country fixed effects do not provide an economic explanation of observed current account balances—as pointed out by Chinn and Prasad (2003), a big fraction of the economically meaningful variation in CA balances can be attributed to differences across countries rather than changes over time. Moreover, fixed effects and the lagged current account balance may simply pick up policy distortions that have persistent effects and would not justify the desirability of current account persistence. These exclusions inevitably penalize model fit when compared to other studies but are necessary for a normative interpretation of the results.

D. Robustness Checks

As part of the 2022 EBA refinements, staff explored several modifications to the CA model following recent contributions to the literature. This subsection discusses these extensions, even if they were not incorporated in the model at this point.

[14] The penalty parameter used for the credit cycle is 1,600. This number is obtained by dividing the penalty parameter of 400,000 used by the BIS for quarterly data by 44 to obtain its annual frequency counterpart, as suggested by Ravn and Uhlig (2002). For the few countries with data limitations, a two-sided HP filter was applied to estimate the credit gap in the initial years of the sample.

[15] Previous versions of EBA refinements have compared this credit gap measure to other transformations of the credit-to-GDP ratio, with the findings suggesting that the former was able to better capture the effects of financial excesses on the current account (see, for instance IMF, 2018). For a discussion of some of the potential limitations of this credit gap measure, see Baba and others (2020).

NFA Components

As discussed above, economies with more positive NFA positions tend to have higher CA balances—though not necessarily higher trade balances—reflecting net income earned on the NFA position, keeping other factors, including valuation effects, constant. Accordingly, numerous empirical studies (including this one) estimate a positive coefficient on the lagged stock of NFA. However, it is plausible that the aggregated NFA is not an adequate regressor as its components have different rates of return, and therefore the composition of the NFA may have implications for the primary income balance, and hence the current account balance.

To investigate this possibility, the CA model was re-estimated while replacing the NFA term with its components: foreign exchange reserves, portfolio equity, FDI and external debt. As reported in column (2) of Table 7, the results from this exercise are mixed. The R-squared of the model rises but the estimated large coefficient on the stock of foreign exchange reserves is hard to interpret. Reserves often include government debt of reserve currency-issuing advanced economies that typically pay a low or even negative growth-adjusted rate of return. These estimation results may reflect endogeneity issues—unobserved country characteristics may drive both the CA balance and the composition of the NFA. In addition, the coefficients on other fundamentals (such as output per worker, demographics and institutional quality) and policy variables (including the fiscal balance) weaken in this more complex specification. Reflecting these mixed results, a decomposed NFA variable is not added to the CA model at this point.

Demographic Polynomials

As described in Section III.B, three demographics variables constructed with specific age groups proxy for the saving rate of the young, prime aged, and old (population growth, the share of prime age savers and the old age dependency ratio, respectively). A recent study by Koomen and Wicht (2022) suggests using the full information of the population age structure (rather than specific groups) to understand how demographic differences across countries can affect the current account. Since this approach could potentially involve estimating a large set of parameters, the effects across age groups are approximated with a third-order polynomial, as proposed by Fair and Dominguez (1991). The estimation results are presented in Table 7, column (3). When the static demographic variables are replaced with these polynomials, the related estimated parameters are not statistically significant and the model fit does not improve. Therefore, the CA model maintains the EBA demographic block introduced by Cubeddu and others (2019).

Capital Mobility

Measuring the degree of capital mobility adequately is important to capture the effects of foreign exchange intervention on the exchange rate and, ultimately, on the current account balance. Hence, additional robustness exercises were also performed on the FXI variable. *De* jure measures of capital account restrictions are not the only factor influencing international capital flows, so other *de facto* measures of international financial integration were also used as proxies for capital mobility.

First, the KAOPEN index initially introduced in Chinn and Ito (2006) was used instead of the FARI.[16] This *de jure* index, in line with the FARI and the Quinn index used in previous versions of the model, measures capital openness based on the restrictions on cross-border financial transactions reported in the IMF AREAER.[17] As shown in column (2) of Table 8, when the FARI is replaced with the Chinn-Ito index, the coefficients and the model fit are very similar to those of the refined model. However, one key drawback of this index is that it is reestimated every time the underlying data are updated to include the most recent year's using the entire sample of the original variables, and historical values change annually even if the underlying data remains unchanged.

Second, following Bayoumi and others (2015), three *de facto* measures of capital mobility were considered: (i) financial integration, defined as the ratio of the sum of external assets plus liabilities to GDP, constructed with EWN data; (ii) BOP financial share flows as percent of BOP total flows; and (iii) BOP financial share flows as percent of GDP.[18] As shown in columns (3)-(5) of Table 8, the estimated coefficients remain similar. However, the model fit worsens when any of these *de facto* measures are used and the probability of inclusion of the interaction of FXI and capital controls falls significantly and below the 50% threshold used to assess the robustness of the regressors. Considering these findings, the *de jure* capital controls index was not replaced with *de facto* capital mobility proxies.

E. Estimating CA Norms and Gaps

The estimated EBA CA model coefficients are used to establish current account *norms* and their corresponding *gaps*. The EBA CA norms and gaps are the main numerical inputs for the IMF staff external sector assessments. The medium-term (or "cyclically-adjusted") norms are the benchmark levels consistent with the underlying macroeconomic and structural fundamentals at their actual values and with medium-term policies deemed desirable or appropriate by staff, once temporary and cyclical factors are excluded.[19] Hence, the norms represent a normative view of the current account and are not necessarily the fitted values of the model. The EBA CA gap is the difference between the cyclically-adjusted current account balance and the cyclically-adjusted norm, and it is equal to the sum of model-identified policy gaps and the regression residual. The residual contains country features or policy distortions not explicitly incorporated into the model.[20]

Using coefficient estimates (denoted with a hat), and omitting country and time subscripts to simplify notation, the cyclically-adjusted current account (that is, the current account balance-to-GDP ratio net of the estimated contributions of the output gap, the commodity terms-of-trade gap and the lagged change in the REER) is given by:

[16] For consistency, Chinn and Ito's KAOPEN index was normalized to be in [0,1], and capital controls were then calculated as (1 – capital openness).

[17] For a description of the Quinn index of capital controls, see Quinn (1997).

[18] Since these ratios can be considerably high for a few countries, the capital mobility indices were also constructed replacing observations above each year's 95th percentile with that percentile's value, or replaced with high openness indicators that take the value of 1 for countries above each year's median. Qualitative results remain unchanged.

[19] See Annex II for a discussion of how policy benchmarks are set.

[20] For instance, pension system features or structural policies, which are not explicitly modeled due to data limitations, might be contributing to the residuals. See Section VII for an analysis of their potential effect on current account balances.

$$\widetilde{CA} = CA - \underbrace{C'\hat{\beta}}_{\substack{Cyclical \\ component}} = \hat{\alpha} + F'\hat{\lambda} + P'\hat{\gamma} + e \qquad (2)$$

Let *P** denote values of policy variables that are deemed desirable in the medium term (and which may or may not coincide with actual values, *P*). Then, the fitted part of the cyclically-adjusted current account can be decomposed into two components: the CA norm and the policy gaps:

$$\widetilde{CA} = \underbrace{\hat{\alpha} + F'\hat{\lambda} + P^{*\prime}\hat{\gamma}}_{CA\,norm} + \underbrace{(P - P^{*})'\hat{\gamma}}_{Policy\ gap} + e \qquad (3)$$

The policy gap measures the extent by which deviations in policy variables from their desirable levels contribute to the overall deviation of the predicted medium-term current account balance from its norm. Thus, the total EBA CA gap can be expressed as:

$$Gap = \widetilde{CA} - CA\,norm = Policy\ Gap + Residual \qquad (4)$$

It is worth noting that the overall current account gap may be zero even when underlying policy distortions exist—the actual current account balance can coincide with the norm when identified policy gaps offset each other or are offset by the residual. In addition, policy gaps may be the result of differences between a country's own policy distortion and their corresponding world average, as policy variables are specified as deviations from world averages. For example, if the fiscal policy stance of a given country is deemed appropriate but all other countries are deemed to have a lower-than-desirable fiscal balance, the *relative* fiscal policy of that country would contribute to the current account gap. In other words, current account gaps reflect both domestic policy distortions and policy distortions in other countries, particularly those of large countries which have a bigger impact on the world average.

Multilateral Consistency

In order to ensure multilateral consistency, EBA gaps must add up to zero—that is, excess deficits must be financed by excess surpluses. Although global CA balances should (theoretically) add up to zero, in practice a small adjustment is necessary to satisfy this constraint. The need for this adjustment stems from two factors. First, CA balances do not add up to zero across the EBA sample, both because the sample excludes some large net commodity exporters and because of the existence of a statistical discrepancy at the world level. Second, since some variables do not enter the regression in deviations from world averages (such as the NFA-to-GDP ratio), their aggregate contribution does not necessarily add up to zero. Therefore, EBA gaps need to be adjusted by a uniform amount (in terms of each country's GDP), and this adjustment is mostly attributed to the norms.[21]

[21] A small fraction resulting from the cyclical changes in commodity prices, captured by the terms-of-trade gap, is attributed to the cyclical component.

F. Estimating Standard Errors

The EBA CA norms are calculated by combining the model's estimated coefficients and year-country-specific values for the regressors, and therefore are subject to the statistical uncertainty associated with the estimates. On that account, the corresponding standard errors of each country's estimated norm are presented along with the model results. The standard errors of the CA norm are obtained as a linear combination of the variance-covariance matrix of the estimated coefficients and the regressors, assuming the cyclical and temporary factors and country fundamentals are fixed at the corresponding country-year values and policy variables are set at their desirable medium-term levels. Specifically:

$$\left[\hat{V}(CA\ Norm_t)\right]^{1/2} = \left[\hat{V}(C_t'\hat{\beta} + F_t{}'\hat{\lambda} + P_t^{*}{}'\hat{\gamma})\right]^{1/2} \quad (5)$$

The estimated standard errors are a reference for staff in setting uncertainty ranges around the results implied by the model. In exceptional circumstances when uncertainty is deemed higher than usual (so the standard errors may not capture it), staff may use broader ranges if properly justified.

IV. The EBA REER Index and Level Models

This section presents the two EBA real effective exchange rate (REER) models: the REER-Index and REER-Level regressions. The REER is equal to the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator. In the EBA framework, the main input of the overall external sector assessment is the CA model. Hence, the starting point for estimating the staff REER gap is transforming the staff CA gap into a REER gap using the CA-REER elasticity, as described in the following section. However, the CA-implied REER gap may not fully capture currency fluctuations due, for instance, to lags between currency movements and CA adjustments. In such cases, the REER models can provide a useful benchmark for the overall assessment. This section presents updated estimates of the two existing EBA REER models: the REER-Index and REER-Level regressions.

The two REER models build on the EBA CA model but capture distinct aspects of the data. The REER-Index model focuses on the determinants of movements in REER indices. A limitation of the model is that its use of REER index data, which are typically normalized to 100 in the base year, precludes assessing how a country's exchange rate level compares to that of other economies. The REER-Level model aims at understanding differences in relative price 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 "Penn effect"). Both models include similar determinants as in the EBA CA model, as most factors that influence the current account also influence the real exchange rate, although some indicators vary across models reflecting differences in economic and statistical significance. For instance, both REER models exclude fiscal policy due to its counterintuitive results and include monetary policy (reflected in interest rate differentials interacted with capital account openness). Figure 2 summarizes the regression specification across the EBA models. The rest of this section will present the sample and estimation method and the estimation results.

Figure 2. EBA Models: Summary of Explanatory Variables in EBA CA, REER Index and REER Level Models

EBA CA Model	REER-Index Model^{FE}	REER-Level Model
Cyclical Factors Output gap (-) Terms of Trade^{X} (+) REER log change^{L} (-)	**Cyclical Factors** Output gap (+) Terms of Trade (+)	**Cyclical Factors** Terms of Trade (+)
Macroeconomic Fundamentals Output per worker^{L} (+) Net foreign assets^{L} (+) Expected growth (-)	**Macroeconomic Fundamentals** Output per worker^{L} (+) Net foreign assets^{L} (-) Expected growth (+) Financial home bias (+)	**Macroeconomic Fundamentals** Output per worker^{L} (+) Net foreign assets^{L} (+) Expected growth (+) Reserve currency status (-) Prod. Tradable/NonTrad (+)
Structural features Demographics (+/-) Institutional quality (-) Oil exporter (+)	**Structural features**	**Structural features** Demographics (+) Trade openness^{L} (-) Institutional quality (+) VAT Revenue (+)
Policies Fiscal balance (+) Public health spending^{L} (-) FXI, Capital controls^{X} (+) Financial excesses (-)	**Policies** Monetary policy, Capital openness^{X} (+) Public health spending^{L} (+) FXI, Capital controls^{X} (-) Financial excesses (+)	**Policies** Monetary policy, Capital openness^{X} (+) Public health spending^{L} (+) FXI, Capital controls^{X} (-)

Note: The sign of the estimated coefficient is in brackets (in red if not aligned with economic priors). Lagged variables have an L superscript, while those interacted have an X superscript. Some policy variables (fiscal, FXI) are instrumented as well. Capital openness is defined as 1 minus the capital controls index. The REER-Index model includes country fixed effects (FE).

A. Model Specification

The REER models are estimated for the period 1990-2019 and for a sample of 41 economies in the index regression and 40 economies in the level regression. Table 3 provides a list of the EBA countries included in both the REER models. The sample is smaller than the 52 economies included in the EBA current account regression due to data constraints.[22] As with the current account model, most REER determinants are expressed as deviations from world averages, some regressors are lagged to address endogeneity concerns, and FXI is instrumented to deal with potential reverse causality issues.[23] Table 2 lists the data sources for all variables included. To interpret model results, an increase (decrease) in the REER implies appreciation (depreciation). In both models, statistical inference is based on heteroskedastic and autocorrelation consistent (HAC) standard errors. Compared to the previous version

[22] We provide out-of-sample estimates for all countries not included in the REER samples but in the EBA sample.

[23] A difference with the CA model is that, for the REER models, world averages are computed using each country's trading partners weighted average.

of the REER models, both newly estimated REER models not only include longer time series and data revisions, but also use BMA to select robust variables, as in the case of the refined CA model.[24]

B. REER Regression Results: Explanatory Variables Common to Both REER Models

This subsection presents the REER-Index and REER-Level estimation results and discusses the regressors included in both models. Table 9 column (1) and column (2) present the new estimates of the refined REER-Index and Level models respectively.[25] As in the current account section, the explanatory variables are grouped into cyclical factors; fundamentals (macroeconomic and structural); and policy variables. The next two sub-sections present the results for variables that are specific to either the REER-Index or the REER-Level models, separately.

