Session 1:	**Evolution of Global Imbalances: Risks and Policy Challenges** Gustavo Adler and Luis Cubeddu (IMF Research Department) *Discussants: Menzie Chinn (University of Wisconsin), Brad Setser (Council on Foreign Relations)* *Moderator: Maurice Obstfeld (IMF Research Department)*
Session 2:	**Conducting External Sector Assessments** Pau Rabanal (IMF Research Department) *Discussants: Alessandro Turrini (European Commission), Mark Sobel (Center for Strategic & International Studies)* *Moderator: Jonathan D. Ostry (IMF Research Department)*
Session 3:	**New Directions and Challenges in the Assessment of Global Imbalances** **Structural Issues: Role of Corporates** Mai Chi Dao (IMF Research Department) *Discussant: Joe Gruber (Federal Reserve Board)* **Trade Costs and Imbalances** Rana Sajedi (Bank of England) *Discussant: Nan Li (IMF Research Department)* **The Role of the U.S. Dollar** Emine Boz (IMF Research Department) *Discussant: Michele Ca'Zorzi (European Central Bank)* *Moderator: Tam Bayoumi (IMF Strategy, Policy and Review Department)*
Panel Discussion	**Global Imbalances: Analytical and Policy Challenges** *Panelists: Peter Bofinger (German Council of Experts and University of Würzburg), Joe Gagnon (Peterson Institute for International Economics), Olivier Jeanne (Johns Hopkins University), Meg Lundsager (Wilson Center), Eswar Prasad (Cornell University)* *Moderator: Gita Gopinath (Harvard University)*

Global Imbalances

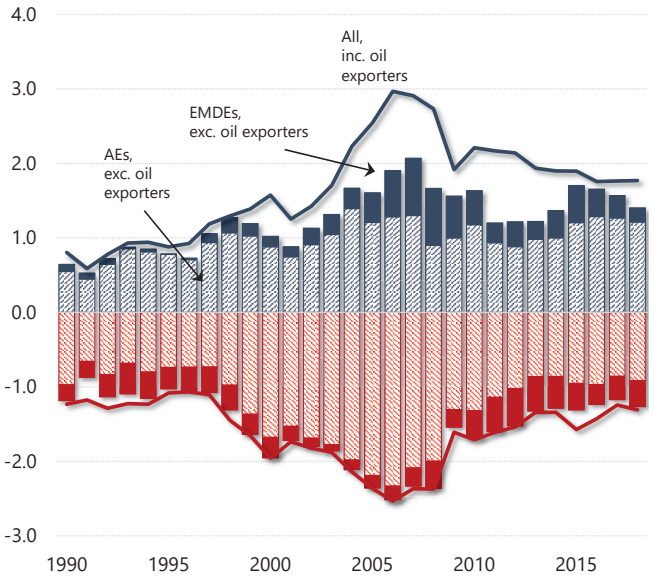
Gustavo Adler
IMF Research Department

IMF Workshop
Assessing Global Imbalances: Lessons and Challenges
Washington DC—December 6, 2018

1. A Positive View of Global Imbalances

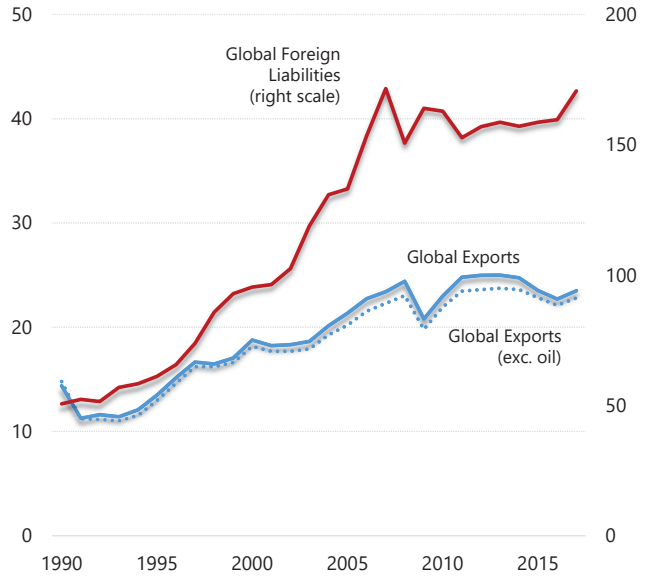
Wider global imbalances, amid greater international integration…

Global Current Account Imbalances, 1990-2017
(percent of World GDP)



Sources: WEO and IMF staff calculations.

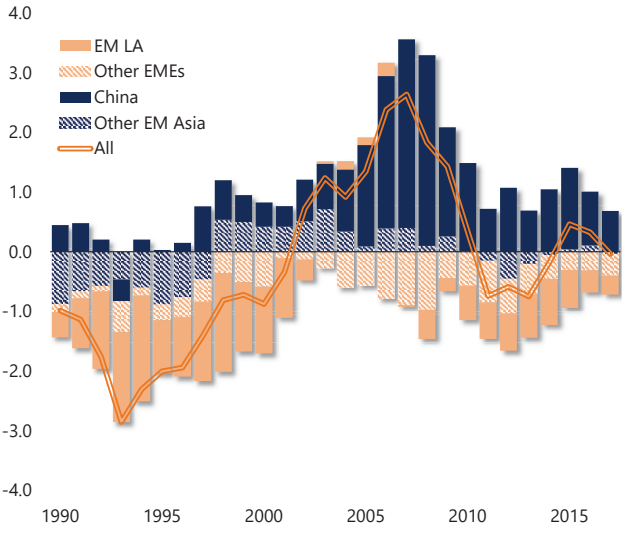
Global Trade and Financial Integration, 1990-2017
(in percent of World GDP)



Sources: WEO, Lane and Milesi-Ferretti database, and IMF staff calculations.

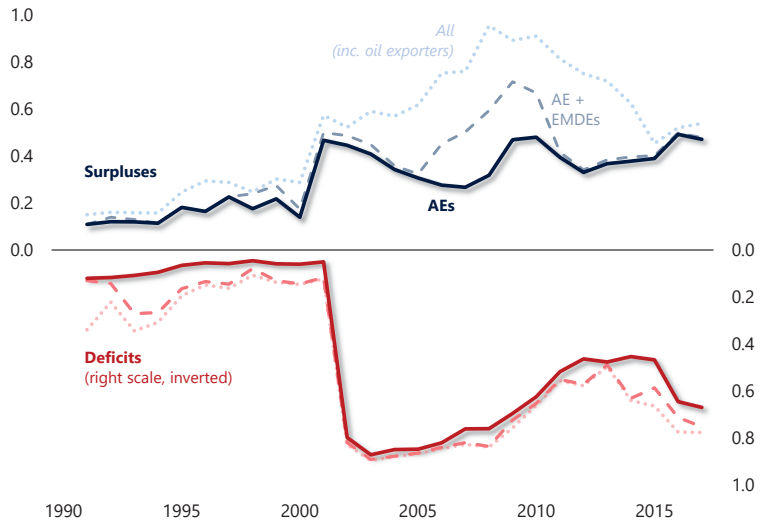
… and mixed progress on global capital allocation …

EMDEs. Current account balances, 1990-2017 1/
(percent of group GDP)



Sources: WEO and IMF staff calculations.
1/ EBA countries only are included.

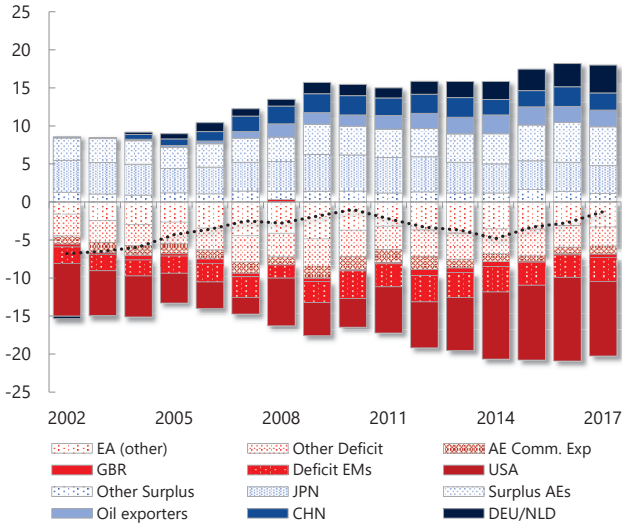
Large and Persistent Imbalances, 1990-2017 1/
(share of current account surpluses and deficits)



Sources: WEO and IMF staff calculations.
1/ Share of current account surpluses (deficits) greater than 2 percent of GDP and at least 5-year lived.

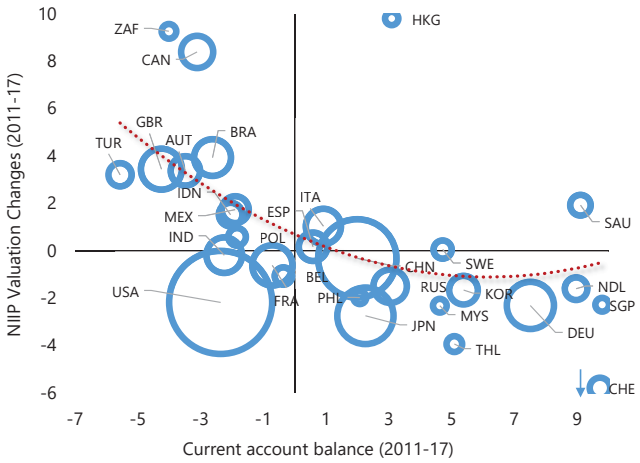
… while persistent flow imbalances have led to diverging stock positions, with valuation effects playing some offsetting role

Net International Investment Positions, 2002-17
(percent of world GDP)



Sources: WEO, Lane and Milesi-Ferretti dataset and IMF staff estimations.

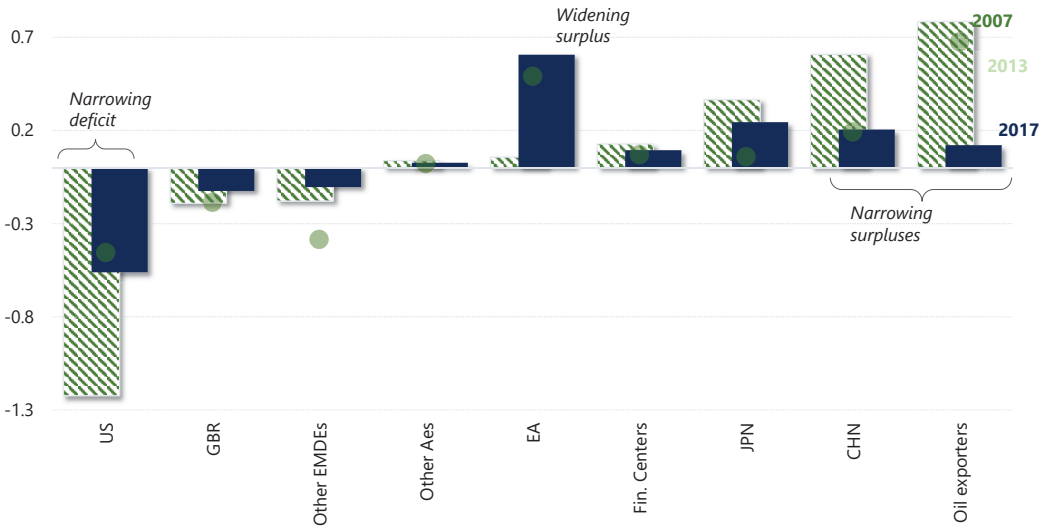
Current account and NIIP valuation changes, 2011-17 1/
(percent of GDP)



Sources: WEO, Lane and Milesi-Ferretti dataset and IMF staff estimations.
1/ See "The Stabilizing Role of NFA Returns" IMF WP 18/79.

A reconfiguration of imbalances since the pre-GFC peak…

Current Account Imbalances, 2007-17
(percent of World GDP)

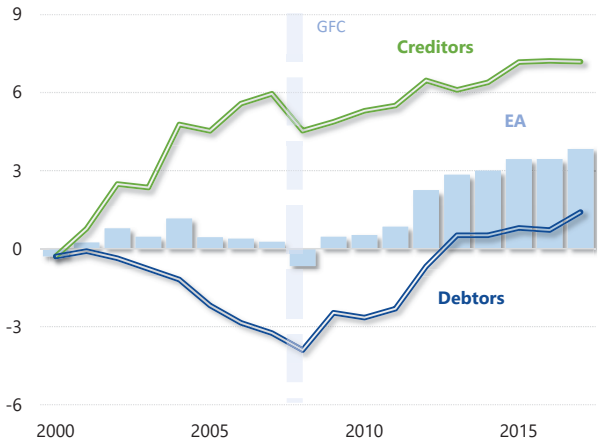


Sources: World Economic Outlook and IMF staff calculations.

… amid lingering asymmetries in the EA, although relative prices are gradually adjusting,…

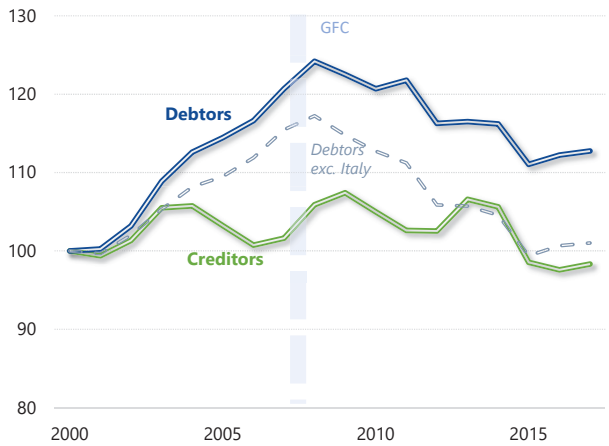
Euro Area Debtors and Creditors. Selected External Indicators, 2000-17 1/

Current Account Balance 1/
(percent of group GDP)



Sources: World Economic Outlook, INS dataset and IMF staff estimations.
1/ Includes large (EBA/ESR) economies only.

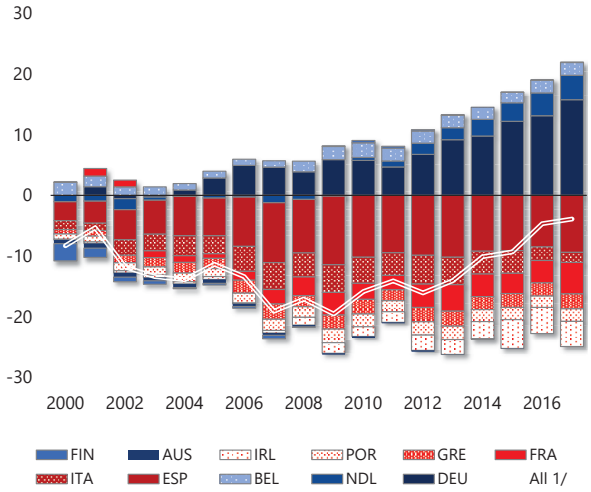
ULC-based REER
(Index 2000=100, GDP-weighted average by group, +=appreciation)



Sources: World Economic Outlook, INS dataset and IMF staff estimations.
1/ Includes large (EBA/ESR) economies only.

… while EA NIIPs continue to diverge

Euro area NIIP
(percent of GDP)

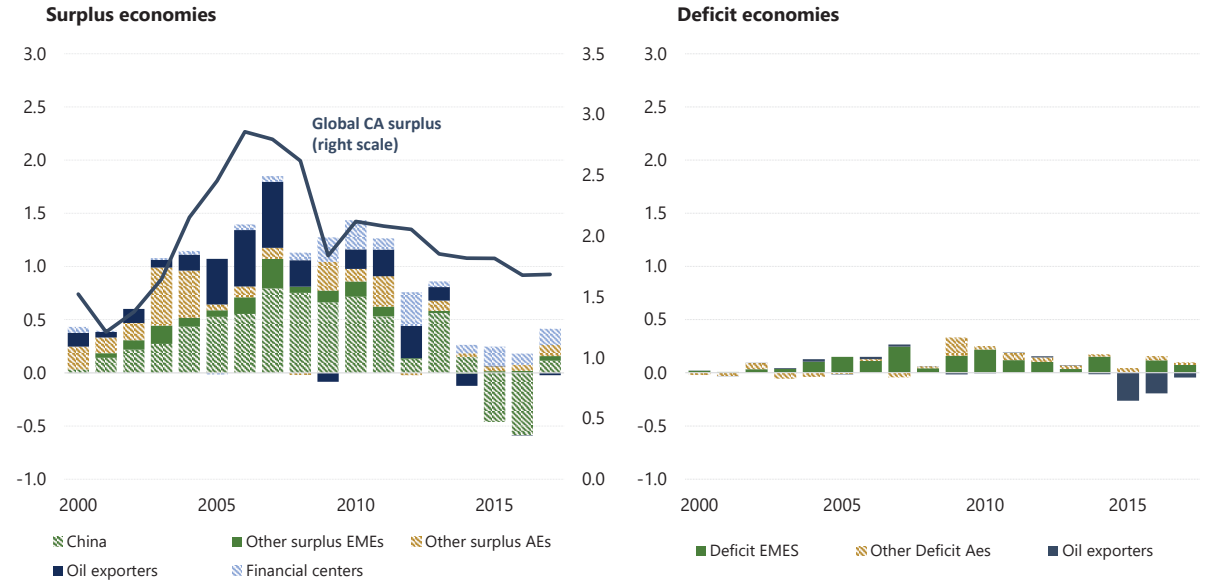


Sources: WEO, Lane and Milesi-Ferretti dataset and IMF staff estimations.
1/ Includes other (smaller) EA economies.