Many of the overlapping regressors in both REER models mirror the current account model, with most parameter estimates exhibiting the expected sign—the opposite to the coefficients reported in the EBA-CA model—and similar statistical significance. Both REER models include the three common policy variables—health spending, foreign exchange intervention and monetary policy variable, proxied by real interest rate differentials. Compared to the current account model, fiscal balance remains excluded from the REER models because its impact was either insignificant or counterintuitive.

Cyclical factors

Commodity terms-of-trade. In a similar manner to the current account model, the commodity terms-of-trade variable is measured as the ratio of a geometric weighted-average price of 42 commodity export categories to the equivalent geometric weighted-average price of commodity imports, each relative to manufactured goods prices in advanced economies. As in the previous version of the models, the REER-Index model uses the index of the commodity terms-of-trade, while the REER-Level uses its level, normalized to its 2011 value, and interacted with trade openness. In both REER models, the coefficient has a positive sign, indicating that more favorable commodity terms-of-trade are associated with a more appreciated exchange rate, in line with expectations.

Macroeconomic and Structural Fundamentals

Net foreign assets (lagged). The relationship between the NFA-to-GDP ratio and the REER can be ambiguous. In general, countries with larger NFA positions tend to have higher current account balances, implying a negative relationship with the real exchange rate (see the current account model, for instance.) This is the case for the estimated coefficient in the REER-Index model. However, countries with negative NFA positions should also 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, which is consistent with the results from the REER-level model.

[24] For a complete description of the differences between the latest generation of the REER models and the previous versions, see IMF (2022).

[25] Table 10 columns (1)-(3) and (4)-(6) reports the previous REER-Index and REER-Level models respectively, as well as the previous 2018 models with updated data.

Output per worker (lagged). This variable partly captures the Balassa-Samuelson effect, where richer countries are expected to have higher non-tradable prices and more appreciated exchange rates (Samuelson, 1994). The estimated coefficients in both REER models are consistent with this hypothesis and suggest a positive association between output per worker and the real exchange rate.

Expected real GDP growth (5 years ahead). Better growth prospects are associated with higher domestic demand, a lower current account, and a real exchange rate appreciation. As expected, the estimated coefficient is positive in both REER models.

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. The estimated coefficient is negative, in line with expectations.

Policy Variables

Monetary policy (interacted). The effect of monetary policy on the exchange rate is captured by the real interest rate differential interacted with capital openness. As in the EBA CA model, both REER models now include the Financial Account Restriction Index (FARI) instead of the Quinn index used in previous EBA versions. A higher real short-term interest rate differential is expected to be associated with a REER appreciation, and this relationship should be stronger with greater capital account openness. The estimated coefficients in both the REER-Index and REER-Level model have the expected sign.

Health spending (lagged). This variable is used to proxy for the level of welfare protection. In economies with a higher provision of social protection, households do not need to have as much precautionary saving, leading to higher domestic demand and a more appreciated real exchange rate. The estimated coefficient for this variable is positive in both models, as expected.

Foreign exchange intervention (interacted). Foreign exchange interventions can affect the nominal and real exchange rate, in particular in economies with less open capital accounts. In the REER models, we instrument FXI in a similar manner to the current account model. The variable is interacted with our new measure of capital controls. The results indicate that official reserve purchases are associated with a real depreciation, with smaller effects in countries where capital is more mobile. The size of the estimated coefficient is larger in REER-Level model compared to the REER-Index model.

C. REER Regression Results: Explanatory and Policy Variables of REER-Index Model

Since the REER-Index model is estimated with country fixed effects, some slow-moving variables, such as institutional quality and certain demographic indicators, are excluded from the model. Additional variables specific only to the REER-Index model include:

Output gap. The output gap is used to control for business cycle fluctuations. A higher output gap is expected to be associated with a more appreciated real exchange rate, reflecting stronger domestic demand relative to potential output. In the Index model, an output gap of 1 percent is associated with an appreciation of the REER by about 0.5 percent.

Financial home bias (lagged). This variable aims at capturing the impact of investor preference for domestic assets (called "home bias") on the REER. It is proxied by the share of domestic debt owned by residents. It has its expected positive sign, as an increase in the degree of home bias should appreciate the exchange rate. The variable is lagged due to endogeneity concerns. The estimated coefficient indicates that an increase in financial home bias is associated with an increase in the real exchange rate.

Financial excesses. This variable is meant to capture the effect of credit booms—captured by private credit-to-GDP ratios above those implied by long-term trends computed with filtering techniques—on domestic demand, and thus on the real exchange rate. The effect has the expected (positive) sign in the REER-Index model. This variable was not included in the REER-Level model, as the estimated coefficient had a counterintuitive sign.

D. REER Regression Results: Explanatory Variables of the REER-Level Model

Since the REER-Level model measures differences in *relative price levels across countries*, proxies for supply-side differences in productivity 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:

Reserve currency status. Currencies that are used in foreign exchange reserve holdings are expected to be more appreciated than others, reflecting a higher global demand for assets denominated in that currency. The variable is constructed as the share of a country's domestic currency in total foreign exchange reserve holdings. In the REER-Level model, the estimated coefficient is negative (against economic priors), albeit lower than in the previous version of the model.

Ratio of traded/non-traded sector productivity (lagged). This variable captures the Balassa-Samuelson effect, where 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 (positive sign). The estimated coefficient has the expected sign.

Demographics (old-age dependency ratio and population growth). Consistent with the CA model, the old-age dependency ratio is expected to be positively related to the real exchange rate, with higher ratios associated with an increase in the demand for services (like old-age services) relative to tradable goods. This variable has the expected sign. Moreover, higher population growth is associated with a more appreciated real exchange rate (Aloy and Gente, 2009). In line with this, the estimated coefficient is positive in the REER-Index model.

Institutional quality. In a similar manner to the CA model, higher institutional risk (or the perception of such risk) is likely to decrease investment and capital inflows, leading to a more depreciated REER. Given that a higher value for this indicator reflects lower institutional risk, the positive estimated coefficient is in line with the expected sign.

VAT revenue. VAT revenue is used as a proxy for the effective rate of indirect taxation. Indirect taxes create a wedge between domestic and foreign prices, appreciating the REER. Thus, an increase in VAT revenues (in percent of GDP) is expected to lead to an appreciation of the REER. The estimated coefficient in the REER-Level model has a positive sign and is statistically significant.

V. Estimated CA-REER Elasticities

Medium-term semi-elasticities between the CA and the REER are a key element of external sector assessments as they help translate the estimated CA gap into a consistent REER gap, and to compare results with those from the REER models. These estimated elasticities can change across countries and over time, depending on features such as the composition of the current account or the degree of trade openness. The EBA framework provides country-specific estimates based on a consistent methodology.

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

$$\frac{\Delta(CA/GDP)}{\Delta REER/REER} = \eta^{CA} \approx \overbrace{\eta^{TB}}^{goods\ and\ services\ trade} + \overbrace{\eta^{IB}}^{income\ account} \qquad (6)$$

where $\eta^{TB} = \frac{\Delta(TB/GDP)}{\Delta REER/REER}$ is the semi-elasticity of the trade balance-to-GDP ratio and $\eta^{IB} = \frac{\Delta(IB/GDP)}{\Delta REER/REER}$ is the semi-elasticity of the income balance-to-GDP ratio. For a given CA gap, the corresponding REER gap (in percent) can then be derived as:

$$REER^{gap} = \frac{CA^{gap}}{\eta^{CA}} \qquad (7)$$

The 2022 version of the EBA framework updates the estimates of the trade balance semi-elasticities and introduces estimates of the income balance semi-elasticities, that were previously assumed to be zero. Estimates suggest that response of the trade balance to REER movements is larger than the income balance response, and that the relation between the CA and the REER still mainly reflects the movement in exports and imports following a change in the REER.

A. Trade Balance Semi-Elasticities

The semi-elasticity of the trade balance-to-GDP ratio with respect to the REER, η^{TB}, is given by:

$$\eta^{TB} = \eta^X s^X - \eta^M s^M \qquad (8)$$

where η^X and η^M are the elasticities of exports and imports with respect to the REER, and s^X and s^M are the nominal shares of exports and imports with respect to GDP. These semi-elasticities are obtained, for each country, by using common panel-estimated values of η^X and η^M and the country-specific export and import shares. In practice, a moving average with an eleven-year window is used to smooth cyclical fluctuations in these shares.[26] Values for η^X and η^M are estimated using data from an unbalanced panel

[26] That is, the elasticity in year N is estimated with averages for the exports and imports to GDP ratios between years N-5 to N+5.

covering all 52 EBA countries and with quarterly data between 1980 and 2019. Specifically, dynamic export (*X*) and import (*M*) equations—with *X* and *M* expressed in nominal USD—are estimated with the following reduced-form equations:[27]

$$\ln(X_{it}) = \sum_{j=1}^{n} \delta_j^X \ln\left(X_{it-j}\right) + \sum_{j=0}^{n} \beta_j^X \ln\left(REER_{it-}\ \right) + \gamma^X \ln(RGDP^{TP}{}_{it}) + \varepsilon_{it} \quad (9)$$

$$\ln(M_{it}) = \sum_{j=1}^{n} \delta_j^M \ln\left(M_{it-j}\right) + \sum_{j=0}^{n} \beta_j^M \ln\left(REER_{it-j}\right) + \gamma^M \ln(RGDP_{it}) + \varepsilon_{it} \quad (10)$$

where both specifications include time and country fixed effects. Equation (9) relates exports to real exchange rates and world demand (proxied by trading partners' real GDP), while imports are assumed to be a function of real exchange rates and domestic demand (proxied by domestic real GDP) in equation (10). Using estimates from the panel regression, long-run export and import elasticities are then obtained as follows:

$$\eta^F = \frac{\sum_{j=0}^{n} \beta_j^F}{1-\sum_{j=1}^{n} \delta_j^F}\ , \text{ with flow } F = \{X, M\} \quad (11)$$

The resulting updated estimates for the elasticities are -0.15 for exports and 0.65 for imports (Table 11). Only the medium-term imports elasticity is statistically significant at standard levels. To guard against the influence of outliers on the estimation results, the relationships in equations (9) and (10) are also estimated while excluding outliers based on Cook's distance (see Table 11, and Cook, 1977 for details). The long-run elasticity of imports does not change when outliers are excluded, while the long-run elasticity of exports increases but remains imprecisely estimated.

B. Income Balance Semi-Elasticities

The method to estimate the income balance semi-elasticity is analogous to the one employed to estimate trade balance elasticities, and it was implemented recently by Colacelli and others (2021). More precisely, the income balance semi-elasticities are given by:

$$\eta^{IB} = \eta^{IC} s^{IC} - \eta^{ID} s^{ID} \quad (12)$$

where η^{IC} and η^{ID} are, respectively, the elasticities of the ratios of income credit and debit flows to GDP with respect to the REER, and s^{IC} and s^{ID} are the ratios of income credit and debit flows to GDP. As in the case of trade flows, the elasticities of income credit (*IC*) and debit (*ID*) flows are estimated using a panel approach with all EBA economies, using annual data from 1986-2019. Following Colacelli and others (2021), the following equations are estimated:

$$ln\left(\frac{IC_{it}}{GDP_{it}}\right) = \delta_1^{IC}\, ln\left(\frac{IC_{it-1}}{GDP_{it-1}}\right) + \sum_{j=0}^{n} \beta_j^{IC}\, ln\left(REER_{it-j}\right) + \gamma_1^{IC}\, ln\left(\frac{FA_{it-1}}{GDP_{it-}}\right) + \varepsilon_{it} \quad (13)$$

[27] 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.

$$ln\left(\frac{ID_{it}}{GDP_{it}}\right) = \delta_1^{ID}\, ln\left(\frac{ID_{it-1}}{GDP_{it-1}}\right) + \sum_{j=0}^{n} \beta_j^{ID}\, ln\left(REER_{it-}\ \right) + \gamma_1^{ID}\, ln\left(\frac{FL_{it-1}}{GDP_{it-1}}\right) + \varepsilon_{it} \qquad (14)$$

where *FA* and *FL* are the stock of foreign assets and liabilities, respectively. As in the case of the exports and imports equations, the estimation includes country and time fixed effects. Long-term elasticities of income credits and debits can then be calculated as:

$$\eta^F = \frac{\sum_{j=0}^{n} \beta_j^F}{1-\delta_1^F}\ , \text{ with flow } F = \{IC, ID\} \qquad (15)$$

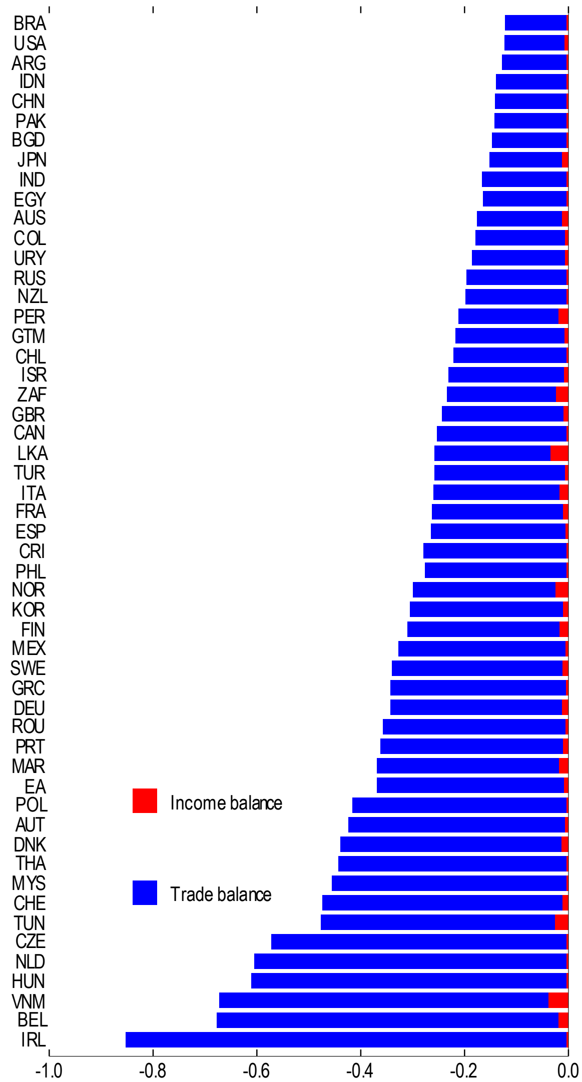
The long-run semi-elasticity of the income balance (as a ratio to GDP) η^{IB} is then derived using η^{IC}, η^{ID}, and the corresponding shares (ratios of income credits and income debits to GDP) as described by equation (15). Using the preferred specification of Colacelli and others (2021), the estimates for the relevant elasticities are η^{IC}=-0.25 for income credits and η^{ID}=-0.13 for income debits, with coefficients statistically significant at the 1 percent and 5 percent levels, respectively. The negative sign in both elasticity estimates, resulting from valuation effects and the currency composition of IIP and income flows, implies that the effects of REER fluctuations on income credit and debit flows will tend to partially offset each other.[28]

C. Country-Specific Elasticity Estimates

Figure 3 provides the updated semi-elasticities for the EBA sample. The trade balance elasticities are obtained by using economy-specific averages of the exports- and imports-to-GDP ratios between 2016-2026, using WEO forecasts where needed. In addition, the refined CA elasticities include income balance elasticities, also using data for 2016-2026 for the income credit- and debit-to-GDP ratios from the WEO database. The updated trade balance elasticities are generally similar to those estimated previously (Cubeddu and others, 2019). On a GDP-weighted basis, the average CA-REER elasticity moves from -0.17 to -0.20, with a median of -0.26, with substantial heterogeneity reflecting the different degrees of (*de facto*) trade openness across economies. A 10 percent REER appreciation is thus on average associated, other things equal, with a 2 percent reduction in the CA balance (as a percentage of GDP).