- **Strengthening of EA's NIIP since GFC mostly driven by expanding creditor positions.**

The reconfiguration reflects shifting policy drivers: FXI has been playing a more muted role…

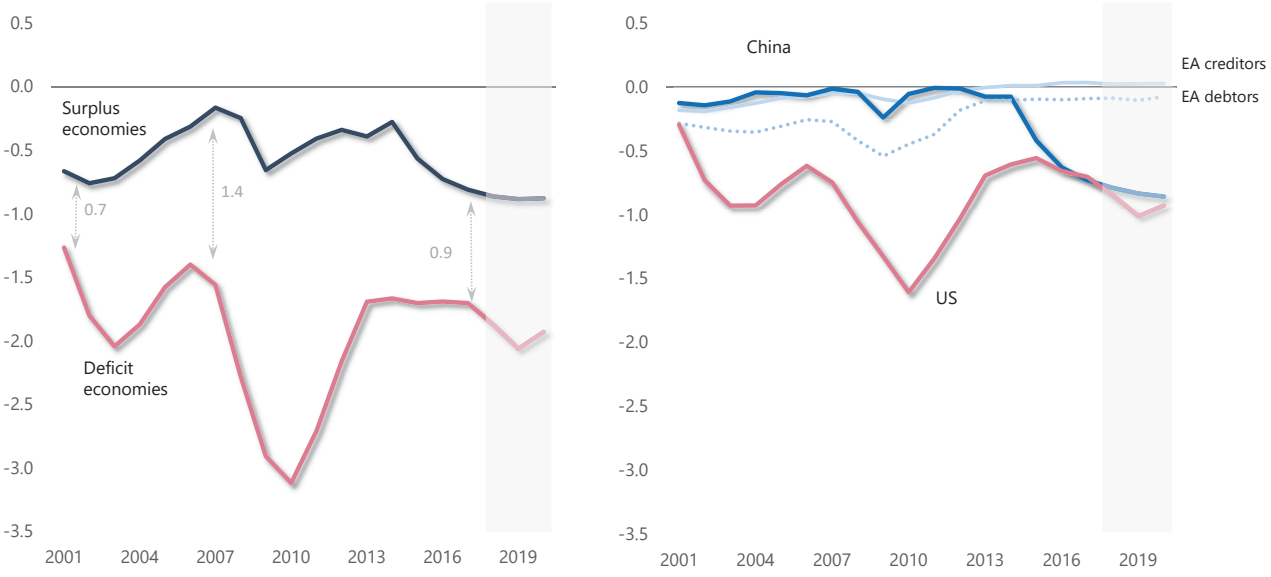
Reserve accumulation, 2000-17
(percent of World GDP)



Sources: WEO and IMF staff calculations.

… and a key surplus EMDE (China) has significantly eased fiscal policy

Selected systemic economies. Structural fiscal balance, 2001-20 1/
(percent of world GDP)

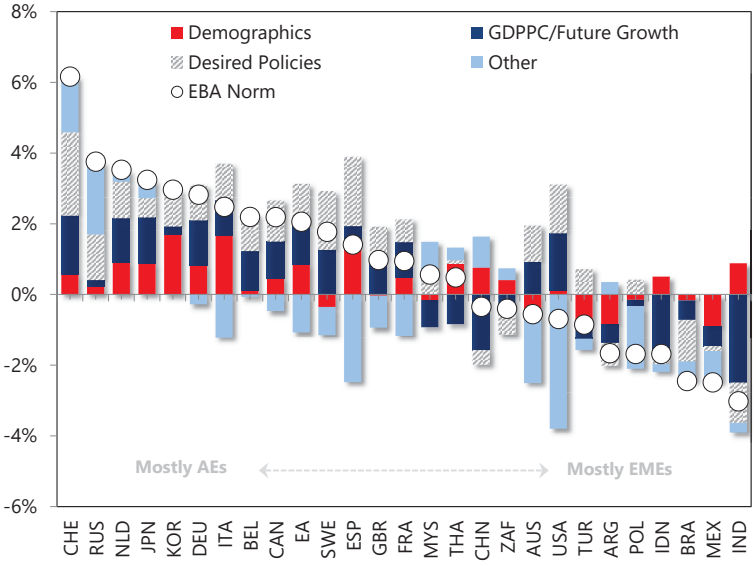


Source: IMF World Economic Outlook and Staff calculations.
1/ Deficit and surplus economies based on prevailing current account balances through the period. Excludes oil exporters.

2. A Normative View

Fundamentals account for some of the imbalances…

Selected Economies: Breakdown of EBA Norms, 2017
(percent of GDP)

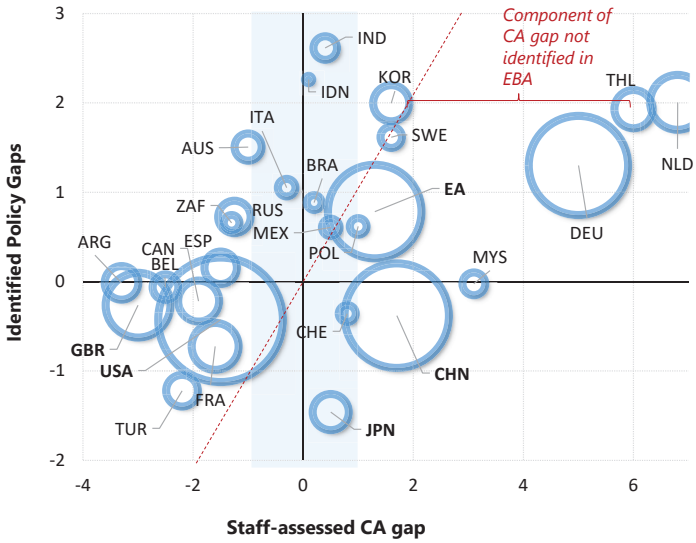


Source: IMF staff calculations.

- **Wide range of CA norm values**
- **Norms for AEs (EMEs) mostly positive (negative)**
- **Key differences in norms between AEs and EMEs**
  - Income level and speed of growth
  - Demographics
  - Desirable policies

… and undesirable policies explain part of the 'excess' imbalances, but a large part remains unexplained in key cases

Staff-assessed CA and Policy Gaps 1/
(percent of GDP)

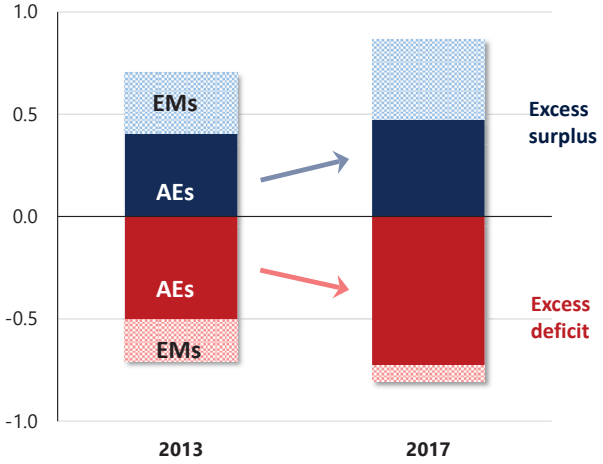


- **EBA model traces part of CA gaps back to undesirable policies**
- **But large part remains un-explained for the main 'culprits'**
- **In some cases, policy gaps mitigate external gaps, hiding underlying distortions.**

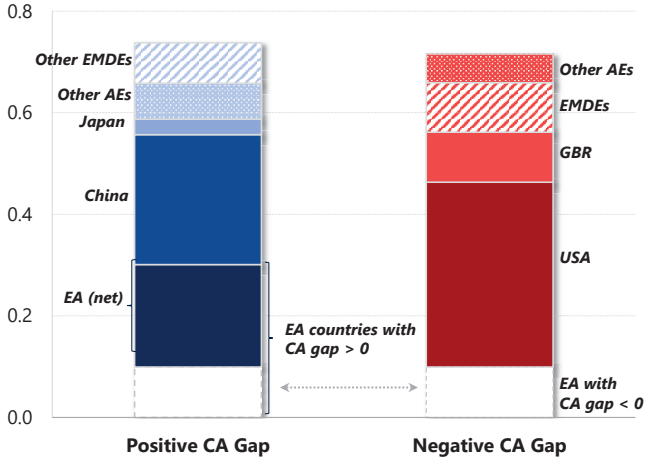
Sources: IMF staff calculations and assessments.
1/ Dot size proportional to external imbalances in percent of world GDP. Contribution of (domestic and external components of) identified policy gaps to CA gap, based on estimated EBA coefficient and staff-assessed desirable policies.

Broadly unchanged "excess" imbalances, with increased concentration in AEs

Global excess imbalances, 2013 vs. 2017
(in percent of global GDP)



Current account gaps, 2017 1/
(in percent of world GDP)

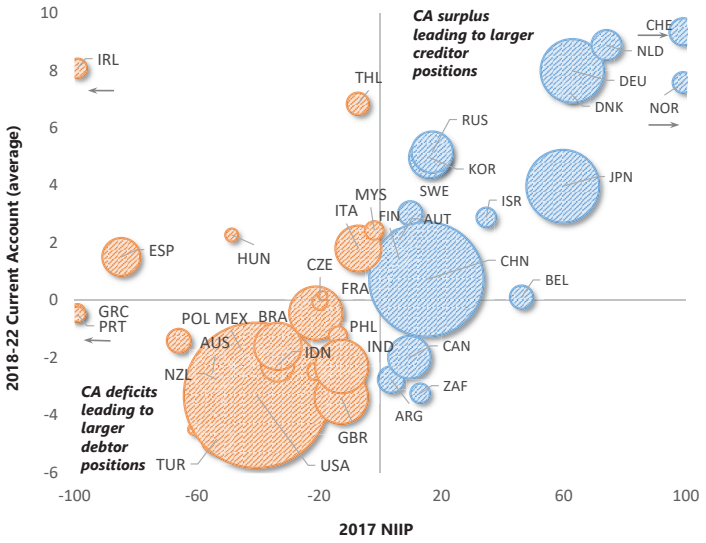


Sources: IMF staff calculations and assessments.
1/ Only ESR countries are included, and systemic 5 economies reported individually. EA economies with positive (negative) CA gaps include Germany and the Netherlands (Belgium, France, Italy and Spain).

3. Outlook, Risks and Policies

A constellation of policies/distortions conducive to further widening of stock positions and increasing risks

Current Account Balance and NIIP, 2017-22 1/
(percent of GDP)



Sources: World Economic Outlook and IMF staff calculations.
1/ Dot sizes proportional to US$ GDP.

Near-term risks

- Faster tightening of US monetary policy
  - Tightening of external financing for EMEs ; USD appreciation
- Trade actions

Medium-term risks

- External indebtedness in key economies may constrain global growth
- Disruptive external adjustment

Policies in the context of closing output gaps

Excess surplus countries

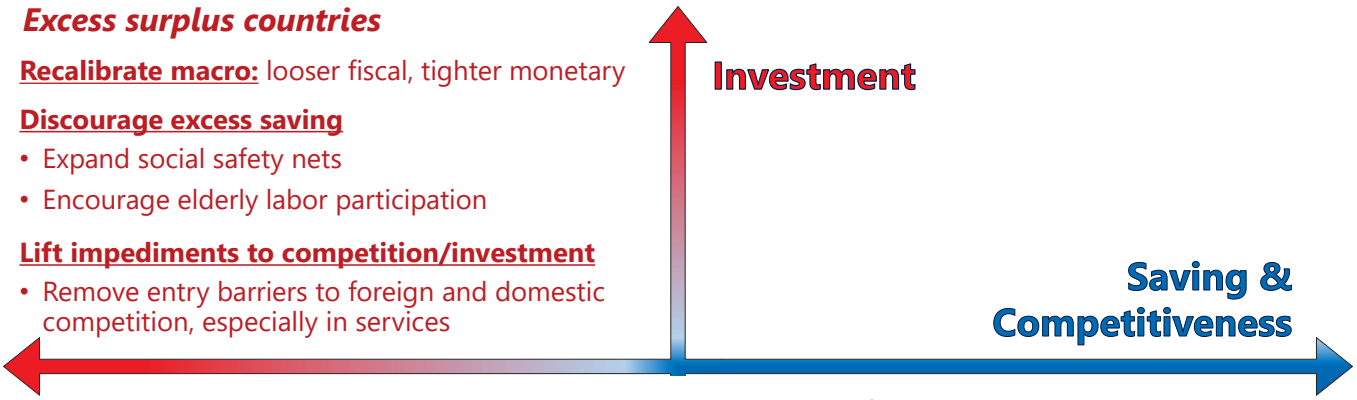
Recalibrate macro: looser fiscal, tighter monetary

Discourage excess saving

- Expand social safety nets
- Encourage elderly labor participation

Lift impediments to competition/investment

- Remove entry barriers to foreign and domestic competition, especially in services



Excess Deficit Countries

Recalibrate macro: Growth-friendly fiscal consolidation

Boost saving

- Reduce pension system generosity

Enhance external competitiveness

- Reforms to reduce labor costs and improve skill base of workforce

Issues for discussion

- **Drivers of persistent surpluses**
  - Structural distortions? Understanding corporate saving trends; barriers to competition and investment
  - Other structural features: income/wealth inequality?
  - Is exchange rate flexibility sufficient? Not working as effectively as in the past? Understanding GVCs and USD invoicing
- **Risks from widening stock positions**
  - Should we worry about the US' NIIP?
  - Are risks of disruptive adjustment amplified by larger gross stock positions (inc. in EMEs)?
  - What role does the NIIP composition play?
- **China:** Is the narrowing of its surplus sustainable?
- **EA:** is rebalancing on the right track? How dependent on the rest of the world?
- **Trade barriers/actions:** To what extent can they affect the configuration of imbalances?
- **Improving policy traction**

Thank you!

2018 External Sector Report: https://www.imf.org/en/Publications/ESR/Issues/2018/07/19/2018-external-sector-report

The Evolution of Global Imbalances: Risks and Policy Challenges

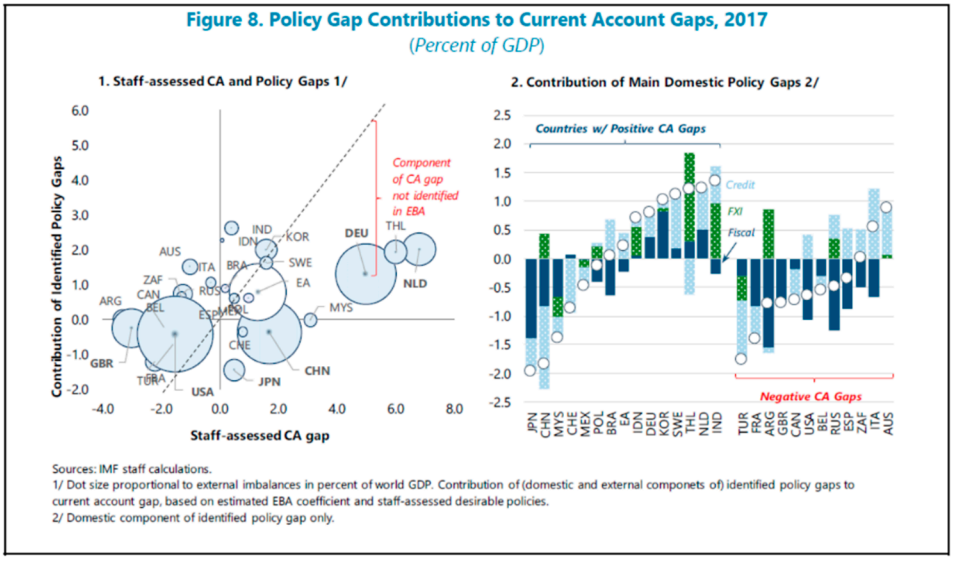
By Menzie Chinn
January 19, 2019

The Imbalances Are Back, but Relocated

One of the major questions open economy macroeconomists puzzled over in the years after the global financial crisis was whether large imbalances would return. Without a clear idea of why global imbalances arose in the 2000's, it was difficult to predict the return of imbalances, let alone diagnose them. This point is highlighted by the fact that the sources of large surpluses have changed somewhat, even as the sources of large deficits have changed. While China, East Asia and the oil exporters were key creditors during the run up to the 2008-9 global recession, the last group has receded in importance, as has China to a lesser extent. Northern European countries, including most prominently Germany and the Netherlands, have taken their place.

Some Are Large *and* Mysterious

Credence to the fact that we do not have a systematic and comprehensive explanation for the pattern of imbalances is provided by the clear fact that for some countries/economies, there is a large, unidentified residual. If the residuals were located in economies that were of secondary import to the global economy, then one would not be so troubled. However, as shown in figure 8 of the 2018 *External Stability Report* (IMF, 2018), some globally important contributors to global imbalances are in "inexplicable" in the context of the External Balances Assessment (EBA) variables, Germany being a particularly notable example.



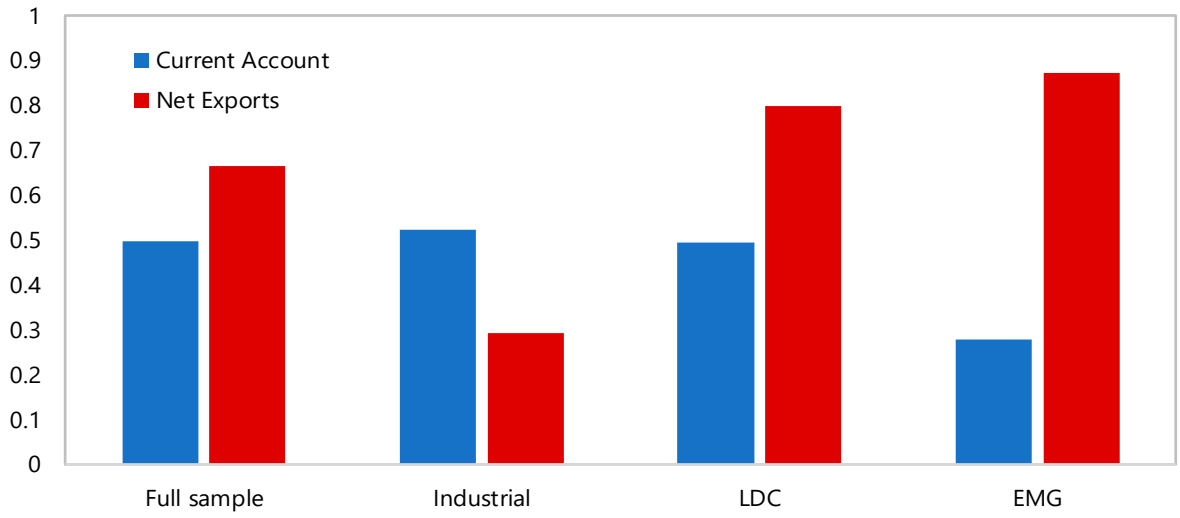
As the figure indicates, there is an enormous unexplained component associated with Germany's current account, while accounting for a large share of the global current account surplus. In contrast, while China's current account is of comparable importance to the global surplus, the unexplained component is half as large. So, in one sense, the remedial policies are clearer for China than they are for Germany, at least insofar as this framework is concerned.