[28] Following a REER appreciation, income credits and debits will be both lower in percent of GDP, to the extent that they are partially denominated in foreign currency. In this context, panel regression estimates of elasticities can be seen as the response of income flows for a country with average share of foreign-currency-denominated flows.

Figure 3. Estimated CA-REER Semi-Elasticities, EBA Sample
(Percent change)



Sources: IMF, World Economic Outlook, and IMF staff estimates. Notes: EA= Euro Area. Data labels use International Organization for Standardization (ISO) codes.

In most cases, the income balance elasticities are close to zero, and smaller in magnitude than trade elasticities. This implies that the response of the income balance-to-GDP ratio to changes in the REER is expected to be modest and the external sector adjustment is mainly driven by the medium-term effects of the REER on the trade balance. This finding is consistent with Colacelli and others (2021), who document that gross income flows (the absolute values of income credits and debits) tend to be significantly smaller than gross trade flows (the absolute values of exports and imports), including in countries where the income balance (credits minus debits) is larger than the trade balance (exports minus imports).[29]

VI. 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. The ES approach is essentially unchanged with respect to the framework described in the CGER (Lee and others, 2008) and the previous EBA methodology papers (Cubeddu and others, 2018 and Phillips and others, 2013). This approach complements estimates from the current account, REER-Index and REER-Level models, by focusing on external sustainability considerations, which in some cases are central to external sector assessments.

Results from the ES approach are insightful when stock positions are considered excessively large, and a 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. In contrast to other EBA models, a key input to the ES approach involves 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. 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. Linking Stock and Flow Positions

The ES approach follows from the law of motion of the country's NFA position. Specifically, and abstracting from errors and omissions, the change in the NFA position between two consecutive periods can be expressed as a function of the current account balance (CA) and valuation changes (VC) on the existing holdings of foreign assets and liabilities:[30]

$$NFA_t - NFA_{t-1} = CA_t + VC_t \qquad (16)$$

[29] These estimates differ from Colacelli and others (2021) and from Behar and Hassan (2022) because of different country samples (respectively 40 and 145 countries, vs. the full EBA sample here), a longer sample period (starting in 1999 in Colacelli and others, vs. 1985 in Behar and Hassan and 1986 in the current paper), and/or a different regression specification (Behar and Hassan included lagged GDP). Both papers emphasize that, contrary to trade balance semi-elasticities which are always negative, income balance semi-elasticities may in some cases be positive (especially for large debtor countries). With a sample including more emerging and developing economies, Behar and Hassan (2022) also found income balance semi-elasticities to be somewhat larger in magnitude. Nonetheless, all papers concur that the trade balance remains the main channel of external adjustment.

[30] For simplicity, this assumes the capital account and errors and omissions are equal to zero.

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 is assumed that $VC_t = 0$.[31] Expressing the previous expression in terms of nominal GDP yields:

$$nfa_t - \frac{1}{(1+\pi_t)(1+g_t)} nfa_{t-1} = ca_t \qquad (17)$$

where nfa_t and ca_t denote, respectively, the ratio of the NFA and CA to nominal GDP, π_t is the inflation rate and g_t is the real GDP growth rate. In the steady-state, denoting variables without a time subscript, the current account balance (*ca*) that stabilize the NFA-to-GDP ratio at a given nfa level are:

$$ca = \left(1 - \frac{1}{(1+\pi)(1+g)}\right) nfa \qquad (18)$$

As long as the nominal GDP growth rate is positive, equation (18) suggests that in the steady state, the current account and the net foreign asset position will have the same sign: creditor (debtor) countries NFA require a positive (negative) current account balance to stabilize both flow and stock positions.

The previous relationship is silent about how the composition of the current account should stabilize overtime. To answer this question, it is necessary to further decompose 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 law of motion for NFA can be rewritten as:

$$nfa_t = nxt_t + \frac{1+r_t}{1+g_t} nfa_{t-1} \qquad (19)$$

This expression illustrates the link between the trade balance plus transfers and the NFA-to-GDP ratio whenever $r_t > g_t$ on a persistent basis.

$$nxt = -\frac{r-g}{1+g} nfa \qquad (20)$$

Equation (20) 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.[32]

[31] See Adler and others (2019) for a discussion on the presence of predictable components of valuation changes.

[32] 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.

B. Implementation

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

1. Choice of a benchmark or desired NFA-to-GDP level. In most cases, the benchmark NFA level is set equal to the last year's level (or the current year if it is available). 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 estimated thresholds below which the risk of a balance-of-payments crisis increases substantially (Catão and Milesi-Ferretti, 2014), or based on reference values, such as 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 (18) using the values for medium-term inflation (π) and medium-term potential growth (g) based on Fund staff forecasts.

3. Estimation of the current account gap. The CA gap is the difference between the cyclically-adjusted CA, using the same adjustment as in the EBA CA model (see Section III.E, equation (2)), and the current account balance that would stabilize the NFA position at its benchmark level.

4. 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 the staff-assessed REER-CA semi-elasticities, for which benchmark values are estimated (see Section V).

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

VII. Complementary Tools

This section summarizes three complementary tools designed to support the interpretation of the part of CA balances not explained by the EBA CA model (residuals), building on earlier work of Cubeddu and others (2019). The first tool facilitates the estimation of measurement and accounting biases due to inflation differentials and the treatment of portfolio equity investment retained earnings in the CA. The second tool provides insights into how pension parameters may contribute to CA balances for a subset of the 52 EBA economies for which the relevant indicators are available. The third tool provides updated insights into the role of labor market and product market regulations, focusing on advanced economies.

A. Measurement and Accounting Biases

The existing CA measurement biases (inflation and portfolio equity retained earnings) will continue to be estimated by IMF staff. The "hybrid" approach used to estimate portfolio retained earnings (see Adler and others, 2019) is set to be dropped, since this approach does not bring any new information (as it combines the two other existing methods), lacks a clear interpretation, and can be prone to measurement issues. A new method was developed for use in the 2022 *External Sector Report*. This method combines national accounts and foreign portfolio holdings data to reapportion the share of domestic corporate saving (or undistributed profit) attributed to foreign portfolio investors. It complements the existing methods (based on financial market data) by capturing activities of multinationals firms missing in domestic stock market data. It also ensures consistency between the measure of retained earnings and external sector data, as both are compiled using the same SNA/BOP methodology. This method can also be complemented with more granular sectoral data shared by country authorities on a case-by-case basis. Annex III presents further details on these methodologies.

B. Pensions

A pension system's generosity, its system of financing, whether participation is mandatory or voluntary, and the share of the population that it covers can theoretically affect private saving, national saving, and the CA balance. In an economy with myopic households or liquidity constraints, moving from a voluntary approach to a mandatory system could result in higher national saving and a rise in the CA balance, although the relationship between pension system features and the CA is not straightforward from a theoretical standpoint. As with other CA drivers, the overall outcome for the CA balance would depend on how pension system parameters compare with those in the rest of the world.

Annex IV analyzes how pensions system characteristics help to explain EBA CA residuals using two different datasets. It finds that some pension system characteristics have implications for CA balances but that the uncertainties associated with the estimates and methodological differences regarding the measurement of pension parameters across databases suggests the need for caution in interpreting the results. Overall, while using the estimates to quantify formal adjustors to normative EBA CA benchmarks is not currently warranted, the results can aid in the interpretation of EBA CA model residuals and the formulation of policy advice.

C. Product and Labor Market Regulations

The stringency of regulations in labor and product markets, as well as reforms aimed at easing them, can, in principle, have an impact on saving, investment, and the CA balance. Easing labor market regulation could, for example, increase export competitiveness and raise the CA balance, while easing product market regulations could raise investment and reduce the CA balance. Introducing product and labor market regulation indicators in the EBA CA model is precluded by data limitations but results for a subset of economies with the necessary data can inform policy discussions on the role of structural reforms. Annex V analyzes the effects of labor and product market regulations on the CA. Overall, while using the results to quantify formal adjustors to normative EBA CA benchmarks is not currently warranted, the results can aid in the interpretation of EBA CA model residuals and the formulation of policy advice.

VIII. Properties of EBA CA Gaps Adjustments

As explained in Section II, the External Balance Assessment (EBA) framework produces multilaterally consistent assessments of current account balances and real effective exchange rates. These assessments tend to persist over time (see for instance, IMF (2022), Figure 1.17). This section evaluates how EBA CA gaps are associated with future CA adjustments towards their norm. It presents estimates of how excess external imbalances adjust, and if so, at what speed.[33]

The analysis in this section shows that EBA gaps tend to adjust over time, but the adjustment is slow and asymmetric across countries. The adjustment is mainly driven by changes in actual current account balances, with changes in current account norms playing only a modest role. Closing policy gaps contributes to external adjustment only when policy gaps and overall current account gaps are aligned. The sample consists of 48 economies in the baseline EBA regression, with Ireland excluded because of large current account volatility in recent years, and Bangladesh, Romania and Vietnam not studied because they were not included in the EBA CA model prior to the 2022 refinements.

Due to data availability constraints, two different subperiods are studied. The first period is 2012–19, where actual assessments are used based on three subsequent vintages of EBA models and available optimal policies (P*). This short period follows from the fact that the EBA methodology was introduced in 2012, and computing EBA norms and gaps requires country teams' inputs on desirable policies, which are not available before 2012. The second period is longer, covering 1987–2019, where the current EBA specification is used, and the sample is extended backwards by assuming that desirable policies (P*) are kept constant at their 2019 level.[34] The following panel regressions are estimated:

$$X_{i,t} - X_{i,t-1} = \alpha X_{i,t-1} + \varepsilon_{i,t} \qquad (21)$$

where *X* represents across different specifications either: (i) IMF staff-assessed current account gaps, (ii) EBA current account gaps, (iii) current account norms, (iv) policy gaps, or (v) EBA residuals.[35] When $\alpha < 0$, the dependent variable *X* follows an exponential process converging toward zero (in the absence of shock $\varepsilon_{i,t}$). A standard measure of speed of converge consists in estimating half-lives, denoted by HL(*X*), defined as the number of years it takes for the dependent variable to close by half.[36] Unlike previous similar studies, the regressions do not include any constant or country fixed effects, as the EBA approach has a strong normative dimension relying on the notion that gaps should close to zero over time.[37]

[33] Other studies have carried out similar assessments of EBA's predecessor, called Consultative Group on Exchange Rate assessments—CGER, (see, for instance, Abiad and others, 2009, and Yeşin, 2016) or a similar exercise on benchmark current account models (see, for instance, Coutinho and others, 2022). Moreover, Lane and Milesi-Ferretti (2012) document that excess imbalances before the global financial crisis had strong predictive power on subsequent adjustments of current account imbalances.

[34] Restricting the second approach (current EBA model, constant P*) over 2012–19 leads to very similar results compared with the first approach using actual models and assessments. This is reassuring and enables the analysis to be focused on results over the longer sample (including crisis episodes).

[35] As explained in Section II, IMF staff-assessed current account gaps include any potential country-specific adjustors to the EBA gap.

[36] The concept of half-life comes from nuclear physics but has been used in previous papers that study real exchange rate adjustment (see, for instance, Rogoff (1996)). Concretely, $HL(X) = -\ln(2)/\ln(1 + \alpha)$.

[37] A robustness exercise assessed how results changed when introducing country fixed effects and a constant. In most cases, country-specific levels of convergence of EBA gaps were found to be non-statistically different from zero. In the remaining cases, EBA gaps not converging toward zero could be related to factors outside EBA (for example, persistent measurement biases or structural factors as laid out in the IMF staff's complementary tools described in Section VII).

All CA gaps adjust, but slowly and with asymmetries across countries. In nearly all cases, regression coefficient α is found to be negative and statistically significant, indicating convergence to zero over time.[38] However, the adjustment is slow: based on 2012–19 and the External Sector Report country sample, IMF staff current account gaps take 6.9 years to close by half (see Figure 4). Adjustment is somewhat faster for EBA gaps over the whole period (half-life of 4.7 years) and over the 2012–19 period (5.7 years).[39]

More interestingly, the results show that there is significant cross-country heterogeneity, depending on initial conditions. A key result is that there is generally a faster adjustment in deficit emerging economies (1.5 years) and slower in advanced surplus economies (6.4 years), as current account deficit countries (in particular emerging markets) are more vulnerable to a sudden stop of external financing. Adjustments are also more rapid during crisis episodes, especially in deficit countries (2.1 years) compared with normal times (5.5 years), in line with Lane and Milesi-Ferretti (2012).[40] Other country-specific features such as labor market institutions may affect the adjustment speed, which is faster when wage bargaining is decentralized (3.7 years) versus centralized (10.8 years), in line with theory (Ju and others, 2014) and empirical evidence (Nieminen and others, 2019).[41] Indeed, more accurate firm-specific price signals under decentralized wage bargaining can speed up labor reallocation following an asymmetric shock, facilitating external rebalancing.[42]

Having shown that CA gaps close over time, but at different speeds, a natural question is how does this adjustment take place? The adjustment of EBA gaps (Table 12, column 1) is mainly driven by changes in actual current accounts or cyclically adjusted current account balances (columns 2 and 3), with changes in the EBA current account norms playing only a modest role (column 4). Changes in the norm are mainly related to the net foreign assets variable (columns 6 and 9), as persistent external imbalances (desirable or excessive) lead to building large external positions over time; however, other fundamentals are also at play for surplus economies (column 7), generating some asymmetry between surplus and deficit countries (columns 5 and 8).[43]

[38] Results do not change much if 2020 and 2021 are included. These years were excluded because of the effect of the COVID-19 pandemic.

[39] Half-lives between 4.7 and 6.7 years correspond to α coefficients between −0.098 and −0.138 (both significant at the 1 percent level). This is in line with Coutinho, Turrini, and Zeugner (2022), who find a coefficient of −0.083 (also significant at the 1 percent level) with a regression over nonoverlapping five-year periods with time fixed effects.

[40] Crisis episodes are defined using the Laeven and Valencia (2020) database, including banking, currency, and debt crises, to which all recession episodes were added (extended to three years to include the immediate crisis aftermath).

[41] Wage bargaining frameworks are taken from the Organisation for Economic Co-operation and Development and Amsterdam Institute for Advanced Labour Studies Institutional Characteristics of Trade Unions, Wage Setting, State Intervention, and Social Pacts database. Decentralized (respectively centralized) systems correspond to coord = 1,2,3 (respectively coord = 4,5).

[42] Additional analysis shows that economies that are more financially closed (based on the Fiscal Analysis of Resource Industries Index) and have less flexible exchange rate regimes (based on the Annual Report on Exchange Arrangements and Exchange Restrictions classification) tend to adjust faster.

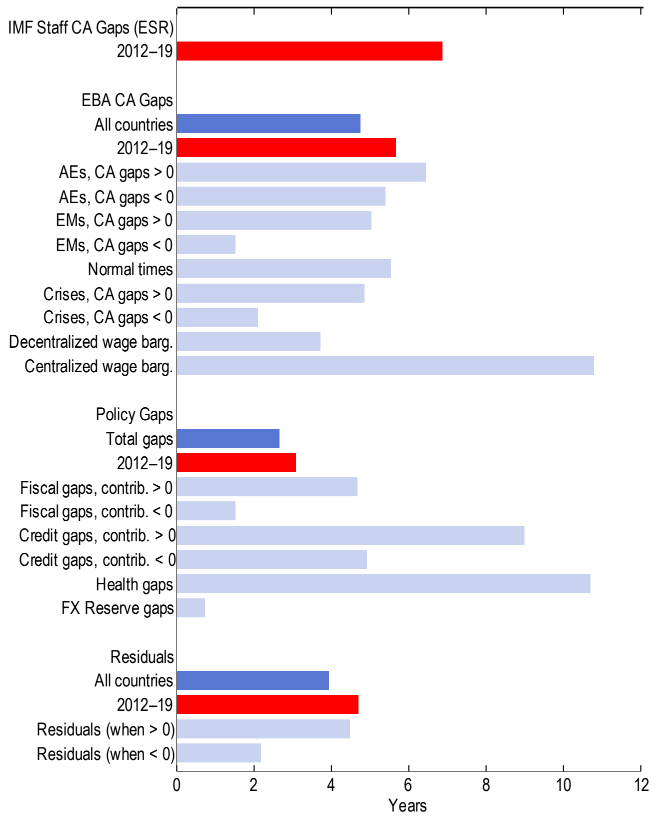
[43] As oil and gas producers, which are often surplus countries, deplete their hydrocarbon reserves, the temporariness of these reserves increases, boosting the need to save and the CA norm. In addition, rapid convergence in emerging countries tend to increase their CA norm (due to closing development gap), which will contribute to changes in the norm in surplus emerging economies (but would tend to widen the CA gap in deficit emerging economies, all else equal).

Digging deeper into the adjustment process, the next question is how much is this adjustment is policy-induced? Policy gaps tend to adjust more quickly than the EBA current account gap, but asymmetrically across countries and for domestic instead of external reasons. All policy gaps are found to adjust over time, with varying speed, depending on the type of gap and country characteristics (see Figure 4, bottom panel). Policy gaps tend to adjust faster than overall EBA current account gaps, with respective half-lives of 2.7 and 4.7 years. The adjustment speed is asymmetric for fiscal gaps (slower when fiscal stance is tighter than warranted) and credit gaps (slower after a credit crunch). Health gaps, meant to proxy for the development of social safety nets, adjust very slowly while foreign exchange reserve gaps (characterizing near-crisis situations) adjust extremely rapidly. Residuals, which can partially reflect policies and distortions that are not explicitly modeled but have long-lasting effects on the CA, adjust relatively slowly, with some asymmetry between surplus and deficit countries (half-lives of 4.5 and 2.2 years, respectively). Quantitively, policy gaps contribute only modestly to overall external adjustment, compared with residuals (Table 13, columns 1–3). Indeed, policy gaps are aligned with overall external gaps in about two-thirds of cases (Table 13, columns 4 and 5): consistent with IMF staff advice, policy gaps should (and do) close for domestic reasons above all, regardless of their impact on external rebalancing (sometimes calling for additional policy measures aimed at external rebalancing). [44]

Finally, looking at whether EBA CA gaps can help predict subsequent exchange rate movements, Table 14 shows that initial EBA CA gaps are associated with future REER adjustments with the correct sign. There is a strong positive association between initial EBA CA gaps and changes in the observed REER over our two sub-periods (Table 14, columns 1–2), in line with Abiad and others (2009). Focusing on REER gaps derived from the EBA methodology (see section III), REER index gaps tend to adjust similarly to the observed REER (column 4), while there is no statistically significant association between changes in REER level gaps and initial EBA CA gaps.

[44] If policy gaps were closed in 2019, the absolute value of EBA gaps in percent of GDP would increase by 0.1 percent of country GDP on average (they would be reduced in US dollar terms). Closing each policy gap can have varying impacts on the absolute dollar amount of EBA gaps: closing fiscal gaps would reduce the overall EBA gap (by $150 billion), whereas closing the credit gap would increase the overall EBA gap (by $125 billion).

Figure 4. IMF Staff and EBA CA Gaps Adjustment: Estimated Half-Lives (in years)



Sources: IMF, External Balance Assessment estimates; IMF country classification; Laeven and Valencia 2020; The OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts; and IMF staff calculations. Note: AE = advanced economy; CA = current account; EBA = External Balance Assessment; EM = emerging market; ESR = External Sector Report; FX = foreign exchange. Red bars are derived from regressions over 2012–2019 (actual P*s); blue bars are derived from regressions over the whole period (P*s assumed constant).

IX. Concluding Remarks

This working paper has presented the latest generation of the EBA methodology updated in 2022, which underpins IMF staff external sector assessments. As was the case with previous refinements, the goal of these revisions was to improve the conceptual framework by drawing from lessons learned during its past implementation, as well as by incorporating the latest available data, feedback received from various stakeholders and the latest advances in the academic literature. A main novelty compared to previous EBA methodology papers is the evaluation of the how estimated CA gaps are associated with future external sector adjustment. The paper finds that CA gaps are associated with future CA and REER movements in the expected way, although the speed of adjustment depends on country characteristics such as the initial CA balance and income level.

While this update reflects staff's current understanding of key determinants of external positions and provides a very useful tool to ensure discipline and multilateral consistency, this paper represents by no means the last refinement to the EBA methodology. IMF staff will continue to explore modelling strategies, drawing from the academic literature and contributions from other policy institutions, and implement them when they improve the fit to the data while conforming to economic priors. At the same time, because all economic models face limitations, including data availability, external sector assessments will continue to rely on staff's judgement and country-specific knowledge. The overall framework allows for this important component, provided it is analytically well-grounded, and is applied evenhandedly and transparently. The application of staff adjustors during the Covid-19 pandemic provides an important example of this approach (IMF 2021, 2022).

A few areas of ongoing and future research include: (i) the assessment of stock imbalances, building on the ES approach to understand risks associated to their size and composition, (ii) the determinants of corporate saving and the role of multinational companies, which are behind the observed large and persistent CA surpluses in some advanced economies, and (iii) understanding how recent risks of fragmentation in trade and financial systems can affect the distribution of current account balances going forward. Progress in these important areas also require further efforts in collecting the necessary data for adequate analysis and inclusion in the EBA methodology.

Table 1. Description of External Sector Assessment Categories

CA Gap	REER Gap (Using Elasticity of −0.2)	Description in Overall Assessment
> 4%	< −20%	… substantially stronger …
2%, 4%	−20%, −10%	… stronger …
1%, 2%	−10%, −5%	… moderately stronger …
−1%, 1%	−5%, 5%	The external position is broadly in line with fundamentals and desirable policies.
−2%, −1%	5%, 10%	… moderately weaker …
−4%, −2%	10%, 20%	… weaker …
<−4%	> 20%	… substantially weaker …

Table 2. EBA Data Sources

	Variables	Sources
CURRENT ACCOUNT	**Current Account**	World Economic Outlook
	Output Gap	World Economic Outlook
	Commodity Terms of Trade	World Economic Outlook and World Integrated Trade Solution(WITS)
	Real Effective Exchange Rate	Information Notice System (INS)
	Net Foreign Assets (NFA) position	EWN: Lane, Milesi Ferretti and World Economic Outlook
	Output per worker, relative to top 3 economies	World Economic Outlook
	Expected real GDP growth (5 years ahead)	World Economic Outlook
	Demographic varaibles	UN World Population Prospects, 2019 Vintage
	Institutional Quality	International Country Risk Guide (ICRG)
	Exhaustible Resources of Oil and Natural Gas	World Economic Outlook, WITS and BP Statistical Review of World Energy
	Fiscal Policy	World Economic Outlook
	Health Spending	OECD, and WDI
	Foreign Exchange Intervention (FXI)	World Economic Outlook, Data Template on International Reserves and Foreign Currency Liquidity
	Capital Account Openness	IMF (Baba and others, forthcoming)
	Credit Gap	BIS (Credit statistics) and World Bank (Global Financial Development Database)
REER INDEX	**Real Effective Exchange Rate**	Information Notice System (INS)
	Trade Openness	World Economic Outlook
	Home bias	BIS (Debt Securities Statistics)
	Real Interest Rates (interacted with capital controls)	International Financial Statistics, World Economic Outlook, Haver, and IMF (Baba and others, forthcoming)
REER LEVEL	**Price Level**	International Comparison Program (ICP), released 2020
	Capital Stock per employed person	Penn World Table version 10.0
	Ratio of Traded/Non-Traded sector Productivity	Mano and Castillo (2015), World Bank World Development Indicator (WDI) Database
	Reserve currency status (RCS)	IMF, COFER
	VAT Revenue	OECD, World Revenue Longitudinal Data set (WoRLD), UNU-WIDER Government Revenue Dataset (2021)

Note: Dependent variables in each model are in bold font.

Table 3. Countries in EBA Models

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

Note: All countries are included in the current account model. For data availability reasons the REER models are estimated with a smaller sample. Asterisks (*) denote countries not included in REER index regression, while sharps (#) denote countries not in REER levels regression.

Table 4. Estimation Results: EBA Current Account Model

	(1) Estimated Coefficient	(2) BMA PIP
Temporary and Cyclical Factors		
Output gap	-0.297***	
	(0.035)	
Commodity terms of trade, interacted with trade openness	0.291***	
	(0.047)	
REER annual log-change (lagged)	-0.015***	
	(0.006)	
Macroeconomic Fundamentals		
Net foreign asset (NFA) position	0.036***	[1.00]
	(0.005)	
Output per worker	0.034***	[1.00]
	(0.013)	
Expected real GDP growth	-0.296***	[0.81]
	(0.108)	
Structural Fundamentals		
Old-age dependency ratio (OAD)	-0.096**	[0.88]
	(0.042)	
Population growth	-0.797**	[0.95]
	(0.364)	
Share of prime-aged savers	0.124**	[0.99]
	(0.056)	
Life expectancy	-0.004***	[1.00]
	(0.001)	
Life expectancy, interacted with OAD	0.013***	[0.99]
	(0.004)	
Institutional quality	-0.046**	[0.81]
	(0.020)	
Oil and natural gas reserves	0.304***	[1.00]
	(0.074)	
Policy Variables		
Fiscal policy	0.307***	[1.00]
	(0.077)	
Health spending	-0.298**	[1.00]
	(0.143)	
FXI, interacted with capital controls	0.631***	[0.92]
	(0.225)	
Credit gap	-0.096***	[1.00]
	(0.014)	
Observations	1,480	
Number of economies	52	
R-squared	0.525	
Root MSE	0.032	

Notes: * significant at 10%; ** significant at 5%; *** significant at 1% based on Driscoll-Kraay standard errors (in parentheses). “BMA” denotes Bayesian model averaging; “PIP” denotes posterior inclusion probability (in brackets).

Table 5. Previous EBA Current Account Models

	(1) 2013 Model	(2) 2015 Model	(3) 2018 Model	(4) 2018 Model (Updated Data)
Temporary and Cyclical Factors				
Output gap	-0.400***	-0.385***	-0.356***	-0.333***
Commodity terms of trade, interacted with trade openness	0.230***	0.197***	0.161***	0.316***
Macroeconomic Fundamentals				
Net foreign asset (NFA) position	0.016**	0.015**	0.023***	0.029***
NFA, interacted with high debt dummy	-0.012	-0.009	-0.006	0.011
Output per worker	0.007	0.033	0.023	0.030
Expected GDP growth	-0.471***	-0.425***	-0.302***	-0.299***
Reserve currency status (RCS)	-0.045***	-0.041***	-0.030***	-0.019
Financial center dummy	0.033***	0.027***		
Structural Fundamentals				
Old-age dependency ratio (OAD)	-0.03	-0.057	-0.069	-0.076*
Population growth	-0.629	-0.565	-0.692*	-0.795**
Aging speed[1]	0.156***			
Rel. dependency ratio, interacted with aging speed		0.130***		
Rel. aging speed, interacted with dependency ratio		0.088**		
Share of prime-aged savers			0.138**	0.154***
Life expectancy			-0.005***	-0.005***
Life expectancy, interacted with OAD			0.013***	0.013***
Institutional quality	-0.109***	-0.109***	-0.047**	-0.048**
Oil and gas reserves	0.615***	0.410***	0.310***	0.357***
Policy Variables				
Fiscal policy	0.324***	0.470***	0.329***	0.313***
Health spending	-0.551***	-0.503***	-0.399***	-0.287**
FXI, interacted with capital controls	0.346**	0.449**	0.754***	0.706***
Demeaned credit	-0.026***	-0.021***		
Credit gap			-0.104***	-0.095***
Output per worker, interacted with capital openness	0.065***	0.046**	0.041*	0.007
Global risk aversion, interacted with capital openness	0.068***	0.040**	0.020	0.014
Global risk aversion, interacted with capital openness and RCS	-0.136*	-0.093	0.002	-0.004
Observations	1,080	1,197	1,367	1,445
Number of economies	49	49	49	49
R-squared	-	-	0.550	0.522
Root MSE	0.033	0.032	0.031	0.032

Notes: * significant at 10%; ** significant at 5%; *** significant at 1% based on Driscoll-Kraay standard errors (not shown). R-squared not reported for 2013 and 2015 models. (1) Aging speed is defined as change in OAD, 20 years ahead.