Inside the Box: the Current Account vs. Net Exports

One distinction that of interest is to know whether the identified policy and structural factors have different effects on the components of the current account. In the conventional approach, net exports, primary and secondary income have the same response to each of the empirical components – or the net export component dominates so much that imposing such equality restrictions doesn't do much violence to the data. In practice, it's become apparent that the net export component is of less importance for some countries (Forbes, 2016) – a not unexpected outcome of the trend toward greater cross-border asset and liability holdings.

It turns out that for industrial countries, the impact of the budget balance on the current account is much larger than on net exports (implying that effects on primary and secondary income are very large). The reverse is true for emerging and developing countries. This is shown in Figure 1,[1] drawn from the sample examined in Chinn and Ito (2019):

Figure 1. External Balance Response to Budget Balance 1/
(Deviations from GDP-weighted world mean)



Source: Chinn and Ito (2019).
1/ The analysis is based on panel data for 23 industrial and 86 developing countries between 1971 and 2015, using non-overlapping 5-year averages of the data; see Chinn (2017).

Figure 1. Response of current account to budget balance (blue), net exports to budget balance (red), for full sample, for industrial countries, for less developed countries, for emerging market group countries. Source: Chinn and Ito (2019).

[1] The analysis is based on panel data for 23 industrial and 86 developing countries between 1971 and 2015, using non-overlapping 5-year averages of the data; see Chinn (2017). All the variables, except for net foreign assets to GDP, are converted into the deviations from their GDP-weighted world mean.

Some Known Unknowns

The impact of structural policy reforms

The report devotes some space to the discussion of pivoting to structural reforms after calibrating demand management. This makes sense, although the extent to which we know how well such policies work, and with what lag, is sorely lacking. Even with that, I think the report could do a better job couching in understandable terms what degree of reform is necessary in order to obtain a given degree of current account adjustment (refer to Box 3 Table). It's hard to think of what a 0.0049 coefficient on the OECD licensing and permitting variable means. It might be more useful to add in what a change from the country X level of regulation to country Y level of regulation implies for the excess current account balance.

Incorporating trade policy

The report does an admirable job attempting to quantify in an intelligent manner the implication of enhanced protection. Text table 1 provides the estimates. The question is how to interpret these coefficients in terms of real actions. For instance, could we convert the administration's actions in 2018 into an equivalent movement in trade costs?

There is the additional question of how to interpret trade costs when trade costs in the form of protection are endogenous. Then, it may be the case in a simple regression that measured tariff rates will show up with a negative coefficient because higher deficit countries tend to raise tariffs to reduce deficits.

And One Unknown Unknown

There is a strong belief that uncertainty—including uncertainty about the future direction of policy—has strong effects on macroeconomic outcomes. However, validation of that belief has in the past been hampered by the lack of good measures. Even as new measures have become available[2], the question has not become more resolved. One of the interesting things about the evolution of some measures of economic policy uncertainty in 2018 is that they did not rise particularly high, despite the anecdotal evidence of elevated uncertainty.

In the context of external balances, it's not clear what types of policy uncertainty should be important. In terms of trade policy (with ramifications for FDI and other capital flows), the amount of uncertainty is fairly high, perhaps high enough to have a noticeable impact.

This is clearly a factor that should be important in explaining the evolution of imbalances, but should also be hard to pin down because, first, it's hard to measure and second, it's difficult to trace out the channels of influence. For instance, would trade uncertainty directly affect imports and exports? Or would it affect investment and saving and thereby drive the current account?

Conclusion

The IMF is making remarkable progress in developing and systematizing the external balance assessment. The nature of the norms, and the interpretation of the deviation from those current account norms is now

[2] See Ferrara, et al. (2018) for a discussion of the different economic uncertainty measures.

better described and understood. However, some country-experiences remain mysterious, and that is problematic to the extent that for instance the German current account is systemically important.

The focus on developing an understanding of structural and trade factors in affecting current account balances is appropriate, particularly given recent developments. However, I suspect the latter relationship is going to be much more difficult to tease out given the multiple channels by which trade policy can affect saving, investment, directly capital and trade flows.

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Comments on the IMF's External Balance Assessment

Brad Setser. This draft February 4, 2019 (Edited 10/25/19).

It is an honor to be asked to present at a conference on the IMF's process of external surveillance. I can claim with a certain degree of credibility that there is almost no topic that I would rather discuss.

It is a particular honor because this conference marks the end of Dr. Obstfeld's tenure as the head of the IMF's research department—and the end of his productive stewardship of the IMF's process of multilateral surveillance.

Of the various international initiatives put forward after the crisis to draw attention to the risks posed by persistent external imbalances, the IMF's external assessment process has generated by far the most significant results. The IMF's workhorse external balance assessment (EBA) model provides a consistent methodology for assessing what constitutes a reasonable surplus (or deficit) and what constitutes an excessive surplus (or deficit). It draws attention to the right three policy variables: fiscal policies, intervention and public health (really social) spending. The coefficients placed on these variables—the estimates for the impact of these policies on the external balance—that emerged out of the latest update of the model are generally reasonable. The fact that the IMF's framework doesn't highlight the impact of trade policies on the overall trade balance is a strength of the model, not a weakness. In the horserace between the IMF's process for external surveillance and the G-20's peer review process, the IMF is ahead by a mile.

I still have a few quibbles with the low weight assigned by the model to the intervention in some countries with more open financial accounts—but I also find the IMF's overall framework and model to be a valuable tool for evaluating countries' policy choices, and for that matter for assessing the global consistency of the IMF's own policy advice of key countries. The External Balance Assessment (EBA) current account model results—and their use by country teams, even if reluctantly—has helped to strengthen the IMF's overall surveillance. The latest iteration of the model has made some important methodological improvements to the treatment of aging, and it is helping the Fund to better understand the distortions that taxation regimes have introduced into the balance of payments of some "financial centers." Dr. Obstfeld, Dr. Cubeddu and the IMF team have every reason to be proud of their accomplishment.

My remarks though won't focus on the many things that the IMF is now doing well but rather on the areas where I believe the IMF could still do better.

Also, I will largely ignore the IMF's assessment of balance of payments of deficit countries. The IMF generally has little trouble criticizing countries for loose fiscal policies or allowing an overly rapid expansion of private credit. The problem historically has been one of symmetry—a country with a ten percent of GDP external surplus would often be lauded as well managed, which only needs to guard against complacency, while a country with a ten percent of GDP external deficit would be severely criticized. The IMF is getting better at the surveillance of surplus countries, but there is still room for further improvement—as much of the "unexplained-by-policies" residual, in my view, reflects the timidity of the IMF's policy advice rather than an underlying problem with the model.

My comments are organized around the three policy variables that the EBA current account model highlights as having a particularly large impact on the external balance—with a focus on the countries where these policy variables have the greatest potential relevance to the IMF's policy advice.

Intervention

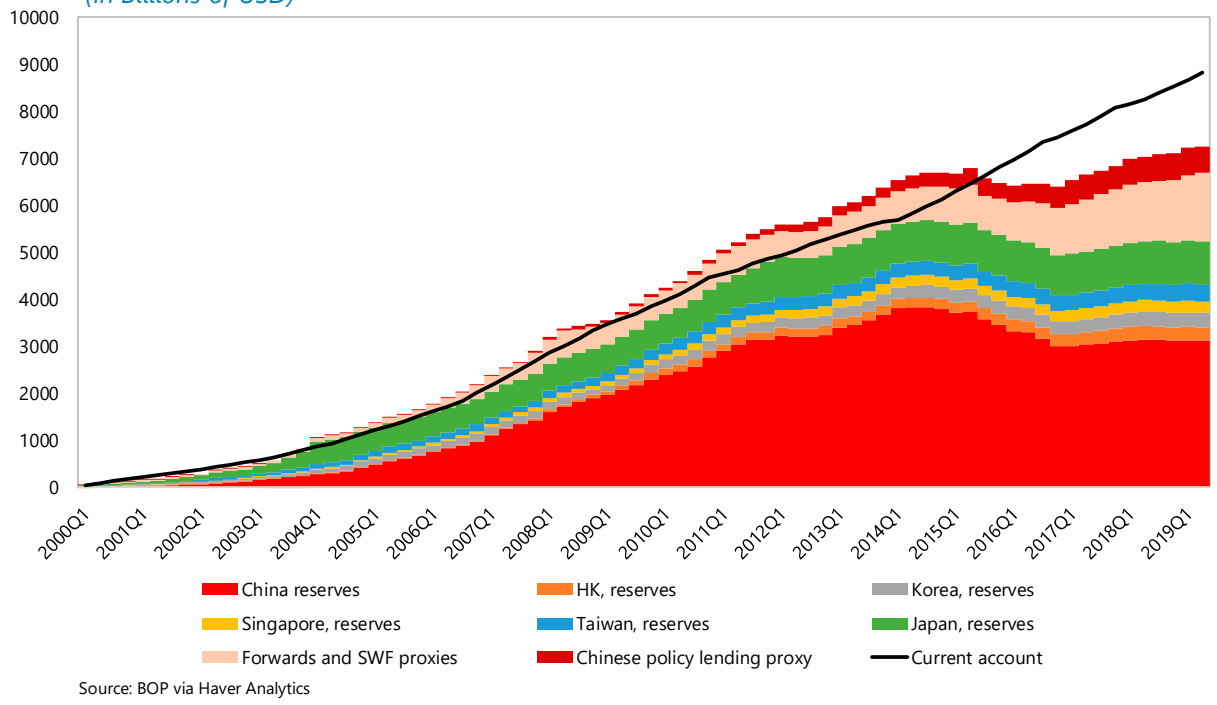
It seems churlish to argue that the IMF still downplays intervention, a variable with an apparent weight of 0.75 in the IMF's workhorse current account model. But the 0.75 coefficient is deceptive, as intervention is interacted with capital controls—and the highest current weight for the "control" variable is 0.5. Consequently, the highest effective weight on intervention is 0.37—meaning that a percentage point of GDP in a "high" controls country like China would be expected to raise the current account surplus by almost 0.4 percent of GDP. In many cases the estimated impact is much lower, as several of the countries that intervene most heavily today have relatively open financial accounts—Thailand's controls have an intensity of 0.25, Korea's controls an intensity of 0.125. That reduces the expected impact of a percentage point of intervention in Thailand to a bit less than 0.2 percentage points of GDP, and the expected impact of a percentage point of Korean intervention to a minimal 0.1 percent of GDP. Especially in the case of Korea, which has a history of blocking the won's appreciation at certain levels, this seems to understate the dynamic impact of intervention. There is a reason why the won never really seems to appreciate through 1050 won to the dollar. For countries like Japan and Switzerland with open financial accounts the IMF's model assigns no impact to either countries' actions in the foreign exchange market.

Alternative specifications—like those proposed by Gagnon, Bayoumi and Saborowski—would assign some weight to intervention and the more-general-accumulation of unhedged foreign assets by the state sector, even with an open financial account. The Gagnon, Bayoumi and Saborowski coefficients in my view better fit the stylized facts for the 2000 to 2015 period. Just a reminder: the rise in official assets of the main East Asian economies accounts for all of their cumulative current account surplus, and on the U.S. side, the rise in global holdings of dollar reserves accounts for the bull of the increase in the net external debt position of the United States over this period. There is scant evidence that private investors would have been willing to accumulate claims on the U.S. of the scale need to cover current account deficits of much more than 3 percent of U.S. GDP between 2000 and 2008, or to fund the rise in the United States net external debt from around 15 percent of U.S. GDP in 2000 to around 45 percent of U.S. GDP today. Remember, governments are much more willing than private investors to hold large-unhedged currency positions—and thus there is reason to think that an official flow often has a larger aggregate impact on the current account than a private flow.

Even if intervention is no longer a systemic concern, it continues to play an important role in some individual cases. Two of the four countries identified as having excessive surpluses in the 2018 External Sector Review intervened heavily in the foreign exchange market in 2017. In the case of Thailand, the IMF did identify intervention as an important contributor to Thailand's large external surplus. But the IMF's policy advice didn't go far enough. Even though Thailand's intervention reached 8 percent of its GDP, "reducing foreign exchange intervention" wasn't a highlighted policy recommendation in the article IV—the actual recommendation was a more diplomatic call to limit intervention to periods of volatility. In the case of Singapore, intervention was essentially ignored. That's a glaring oversight, as in Singapore's case, actual intervention—counting the large rise in government deposits and government managed portfolio outflows—is likely much higher than the large increase in the reserve position. Singapore obviously conducts monetary policy through its exchange rate target, but that doesn't mean the level that

Asia: Official Asset Growth vs. the Cumulative Current Account Surplus

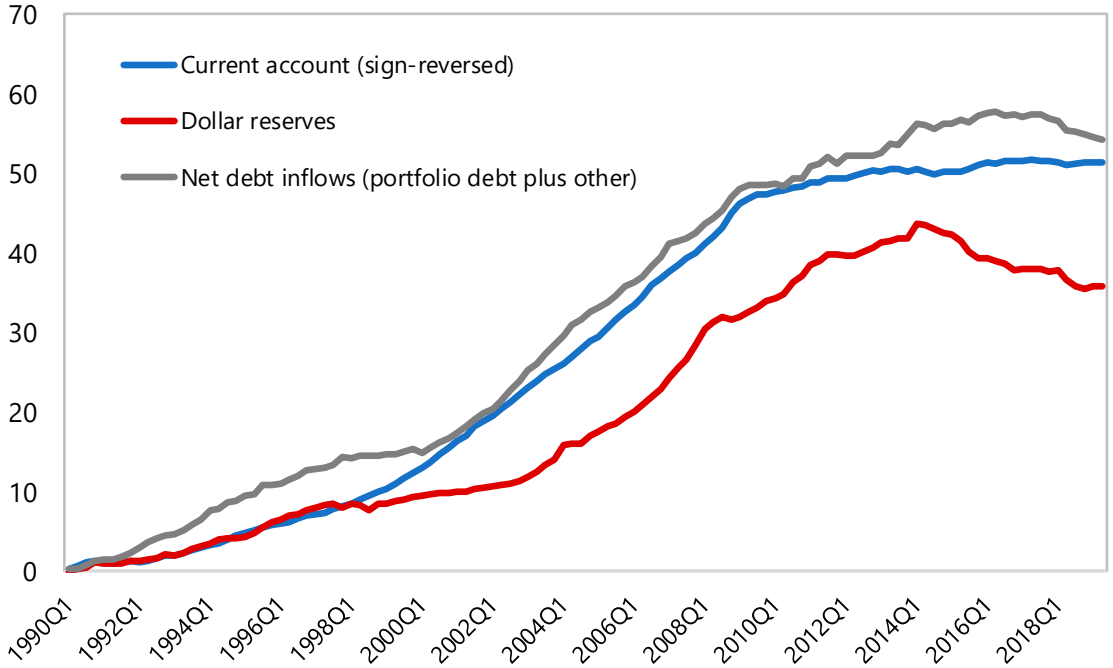
(In Billions of USD)



Source: BOP via Haver Analytics

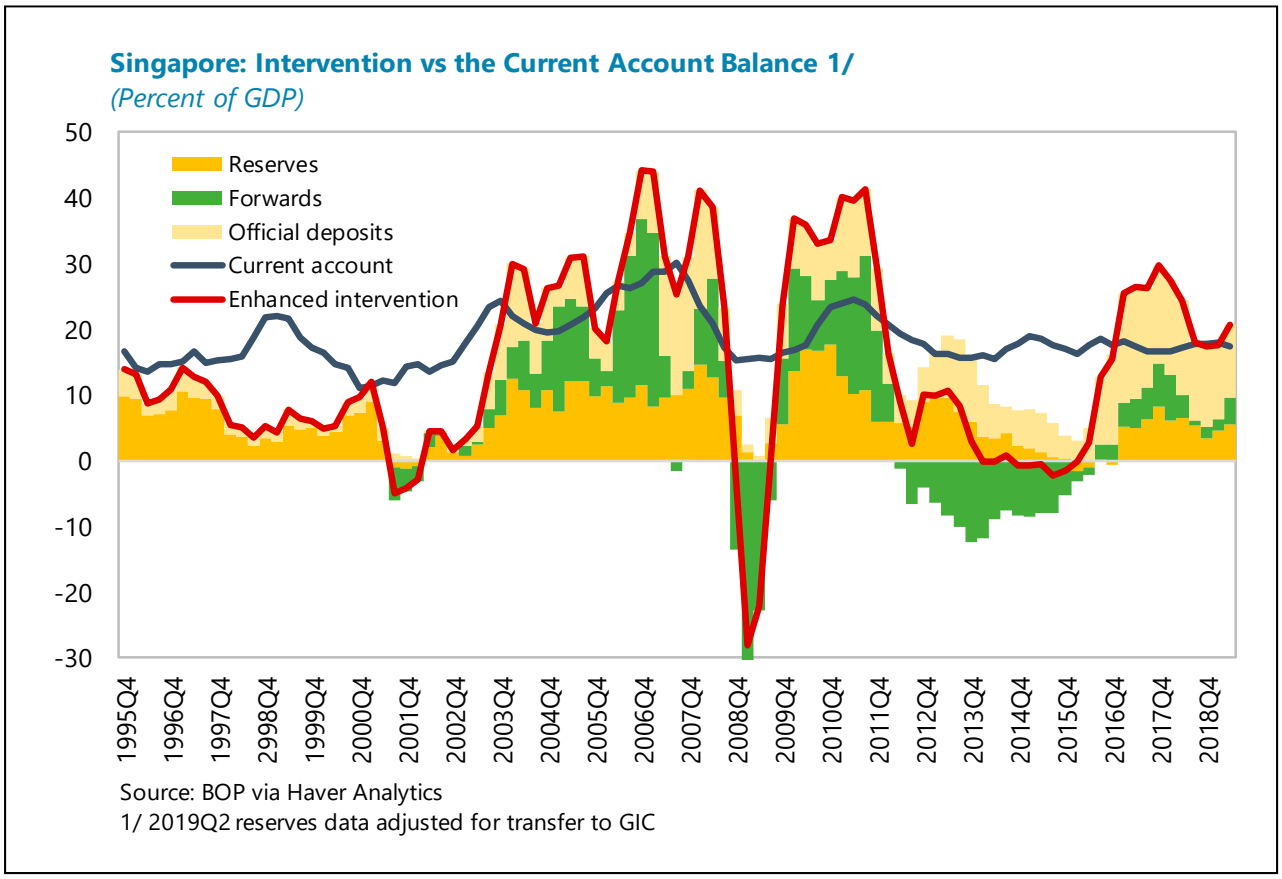
United States: Cumulative Current Accont Deficit since 1990 vs. Estimated Growth in Dollar Reserves

(Percent of GDP)



Sources: Bureau of Economic Analysis and IMF, COFER.