Table 6. EBA Current Account Model Fit

	R-squared	Country FE	Lagged CA	Economies	Years
Refined model	0.53	No	No	52	1986-2019
Comparator IMF papers					
Cubeddu and others (2019)	0.55	No	No	49	1986-2016
Cubeddu and others (2019), updated data	0.52	No	No	49	1986-2019
Phillips and others (2013)	0.52	No	No	49	1986-2010
Lee and others (2008)	0.52	No	No	54	1973-2004
Lee and others (2008)	0.56	Yes	No	54	1973-2004
Lee and others (2008)	0.62	No	Yes	54	1973-2004
Comparator external papers					
Chinn and Ito (2022)	0.39	No	No	162	1972-2016
Coutinho, Turrini and Zeugner (2018) - EC	0.64	No	No	65	1987-2016
Coutinho, Turrini and Zeugner (2022)	0.62	No	No	65	1987-2018
Gagnon and Sarsenbayev (2021)	0.53	No	No	138	1986-2018
Gagnon and Sarsenbayev (2021)	0.70	Yes	No	138	1986-2018
Gruber and Kamin (2007)	0.36	No	No	59	1982-2003
Herman, Harris and Hall (2021) - GERAF	0.39	No	No	51	1986-2018

Table 7. Robustness Checks on NFA, Demographics

	(1) EBA CA Model	(2) NFA Decomposition	(3) Demographic Polynomials
Temporary and Cyclical Factors			
Output gap	-0.295***	-0.312***	-0.300***
Commodity terms of trade, interacted with trade openness	0.291***	0.296***	0.290***
REER annual log-change (lagged)	-0.015***	-0.014**	-0.015**
Macroeconomic Fundamentals			
Net foreign asset (NFA) position	0.036***		0.037***
Reserves		0.058***	
Net portfolio equity		0.027***	
Net FDI		0.058***	
Net external debt + derivatives		0.032***	
Output per worker	0.034***	0.025**	0.025**
Expected real GDP growth	-0.296***	-0.310***	-0.268**
Structural Fundamentals			
Old-age dependency ratio (OAD)	-0.096**	-0.080**	
Population growth	-0.797**	-0.651*	
Share of prime-aged savers	0.124**	0.124**	
1st order demographic polynomial			-0.074
2nd order demographic polynomial			0.015
3rd order demographic polynomial			-0.001
Life expectancy	-0.004***	-0.003**	-0.005***
Life expectancy, interacted with OAD	0.013***	0.010**	0.014***
Institutional quality	-0.046**	-0.037*	-0.050**
Oil and natural gas reserves	0.304***	0.323***	0.326***
Policy Variables			
Fiscal policy	0.307***	0.259***	0.315***
Health spending	-0.298**	-0.303**	-0.318**
FXI, interacted with capital controls	0.631***	0.599***	0.584***
Credit gap	-0.096***	-0.089***	-0.098***
Observations	1,480	1,473	1,480
Number of economies	52	52	52
R-squared	0.523	0.552	0.522
Root MSE	0.032	0.031	0.032

Note: * significant at 10%; ** significant at 5%; *** significant at 1% based on Driscoll-Kraay standard errors (not shown).

Table 8. Robustness Checks on Capital Mobility

	(1) EBA CA Model (FARI)	(2) Chinn-Ito	(3) Financial Openness	(4) Capital Mobility (% of BOP)	(5) Capital Mobility (% of GDP)
Temporary and Cyclical Factors					
Output gap	-0.297***	-0.301***	-0.309***	-0.299***	-0.308***
Commodity terms of trade, interacted with trade openness	0.291***	0.286***	0.300***	0.301***	0.298***
REER annual log-change (lagged)	-0.015***	-0.013**	-0.015***	-0.015***	-0.016***
Macroeconomic Fundamentals					
Net foreign asset (NFA) position	0.036***	0.036***	0.033***	0.032***	0.033***
Output per worker	0.034***	0.035***	0.038***	0.036***	0.036***
Expected real GDP growth	-0.296***	-0.264**	-0.316***	-0.304***	-0.319***
Structural fundamentals					
Old-age dependency ratio (OAD)	-0.096**	-0.090**	-0.108**	-0.109**	-0.109**
Population growth	-0.797**	-0.762**	-0.867**	-0.891**	-0.880**
Share of prime-aged savers	0.124**	0.125**	0.124**	0.127**	0.123**
Life expectancy	-0.004***	-0.004***	-0.005***	-0.005***	-0.005***
Life expectancy, interacted with OAD	0.013***	0.013***	0.015***	0.015***	0.014***
Institutional quality	-0.046**	-0.045**	-0.054***	-0.054***	-0.053**
Oil and natural gas reserves	0.304***	0.304***	0.290***	0.308***	0.300***
Policy variables					
Fiscal policy	0.307***	0.306***	0.306***	0.307***	0.307***
Health spending	-0.298**	-0.306**	-0.241	-0.213	-0.227
FXI, interacted with capital controls	0.631***	0.528***			
	[0.92]	[0.91]			
FXI, interacted with (1 - capital integration)			0.558***	0.626**	0.540**
			[0.50]	[0.48]	[0.32]
Credit gap	-0.096***	-0.097***	-0.088***	-0.092***	-0.091***
Observations	1,480	1,480	1,480	1,480	1,480
Number of countries	52	52	52	52	52
R-squared	0.525	0.523	0.481	0.486	0.481
Root MSE	0.032	0.032	0.033	0.033	0.033

Notes: *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent based on Driscoll-Kraay standard errors (not shown). Posterior inclusion probability (PIP) of alternative capital controls measures in brackets.

Table 9. Estimation Results: EBA REER Models

	(1) REER-Index		(2) REER-Level	
Temporary and Cyclical Factors				
Output gap	0.516**	[0.94]		
	(0.020)			
Commodity terms of trade (index)	0.160***	[1.00]		
	(0.000)			
Commodity ToT (log level interacted with trade open)			0.054	[0.67]
			(0.135)	
Macroeconomic Fundamentals				
Net foreign assets (NFA) position (lagged)	-0.105***	[1.00]	0.112***	[1.00]
	(0.000)		(0.000)	
Output per worker (log, lagged)	0.241***	[1.00]	0.247***	[1.00]
	(0.000)		(0.000)	
Expected real GDP growth 5 years ahead	3.112***	[1.00]	3.308***	[1.00]
	(0.000)		(0.007)	
Reserve currency status			-0.174**	[0.93]
			(0.019)	
Financial home bias (lagged)	0.258***	[1.00]		
	(0.000)			
Traded/Non-traded productivity (log, lagged)			0.180***	[1.00]
			(0.000)	
Structural Fundamentals				
Old-age dependency ratio (OAD)			0.894***	[1.00]
			(0.000)	
Population growth			9.081***	[1.00]
			(0.000)	
Institutional quality			0.587***	[1.00]
			(0.000)	
Trade openness (lagged)	-0.153	[0.99]	-0.400***	[1.00]
	(0.108)		(0.000)	
VAT revenue, % of GDP			1.209**	[1.00]
			(0.026)	
Policy Variables				
Real interest rates * capital account openness	0.875***	[0.97]	1.511***	[0.99]
	(0.003)		(0.006)	
Health spending (lagged)	1.886**	[1.00]	3.580***	[1.00]
	(0.012)		(0.000)	
Credit gap	0.099**	[0.93]		
	(0.012)			
Foreign exchange intervention (interacted with capital contro	-1.901*	[0.76]	-9.290***	[0.99]
	(0.068)		(0.000)	
Constant	4.447***		0.172***	
	(0.000)		(0.000)	
Observations	1,105		1,078	
Number of economies	41		40	
R-squared	0.557		0.8005	
Root MSE	0.0904		0.1937	

* significant at 10%; ** significant at 5%; *** significant at 1% based on Driscoll-Kraay standard errors (in parentheses). Posterior inclusion probability (PIP) in brackets.

Table 10. Estimation Results: EBA REER Models (Comparison with Previous Models)

	(1)	(2)	(3)	(4)	(5)	(6)
	REER-Index			REER-Level		
	2015 Model	2018 Model	2018 Model (Updated Data)	2015 Model	2018 Model	2018 Model (Updated Data)
Temporary and Cyclical Factors						
Output gap		0.392*	0.533***			
Commodity terms of trade (index)	0.092*	0.184***	0.182***			
Commodity terms of trade (log level, interacted with trade openness)				0.059***	0.064***	0.0257
Macroeconomic Fundamentals						
Net foreign assets (NFA) position (lagged)		-0.109***	-0.104***	0.105***	0.056***	0.0667***
Output per worker (lagged)	0.698***	0.217***	0.167***	0.164***	0.171***	0.284***
Expected real GDP growth 5 years ahead	1.858***	2.012***	2.834***	1.758*	1.961**	1.720**
Reserve currency status	0.036	-0.068	-0.035	-0.332***	-0.357***	-0.204***
Financial home bias (lagged)	0.370***	0.193***	0.223***			
Capital stock per employed person (lagged)	-0.493***			0.087***	0.110***	0.0153
Traded/Non-traded productivity (log, lagged)				0.225***	0.184***	0.116***
Structural Fundamentals						
Demographic block						
Old-age dependency ratio (OAD)				0.911***	0.362*	0.739***
Population growth	0.859	2.003	0.117	6.018***	2.570	3.475
Aging speed				0.631**		
Institutional quality				0.423***	0.653***	0.525***
Trade openness (lagged)	-0.305***	-0.208**	-0.159*	-0.314***	-0.336***	-0.328***
VAT revenue, % of GDP				1.195**	0.662	1.511***
Share of administered prices in CPI	-2.124***	-1.713***	-1.747***	-2.543***	-2.809***	-2.412***
Policy Variables						
Real interest rates * capital account openness	0.662***	0.697***	0.793***	0.889**	0.585*	1.721**
Health spending (lagged)	1.235	2.040**	2.046**	1.742**	4.196***	3.067***
Foreign exchange intervention (interacted with capital	-1.731***	-2.479*	-2.782**	-2.097*	-3.561*	-6.017***
Credit gap	0.133***	0.093*	0.090**	0.119***	0.032	-0.104
Capital Controls						
Global risk aversion (lagged, interacted with capital openness)	-0.260***	-0.164**	-0.056	-0.318**	-0.150	0.0839
Global risk aversion (lagged, interacted with capital openness and reserve currency)	0.838**	0.483	0.261	1.005*	0.829	0.398
South Africa Apartheid (pre-1994)	0.305***					
Constant	4.329***	4.482***	4.486***	0.189***	0.186***	0.186***
Observations	882	1,004	1,117	876	990	1,077
R-squared	0.606	0.548	0.530	0.905	0.895	0.877
RMSE	0.083	0.089	0.090	0.140	0.146	0.153
Number of Countries	40	40	40	39	39	39

* significant at 10%; ** significant at 5%; *** significant at 1% based on Driscoll-Kraay standard errors (not shown).

Table 11. Estimation Results: Exports and Imports Medium-Run Elasticities

	Full Sample	Excluding Outliers[1]
Exports	-0.152	-0.464
	(0.397)	(0.433)
Imports	0.645***	0.561***
	(0.184)	(0.118)
Sample Period	1980-2019	1980-2019
Countries	52	52

Notes: *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent based on robust standard errors (in parentheses). (1) Observations with Cook's distance greater than 4/N, where N is the sample size, are discarded.

Table 12. EBA Gaps Adjustment: Changes in CA Balances or Changes in the Norm?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Surplus Countries (CA Gaps > 0)			Deficit Countries (CA Gaps < 0)		
Variables	Change in EBA CA Gap	Change in Actual CA	Change in Cycl. Adj. CA	Change in EBA CA Norm	Change in EBA CA Norm	Change in NFA Contrib.	Change in Norm Excl. NFA	Change in EBA CA Norm	Change in NFA contrib.	Change in Norm Excl. NFA
EBA CA Gap (lagged)	-0.1358***	-0.1258***	-0.1098***	0.0212***	0.0255***	0.0135***	0.0106***	0.0086*	0.0128***	-0.0072
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.093)	(0.000)	(0.115)
Observations	1,331	1,331	1,331	1,331	750	750	750	581	581	581
R-squared	0.070	0.047	0.047	0.042	0.073	0.049	0.019	0.005	0.043	0.004
Number of economies	48	48	48	48	46	46	46	45	45	45
Rho	0.0445	0.0600	0.0269	0.140	0.136	0.502	0.114	0.0737	0.475	0.0288

Sources: IMF, External Balance Assessment estimates; and IMF staff calculations. Notes: *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent; p-values are in parentheses. CA = current account; Cycl. Adj. = cyclically adjusted; EBA = External Balance Assessment; NFA = net foreign assets. Regressions based on the whole period (P*s assumed constant); column (6) and (9) correspond to the change in EBA norm due to the contribution of the NFA variable, whereas column (7) and (10) correspond to the change in norm excluding the contribution of the NFA variable).

Table 13. EBA Gaps Adjustment: Contribution of Policy Gaps and Residuals

	(1)	(2)	(3)	(4)	(5)
	Change in	Change in	Change in Policy Gaps		
Variables	EBA CA Gap	EBA Residual	All	if Aligned	if Nonaligned
EBA CA Gap (lagged)	-0.1251***	-0.1110***	-0.0140	-0.0509***	0.1185***
	(0.000)	(0.000)	(0.110)	(0.000)	(0.000)
Observations	1,331	1,331	1,331	849	482
R-squared	0.064	0.049	0.002	0.030	0.087

Sources: IMF, External Balance Assessment estimates; and IMF staff calculations. Notes: *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent; p-values are in parentheses. CA = current account; EBA = External Balance Assessment. Regressions based on the whole period (P*s assumed constant); p-values are in parentheses; *** p < 0.01.