Singapore targets against the basket should be excluded from IMF surveillance. Hard hitting surveillance of surplus countries would do more than commend Singapore's authorities for their "successful stewardship."



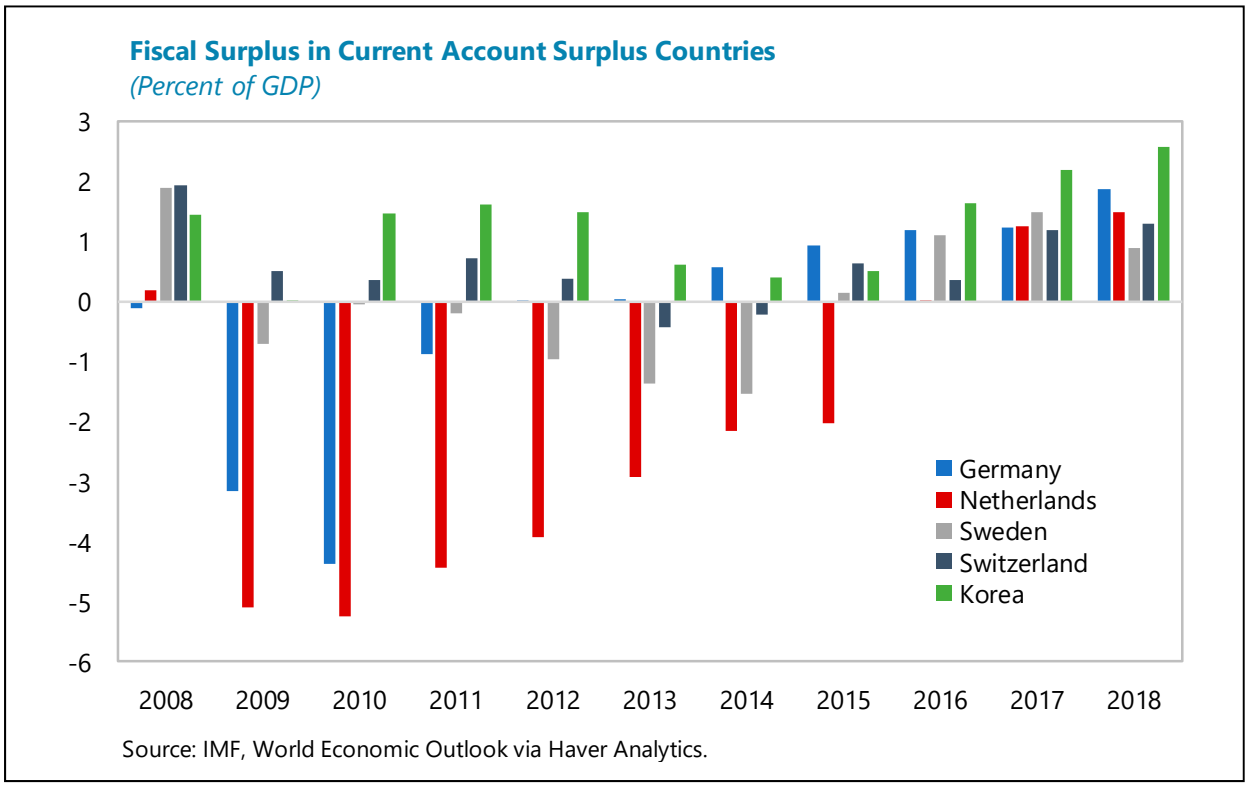
Fiscal

The latest incarnation of the EBA model reduced the coefficient on fiscal policy from around 0.4 to around 0.33, meaning that a percentage point change in the fiscal balance would change the external balance by about a third. That's a reasonable estimate. And no one doubts that fiscal policy continues to be a major focus of the IMF's surveillance.

Indeed, fiscal policy gaps likely contribute more to excessive external deficits and surpluses than at any time in the past fifteen years. The gap between the United States' large fiscal deficit (now around 5 percent of its GDP) and the euro area's now very modest fiscal deficit (perhaps a half point of the euro area's combined GDP) clearly explains much of the difference in the cyclical position and monetary stance of the world's two biggest economies. Korea's fiscal position is even tighter than that of the euro area. A number of large current account surplus countries are now running fiscal surpluses that approach 2 percent of their GDP.

Even so, the identified policy gaps associated with the fiscal stances of the major surplus countries generally remains small, as the de facto fiscal norm for the IMF remains a fiscal balance of around zero. And when external risk and domestic fiscal risks trade off, the IMF continues to prioritize reducing domestic fiscal risk even if this means larger not smaller external imbalances.

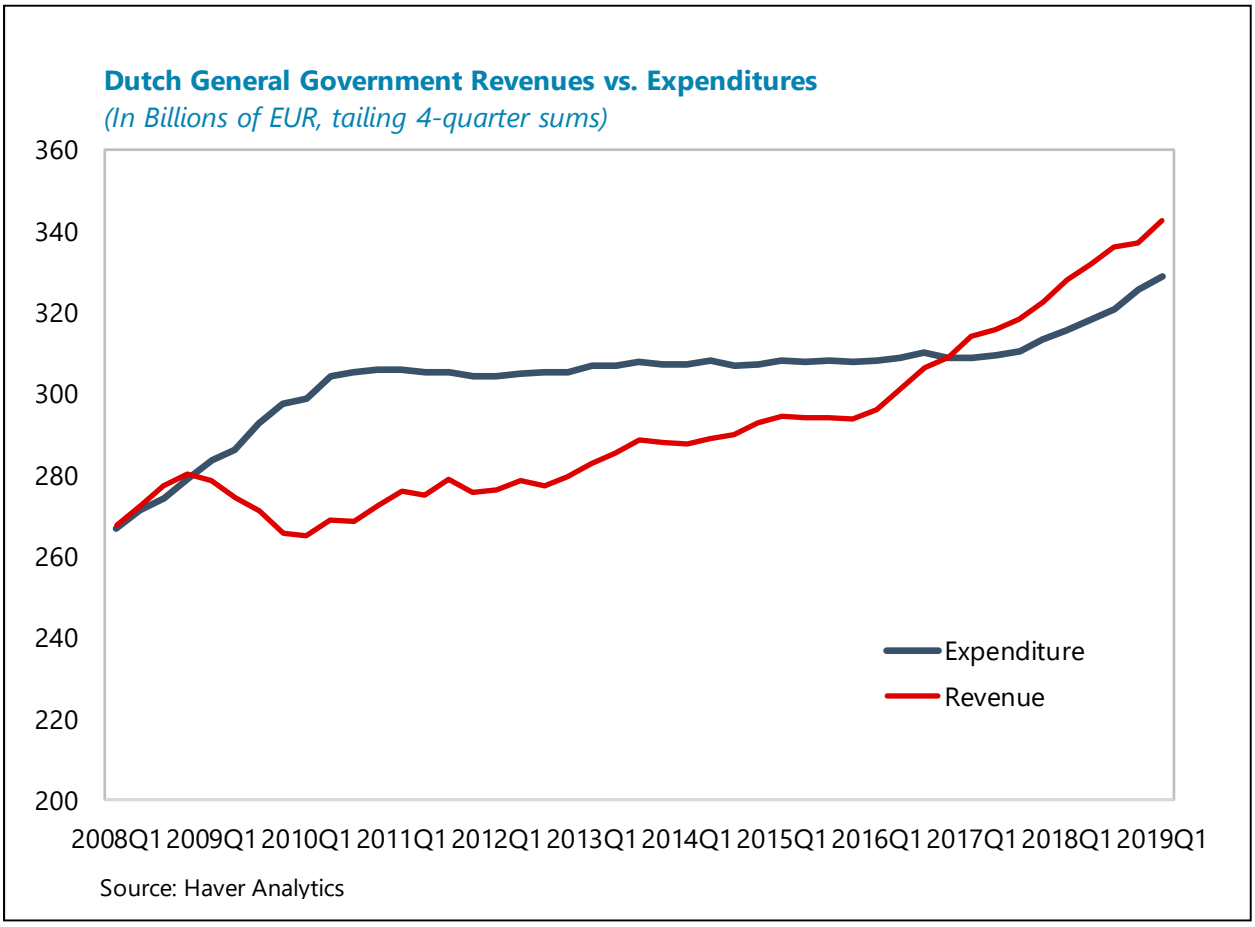
Consider the IMF's fiscal recommendations for the three largest surplus regions/ countries: the euro area; China and Japan. In each case, a looser fiscal stance would help reduce global imbalances. Yet the IMF's isn't recommending a fiscal expansion in any of these economies. The euro area's current account surplus is about 1 percent of GDP larger than warranted by fundamentals, yet the IMF recommends that the euro area's fiscal stance remains neutral, not expansionary. In Japan, the current account is about what the IMF believes is warranted—but if Japan followed the IMF's fiscal advice and brought its fiscal deficit down from four percent of its GDP to zero, Japan's external surplus would move above the level implied by the model. China's 2017 external surplus was a bit larger than what the IMF believed is warranted—yet the IMF is advocating a substantial fiscal consolidation—particularly if the IMF's advice to reduce the "off balance sheet fiscal deficit" is taken into account. In each case, the IMF's fiscal advice to address "internal" risks appear to have trumped concerns about the external balance. There are also a set of "twin surplus" countries, including the main twin surplus countries inside the euro area, where the IMF is recommending a fiscal expansion. Yet the expected impact of such policies remains modest, largely because of self-imposed limits on the size of the fiscal expansion the Fund is willing to recommend.



The IMF's surveillance of these countries poses a particular challenge, as several twin surplus countries have a history of promising a fiscal loosening that then fails to materialize. Hope strings eternal: Germany's fiscal surplus, which reached 1.75 percent of German GDP in 2018, is now expected to fall in 2019. Yet Germany has a history of understanding revenue growth, and thus delivering less net stimulus than expected. German tax revenues have consistently over-performed budget projections, with the over-performance reaching close to half a point of GDP in recent years[1].

[1] See IMF (2017).

The IMF here needs to be as vigilant here as it historically has been in assessing claims that countries with excessive deficits will bring their deficits down. Consider the case of the Netherlands, one of the four countries singled out for excessive surpluses in the external surveillance report. The IMF's 2018 article IV commended the Dutch coalition agreement for its "broad-based fiscal expansion." Yet the Dutch fiscal surplus set a record in the first three quarters of 2018, as revenue growth far exceeded expenditure growth. The Dutch surplus is now 2 percent of its GDP—bigger than that of Germany. The Dutch now argue, somewhat implausibly, that they have no room to reduce its headline surplus below a percentage point of its GDP, without violating the euro area's rules against running a structural deficit—even though the cyclical upswing in the Netherlands is very recent.



The broader point is simple: there is more scope for fiscal policy to support global adjustment and global demand than either the Fund, let alone the twin surplus countries, think. The modest contribution of "policy" to closing identified excess surpluses often reflects a decision on the part of the Fund to pull its punches and to retain credibility with the authorities—rather than a flaw in the Fund's modelling.

Social spending

The public health spending variable is one of the great analytical successes of the IMF's external modelling. The IMF's analytic work has helped to identify a plausible set for "win-win" policy changes that would facilitate both domestic and external adjustment, notably in Asia.

Yet the estimated ability of social spending to make a material difference is limited by timidity of the IMF's policy recommendations. Given the low level of China's current spending on public health (the EBA data table put it at 3.2 percent of GDP, a recent staff paper puts it at 2.5 percent of GDP) there is no doubt why the identified policy gap is only 1.3 percent of GDP. Doubling China's health spending to around 6 percent of China's GDP would still leave a bit below the global "norm" (8 percent of GDP). Strong policies to bring savings rates down (and raise consumption) take on additional importance, given that the Fund is advocating for a large reduction in China's augmented fiscal deficit which, absent other policy changes to reduce China's very high level of household savings, would tend to raise China's external surplus.

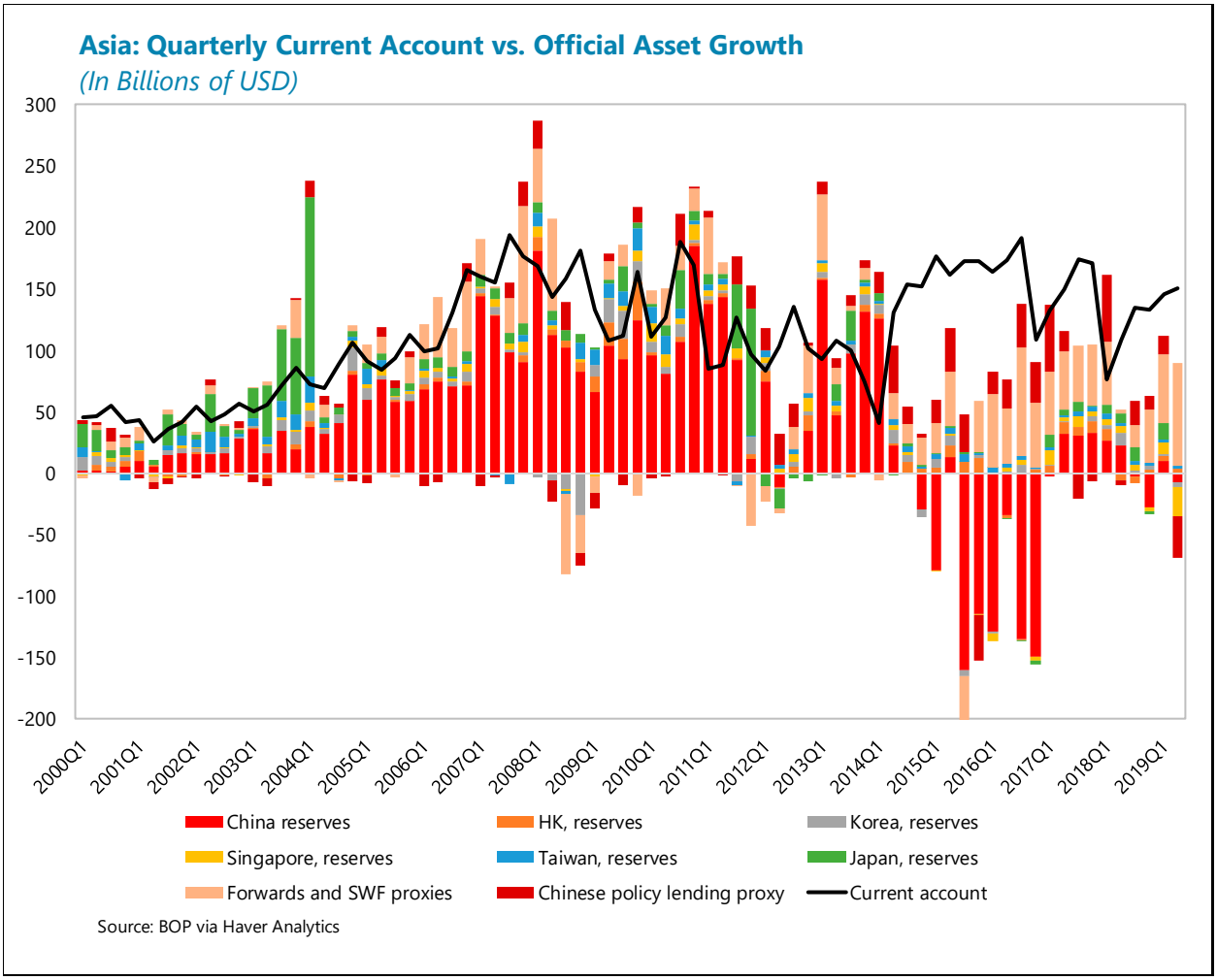
Be bold

This analysis suggests a relatively straight forward agenda for improving the IMF's surveillance: make bolder policy recommendations in the areas that the Fund's analytic work have indicated really matter for external adjustment. Rather than asking a country to "limit intervention to avoiding disorderly market conditions," the Fund should explicitly ask surplus countries to intervene less. For countries running large fiscal surpluses, the IMF should evaluate surplus countries' promises of more spending more critically and be willing to advocate a bigger swing in fiscal policy, if that is needed to bring down a large external surplus. The IMF's fiscal policy advice in surplus countries is still effectively limited by the de facto lower bound for the allowed fiscal deficit. Just as the interest rates can be slightly negative, the IMF is willing to recommend small fiscal deficits (of 0.5 pp of GDP or so) in "twin" surplus countries—but there is still a reluctance to recommend any significant deviation from budget balance. If there is a concern that more aggressive policy recommendations wouldn't be "heard" in the surplus country, the IMF should discount concerns about the unexplained residual in the model—as the size of the policy gap in the model is a function of excluding more aggressive policy shifts on political grounds. For countries that haven't made sufficient investment in their social safety net, the implications of limited social spending should gain greater prominence in the IMF's country surveillance and broader public messaging. The IMF's article IV always calls for China to limit credit growth, while recommendations for increased social spending tend to come and go.

The IMF has received criticism for not highlighting the possibility that different rates of trade liberalization in services and goods may have contributed more to trade imbalances. Call me skeptical. I don't see any evidence that the U.S. hasn't made trade in services, and notably stronger IPR protection, a major priority in its recent trade deals. And I don't particularly see why differential the liberalization of services trade—particularly as many of the measures discussed under the rubric of liberalizing trade in services actually don't have any bearing on trade at the border but rather on cross-border investment—would have any more of an impact on the trade balance than differential tariffs on goods. For countries that aren't part of a single market with harmonized internal regulation, a significant amount of trade in services boils down to tourism—and for countries like the United States, an uncomfortably large share of services trade involves a low tax jurisdiction. The services trade deficit of Germany and China basically disappears if you net tourism out, and the largest destination for many IPR heavy subcategories of U.S. services exports is Ireland. The basic insight that the level of trade liberalization impacts the level of trade, not the level of the trade balance is an important one.

There are other areas that would likely be more fruitful for the IMF to investigate—I personally think the most interesting frontier centers around government policies in the large surplus countries that encourage outflows through pension funds, often government controlled, and life insurers. Such policies

directly influence a country's overall external position, not just the level trade. And some surplus countries appear to have taken steps to increase their impact on the foreign exchange market by discouraging hedging—or, in Taiwan's case, allowing its regulated insurance sector to only partially hedge their very large foreign bond portfolio. Japan's decision to coordinate the announcement of the international diversification of its Government Pension Investment Fund's portfolio (with an expansion of the Bank of Japan's bond purchases in 2014), Korea's decision to end hedging of the National Social Security Fund's large external portfolio, and the willingness of Taiwan's regulators to allow life insurers to run an open foreign exchange position of a size that appears to pose risks to financial stability, all likely have had a large impact on global portfolio flows. Countries with already substantial reserves have an incentive to use government policy in more subtle ways to encourage outflows to continue to run large surpluses and avoid crossing any of the trip wires associated with visible intervention. The bulk of official asset accumulation these days isn't taking place on the balance sheet of the central bank, and it isn't showing up in the balance of payments as reserves.



Let me conclude by returning to where I started. The IMF's process of external surveillance is at the cutting edge of applied policy research globally. It has identified the right variables and generally puts the right weight on those variables. There are large gains that could be made simply by taking the insights

that have emerged out of this analytical work and asking whether they can be more aggressively incorporated into the IMF's actual policy advice in major surplus countries.

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WP/19/65

IMF Working Paper

The External Balance Assessment Methodology: 2018 Update

by Luis Cubeddu, Signe Krogstrup, Gustavo Adler, Pau Rabanal, Mai Chi Dao, Swarnali Ahmed Hannan, Luciana Juvenal, Nan Li, Carolina Osorio Buitron, Cyril Rebillard, Daniel Garcia-Macia, Callum Jones, Jair Rodriguez, Kyun Suk Chang, Deepali Gautam, and Zijiao Wang

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IMF Working Paper

Research Department

The External Balance Assessment Methodology: 2018 Update[1]

Prepared by Luis Cubeddu, Signe Krogstrup, Gustavo Adler, Pau Rabanal, Mai Chi Dao, Swarnali Ahmed Hannan, Luciana Juvenal, Nan Li, Carolina Osorio Buitron, Cyril Rebillard, Daniel Garcia-Macia, Callum Jones, Jair Rodriguez, Kyun Suk Chang, Deepali Gautam, and Zijiao Wang

Authorized for distribution by Giovanni Dell'Ariccia

March 2019

Abstract

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

JEL Classification Numbers: F21, F31, F32, F41, F42, G15, G18, O16, O24.

Keywords: current account; exchange rates; external sustainability; global imbalances.

Corresponding Authors' E-Mail Addresses: lcubeddu@imf.org; gadler@imf.org; prabanal@imf.org;

[1] The paper was produced under the guidance of Maury Obstfeld and Jonathan D. Ostry, and in close collaboration with the IMF's External Sector Report Coordinating Group. Alan Auerbach, Menzie Chinn, Giovanni Dell'Ariccia, Romain Duval, Joe Gagnon, Gita Gopinath, Gian Maria Milesi-Ferretti, Dennis Quinn, Brad Setser, Livio Stracca, Alessandro Turrini, and Kenichi Ueda provided useful feedback. The paper also benefited from comments by the IMF Executive Board, country authorities, and participants of a 2018 IMF Workshop on Global Imbalances.

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I. INTRODUCTION

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

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

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

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

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

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

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

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

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

II. THE EXTERNAL SECTOR ASSESSMENT FRAMEWORK

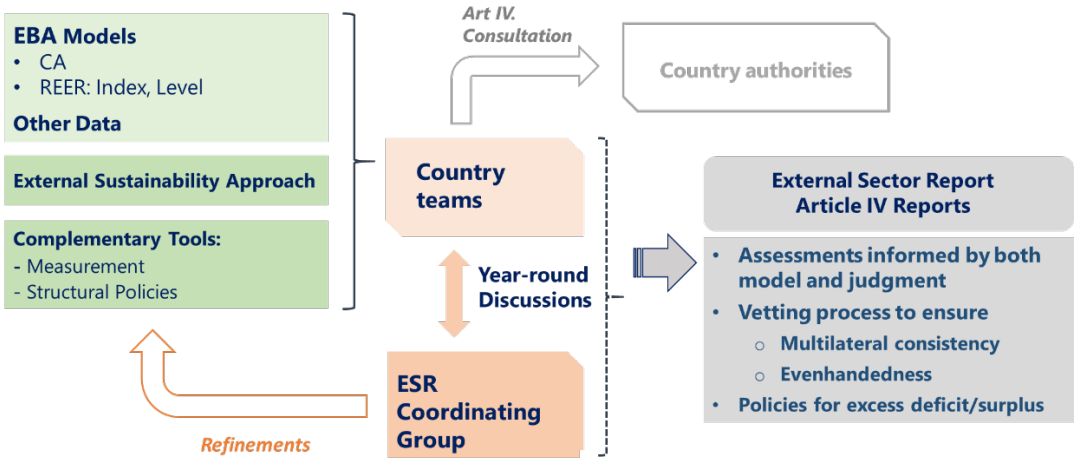
There are good reasons for countries to run current account surpluses and deficits at certain points in time; for example, to smooth out the effect of temporary shocks or to allow capital to flow from countries where it is more abundant to countries where it is scarcer. Thus, the main challenge when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

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

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

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

Figure 1. The IMF's Current External Assessment Framework



III. THE EBA CURRENT ACCOUNT MODEL

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

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

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

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

A. Sample and Estimation Method

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

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

B. Regression Model and Results

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

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

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

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

Cyclical Factors

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

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

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

Macroeconomic Fundamentals

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

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

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

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

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

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

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

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

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

Structural Fundamentals

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

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

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

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

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

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

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

Policy Variables

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

C. Model Fit and Robustness

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

Institutional quality

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

Financial excesses

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

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

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

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

Demographics

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

Foreign Exchange Intervention

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

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

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

IV. EBA REAL EXCHANGE RATE MODELS

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

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

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

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

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

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

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

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

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

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

A. Sample and Estimation Method

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

B. Common REER Determinants

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

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

Cyclical factors

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

Macroeconomic Fundamentals

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

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

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

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

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

Structural country features

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

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

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

Policy Variables

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

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

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

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

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

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

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

C. REER-Index Determinants

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

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

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

D. REER-Level Determinants

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

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

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

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

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

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

E. REER Model Fit and Robustness

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

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

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

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

A. Gaps and Norms

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

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

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

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

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

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

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

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

Defining the cyclically-adjusted current account as:

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

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

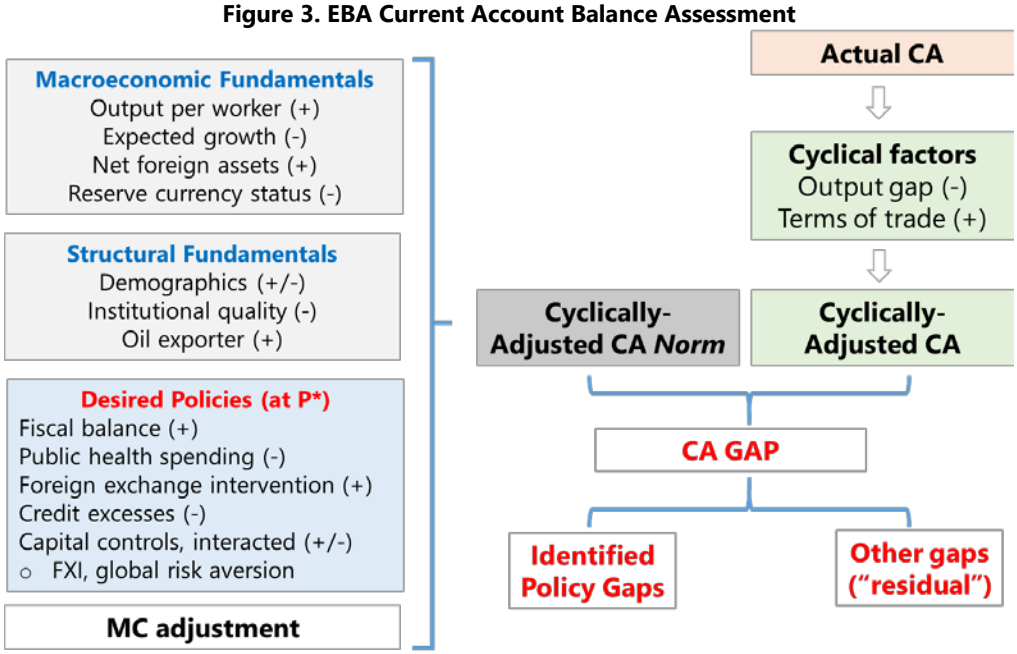
[32] The estimation of REER norms and gaps follows a similar procedure. One important difference is that, unlike the current account, the REER is not cyclically adjusted.

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

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

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

Figure 3. EBA Current Account Balance Assessment



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

B. Benchmarks for Policy Variables (P*)

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

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

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

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

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

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

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

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

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

C. Standard Errors of Estimated Norms

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

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

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

D. Multilateral consistency

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

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

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

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

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

VI. CURRENT ACCOUNT-REER ELASTICITIES

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

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

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

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

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

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

A. Original CGER Approach

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

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

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

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

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

B. CGER-Inspired Approach

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

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

and

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

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

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

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

C. Elasticity Estimates

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

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

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

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

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

VII. THE EXTERNAL SUSTAINABILITY APPROACH

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

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

A. Link Between Stock and Flow Positions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

B. External Sustainability Approach in the EBA Framework

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

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

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

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

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

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

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

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

VIII. COMPLEMENTARY TOOLS

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

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

A. Measurement Issues

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

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

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

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

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

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

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

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

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

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

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

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

B. Structural Tools

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

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

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

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

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

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

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

IX. Concluding Remarks

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 7. EBA REER Models Regression Results

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

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

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

Dependent variable: REER (+=appreciation)

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

Table 8. EBA REER Models Regression Results, 2015 Models

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

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

Table 9. Unit Root Tests

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

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

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

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

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

Table 10. Cointegration tests

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

1/ Based on fitted residuals

2/ Assumes the same cointegrating vector across countries.

The alternative hypothesis is that all panels are cointegrated.

Table 11. CA to REER Elasticities

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

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

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

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

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

Source: OECD, WEF, and Staff Estimates

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

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

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

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

2/ Applied only to Switzerland and the Netherlands.

Annex II: Data Sources

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

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

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

Annex III: Variables Definition in the EBA Models

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Annex IV: List of Countries in the EBA Models

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

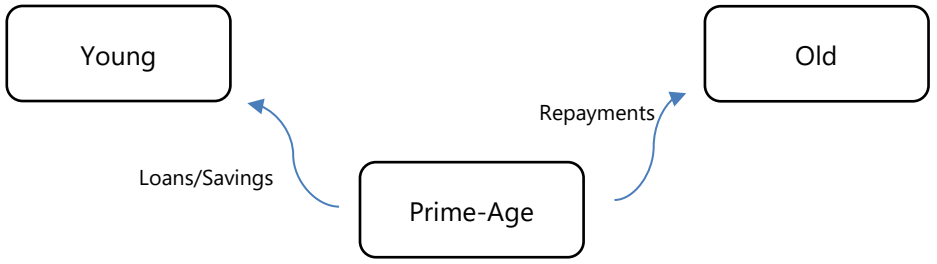
Notes: All countries are included in the current account model. Asterisks (*) denote countries not included in REER index regression, while sharps (#) denote countries not in REER levels regression for data availability reasons.

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

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

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

Figure A.1. Baseline Model: Flow of Resources



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

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

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

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

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

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

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

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

Table A.1. Comparison of Demographics Specifications

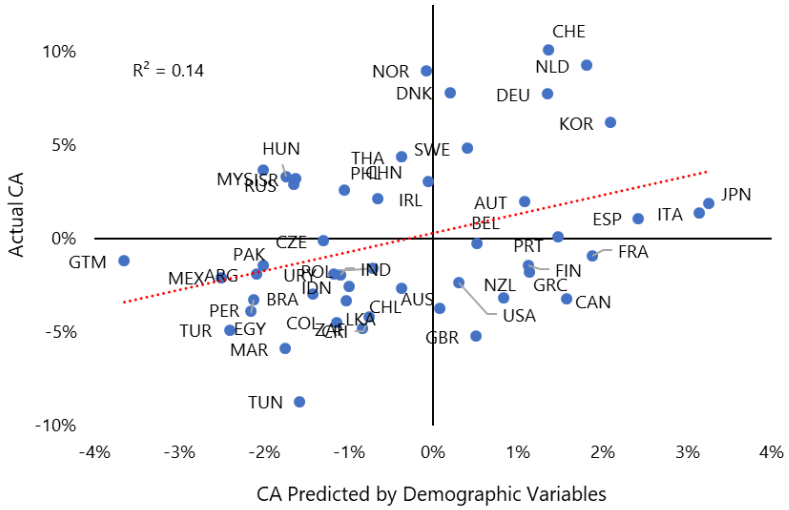
	2015 EBA	2018 EBA
Static Effects	• Old age dependency (OAD) ratio (ages 65+/30-64) • Population growth	• OAD (ages 65+/30-64) • Population growth • Current share of prime savers (ages 45-64) as a proportion of the total working-age population (ages 30-64)
Dynamic Effects	• Interaction of relative aging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

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

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

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

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



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

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

Annex VI: Estimation of Exhaustible Resources in the EBA Models

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

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

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

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

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

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

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

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

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

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

Table A.2.: Benchmark for Public Health Spending

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

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

Session 2:

Alessandro Turrini (European Commission) acted as a discussant for the presentation by Pau Rabanal. He started his discussion elaborating on the different context in which external sector assessment is conducted in EU surveillance. In this respect, he stressed that in EU surveillance macroeconomic imbalances are the object of a comprehensive assessment, with no separate process for external sector imbalances as it is the case with IMF surveillance, and with recommendations in the context of the Macroeconomic Imbalances Procedure spanning a wide range of macro stability-related issues, arising not only from the external sector. Turrini also made the point that the IMF has traditionally been in the lead in the development of methodologies for assessing current accounts and exchange rates, with other institutions, including the Commission, gradually adopting the best practices developed in the fund.

Turrini agreed that the move from CGER to EBA methodologies was a positive development on several respects, notably a current account model better able to capture financial determinants, and that a similar evolution was reflected also in the methodologies used in the Commission. Turrini also highlighted some differences in the Commission methodology as compared to EBA, partly linked to the fact that in the EU framework there is no stand-alone external surveillance similar to that of the IMF. In particular the Commission adopts a more agnostic and simplified treatment of policy variables when estimating current account norms, with no country-specific estimation of policy gaps, and policy variables (measured as differences compared with world averages) not entering the calculation of current account norms.

Regarding the recent revisions in the EBA methodology, Turrini stressed that that they go in the right direction. In particular, the revision of the specification of demographic factors permits to obtain less volatile current account norms. He noted that, in light of the 2018 EBA methodology revision, current account norms calculated by the Fund and the Commission are quite similar for most EU countries, as they were before the 2015 revision of the specification for the demographic effects in the fund methodology. Moreover, the revised specification of demographic permits to take into account additional relevant aspects of the relation between the demographic structure and current accounts, namely the hump-shaped relation between age structure and savings and the role of old-age survival risk on savings decisions. On this respect, Turrini also pointed out that future EBA specifications could take into account another regularity captured by the Commission current account model specification, namely that the effect of old-age dependency ratios on current account balances also appears to be strongly linked to variables capturing the generosity of welfare systems. Where the welfare system is more generous, a younger population is associated to a lesser extent to more savings and therefore to a more positive current account balances, this is what is suggested by interaction the old-age dependency ratio with a variable like health spending on GDP.

Turrini acknowledged the need to overcome the simplistic dummy approach to take into account "financial center" effects. He welcomed the ex-post correction in the 2018 EBA methodology to make equivalent the treatment of portfolio reinvested earnings to that of dividends in the income balance, acknowledging that this is a measurement issue likely to affect especially countries that are an important base for the operation of multinational firms. He noted however that such a correction accounts for a rather small share of the portion of current account norms associated with the financial center dummy. For this reason, in the current EBA approach additional country-specific ex-post adjustments are considered where necessary. Turrini remarked the importance of such ex-post adjustments, and that carrying out such adjustments in a consistent fashion might sometimes be a challenge, as they may require information not equally easily available in different countries.