Table 14. EBA Gaps: REER Adjustment

Variables	(1) Change in REER	(2) Change in REER	(3) Change in REER Gaps Index	(4) Change in REER Gaps Level
EBA CA Gap (lagged)	0.170***	0.361***	0.364***	0.212
	(0.001)	(0.000)	(0.001)	(0.149)
Observations	1,331	336	275	193
R-squared	0.008	0.04	0.04	0.01

Sources: IMF, External Balance Assessment estimates; and IMF staff calculations. Notes: *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent; p-values are in parentheses. CA = current account; EBA = External Balance Assessment; REER Real Effective Exchange Rate. Regression in col (1) based on the whole period (P*s assumed constant); Regressions in col(2)-(4) based on the 2012-2019 sample.

Annex I. Measuring Commodity Long-Term Prices

A. Construction of the Commodity Terms-of-Trade Gap

Frequency of filtering. Numerous studies report that commodity price fluctuations follow “commodity supercycles” that are longer than standard business cycles (see for example, Erten and Ocampo 2013; Jacks 2013; Stuermer 2018 and Jacks and Stuermer 2020). To incorporate these findings in the EBA model, the commodity terms-of-trade gap is constructed using band-pass filters (as discussed below) instead of the Hodrick-Prescott (HP) filter with smoothing parameter of λ=100 that is typically used for business cycle analysis at annual frequencies.

Sequencing of the variable construction. Construction of the terms-of-trade gap proceeds as follows: (i) applying filtering techniques to individual commodity price series to obtain corresponding gaps (an oil price gap, a copper price gap, and so on); and (ii) aggregating all commodity price gaps, using country-specific trade weights, to build country-specific terms-of-trade gaps. Proceeding this way brings benefits in terms of transparency, as the contributions of each commodity price gap to a country’s overall commodity terms-of-trade gap can be readily calculated.

Sample. Price gaps are calculated for a sample of 42 individual commodity price series, as in Cubeddu and others (2019). Since long annual time series are needed to estimate “super-cycles”, data from the Fund (available since 1980) are extended backwards (up to 1850) using the following external datasets:

- World Bank Commodity Price Data (The Pink Sheet): annual prices, 1960 to present, nominal US dollars.
- Pfaffenzeller and others (2007): annual prices, 1900 to 2003, nominal US dollars.
- Jacks (2013), updated dataset: annual real prices, 1850 to 2015, converted to nominal US dollars using US official CPI.
- Schwerhoff and Stuermer (2015), updated dataset: annual prices, 1700 to 2018, nominal US dollars.

Estimation. The log of the price of commodity *k* at time *t* can be decomposed as follows:

$$lnP_{k,t} = LTT_{k,t} + CSC20\_70_{k,t} + STF_{k,t}$$

where $LTT_{k,t}$ denotes the long-term trend; $CSC20\_70_{k,t}$ denotes the commodity super-cycle (defined as fluctuations in frequencies in the 20-70 years range, following Jacks, 2013); and $STF_{k,t}$ denotes short-term fluctuations.

The decomposition proceeds in two steps: (i) isolating the commodity super-cycle component $CSC20\_70_{k,t}$, using the Christiano-Fitzgerald band-pass filter; and (ii) applying the Butterworth high-pass filter (with parameter 40) to the residual, to distinguish the long-term trend $LTT_{k,t}$ from the short-term fluctuations $STF_{k,t}$.

The commodity price gap associated to commodity *k* is then defined as:

$$gap_{k,t} = CSC20\_70_{k,t} + STF_{k,t} = lnP_{k,t} - LTT_{k,t}$$

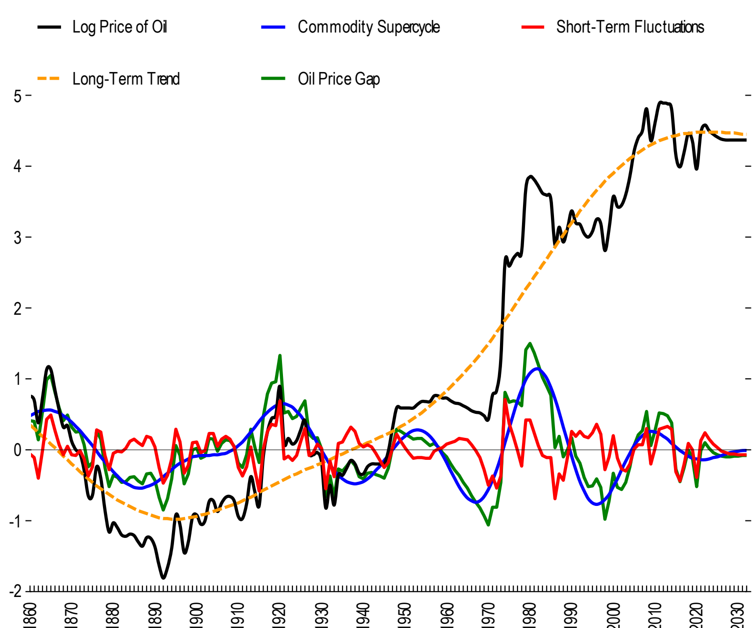
and commodity price gaps are aggregated using country-specific Comtrade weights to construct country-specific commodity terms-of-trade gaps, defined as:

$$commoToT\,gap_{i,t} = \sum_{k} (\omega_{k,i,t}^{Comtrade,X} - \omega_{k,i,t}^{Comtrade,M}) \times gap_{k,t}$$

Finally, the analysis multiplies the country-specific commodity terms-of-trade gap by the openness ratio.

Results. Annex Figure 1 below illustrates the approach in the case of oil prices. Prices in log (black line) are decomposed into (i) a long-term trend (orange, dashed line); (ii) a commodity supercycle (blue line); and (iii) short-term fluctuations (red line). The oil price gap (green line) is defined as the sum of short-term fluctuations and the commodity supercycle.

Annex Figure 1. Oil Price Decomposition and Price Gap



Sources: IMF Primary Commodity Price System, World Bank Commodity Price Data ("Pink Sheet"), Jacks (2013), Minneapolis Fed, and IMF staff estimates. Notes: Historical series extended between 2021 and 2027 using WEO forecasts, and beyond 2027 (up to 2032) using a no-change assumption.

B. Construction of the Oil and Natural Gas Reserves Variable

The oil and gas reserves variable is included in the EBA CA model to capture the effects of income from these exhaustible resources. Given the "temporariness" of the resource endowment of oil and gas, it is central for the decision by net exporters of how much to save for future generations.

The variable is defined as an interaction of each commodity's net external balance with a measure of its temporariness, given by the ratio of current oil/gas extraction to proven reserves.[45] The revised construction process of the commodity terms-of-trade gap can be further leveraged to construct the oil and gas reserves variable. By using the corresponding price series and gaps, it is possible to:

1. *Neutralize short- and medium-term price fluctuations in net exports of oil and gas*. Oil and gas price gaps (calculated when constructing the commodity terms-of-trade gaps) are used to correct net oil and gas exports series so that they are valued at their long-term prices (the prices consistent with a zero-price gap).

2. *Adapt the measure of net exports of oil and gas*. The net external balance of oil and gas can be affected by both price and volume fluctuations. As short- and medium-term price fluctuations are already neutralized by using the long-term estimated price, a 3-year moving average was found to be enough to smooth the remaining short-term fluctuations in trade volumes.

Specifically, the oil and gas reserves variable is defined as:

$$Oil\&Gas_{i,t} = \sum_{k\epsilon\{oil,gas\}} \left(\frac{1}{3} \sum_{s=t-3}^{t-1} \frac{X_{k,i,s}}{Y_{i,s}} \times \frac{P_{k,s}^{tren}}{P_{k,s}} \right) \frac{temp_{k,i,t}}{temp_{oil,NOR,2010}}$$

where $X_{k,i,s}$ denotes nominal oil and gas net exports (if positive; zero otherwise) and $Y_{i,s}$ denotes nominal GDP. The nominal external balances of oil and gas are assessed as if oil and gas prices were at their long-term trend level (i.e., they are multiplied by the corrective factor $\frac{P_{k,s}^{trend}}{P_{k,s}} = exp(-gap_{k,s})$). This helps to insulate the oil and gas reserves variable from short and medium-term price fluctuations, thus enhancing its structural nature and contributing to norm stability. $\frac{temp_{k,i,t}}{temp_{oil,NOR,2010}}$ denotes a measure of resource temporariness, calculated with the ratio of current oil/gas extraction to proven reserves (the inverse of "years-till-exhaustion"), both in volume terms, relative to the value of this ratio for Norway in 2010.

[45] In light of ongoing discussions about decarbonization amid the climate transition, how much of the proven reserves will effectively be extracted remains unclear. If "effective" proven reserves were to be lower than currently thought, then the degree of "temporariness" of the resources would increase, and oil/gas net exporters' CA norms would increase, all else equal. Such considerations are left for future research.

Annex II. Benchmarks for Policy Variables (P*)

The estimation of current account norms requires specifying normative policy benchmarks (P*) for the appropriate levels (that is, the levels deemed desirable in the medium term by staff) of each policy variable. It is important to note that P* settings for fiscal policy, health spending and the credit gap are not aimed at targeting a specific level of the current account, but instead are aimed at meeting medium-term domestic objectives. The different policy benchmarks are guided by the following considerations:

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 in such cases where cyclical considerations may be important.

Public health spending. 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. However, staff can choose actual spending levels, if deemed appropriate, or a different desired public health spending level to the extent that a clear justification is provided.

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 (0.29 in 2019, out of a potential 0 to 1 range), or a country's actual level, whichever is smaller.

Foreign exchange intervention. Over the medium-term, FXI 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 if they reflect the necessary, temporary, build-up of reserves to reach an adequate level of reserves over the medium-term.

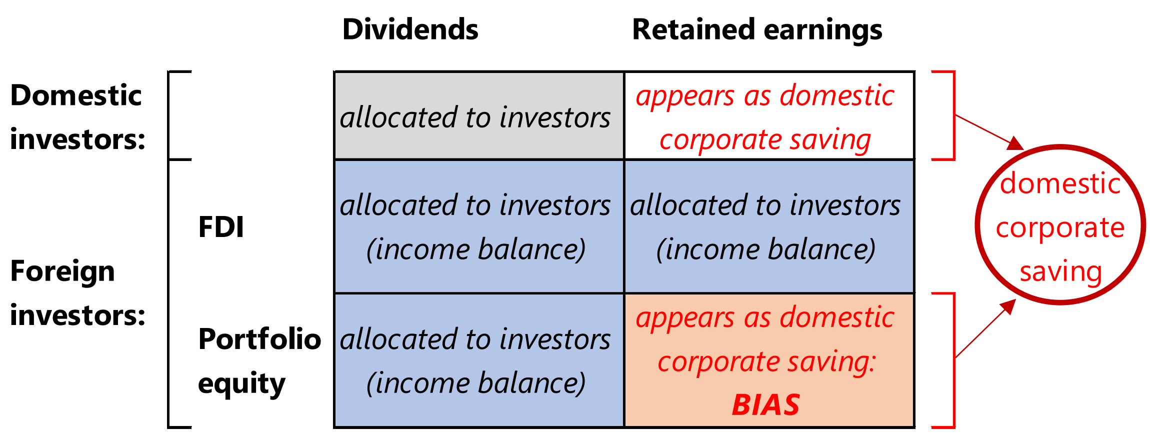
Credit gap. Credit gaps are estimated directly and hence the P* of this policy variable (the desirable credit gap over the medium term) should be zero in most cases. However, adjustments can be considered if the credit gap estimate does not provide an accurate picture of financial imbalances. This might 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).

Annex III. Measurement Biases

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. In particular, the statistical treatment of investment income (in nominal and transaction-based terms, following the BPM6 international standard) departs from the relevant economic concept (accumulation of real net external wealth on an ultimate owner basis), thereby biasing key external accounts statistics such as the current account balance in two ways:

- *Inflation bias*. Investment income is recorded in nominal terms. However, for debt instruments, nominal interest income also compensates for the expected erosion of the real value of the principal through inflation. The latter leads to systematic bias in NIIP valuation changes.
- *Portfolio equity retained earnings bias*. While for direct investment equity (FDI), both dividends and retained earnings are recorded in the income balance, for portfolio equity only dividends are recorded (see Annex Figure 2). Retained earnings on portfolio equity (although income from an economic perspective) are reflected in NIIP valuation changes only.

Annex Figure 2. Allocation of Corporate Profits in the National Accounts



The previous EBA methodology (Cubeddu and others, 2019) introduced a complementary tool to adjust for the two above-mentioned measurement biases outside of the main EBA current account model. Measurement estimates were derived following Adler and others (2019), including (i) two different approaches to assess the inflation bias (realized inflation, forecasted inflation); and (ii) three different approaches to assess the portfolio equity retained earnings bias (stock, flow, hybrid). The 2022 refinements left the inflation bias estimation methodology unchanged, and focused on improving portfolio equity retained earnings bias estimates. More precisely:

1. While the stock and flow method were kept, the *hybrid* method was discontinued, as it does not bring any new information and can introduce a bias when stock and flow data were not fully consistent. Denoting by $RE(m)$ the portfolio equity retained earnings bias on the liability side according to method m, dy the dividend yield ratio and pe the price-earnings ratio in the domestic

economy, DIV the dividends paid on portfolio equity liabilities, and L the stock of portfolio equity liabilities:

$$RE(flow) = \left(\frac{1}{dy \times pe} - 1\right) \times DIV = \frac{RE_{dom}}{DIV_{dom}} \times DIV$$

$$RE(stock) = \left(\frac{1}{pe} - dy\right) \times L = \frac{RE_{dom}}{n \times p} \times L$$

$$RE(hybrid) = \frac{L}{pe} - DIV = \frac{RE_{dom}}{n \times p} \times L + \left(\frac{L}{n \times p} . DIV_{dom} - DIV\right)$$

where p and n are, respectively, the price and number of equities, and DIV_{dom} and RE_{dom} the dividends and retained earnings derived from domestic financial market data.[46] The first two approaches assume some proportionality (based either on flow or stock data) between the retained earnings bias and retained earnings computed domestically based on financial market data. In contrast, the hybrid approach is more difficult to interpret, as it mixes flow and stock data (already used in the previous approaches). It can also generate a bias if stock and flow data are not fully consistent (cf. parenthesis term in the third equation above).

2. A new *corporate saving* method was introduced, combining national accounts and foreign portfolio holdings data (Allen and Rebillard, forthcoming). The existing *flow* and *stock* approaches use financial market data and implicitly assume that firms with foreign shareholders have the same payout ratios as domestic listed companies. Conversely, the *corporate saving* approach uses national account data and implicitly assumes similar average saving behavior across firms with different foreign ownership ratios. Specifically, the *corporate saving* approach uses foreign portfolio holdings data to reapportion the share of domestic corporate saving, net of depreciation, that should be attributed to foreign portfolio investors instead of domestic investors (see orange cell in Annex Figure 2). In practice, country *i*'s portfolio equity retained earnings bias (on the liability side) is computed as:

$$RE_i^L = S_i \times \left(\frac{for_i \times peq_i}{(for_i \times peq_i) + (1 - for_i)}\right),$$

where S_i denotes corporate saving (net of depreciation), for_i denotes the foreign ownership rate (percentage owned by both FDI and foreign portfolio equity investors in overall equity liabilities of the corporate sector), and peq_i denotes the share of portfolio equity investors among foreign investors (FDI and portfolio equity).[47] The asset side is calculated as a CPIS-weighted sum of partner countries' portfolio equity retained earnings on the liability side, with the net balance obtained as $RE_i^{net} = RE_i^A - RE_i^L$.

Generally, the estimates based on the new *corporate saving* approach are broadly in line with other existing estimates (*stock*, *flow*), but they can differ in countries where the level of retained earnings of

[46] Concretely, DIV_{dom} and RE_{dom} are defined by:

$$dy \equiv \frac{DIV_{dom}}{n \times p} \quad \text{and} \quad pe \equiv \frac{n \times p}{(DIV_{dom} + RE_{dom})}$$

[47] In turn, for_i and peq_i are calculated in the following manner: (i) portfolio equity liabilities (excluding investment funds) plus FDI equity liabilities, as a share of outstanding equity liabilities of the domestic corporate sector; and (ii) portfolio equity liabilities (excluding investment funds) as a share of foreign portfolio equity liabilities (excluding investment funds) plus FDI equity liabilities.

listed firms deviates considerably from that of the overall domestic corporate sector. As the three approaches are complementary, adjustors to the EBA model results to account for the portfolio equity retained earnings bias are designed as the average of the three approaches. In some cases, more granular data (e.g. distinguishing between multinational companies, large firms, and SMEs) can be used to refine the corporate saving approach estimate.

Annex IV. Pension Systems and Current Accounts

This Annex explores the relation between pension system parameters and CA balances. The analysis assesses how pension system replacement and coverage rates—which indicate the share of worker's salaries that the system replaces on retirement and the share of the population covered, respectively—relate to the part of CA balances not already explained by the refined EBA CA model. Since the necessary pension data are not available for the full EBA sample of 52 economies during 1986-2019, the analysis focuses on a subsample for which the data are available.

The relationship between pension system features and the CA is not straightforward from a theoretical standpoint. A pension system's generosity, its system of financing, whether participation is mandatory or voluntary, and the share of the population that it covers can theoretically affect private saving, national saving, and the CA balance. In an economy with myopic households or liquidity constraints, moving from a voluntary approach to a mandatory system can result in higher national saving and a rise in the CA balance. More generous pension system parameters, in terms of coverage and replacement rates, should in principle amplify these effects. In addition, mandatory systems with a fully funded (FF) financing scheme, where workers accumulate funds for their retirement in accounts, may raise the CA balance by more than pay-as-you-go (PAYG) schemes, which are based on intergenerational budgetary transfers.[48] As with other CA drivers, the overall outcome for the CA balance depends on how the pension system parameters compare with those in the rest of the world.

International evidence of these effects on CA balances is limited, in part reflecting gaps in comparable data on pension systems across economies and over time. A recent paper by the Swiss National Bank staff (Koomen and Wicht 2022; KW henceforth) collects data on mandatory pensions system replacement rates, as well as coverage rates, for 49 economies over 30 years (1986-2016). The authors find that mandatory FF systems' replacement rates come with higher CA balances, and more so in economies with higher coverage rates, but that the replacement rates of PAYG systems are unrelated to CA balances.

A. Data and Related Caveats

The analysis starts by using the KW dataset on mandatory pension indicators which are available for 49 economies (all in the EBA sample) during 1986-2016. KW include in their dataset mandatory FF and PAYG replacement rates based on the estimates of Bloom and others (2007) who use information found in the biennial US Social Security Administration (SSA) reports, Social Security Programs Throughout the World Surveys. KW fill observations missing in Bloom and others (2007) based on the nearest available year, and use the SSA reports to fill missing observations for countries for which data are not available. KW only consider mandatory systems.

To extend the analysis to consider both mandatory and voluntary systems, and to facilitate updating the related data over time, the analysis also uses a second data source: the replacement rates for voluntary

[48] For a discussion of theoretical channels through which economies with similar demographic trends can have different saving behavior due to different pension systems, see Amaglobeli and others (2019).

and mandatory pension schemes published in the Organisation for Economic Co-operation and Development (OECD) Pensions at a Glance biennial reports. The OECD reports present tables with mandatory and voluntary replacement rates computed for 51 OECD and G20 economies (not all of which are in the EBA sample) spanning 2005-2021. The tables report the OECD staff estimates of total mandatory and voluntary pension replacement rates (gross pension entitlement divided by gross pre-retirement earnings) for different levels of worker earnings. The present analysis uses the OECD staff estimates for full-career average income-earning workers.

To obtain a measure of *coverage* rates that is comparable across economies and over time, the analysis follows the approach of KW and uses a proxy based on the self-employment share. As KW explain, measures of the pension coverage rate over time are not widely available but the self-employed are more likely to be excluded from pensions systems than employees are. On this basis, the authors propose a proxy for the coverage rate defined as 1 minus the share of workers that are self-employed, annual data for which are available from the International Labour Organization (ILO) via the World Bank *World Development Indicators* (WDI) database.

B. Estimation Results

The analysis estimates the relation between the aforementioned pension indicators and the residuals from the latest (refined) EBA CA model for economies for which the pension indicators are available. Using the fitted values from this relation provides an estimate of the contribution of the pension system parameters to explaining CA balances. Annex Table 4.1 reports the estimated relation between the residuals of the refined EBA CA balance equation and the pension system parameters. The variables enter the equation in demeaned form—in deviation from the GDP-weighted sample average.[49] Following KW, the specifications include the replacement and coverage rates as explanatory variables, as well as interactions between them. The *R*-squared statistics indicate that the pension variables explain between 1.7 and 8.6 percent of the variation of EBA CA model residuals. This result represents a noticeable improvement in fit, considering that the baseline EBA CA equation has an *R*-squared of about 52 percent. The proportion explained is larger for the subsample of 36 EBA economies for which the OECD replacement rates are available (columns 3-6) than for the 49 EBA economies for which the indicators of KW are available (columns 1-2).

The estimated relation with CA balances is stronger for mandatory FF replacement rates than for PAYG rates, as expected (columns 1 and 2). The relation with FF rates is especially strong for economies with larger coverage rates. These results are broadly consistent with those of KW. To gauge the economic significance of the results, consider that, based on column 2, a 10-percentage point rise in the mandatory FF replacement rate is associated with a 0.41 percentage point of GDP rise in the CA balance (0.1 × 4.08) at the sample average coverage rate. When the coverage rate is one standard deviation higher (by

[49] A potential concern is that the pension system variables may be correlated with other variables included in the EBA CA model, which could contaminate the associated estimates. However, robustness analysis suggests that this concern is not warranted: re-estimating the latest EBA CA equation while adding the pension system indicators (for the subset of economies for which these are available) yields very similar coefficient that are economically and statistically indistinguishable from those reported in Table 4.

18 percentage points) a 10-percentage point rise in the FF replacement rate is associated with a 0.57 percentage point of GDP rise in the CA balance.

The results based on OECD *Pensions at a Glance* mandatory and voluntary replacement rates confirm the strong relation between mandatory replacement rates and CA balances, especially at high levels of coverage rates (columns 3-4). The estimated relation between voluntary replacement rates and CA balances is, as expected, relatively weak with estimated coefficients that are statistically indistinguishable from zero. Finally, the OECD mandatory *private* replacement rates have a stronger estimated relation with the CA than do mandatory *public* replacement rates, especially at higher rates of pension coverage (columns 5-6). Since mandatory private replacement rates are often FF, this stronger estimated relation is consistent with the results based on the KW dataset which indicate a stronger relation for mandatory FF replacement rates. By the same token, since mandatory public replacement rates are often PAYG, their weaker estimated relation with the CA is consistent with the results based on the KW dataset which indicates a weaker relation for PAYG replacement rates.

C. Contribution to CA Balances

The estimation results in Online Annex Table 4.1 can be used to estimated CA contributions from pension variables to CA balances. There are considerable uncertainties associated with the different estimates, which in part reflect the fact that the aforementioned replacement rates are estimates of *theoretical* future rates. The replacement rates can differ significantly depending on the assumptions used to construct them. Overall, while directly using the results reported here to quantify formal adjustors to normative EBA CA benchmarks is not warranted, the results can aid in the interpretation of EBA CA model residuals and the formulation of policy advice.

Annex Table 1. EBA CA Model Residuals and Pension System Parameters

	Source of replacement rate data					
	KW dataset		OECD dataset			
Variable	(1)	(2)	(3)	(4)	(5)	(6)
PAYG replacement rate #	0.956	1.145				
	(0.675)	(0.769)				
Mandatory FF replacement rate #	3.083***	4.087***				
	(0.895)	(1.006)				
Coverage rate #	2.397**	-1.611	5.080***	-2.139	4.812***	-1.988
	(1.027)	(2.171)	(1.559)	(3.824)	(1.510)	(3.779)
PAYG replacement rate x Coverage rate #		4.892				
		(3.278)				
Mandatory FF replacement rate x Coverage rate #		9.354***				
		(2.573)				
Mandatory replacement rate #			3.026**	3.818***		
			(1.266)	(1.359)		
Voluntary replacement rate #			-5.009*	-1.072	-4.437	-1.716
			(2.911)	(3.819)	(2.749)	(3.754)
Mandatory replacement rate x Coverage rate #				15.428***		
				(5.927)		
Voluntary replacement rate x Coverage rate #				-41.486		-35.698
				(26.265)		(25.958)
Mandatory public replacement rate #					2.590**	1.936
					(1.150)	(1.338)
Mandatory private replacement rate #					7.083***	3.762*
					(1.735)	(1.938)
Mandatory public replacement rate x Coverage rate #						9.689*
						(5.255)
Mandatory private replacement rate x Coverage rate #						51.287***
						(11.305)
Constant	0.068	0.067	-0.477	0.098	-0.715**	-0.212
	(0.208)	(0.205)	(0.384)	(0.521)	(0.358)	(0.521)
Observations	1,254	1,254	484	484	475	475
R-squared	0.017	0.025	0.044	0.062	0.072	0.086
Number of economies	49	49	36	36	36	36

Notes: # denotes deviations from world GDP-weighted average. Sample is 1986-2019. Pension variables for missing years imputed based on nearest year available. Heteroskedasticity and autocorrelation robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Annex V. Measuring the Effects of Structural Policies

The stringency of regulations in labor and product markets, as well as reforms aimed at easing them, can have an impact on saving, investment, and the CA balance. Several studies have confirmed this relationship both from the theoretical and empirical point of view (for example, Cacciatore and Fiori' 2016; Duval and others, 2022). While introducing product and labor market regulation indicators in the EBA CA model is precluded by data limitations, an analysis of the relation between the EBA CA model residuals and indicators of regulatory stringency for a subset of economies with the necessary data can inform policy discussions on the role of structural reforms.

The equation estimated is as follows:

$$\hat{\mu}_{jt} = \alpha + S_{jt}\gamma + \varepsilon_{jt}$$

where $\hat{\mu}$ denotes the estimated EBA CA residual for country j in year t, and S_{jt} is a vector of variables measuring regulatory stringency, expressed as deviations from their-GDP weighted world average. The analysis considers indicators on product and labor market regulations produced by the OECD staff.[50] Specifically, these include the OECD overall indicator for product market reforms, a product market regulation sub-indicator capturing "legal barriers to entry", and an aggregated indicator of labor market regulations that combines sub-indicators on severance pay at different tenures (9 months, 4 years, and 20 years) and strictness of regulation on the use of fixed-term contracts (valid cases for fixed-term contracts, and maximum numbers of fixed-term contracts).[51]

Annex Table 5.1 sumarizes the findings on the extent to which the EBA CA residuals relate to indicators of labor and product market regulations. The results show that the CA relation with the OECD overall indicator for product market reforms has the opposite sign from what could be expected based on theory and is also not statistically significant (column 1). However, the sub-indicator capturing "legal barriers to entry" is found to have the expected positive relation with CA balances: deregulation along this dimension (lower barriers) is associated with lower CA balances, although the relationship is not statistically significant at conventional levels (column 2). The combined indicator of labor market regulations has a negative relation with the CA balance. Overall, these suggest that, while several structural indicators are not strongly associated with CA balances, some product market reforms, notably reducing barriers to entry, are associated with a lower CA balance. Moreover, an easing of some labor market regulations is associated with a higher CA balance. The results presented in column 2 are those of the preferred specification.

[50] The latest dataset used here covers Product Market Regulation (PMR) and Employment Protection Legislation (EPL) for years spanning 1998 to 2018 for 22 AEs. The indicators run from 0 to 6, with 6 being most heavily regulated. For the purposes of the current analysis, data for missing observations are imputed using the nearest available year.

[51] The rationale for using the combined labor market indicator is twofold: first, it summarizes the impact of regulation both in terms of cost (the severance pay) and restrictions (the use of fixed-term contracts); and second, it was found to explain well the EBA residuals in previous studies (including Cubeddu and others, 2019). However, it is important to acknowledge that some aspects of labor market regulation such as minimum wage legislation, collective bargaining, universal income, and the labor tax wedge are not captured by it.

Overall, while using the results to quantify formal adjustors to normative EBA CA benchmarks is not currently warranted, the results can aid in the interpretation of EBA CA model residuals and the formulation of policy advice. Ultimately, however, the impact of structural reforms on the CA will be highly country-specific and will depend on the mix of reforms implemented. Depending on the type of reform, the persistence of the effect on the CA may also vary. This calls for granular policy recommendations regarding structural reforms based on country-specific circumstances, within the overall package of recommended policies.