Turrini also remarked that the omitted variable problem associated with the dropping of the financial center dummy may alternatively be addressed by revising the specification of the empirical current account equation. In particular, the financial sector dummy is likely to partly be capturing the fact that firms providing merchanting services or carrying out contract manufacturing establish their headquarters in few locations, which tend to exhibit higher current account balances other things

being equal (e.g., Beusch et al., 2013). More generally, the financial center dummy helps partly capturing the role played by corporate net savings in driving current account balances. Since the early 2000s, in a number of advanced economies the corporate sector is moving from a negative into a positive net savings position. Growing shares of gross operating surpluses are not fully translated into an increased incidence of dividends (e.g., Cheng et al., 2017; Dao and Maggi, 2018). At the same time, corporate investment shares on GDP have exhibited moderate dynamics, implying a growth in net savings on GDP for the corporate sector. Such net savings have largely been reflected in increased cash holdings. A number of explanations have been put forward to account for these trends, including changing corporate tax rates, a growing share of intangible assets not easily financed by banks against collateral, changing corporate governance.

The fact that current account balances are to a fair extent associated with net savings of the corporate sector implies that a variable like the financial center dummy (equal to one in countries characterized by important multinational and offshore activities) explains a quite sizable share of current account norms. Such a result depends on the fact that large corporations are not equally distributed across countries, that headquarters are often registered in financial centers, and that large corporate net savings are not offset by the net savings behavior of corporate owners.

This feature of the distribution of net savings across sectors has also more far reaching implications for the empirical modelling of current accounts. Standard specifications of current account empirical equations normally include variables that are interpreted as determinants of the net savings position of households and government. The underlying assumptions is that the net savings position of corporations are negligible or offset by the behavior of corporate owners. A challenge for future current account empirical modeling will be that of incorporating specific determinants of corporate net savings (e.g., measures of the incidence of intangible assets…) with a view to account for the lumpy cross-section distribution of large corporations and their impact on aggregate net savings without having to resort to the ad-hockery of a dummy variable approach.

The above is a goal for the medium term. One could nonetheless envisage intermediate approaches that help capturing omitted variables linked to the presence of large corporate net savings, without the limitations of the dummy approach used in the EBA specification up to 2018. One may think for instance of replacing the time invariant dummy approach with time-varying indicators reflecting the incidence of corporate net savings, or time-varying ordinal indicators capturing phenomena such as merchanting.

Turrini concluded his discussion highlighting some avenues for further improvement of the EBA specification. A first set of considerations was raised regarding the credit variable and the NIIP variable. Turrini acknowledged that expressing this variable as a difference from filtered credit data (by means of the HP filter used by the BIS) constitutes an improvement compared with the previous practice of expressing credit as a difference from the country-specific average. The current formulation permits to take into account that drivers of sustainable credit can vary over time. Turrini however wondered whether "financial excesses" in EBA shouldn't preferably be measured against a benchmark allowing also for opportune cross-sectional variation. The current benchmark for credit, being simply the outcome of filtering country-specific data, tend to justify what has been observed historically in a given country, but cannot help understanding whether this credit history was justified on the basis of country characteristics (e.g., economic and institutional development…). An alternative would be that of moving towards a credit benchmark constructed in the spirit of "credit norms", i.e., credit predicted on the basis of country-specific fundamentals.

Similar considerations apply to the NIIP variable. In the EBA formulation, the actual NIIP is considered a fundamental, and contributes as such to the construction of the current account norm. However, one may argue that the observed NIIP is not necessarily a representative NIIP level that provides the best basis for computing a norm. In the present Commission approach to estimate current account norms, the polar case is considered, i.e., the NIIP variable does not enter the computation of the norms, which is equivalent to adopting an NIIP benchmark equal to zero. Quite likely, none of these

solutions are ideal. One may imagine as a better alternative for the NIIP variable to be used to compute current account norms an "NIIP norm" that would be expected on the basis of fundamental country characteristics (e.g., Turrini and Zeugner, 2018). Such NIIP norms would also provide a basis for defining targets for the NIIP for the alternative current account benchmark, i.e., the external sustainability approach.

A second set of considerations for further improvements concerned the modeling of short-term current account dynamics. A first avenue for improvement in this respect would consist of better identifying relevant temporary factors that help explaining current accounts and that would be excluded from the computation of norms. One example are lagged changes in real effective exchange rates or analogous relative price variables. The effect of variations in relative prices on trade balances and current accounts unfolds only gradually having a temporary impact only. Controlling for such factors (as it is in the current Commission empirical specification) would help improving the fit of the model. Moreover, the coefficient of such variable could be used to compute a more complete adjustment of current account from transitory factors (not only cyclical factors but also lagged REER changes) when computing current account gaps, along the lines of the practice followed under CGER.

A second avenue that could be explored would be that of allowing a dynamic structure to the empirical equation. The absence of the lagged current account dependent variables from the set of regressors is at the heart of the limited fit of the model in time series. This is not per se a major drawback, as model predictions and current account norms permit to explain a fair portion of the cross-section dispersion in actual current account outturns. Moreover, in the sample used in EBA current account regressions the residual autocorrelation issue associated with omitting dynamics in its specification is effectively dealt with GLS estimation. Nonetheless, introducing dynamics explicitly would help acquiring additional information on the speed at which current accounts are moving towards norms. Such adjustment speed could be made country-specific, adopting Pooled Mean Group estimation (Pesaran, 1999).

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Session 2:

Strengthening the External Balance Assessment (EBA) and External Sector Report (ESR) Process and Presentation

By Mark Sobel
Deputy Assistant Secretary for International Monetary and Financial Policy at the U.S. Treasury, 2000-15. US representative to the IMF, 2015-18. U.S. Chairman at OMFIF and Non-Resident Senior Advisor at CSIS, current.

It is a great honor to participate in the IMF's conference on the External Sector Report and join many of the world's leading international economists. My value added would be in offering thoughts on the EBA and ESR from the perspective of a former—now unshackled—U.S. official, long actively involved in overseeing IMF policy discussions and relations, including on exchange rate issues. While my insights may thus be biased, perhaps they are of some marginal utility.

The advent of the EBA/ESR was an extraordinarily welcome development and an improvement on the former Coordinating Group on Exchange Rates (CGER) process, even if at times EBA/ESR seems overly engineered. The ESR is one of the IMF's most important publications and should have full "flagship" status. With EBA at its core, the ESR stands out for its excellence. It represents a major enhancement in the IMF's exchange rate analysis and a reaffirmation of the Fund's basic mandates, namely the Fund was created to help avoid beggar-thy-neighbor currency policies and the bilateralization of exchange rate disputes. The Research and SPR teams preparing the document are first class, intelligent, cooperative and thoughtful.

But with respect to the EBA and ESR process and presentation, important improvements can be made. Based on my experiences, below is a discussion of aspects of the EBA/ESR, followed by recommendations for improvements.

The EBA Model

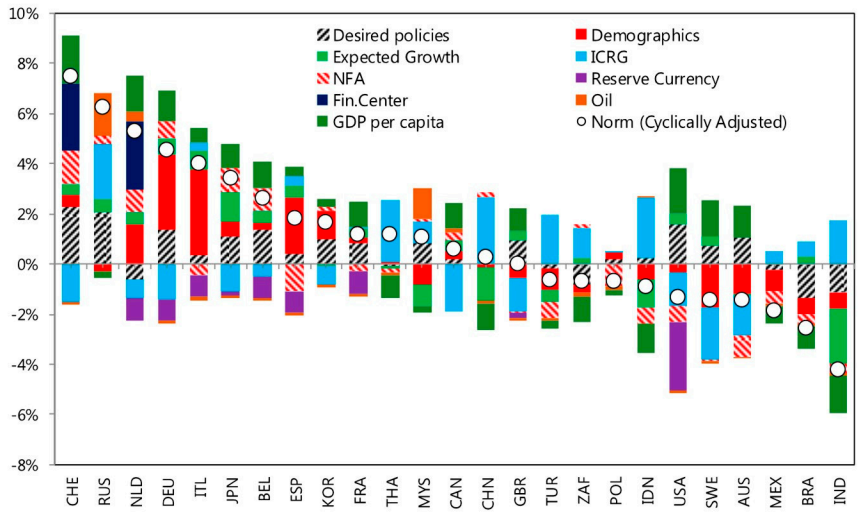
If a picture is worth a thousand words, the chart below from the 2017 ESR offers a good overview of what is entailed in determining EBA current account norms.

Often, debates around EBA center on "desired policies"—the shaded part of the bars. These are important and completely justified debates. For example, there are discussions about the impact of foreign exchange intervention on current account positions. Similarly, there are debates about what constitutes a "desirable" fiscal policy, which can take on added meaning when the IMF has strongly supported adherence to the Stability Growth Pact in the case of surplus EU countries. Also, what constitutes desirable health or pension policy can be subjective. Over time, discussion has rightly emerged about what constitutes the desirable degree of corporate and household saving, given their impact on national saving and thus current accounts via the S-I balance; this work should be furthered. To their credit, IMF staff is not shying away from these challenges.

But what the chart below also shows is that structural factors—such as demographics, institutions, etc.—are every bit as, if not more, important than desired policies in computing EBA norms. These factors are extremely relevant to calculating norms and fully belong in the model.

Figure 7. Estimated Current Account Norms and Main Components, 2016 1/

(percent of GDP)



Source: IMF Staff assessments.
1/ Norms are sorted from highest to lowest. Excludes Hong Kong SAR, Saudi Arabia and Singapore as they are not part of the EBA sample.

The EBA team has admirably provided tremendous transparency to the public about the model and its derivation, as exemplified by the ESR's excellent 2018 "technical supplement". Still, given the sensitivity of model outcomes to the assumptions, a dive into some of the structural variables is warranted.

- In 2015, interactive variables were suddenly added to the "demographic" factor, substantially boosting overnight the current account norms for certain large surplus countries, even though demographic shifts tend to move slowly. The demographic equations were then modified in 2018. The modifications had the effect of pulling sharply down by several percentage points of GDP current account norms for Germany and the Netherlands, for example, thus increasing the gap—and out-of-lineness—between the actual current account position and norm for these two large surplus countries. One possible implication of the modified results is that past current account gaps—and associated currency valuations—for surplus countries in particular were considerably understated.
- For the institutions variable, the Fund until 2018 had used a subset of five indicators (curiously including religious tensions and democratic accountability) from the 22 indicators in the Institutional Country Risk Guide (ICRG; indicators excluded, for example, were government stability, law and order, and bureaucratic quality). But using the full set of indicators for a country such as China yielded very different results—the institution variable pulled China's norm 2.8 percentage points of GDP in the surplus direction under the 5-indicator approach, but only 0.8 points using the full set of indicators.
- The 2018 EBA excludes the financial center dummy, which had previously been incorporated only for a few ad hoc countries, with significant effect (see chart above; Netherlands and Switzerland).
- The reserve variable also warrants further exploration. Undoubtedly, a reserve currency country is typified by liquid and open capital markets, which renders financing easier, facilitating current account deficits. However, the EBA model should exclude "excess reserve accumulation" from the calculation

(or perhaps the excess should be considered a policy distortion). Calculating the "excess" is subjective; a range of measures such as reserves/GDP, Greenspan-Guidotti rule, months of imports should be used; the Fund's Reserve Asset Metric can also be used but given that its results are at time not intuitive, it should only be used in conjunction with the other metrics. Further insofar as there is a relationship between reserve currency status and safe assets, not all euro-area countries should have the same reserve currency result. For example, bunds are clearly a safer instrument to hold than Greek government bonds.

- In deriving current account gaps, the IMF staff also uses a cyclically adjusted current account balance. That brings into question calculations of potential GDP and output gaps. There are substantial debates about the IMF's potential GDP estimates, and their plausibility.
- Given the multilaterally consistent nature of the ESR/EBA exercise, changes in current account norms and gaps for the largest economies of the world can substantially alter the results, and thus the assessment of global imbalances and currency valuations. For example, the Chief Economist of the Institute for International Finance, Robin Brooks—an ex-IMF staffer, has questioned whether the Fund's output gap estimates are far off base, especially for peripheral Euro-zone countries, thus skewing the euro-area's current account norm. (https://www.magnetmail.net/actions/email_web_version.cfm?ep=5pZ0lq7b-4wFaVW5PpoaMbkTAJSNiZ8I1rDzTqzuXZrg-ianaD6aExsJ5Z2M4jxI5PfAHQHdb5dmgqe6qRBEVzsh63YA2qiuj40vfgpb2HR2xHDKPQCVfZDLe375xgkj).

Exchange Rate Valuations

The ESR/EBA should clearly highlight the degree of a country's exchange rate under/over valuation. Unfortunately, while the ESR/EBA exercise has visibly highlighted whether a country's fundamentals are "higher" or "lower" than justified by medium term fundamentals and desirable policies, its assessment of exchange rate valuations is obscure to the reader.

ESR/EBA uses several exchange rate models—a current account-based approach, a real exchange rate approach, and an external sustainability model. To quote the 2018 ESR, "greater weight continues to be given to the current account model, because real exchange rates tend to be more volatile and difficult to explain econometrically."

- Despite this language, Figure 6 of the 2018 ESR—the main text chart on exchange rate valuations—includes a chart on REER gaps, with the gap defined as the average of the level and index-based REER regressions.
- The country pages are very confusing and do not provide a clear estimation of exchange rate over/undervaluation. The German country page's real exchange rate section references the valuation resulting from the REER level model (-19 percent) and the CA gap assessment (-15 to 20 percent) and concludes the REER undervaluation is 10 to 20 percent. The China page uses the REER index regression, but then points to a huge range of under to overvaluation, and then explains it all away in suggesting the REER is in line with fundamentals and desirable policies. The France page notes that the REER models do not point to overvaluation, but the CA gap model does so, roughly 4 to 8 percent. For Japan, the country page suggests the REER models point to undervaluation of 17-18 percent, but the staff CA gap range points to an undervaluation of -13 percent to overvaluation of 6 percent. Korea uses a current account gap range, showing an undervaluation of 1 to 12 percent.
- In pointing to under/overvaluation, sometimes staff does so based on the EBA CA or regressions results, or staff point to a variety of measures to draw offsetting and inconclusive views, and at other times point to wide staff ranges around the EBA norms to highlight a large range of estimates for

currency valuation. The ranges can be so wide—as in the case of Korea above—as to render currency valuation assessments rather meaningless.

- Deriving under/overvaluation estimates from the current account gap and standard elasticity calculations seems straightforward and relatively comprehensible. Doing so is to be recommended and would stand in stark contrast to staff's current confusing and obscure presentation.

The ESR Process

The ESR is a product of the Research, SPR, and area country departments. At times, given IMF member country sensitivities about EBA results, ESR outputs can appear to be biased and arbitrary, as reflected in various staff adjustments or writings.

For example, the 2017 Thai Article IV noted that while Thailand had a current account gap of nearly 8 percent of GDP, up to 4 percent of that was explainable by "political uncertainty". The effect of political uncertainty still played a significant role in reducing the current account gap in 2018. In earlier years, the Korean gap had been lowered by 2-1/2 percent of GDP in view of precautionary saving associated with Korean reunification. Little credible justification for these conclusions was provided.

The staff also include ranges around current account gaps. These can at times be wide, especially in the case of surplus countries—+/-2 percent for Switzerland, Thailand, and around 1-1/4 to 1-1/2 percent for Germany, China, and Japan.

If the ranges are wide, then the over/undervaluation estimate for any given model will be wide. For example, as discussed above, the Japan country page points to a range of -13 percent undervaluation to 6 percent overvaluation. Similarly, per above, the 2017 Korea Article IV, conducted in early 2018, observed that given different model results, overall the 2017 REER was assessed to be 1 to 12 percent below the level consistent with fundamentals and desired policies. Needless to say, whether a currency is 1 percent vs. 12 percent undervalued makes a huge difference in an assessment of the external position and currency valuation.

Staff adjustments to the EBA country results can seem arbitrary and biased, embodying excessive discretion. They can create the impression that the ESR is somewhat of a negotiated document in which staff—presumably area department staff—at times skews outputs during the negotiation process to show deference to country sensitivities.

RECOMMENDATIONS TO STRENGHTEN THE EBA/ESR

1. The ESR's status should be elevated. Even if produced only one time a year, it should be accorded full "flagship" status. Efforts should be made to make the ESR a more timely document (e.g. it now comes out in mid-year, using previous end-year data).
2. The ESR/EBA should be "owned" by one person in the Fund, reporting to Management, who will be fully "accountable" for the final product. That person should be the Director of Research. The Director should be allowed to overrule staff judgments deemed as unwarranted or entailing excessive discretion. This "ownership" will help allow unnecessary arbitrariness and capriciousness to be stricken from the ESR.
3. Any changes in the EBA methodology—such as the addition of interactive variables to the demographic factor—should be road-tested in advance with a group of leading external economic experts. As with the 2018 technical supplement, all refinements should be published.

4. The ESR should emphasize and rely far more heavily on the EBA results. The role of staff discretion in adjusting EBA outputs in the ESR process should be sharply scaled back and curtailed.

5. If in turn an Area Department believes that an EBA result is significantly out-of-line, the Area Department should be able to include a dissenting comment in the ESR or on the country page (as well as a fuller explanation in the country Article IV). We should not pretend that staff views are monolithic.

6. The ESR's exchange rate presentation needs to be overhauled and made far more transparent and comprehensible. The ESR discussion and any charts should give emphasis to the valuation resulting from the current account gap and a standard elasticity. The staff should be compelled to put forward one point estimate for over/undervaluation for a given country and staff ranges around norms should be eschewed. To the extent that staff wishes to present other models, there should be a table clearly presenting the over/under valuation resulting from each model.

7. EBA outcomes depend heavily on estimates of potential GDP. The Fund's estimates have been increasingly challenged. (As noted, in particular, see recent work by IIF Economics team.) The Research Department should reexamine staff's potential GDP and output gap estimates and their impact on current account norms and currency valuations.

8. The ESR should also include a section on global reserves—stocks and flows. This section should highlight a diverse set of metrics for examining reserve adequacy, including—but not limited to—the staff's Reserve Adequacy Model (RAM). The RAM itself should be reexamined to gauge whether its results make intuitive sense. Serious questions have been raised for years about whether the RAM overweights the role of M2.

9. The Fund should keep the role of intervention and its impact on current account positions under continuous focus. In so doing, the Fund should clarify its focus on intervention. IMF surveillance principles state that intervention is to be undertaken to counter disorderly market conditions. But IMF country teams appear to have a supremely elastic definition of "disorderly", and how can a staff team assess whether intervention is undertaken in disorderly conditions if countries do not share intervention data and staff is unable to assess market conditions at any point in time. It does not suffice to simply argue that there can be other rationales for undertaking intervention beyond disorderly market conditions.

10. The Fund should continuously examine structural variables in EBA and ensure appropriate economic rigor in its judgments of "desired policies". The so-called "picture worth a thousand words" should be included in every ESR.

WP/18/262

IMF Working Paper

The Rise in Corporate Saving and Cash Holding in Advanced Economies: Aggregate and Firm Level Trends

by Mai Chi Dao and Chiara Maggi

 WP1/8/262

IMF Working Paper

Research Department

The Rise in Corporate Saving and Cash Holding in Advanced Economies: Aggregate and Firm Level Trends

Prepared by Mai Chi Dao and Chiara Maggi[1]

Authorized for distribution by Luis Cubeddu

November 2018

Abstract

Using cross-country national accounts and firm-level data, we document a broad-based trend in rising gross saving and net lending of non-financial corporates across major industrialized countries over the last two decades, though most pronounced in countries with persistent current account surpluses. We find that this trend holds consistently across major industries, and is concentrated among large firms, driven by rising profitability, lower financing costs, and reduced tax rates. At the same time, higher gross corporate saving have not supported a commensurate increase in fixed capital investment, but instead led to a build-up of liquid financial assets (cash). The determinants of corporate cash holding and saving are also broad-based across countries, with the growth in assets of large firms, R&D intensity, and lower effective tax rates accounting for most of the increase over the last 15 years.

JEL Classification Numbers: G31, F12, O32

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Authors' E-Mail Addresses: mdao@imf.org; chiaramaggi2018@u.northwestern.edu

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1 Introduction

The role of the non-financial corporate sector in driving various aggregate structural trends such as the decline in labor income shares (see Autor et al. (2017); Chen et al. (2017)), higher average mark-ups and profit shares (De Loecker and Eeckhout (2017); Barkai (2016)), and declining investment and productivity growth (Gutiérrez and Philippon (2017)) has been gaining increased attention in the literature. Meanwhile in policy circles, there is mounting interest in understanding the corporate sector's role in driving the increase and persistence of current account surpluses of some countries (IMF (2017)). That said, we still lack a systematic analysis of the macro and micro level trends in corporate profits, saving and investment, and the vast majority of studies have so far focused on the behavior of corporate saving and investment in the US, posing the question of whether the identified patterns and mechanisms hold across a wider set of countries.

This paper fills the gap by documenting and analyzing the evolution of corporate saving-investment balances in major advanced economies starting from the mid 1990s. We contribute to the literature and policy debate by providing an in-depth look at the sources and uses of corporate saving, extending the analysis beyond the US to a sample covering nine (G7+2) major advanced economies where reliable national accounts and firm level data are available (US, UK, Canada, France, Germany, Italy, Japan, Korea, the Netherlands). We combine both flow of funds and sectoral balance sheet data from national accounts with firm-level income statements and balance sheets data to arrive at a consistent view of the main trends and drivers.

First, using national accounts data, we document that the corporate sector swung from being a net borrower of funds from the rest of the economy to a net lender starting in the early 2000s across advanced economies, and study the extent to which this has been driven by rising gross saving or declining investment. Second, we decompose the change in corporate saving into contributions from the different *sources*: firms' profitability, property income, interest payments, tax payments, and shareholder payout. The secular increase in corporate gross saving across major advanced economies

has been accompanied by stagnating or declining investment in physical capital. Saving in excess of investment in physical capital is reflected in an increase in net lending (i.e. excess saving) of the corporate sector with respect to the rest of the economy. We therefore investigate the *uses* that firms make of these excess saving. We do so by looking at aggregate balance-sheet data of the non-financial corporate sector to shed light on how excess saving are allocated across different financial assets. Finally, we drill down to firm-level balance-sheet data to analyze the micro characteristics of firms driving the macro dynamics of corporate saving observed in aggregate data.

We document several empirical facts using sectoral balance sheet and flow of funds data. First, we find that the rise in corporate excess saving, in other words the trend towards a net lending position to the rest of the economy, is broadly common to all corporate sectors across our sample of major advanced economies, but is most pronounced in countries with persistent current account surpluses. Second, the increase in gross corporate saving mostly come from a combination of higher profitability and lower interest payments that have not been matched by higher taxes and dividends. Third, the analysis of aggregate balance sheets for non-financial corporations in each country reveals that these excess saving have been most consistently stored in very liquid assets, such as currency, deposits and short-term debt.

Importantly, we find a robust co-movement between national accounts and firm-level data, which come from the Thompson Reuters Worldscope database and mainly draw from balance sheets data and income accounts of large, listed firms. This suggest that the saving-investment behavior of large corporations track well the aggregate corporate net lending trends from national accounts, and that studying the saving behavior of large public firms allows us to gain important insights into aggregate trends. Several important results emerge from firm-level data. First, we find that the rise in corporate net lending and cash holding is driven to a large extent by trends within-firms rather than compositional changes. That is, higher average and aggregate net lending and cash ratios are primarily a result of higher propensity to retain earnings and hold cash by a typical large firm, rather than due to compositional shifts where low saving/low cash firms exit and/or high saving/high cash firms enter the sample.

Second, we identify at the micro-level the characteristics of firms with the greatest propensity to hold liquid assets and retain earnings. Consistent with the correlation between firms' excess saving and liquid assets holding, we find that determinants of cash-holding also explain most of the variation in net lending within and across firms. Among the most robust and material determinants of higher corporate net lending within firms over time are rising profits and asset size, lower effective tax rates, and especially until the early 2000's, increasing spending on $R\&D$.

While our paper does not pin down fundamental causes for the rise in corporate saving, the detailed patterns documented point to important macroeconomic implications of the increasing dominance of large firms (see 2018 Jackson Hole conference). Firms that save much more than they invest tend to be larger and more profitable, engage strongly in $R\&D$ and have low effective tax rates as they are more likely to exploit complex international tax strategies. Therefore, the recently documented rise in industrial concentration is thus likely to have contributed to the trend in rising corporate saving (see Dao et al. (2018)). The detailed documentation of cross-country and sectoral corporate saving-investment trends should help shed further light into better understanding the shifts and persistence of aggregate flow of funds and external balances in key economies, including on whether public policies can play a role.

2 Literature Review

Our paper builds on two strands of literatures. First, it contributes to the macro literature on corporate saving and the implied rise in the net lending position of corporations. This literature is mostly based on macro evidence from sector-level data, as is the first part of our analysis. Secondly, our paper relates to the very extensive corporate finance literature analyzing the rise in cash holding by US corporations. Papers in this area are mostly empirical and use balance-sheet data at the firm level to identify the drivers of cash accumulation, as we do in the second part of our work. One contribution of our paper is to integrate the corporate view of firms' cash holding with the more macro-level analysis of aggregate corporate sector flow of funds, thus

providing a consistent top-down understanding of the main trends.

With reference to the first group of macro studies, André et al. (2007) and IMF (2006) were among the first to document the global rise in corporate saving relative to investment in advanced economies, leading to a rise in the net lending position of the non-financial corporate sector. These earlier studies stress the importance of both cyclical and structural factors underlying the rise in corporate saving. In particular, they show how the rise in the corporate net lending position can be explained by a rise in profitability induced by a fall in taxes and interest rates, as well as by a fall in the price of capital, which lowered the cost of investment and therefore contributed to the rise in gross saving. Gruber and Kamin (2016) focus on the role of declining investment in boosting corporate net lending in OECD countries and conclude that this decline was largely cyclical. All these papers generally conclude that corporate net lending positions would reverse substantially as the recovery from the GFC takes hold, a presumption that did not materialize consistently across major advanced economies. Relative to these studies, our paper goes in considerably more detail in assembling different sources of data to analyze the patterns and drivers of corporate net lending as well as the flow of funds across sectors, extending both the country and time coverage, and reconciling the macro and micro level patterns.[1]

While this macro literature mostly aimed at empirically documenting various facts associated with higher corporate saving, a limited number of papers took a more structural approach and developed models to explain the cause of the corporate saving glut and perform counter-factual analysis. For example, Armenter and Hnatkovska (2017) explain the rise in net lending of US corporations by proposing a general equilibrium model where corporate saving arise from the precautionary motive of firms seeking to accumulate financial assets and fund such purchase via equity issuance to avoid being financially constrained in the future, even though debt is fiscally advantageous. More

[1]The rise in corporate saving has also been documented for emerging market economies. Bacchetta and Benhima (2015) link the increase in corporate saving in fast-growing EM's with credit constrained firms' need for liquid assets, leading to a complementarity between domestic investment and capital outflows. A similar mechanism is presented in Fan and Kalemli-Özcan (2016), who in addition argue that financial liberalization may not reduce overall corporate saving due to offsetting mechanisms.

recently, Chen et al. (2017) develop a general equilibrium model where the decline in the price of investment goods and real interest rates cause firms to replace labor with capital and increase corporate saving. These saving are then used for share buyback instead of dividend payout due to tax incentives, boosting the average corporate net lending position.

The second branch of literature our paper builds on documents and explains the rise in cash holding at the firm level. This literature is focused on the US and mostly relies on reduced-form evidence from Compustat balance-sheet data. Several factors have been shown to predict cash accumulation by firms. Bates et al. (2009), for instance, finds that firms with higher idiosyncratic risk, higher R&D expenditures, high Tobin's q recorded the largest increase in cash holdings. The importance of R&D especially for entrants in recent cohorts has also been emphasized by Begenau and Palazzo (2016), who show that the shift towards intangible capital of the average firm in Compustat is driven by R&D-intensive firms that go public with progressively less tangible capital relative to assets, while non R&D-intensive firms keep their tangibility ratios relatively stable over time. Along the same lines, Graham and Leary (2016) attributed the rise in average cash-holding to health and tech firms going public with large cash balances. This result is in line with Booth and Zhou (2013), who showed that the rise in average cash-to-asset ratio is driven by changing firm characteristics of high-tech firms. Closely related to the role of R&D, another strand of literature studies how increased product market competition gives rise to higher cash holdings by the need to rely on internal funds to finance future investment and gain strategic competitive edge, see e.g. Della Seta (2011), Ma et al. (2014), Morellec et al. (2014) and Lyandres and Palazzo (2016). This contrasts with the idea that firms store cash for lack of investment opportunities, and is rather in line with evidence that the shadow value of cash holding has increased significantly, as in Bates et al. (2016). Finally, wile this last group of paper focuses on understanding how the evolution of certain firms' characteristics has shaped that of cash holdings, other papers in this literature focus instead on the change in institutional factors that affected the business environment. For example, Foley et al. (2007) studied the role of tax-induced

motive for cash holdings, while Azar et al. (2016) highlights the changes in the costs of holding cash over time. The recent paper by Graham and Leary (2017), studying cash holding over almost a century in the US, also finds that macroeconomic conditions external to the firm, in particular profit opportunities and tax incentives have had an important impact on cash holding among established firms in the US since 2000.

While our paper is motivated by the stylized facts of the first branch of macro literature on net lending, we establish a tighter connection with the conceptual and empirical framework of the second branch of corporate finance literature. Relative to this second group of papers on corporate cash holdings, we are extending the empirical framework to firms in other advanced economies outside the US. Moreover, we link the empirical determinants of cash holdings with the net lending position of firms, consistent with our goal to connect with the macro literature. In doing so, we show that evolving motives for cash holding have also been shaping the rise in corporate saving and net lending, with potentially sizable implications for current accounts across countries.

3 Aggregate Stylized Facts

To study corporate excess saving, we compute the net lending position of the corporate sector with respect to the rest of the economy. As is common in the literature, we focus on non-financial corporates only, as financial corporations' balance sheet compositions are strongly influenced by regulatory standards.

Consider the following definition of net lending:

$$NetLend = GrossSaving - CapitalExpenditure, \tag{1}$$

where $GrossSaving$ stands for the amount of firms' aggregate net income, gross of depreciation, that are not distributed to shareholders, while $CapitalExpenditure$ refers to firms' aggregate investment in physical capital.

In Figure 1, we aggregate the net lending position of the non-financial corporate

sector and its two components, gross saving and capital expenditure, to the level of the G7 group as a whole.[2] Up until the early 1990's, corporations had persistently been net borrowers of funds as one would expect, but this behavior has reversed since then. The striking pattern shown in Figure 1 is that corporations across the G7 have started consolidating their net lending position, both through larger gross saving and lower investment rates, since the early 1990's. Around the early 2000's, non-financial corporations in the G-7 have swung from being net borrowers of funds from the rest of the economy to net lenders.[3] This means that the rise in net lending is a relatively long-standing phenomenon, pre-dating the recent Global Financial Crisis.

In the remainder of this section, we show that the aggregated stylized fact of rising corporate net lending also holds within the vast majority of individual countries in our sample. First, we explore firms' net lending dynamics by country and show how they contribute to each country's overall saving-investment or current account balance. Secondly, we investigate the *sources* of corporate excess saving. That is, we examine whether the increase in excess saving is mainly due to firms' rising profitability, falling share of distributed income in percent total profits, decreasing capital investment, or a combination of all of these facts. Finally, we study the evolution of the *uses* of excess saving, documenting shifts in firms' asset composition that accompany their increasing net lending position.

3.1 Corporate net lending and current account positions

Consider the following definition of a country's current account balance:

$$CA = Saving - Investment = NetLendingoftheTotalEconomy = \sum_{s} NetLend_s, \tag{2}$$

[2]The G-7 group represents the largest industrialized countries worldwide and is computed as the GDP-weighted average of the US, UK, Canada, Japan, Germany, Italy, and France.

[3]Our dataset starts from 1995, because this is as far back in time as we can go with European data, provided by Eurostat and compiled according to the European System of National and Regional Accounts (ESA) 2010. Accordingly, ESA 2010 represents the newest internationally comparable EU accounting framework consistent with the worldwide guidelines on national accounting set out in the System of National Accounts 2008 (SNA 2008).

where $s \in \{HH\&NPISH, FC, NFC, GG\}$ indexes each of the sectors that sum up to the total *domestic* economy, that is, households and non-profit institutions serving households (henceforth $HH\&NPISH$), corporations - further separated into financial (FC) and non-financial (NFC) corporations and the general government (GG).

Figure 2 plots the net lending position of each sector within each country of our sample and shows how the sectoral net lending position contributes to the net lending of the domestic economy. Three interesting facts emerge from Figure 2. First, while countries in the sample show very heterogeneous dynamics of their current account position[4], the corporate sector became a net lender everywhere, except for France and Korea, with different timing across countries starting from the early 2000s. In Korea, corporations are still net borrowers, but they decreased their net borrowing position dramatically in the last 15 years. Hence, the increase in corporate excess saving is a robust feature across major economies, regardless of their current account position.

The contribution of the corporate sector to overall current account balances is even more prominent in periods of large changes to the external balance. Whenever there is a large upward spike in a country's current account balance, and regardless of the current account level, most of the increase is driven by the corporate sector. This is the case for example in Germany in the early 2000, Korea after the Asian crisis, the US in 2009, and Italy in 2012. Second, in countries where firms became net lenders, $HH\&NPISH$ have not offset this shift by increasing their net borrowing position as would be the case if households would "pierce the corporate veil" as predicted by theory (see Poterba et al. (1987)). Rather, with household net lending position unchanged, higher corporate net lending tends to translate into a higher a private net lending position overall. Finally, while the private sector is significantly contributing to the overall current account balance, the government also plays an important role in determining the current balance positions. In the UK and the US, for instance, government's borrowing from the rest of the economy more than compensated the

[4]On the one hand, countries like Germany, Japan, Korea and the Netherlands have been recording large and persistent current account positions. On the other hand, the UK and the USA have been constantly running current accounts deficits. Evidence is mixed for Canada, which turned into a deficit country only since 2013, France, in deficit since 2007, and Italy, which is currently running a current account surplus after being in deficit since the 2000.

private sector's saving surplus, so that these countries have been running a persistent current account deficit. In Germany, Japan, Korea and the Netherlands, on the other hand, the saving behavior of the private sector has not been compensated by the government, so that these countries show a persistent current account surplus position. Overall, given the role that corporate net lending has in driving overall current account positions across countries, it is increasingly important to understand the drivers of corporate saving and net lending as new insights may shed light on drivers and causes for global imbalances.

3.2 The sources of corporate net lending

In this section we focus on sources behind the rise in firms' net lending position, restricting our analysis to the non-financial corporations as is common in the literature.[5]

We first analyze the dynamics of the components of net lending as defined in equation (1). Consider again Figure 3, which plots net lending for the non-financial corporate sector, decomposing it into the underlying series for gross saving and capital expenditure. In most countries, we see a positive trend in gross saving. The rise is particular significant and persistent in Germany, Japan, Korea and in the Netherlands. On the other hand, capital expenditure fell everywhere or showed no trend. The fall in capital expenditure is particularly stark in Germany and UK. We can summarize our findings as follows: (i) while saving more and more of their profits over time, firms have not been using these saving to finance greater capital expenditures, (ii) in all countries, the shift of corporations to net lenders has been driven by a combination of both a rise in gross saving and a fall in capital expenditure, (iii) Germany, Japan, Korea and the Netherlands, which are the countries with the greatest and most persistent current account surpluses, show the most significant rise in firms' gross saving.