Annex Table 2. EBA CA Model Residuals and OECD Product and Labor Market Rigidities

	(1)	(2)
Product market regulation	-0.018	
	(0.9838)	
Legal barriers to entry		0.773
		(0.6128)
Labor market regulation	-0.408	-0.722**
	(0.2803)	(0.2958)
Observations	484	352
Number of economies	22	22
R-squared	0.003	0.011

Notes: Dependent variable is the EBA CA model residual in percentage points of GDP. * significant at 10%; ** significant at 5%; *** significant at 1%.

References

Abiad, Abdul, Prakash Kannan, and Jungjin Lee, 2009, “Evaluating Historical CGER Assessments: How Well Have They Predicted Subsequent Exchange Rate Movements?” IMF Working Paper 9/32 (Washington: International Monetary Fund).

Adler, Gustavo, Noemie Lisack, and Rui Mano, 2015, "Unveiling the Effects of Foreign Exchange Intervention; A Panel Approach," IMF Working Paper 15/130 (Washington: International Monetary Fund).

Adler, Gustavo, Daniel Garcia-Macia and Signe Krogstrup, 2019, “The Measurement of External Accounts,” IMF Working Paper 19/132 (Washington: International Monetary Fund).

Allen, Cian, and Cyril Rebillard, 2022, “Retained Earnings and the Current Account,” IMF Working Paper (unpublished; Washington: International Monetary Fund).

Aloy, Marcel, and Karine Gente, 2009, “The Role of Demography in the Long-Run Yen/USD Real Exchange Rate Appreciation,” *Journal of Macroeconomics*, Vol. 31, No. 4, pp. 654–67.

Amaglobeli, David, Hua Chai, Era Dabla-Norris, Kamil Dybczak, Mauricio Soto, and Alexander Tieman, 2019, “The Future of Saving: The Role of Pension System Design in an Aging World,” IMF Staff Discussion Note 19/01 (Washington: International Monetary Fund).

Baba, Chikako, Ricardo Cervantes, Salim M. Darbar, Annamaria Kokenyne, and Viktoriya V. Zotova, 2022, “New Measures of Capital Flow Restrictions—AREAER Indices” (unpublished; Washington: International Monetary Fund).

Baba, Chikako, Salvatore Dell'Erba, Enrica Detragiache, Olamide Harrison, Aiko Mineshima, Anvar Musayev, and Asghar Shahmoradi, 2020, "How Should Credit Gaps Be Measured? An Application to European Countries," IMF Working Papers 2020/006 (Washington: International Monetary Fund).

Bayoumi, Tamim, Joseph Gagnon, and Christian Saborowski, 2015, “Official Financial Flows, Capital Mobility, and Global Imbalances,” *Journal of International Money and Finance*, Vol. 52, Issue C, pp. 146–74.

Behar, Alberto, and Ramin Hassan, 2022, “The Current Account Income Balance: External Adjustment Channel or Vulnerability Amplifier?,” IMF Working Papers 2022/106 (Washington: International Monetary Fund).

Bergstrand, Jeffrey H., 1991, “Structural Determinants of Real Exchange Rates and National Price Levels: Some Empirical Evidence,” *American Economic Review*, Vol. 81, No. 1, pp. 325–34.

Blanchard, Olivier J., and Mitali Das, 2017, "A New Index of Debt Sustainability," NBER Working Paper No. 24068 (Cambridge, Massachusetts: National Bureau of Economic Research).

Bloom, David E., David Canning, Richard K. Mansfield, and Michael Moore, 2007, "Demographic Change, Social Security Systems, and Savings," *Journal of Monetary Economics*, Vol. 54 (1), pp. 92–114.

Bussière, Matthieu, Marcel Fratzscher, and Gernot Müller, 2010, Productivity Shocks, Budget Deficits and the Current Account, *Journal of International Money and Finance*, Vol. 29, No. 8, pp. 1562–79.

Cacciatore, Matteo, and Giuseppe Fiori, 2016, "The Macroeconomic Effects of Goods and Labor Market Deregulation," *Review of Economic Dynamics*, Vol. 20, pp. 1–24.

Cashin, Paul, Luis F. Céspedes, and Ratna Sahay, 2004, "Commodity Currencies and The Real Exchange Rate," *Journal of Development Economics*, Vol. 75, pp. 239–68.

Catão, Luis A.V., and Gian Maria Milesi-Ferretti, 2014, "External Liabilities and Crises," *Journal of International Economics*, Vol. 94, pp. 18–32.

Ca'Zorzi, Michele, Alexander Chudik, and Alistair Dieppe, 2012, "Thousands of models, one story: Current account imbalances in the global economy," *Journal of International Money and Finance*, Vol. 31 (6),

Chinn, Menzie, and Eswar Prasad, 2003, "Medium-Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration", *Journal of International Economics*, Vol. 59, No. 1, pp. 47–76.

Chinn, Menzie D. and Hiro Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," *Journal of Development Economics*, Vol. 81(1), pp. 163–92.

_____, 2007, "Current Account Balances, Financial Development and Institutions: Assaying the World 'Saving Glut'," *Journal of International Money and Finance*, Vol. 26, No. 4, pp. 546–69.

_____, 2022, "A Requiem for "Blame It on Beijing": Interpreting Rotating Global Current Account Surpluses," *Journal of International Money and Finance*, Vol. 121, https://doi.org/10.1016/j.jimonfin.2021.102510.

Christiansen, Lone, Alessandro Prati, Luca A. Ricci, and Thierry Tressel, 2010, "External Balance in Low Income Countries," *NBER International Seminar on Macroeconomics*, Vol. 6, No. 1, pp. 265–322 (University of Chicago Press).

Colacelli, Mariana, Deepali Gautam, and Cyril Rebillard, 2021, "Japan's Foreign Assets and Liabilities: Implications for the External Accounts," IMF Working Paper 21/26 (Washington: International Monetary Fund).

Cook, R. Dennis, 1977, "Detection of Influential Observations in Linear Regression," *Technometrics* (American Statistical Association).

Coutinho, Leonor, Alessandro Turrini, and Stefan Zeugner, 2018, "Methodologies for the Assessment of Current Account Benchmarks," Discussion Paper 086 (European Commission).

_____, 2022, "Assessing the Euro Area Current Account," *Journal of International Money and Finance*, Vol. 121, https://doi.org/10.1016/j.jimonfin.2021.102512.

Cubeddu, Luis, Signe Krogstrup, Gustavo Adler, Pau Rabanal, Mai Chi Dao, Swarnali Ahmed Hannan, Luciana Juvenal, and others, 2019, "The External Balance Assessment Methodology: 2018 Update." IMF Working Paper 19/65 (Washington: International Monetary Fund).

Dao, Mai Chi, and Callum Jones, 2018, "Demographics, Old-Age Transfers and the Current Account," IMF Working Paper No. 18/264 (Washington: International Monetary Fund).

Daude, Christian, Eduardo Levy Yeyati, and Arne Nagengast, 2016, "On the Effectiveness of Exchange Rate Interventions in Emerging Markets," *Journal of International Money and Finance*, Vol. 64, pp. 239–61.

Dell'Ariccia, Giovanni, Deniz Igan, Luc Laeven, Hui Tong, Bas Bakker, and Jérôme Vandenbussche, 2012, "Policies for Macrofinancial Stability: How to Deal with Credit Booms," IMF Staff Discussion Note No. 12/06 (Washington: International Monetary Fund).

Duval, Romain, Davide Furceri, and João Jalles, 2022, "Labor and Product Market Reforms and External Imbalances: Evidence from Advanced Economies," *Journal of International Money and Finance*, Vol. 121, https://doi.org/10.1016/j.jimonfin.2021.102513.

Eggertsson, Gauti B., Neil R. Mehrotra, and Jacob A. Robbins, 2017, "A Quantitative Model of Secular Stagnation," NBER Working Paper No. 23093 (Cambridge, Massachusetts: National Bureau of Economic Research).

Erten, Bilge, and José A. Ocampo, 2013, "Super Cycles of Commodity Prices Since the Mid-Nineteenth Century," *World Development*, Vol. 44, pp. 14–30.

Fair, Ray, and Kathryn Dominguez, 1991, "Effects of the Changing U.S. Age Distribution on Macroeconomic Equations," *American Economic Review*, Vol. 81, Issue 5, pp. 1276–94.

Gagnon, Joseph E., 2017, "Do Governments Drive Global Trade Imbalances?" PIIE Working Paper 17–15 Peterson Institute for International Economics (Washington, DC).

Gagnon, Joseph E., and Madi Sarsenbayev, 2021, "Fiscal and Exchange Rate Policies Drive Trade Imbalances: New Estimates," PIIE Working Paper 21–4, Peterson Institute for International Economics (Washington, DC).

Gourinchas, Pierre-Olivier, Rodrigo Valdés, and Oscar Landerretche, 2001, "Lending Booms: Latin America and the World, NBER Working Paper No. 8249 (Cambridge, Massachusetts: National Bureau of Economic Research).

Gruber, Joseph W., and Steven B. Kamin, 2007, "Explaining the Global Pattern of Current Account Imbalances," *Journal of International Money and Finance*, Vol. 26, No. 4, pp. 500–22.

Herman, Alexander, Max Harris, and Daniel Hall, 2021, "Global Exchange Rate Assessment Framework," Office of International Affairs, US Department of the Treasury.

Hoeting, Jennifer A., David Madigan, Adrian E. Raftery, and Chris T. Volinsky, 1999, "Bayesian Model Averaging: A Tutorial," *Statistical Science*, Vol. 14, No. 4, pp. 382–401.

Houthakker, H.S., and Stephen P. Magee, 1969, "Income and Price Elasticities in World Trade," *Review of Economics and Statistics*, Vol. 51, No. 2 (May), pp. 111–25.

International Monetary Fund, 2015, "Technical Supplement to the 2015 External Sector Report," Washington, DC.

_____, 2018, *External Sector Report: Refinements to the External Balance Assessment Methodology—Technical Supplement*, Washington, DC.

———, 2019, "The Revised EBA-Lite Methodology," IMF Policy Paper 2019/026, Washington, DC.

———, 2021, *External Sector Report*, Washington, DC.

———, 2022, *External Sector Report*, Washington, DC.

Jacks, David S., 2013, "From Boom to Bust: A Typology of Real Commodity Prices in the Long Run," NBER Working Paper No. 18874 (Cambridge, Massachusetts: National Bureau of Economic Research).

Jacks, David S., and Martin Stuermer, 2020, "What Drives Commodity Price Booms and Busts?" *Energy Economics*, Vol. 85, Article 104035.

Ju, Jiandong, Kang Shi, and Shang-Jin Wei, 2014, "On the Connections between Intra-Temporal and Intertemporal Trades," *Journal of International Economics*, Vol. 92, pp. S36–S51.

Koomen, Miriam, and Laurence Wicht, 2022, "Demographics and Current Account Imbalances: Accounting for the Full Age Distribution," *IMF Economic Review*, https://doi.org/10.1057/s41308-022-00176-6.

_____, 2022, "Pension Systems and the Current Account: An Empirical Exploration," *Journal of International Money and Finance*, Vol. 120.

Kumhof, Michael, and Douglas Laxton, 2007, "A Party without a Hangover? On the Effects of U.S. Government Deficits," IMF Working Paper No. 07/202 (Washington: International Monetary Fund).

Laeven, Luc, and Fabian Valencia, 2020, "Systemic Banking Crises Database II," *IMF Economic Review* Vol. 68 (2): 307–61.

Lane, Philip R., and Gian Maria Milesi-Ferretti, 2012, "External Adjustment and the Global Crisis," *Journal of International Economics,* Vol. 88 (2): 252–65

Lee, Jaewoo, Gian Maria Milesi-Ferretti, Jonathan D. Ostry, Alessandro Prati, and Luca A. Ricci, 2008, "Exchange Rate Assessments: CGER Methodologies," IMF Occasional Paper No. 261 (Washington: International Monetary Fund).

Masanjala, Winford H., and Chris Papageorgiou, 2008, "Rough and Lonely Road to Prosperity: A Reexamination of the Sources of Growth in Africa Using Bayesian Model Averaging," *Journal of Applied Econometrics*, Vol. 23, No. 5, pp. 671–82.

Mendoza, Enrique, and Marco E. Terrones, 2012, "An Anatomy of Credit Booms and their Demise," *Journal Economía Chilena (The Chilean Economy Journal)*, Vol. 15, No. 2, pp. 4–32.

Nieminen, Mika, Kari Heimonen, and Timo Tohmo, 2019, "Current Accounts and Coordination of Wage Bargaining," *Open Economies Review* Vol. 30 (2): 319–41.

Pfaffenzeller, Stephan, Paul Newbold, and Anthony John Rayner, 2007, "A Short Note on Updating the Grilli and Yang Commodity Price Index," *World Bank Economic Review*, Vol. 21, No. 1, pp. 151–63.

Phillips, Steven, Luis Catão, Luca Ricci, Rudolfs Bems, Mitali Das, Julian Di Giovanni, Filiz Unsal, Marola Castillo, Jungjin Lee, Jair Rodriguez, and Mauricio Vargas, 2013, "The External Balance Assessment (EBA) Methodology," IMF Working Paper 13/272 (Washington: International Monetary Fund).

Quinn, Dennis P., 1997, “The Correlates of Change in International Financial Regulation,” *American Political Science Review*, Vol. 91, pp. 531–51.

Ravn, Morten, and Harald Uhlig, 2002, “On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations,” *Review of Economics and Statistics*, Vol. 84, No. 2, pp. 371–75.

Rogoff, Kenneth, 1996, “The Purchasing Power Parity Puzzle,” *Journal of Economic Literature*, Vol. 34 (June), pp. 647−68.

Sala-i-Martin, Xavier, Gernot Doppelhofer, and Ronald I. Miller, 2004, “Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach,” *American Economic Review*, Vol. 94, No. 4, pp. 813–35.

Samuelson, Paul A., 1994, “Facets of Balassa–Samuelson Thirty Years Later,” *Review of International Economics*, Vol. 2, No. 3, pp. 201–26.

Schwerhoff, Gregor and Martin Stuermer, 2015, “Non-Renewable Resources, Extraction Technology and Endogenous Growth,” Dallas Fed. Working Paper, No. 1506 (Revised version published on August 26, 2019).

Stuermer, Martin, 2018, “150 Years of Boom and Bust: What Drives Mineral Commodity Prices?” *Macroeconomic Dynamics*, Vol. 22, pp. 702–17.

Yeşin, Pinar, 2016, “Exchange Rate Predictability and State-of-the-Art Models,” SNB Working Paper 2/2016, Swiss National Bank, Zurich.

PUBLICATIONS