Secondly, we delve deeper into the dynamics of gross saving and check the evol-

[5]Indeed the evolution of net lending for the corporate sector as a whole is largely determined by that of non-financial corporations

ution of its components, focusing in particular on countries which experienced the strongest increase: Germany, Japan, Korea and the Netherlands. Accordingly, consider the following definition

$$\begin{aligned} GrossSaving &= GrossProfit - Dividends\,paid \\ &= NetIncome + Depreciation - Dividends\,paid, \\ NetIncome &= GOS + PI + NetRE_{FDI} + NetTransfers \\ &- Net\,Interest\,paid - IncTaxes, \end{aligned} \tag{3}$$

where $GrossProfit$ stands for firms' profit (net income) gross of the depreciation of physical capital. The first decomposition allows us to determine whether the rise in firms' saving is driven by a rise in firms' incomes or by a fall in distributed dividends. Moreover, we can decompose the change in net income into gross operating surplus (GOS), net property incomes (PI) and transfers received, less net interest and corporate income taxes paid. Accordingly, consider Figure 4, which decomposes for each country the total change in gross saving rates over the whole sample period into source components according to national accounts definition. In all countries where gross saving have increased over the last 20 years, they has been doing so on the back of increased profits, both from domestic operations (GOS), and/or from (real and financial) investments abroad (reflected in FDI related retained earnings and net PI), as well as by lower interest payments. At the same time, dividend payouts, while also increasing, have done so by much less than corporate income, leading to saving rates that stand up to 3-7 percent of GDP higher now compared to 20 years ago. Payment of corporate taxes, instead of rising proportionately with profits, have instead declined in almost all advanced economies shown, and in countries where tax payments have increased, they did so by much less than corporate profits (Germany, Korea).

For countries where the corporate gross saving rate increased, Japan, Korea, Germany and the Netherlands exhibited the most persistent positive trend in firms' profitability, as shown by the breakdown year by year in Figure 16 in the Appendix.

Among these countries, distributed income as a share of profits fell particularly post-GFC in Germany. Profitability has been rising in the US as well, with the exception for the years of the global financial crisis. In summary, among countries which exhibit the strongest rise in firms' saving and the most persistent current account surpluses, higher profitability (broadly defined, including income from financial investment and FDI) has been the most important source for this trend, reflecting forces that give rise to increased ability of firms to extract operating surpluses, while the decrease in distributed income played a role, if any at all, only during the GFC (US, Japan, Korea) or afterward (as for Germany). By contrast, the impact of taxes and interest payments is less uniform. Notably, the corporate sector in Japan and Korea stand out during the mid-1990's to early 2000's, when higher corporate net income was mostly driven by declining interest payments, reflecting large-scale deleveraging in the aftermath of banking crises.

Zooming in on the positive trend in GOS, in turn, we can further shed light on whether higher corporate GOS has been a result of stronger productivity growth (relative to other sectors of the economy), or lower labor income shares and production taxes, or both. That is, we decompose:

$$GOS = GVA - CompEmp - ProdTax$$

Figure 5 summarizes the relationship between long-run changes in GOS and corporate gross value-added (GVA), both expressed in percent of GDP, as well as labor incomes shares respectively.[6] Clearly, both a higher share of corporate GVA as well a lower share of GVA that is paid to labor have been accompanying higher shares of GOS in countries where it increased the most. While the former shift could be driven by higher productivity growth or structural transformation, the latter trend, widely documented (see e.g. Dao et al. (2017)) can be the result of technology, globalization, or changes in workers' bargaining power.

To summarize, the rise in corporate net lending has been driven by a combination

[6]That is, we show each country's position along the schedule $\Delta\frac{GOS}{Y} = \beta_1\Delta\frac{GVA}{Y} - \beta_2\Delta\frac{wL}{GVA} - \beta_3\Delta\frac{ProdTax}{GVA}, \beta_1, \beta_2, \beta_3 > 0$.

of rising gross saving and falling capital expenditure. Among countries with the most significant increase in gross saving and current account surpluses (Japan, Korea, Netherlands, Germany), this trend was mostly driven by a rise in gross profitability, and, only after the global financial crisis, to a fall in dividends distributed as a share of total profits. Across much of the sample, rising operating surpluses (including retained earnings and property income from foreign operations) have been further supported by lower interest payments and stagnating tax payments (i.e. declining effective tax rates).

3.3 The uses of corporate net lending

Having documented the pervasive trend in rising corporate net lending and the dominant source for this trend, we now turn to the question of how firms have been using these excess saving. That is, we document how firms have been allocating their excess saving across different types of assets on their balance sheets. This exercise will shed light on the reasons behind firms' accumulation of internal resources, depending on the dominant type of financial asset they invest in. To start off, consider the following equation describing the use of firms' gross saving:

$$GrossSav = CapInvestment + EquityBuybacks + \underbrace{\Delta NetFinancialAssets}_{\Delta FinAssets - \Delta DebtLiab}. \quad (4)$$

This equation shows that corporations must choose how to allocate the fraction of profits that they do not distribute to shareholders among investment in physical capital, paying shareholders through equity buybacks and adjusting the composition of their balance sheets.

At the aggregate level, it is not possible to measure actual value of equity buyback of the total corporate sector as we only observe the net change of equity liability of all firms, which subsumes new equity issuances of existing firms and new entrants. However, we know from other studies that, although equity buybacks do represent a common use of corporate excess saving, they cannot account for the bulk of the rise in corporate net lending in OECD countries (e.g. Chen et al. (2017)). In other

words, much of the excess saving must have gone toward changing the composition of balance sheets and the net financial asset position (the last term on the right hand side of equation 4). We also confirm that this is the case by plotting the time series of aggregate corporate net lending flows against the evolution of corporate net financial asset positions in Figure 6. To build our measure of the net financial asset position (NFA hereafter), we follow Armenter and Hnatkovska (2017) and define it as the difference between the sectoral financial assets minus debt. When constructing debt, we subtract equity from the total value of liabilities. Details on how we construct each measure from the sectoral balance sheet data of each country are provided in the Appendix. By and large, increasing net lending is strongly associated with improving net asset position and vice versa within each country. A simple panel regression with country fixed effects shows that a 1 percent of GDP higher net lending rate within countries is associated with a 1.6 percent higher net financial asset position of the corporate sector on average, with the coefficient estimate being highly statistically significant. Accordingly, in the following, we abstract from equity buyback and focus on the balance-sheet impact or use of firms' net lending through the following approximation:[7]

$$NetLend = GrossSav - CapInvestment \approx \Delta NetFinAssets. \tag{5}$$

In Figure 7, we decompose the evolution of the aggregate NFA position into the underlying series for financial assets and debt. Clearly, firms have not used their excess saving to pay down debt in a systematic way across countries. Indeed, with the exception of Italy and Japan, the level of debt has increased in all countries. Instead, the data suggest that firms have been increasing both overall financial assets and debt, but they have been using their excess saving to increase their overall asset position beyond the increase in debt.

We can also more systematically account for the different uses of net lending

[7]We do not rule out that some of the balance sheet composition change is driven by the motive of share buybacks, e.g. cash position may be higher in times when the firms decides to buy back shares using its internal funds, possibly with some lag, and revisit the buyback motive for net lending and cash holding at the firm level in section 4.

flows by jointly correlating them with all major uses recorded in aggregate financial accounts. That is, we regress the share of non-financial corporate net lending over GDP on the main balance-sheet variables from the assets side. Overall, corporate saving in excess of investment (i.e. corporate net lending) can be used to either buy back shares, pay down debt, or acquire financial assets (which in turn can be broken down into equity, loan/account receivables, debt or cash assets). While all uses have been relevant in different countries and years, simple regressions using flow of funds and sectoral financial accounts data across countries in our sample show that the accumulation of cash has been the most salient use of corporate net lending. As shown in Table 1, changes in the cash ratio (that is, cash in percent of total financial assets) are strongly associated with higher corporate net lending positions, both in the pooled and within-country regressions, suggesting that cash accumulation has been a major use of corporate net lending.

To illustrate the tight link between corporate excess saving/net lending and cash holding, we plot the two series against each other for each country in the sample. As it turns out, the rise in corporate net lending position has been mirrored by that in the stock of cash and liquid assets on firms' balance sheets. We show this fact in Figure 9, which plots the share of corporate net lending over GDP with the share of cash and liquid assets over total financial assets.[8] The correlation between net lending and cash ratios is very tight within each country, implying that, at least in the short-run, firms have been accumulating excess saving to boost cash holdings. Among countries in the sample, the correlation between net lending and cash holding has been particularly strong in Germany and the Netherlands.

While the evidence thus far does not necessarily imply a causal relationship between holdings of liquid assets and corporate net lending, it still suggests that, whatever the motives for the rise in cash holdings, they likely play a role in driving a rise in net lending as well. This leads to the second part of our analysis, where we

[8]We construct this graph with sectoral balance-sheet data for non-financial corporations, as recorded in the Financial Accounts of each country. Our measure of cash and liquid assets includes short-term securities, mutual fund shares and repo; see the Appendix for details on how this variable is constructed using sectoral balance-sheet. Note that for Korea, we lack consistent aggregate balance-sheet data spanning across the entire sample.

move to micro data to identify the characteristics of firms that account for the rise in corporate cash holdings and net lending flows, and provide a more granular view of the aggregate trends documented so far.

4 Firm-level analysis

In the following, we use firm-level data to further shed light on the determinants of cash holding, as such factors are likely to be driving the corporate saving dynamics established in the previous analysis. We use a comprehensive dataset covering consolidated financial statements of publicly listed companies in major advanced economies from Thomson Reuters Worldscope. Although public firms only make up a subset of firms of each country, they encompass the largest and most profitable firms and hence are likely to drive the aggregate saving dynamics of the whole corporate sector. In fact, unlike aggregate employment and wage bill, which are to a large extent determined by small and medium-sized enterprises, aggregate profits and investment are much more concentrated among large firms, which renders our dataset well-suited to study the behavior of corporate saving. Table 2 summarizes the coverage in our firm-level data for the G7+2 countries in the sample between 1999 and 2014 by showing the ratio of total gross profits, gross saving and investment, aggregated over all non-financial firms in our dataset relative to the corresponding measure in national accounts. Although capturing only a subset of firms in the economy and despite differences in definition of profits and saving from the system of national accounts and corresponding measurement in corporate financial statements, our micro data captures on average a large share of aggregate profits, saving and investment (more than 30 and up to 75 percent of national gross saving) .[9]

More importantly, the excess saving rate - our main object of interest - aggregated from our firm-level data tracks well the actual aggregate corporate net lending rate from national accounts data. We check this by plotting in Figure 10 the aggregate

[9]Differences in definition concern the treatment of income from subsidiaries abroad, employer contributions to pension funds, exercise of stock options, see André et al. (2007).

NFC net lending rate (in percent of GDP) from flow of funds/national accounts data used above against the median net lending rate (in percent of sales) of all companies in Worldscope aggregated over all firms in each country and year. As expected, with the exception of Canada, the two series show very strong correlation. The correlation coefficient ranges from 0.3 (in France) to 0.9 (in Germany). Studying the saving and cash management behavior of publicly listed firms therefore potentially offers both the granularity to understand the microeconomic determinants of corporate saving, as well as the macro-relevance of such factors in terms of shaping the aggregate saving investment balances.

4.1 Stylized facts

We start by documenting the relationship between cash holding and firm size. In Figure 11, we plot the median holding of cash and short-term investment over total assets by quantiles of firm size (in terms of total assets, though robust to total sales) averaged over the first and second decade of the sample. The cash-size schedule is mostly downward sloping within each period, consistent with the well-documented fact that smaller firms hold a higher share of their assets as cash. Over time however, cash ratios have increased for all size classes in most countries, except in Japan where cash holdings of the largest firms has somewhat decreased (from very high levels) and in Italy, where smaller and medium-size firms have shown some reduction in cash stocks as well.

We repeat the same exercise with firms' net lending positions, as shown in Figure 12. In particular, we plot the median share of net lending over total sales by quantiles of firm size. Consistent with the trend at the macro level, the net lending position of corporations in our data has also increased over time, and generally did so over the entire spectrum of firm size, similar to the trend in cash holdings. Finally, in Figure 8 we document that the rise in cash accumulation over the period $1995 - 2014$ is also common across industries, and is particularly pronounced for IT-intensive industries, again pointing to a broad-based trend.

Changes in average and median cash ratios in the aggregate or individual indus-

tries as documented so far can be driven either by changing cash holding among incumbent firms firms, or by changing composition of firms. For example, Begenau and Palazzo (2016) argue that the firms entering the stock market in the 1980's and 1990's in the US typically held more cash at entry, compared to incumbent firms. If this trend had continued and operated also in other countries, the broad based increase in cash ratios could be driven primarily by shifting composition of public firms across advanced economies, most notably by the increasing importance of high-tech, R&D-intensive firms as was the case with NASDAQ firms in the US in the last few decades (Begenau and Palazzo (2016); Graham and Leary (2016)). To separate the compositional change driven by entry/exit from the change among incumbent firms, we conduct a decomposition of the average cash ratio evolution in each country along the extensive (that is, driven by entry and exit) and the intensive (that is, driven by evolution of the average incumbent firm) margins as follows:

$$\begin{aligned}\Delta\frac{CH_t}{A_t} &= \underbrace{\left(\frac{A_t^I}{A_t^I+A_t^{entr}}\frac{CH_t^I}{A_t^I}-\frac{A_{t-1}^I}{A_{t-1}^I+A_{t-1}^{exit}}\frac{CH_{t-1}^I}{A_{t-1}^I}\right)}_{\text{intensive margin}} \\ &+ \underbrace{\left(\frac{A_t^{entr}}{A_t^I+A_t^{entr}}\frac{CH_t^{entr}}{A_t^{entr}}-\frac{A_{t-1}^I}{A_{t-1}^I+A_{t-1}^{exit}}\frac{CH_{t-1}^{exit}}{A_{t-1}^{exit}}\right)}_{\text{extensive margin}},\end{aligned}$$

with the superscript I designating the corresponding variable (cash stock CH and total assets A) of incumbent firms. Figure 13 presents the decomposition for each of the G-7 countries where coverage in the Worldscope dataset has sufficient mass of surviving firms for the exercise to deliver reasonably stable results. A common feature among most countries is that the increase in average cash ratios in the last decade has been primarily driven by rising cash ratios within incumbent firms. Interestingly, this represents a notable shift for the US, where for the years prior to the 2000's, our decomposition confirms the finding in the literature that the rise in average cash holding had been driven by high-tech firms intensive in R&D entering the stock market with higher cash reserves. However, since the early 2000's, this trend has flattened

and even started reversing around the mid 2000 (when entry and exit of firms has started to contribute negatively to average cash holding), while the continued rise in cash stocks has been driven by higher cash holdings of incumbent public firms (also observed in Graham and Leary (2017)). This trend is confirmed for the other G-7 countries outside the US: cash holding as a share of overall assets has been rising within incumbent firms in Germany, France, Canada and the UK, while it also started to pick up in Japan and Italy around the global financial crisis, just when aggregate corporate net lending in these two countries also increased substantially (see Figure 2), reversing the current account deficit into a surplus in the case of Italy. In light of the prominent role of the intensive margin for the increase in corporate cash and net lending in the last decade, which further complements the uniform pattern of higher net lending and cash holding across the distribution of firm size (Figure 11), we focus on drivers of cash holding among and within incumbent firms in the following.

4.2 Drivers of corporate cash holding

The finance literature has established a widely-used empirical framework to estimate drivers of corporate cash holding, mainly focused on the US, underpinned by various theoretical motives for cash holding, notably the precautionary, transactional, and agency motives (see e.g. Bates et al. (2009) the US and Pinkowitz et al. (2015) for a cross-country study). We follow the literature in specifying a simple regression model that combines firm-level and aggregate level data across the sample of industrial countries. In doing so, we can exploit the heterogeneity in cash holding across firms, industries, and countries, as well as the differential timing of the rise in cash holding and net lending across these dimensions. In light of the observation that the rise in cash holding is driven by evolutions within incumbent firms, we limit the regression to firms which are observed for at least 18 years (out of the 20-year sample).

The first set of results obtained by pooling observations across all incumbent firms within each country are reported in Table 3 and broadly confirm previous findings in the literature. First, consistent with the *transaction motive* of cash holding, cash ratios decrease with firm size (as measured by the log of total book assets) as larger

firms benefit from economies of scale in their operational transactions, see (Miller and Orr, 1966). The transaction motive would also predict that firms with more volatile cash flows hold more cash reserves to avoid having to sell other assets and incur transaction costs, consistent with our positive estimate on industry-level and aggregate volatility. We follow Bates et al. (2009) in computing the industry cash-flow volatility as follows: for each firm-year the standard deviation of a firm's cash-flow to assets is computed for the past ten years. We limit the computation to firms with at least three running 10-year observations available over the sample period. Finally, the firm-level observations are averaged over the two digit SIC industries. Aggregate uncertainty is measured by the policy uncertainty (EPU) index from Baker et al. (2016).

Most of the recent theoretical and empirical work have centered around the *precautionary motive* of cash holding, which predicts that firms facing more uncertainty from various sources should hold more cash for self-insurance. This precautionary motive applies particularly to firms with stronger growth opportunities, as the cost of foregoing an investment opportunity due to a lack of funds is higher for them; and it should also be stronger for firms with investment projects that are subject to more severe informational asymmetries, for which internal financing is more crucial. Consistent with these priors, we estimate a positive, statistically significant effect of Tobin's Q (market-to-book value), as well as $R\&D$ intensity ($R\&D$ spending in percent of sales) and age (IPO year) on the cash ratios across firms. The positive effects of industry-level cash flow volatility and aggregate policy uncertainty (measured by the EPU index) are also consistent with the precautionary motive, in addition to the transaction motive. Informational asymmetry may also explain the negative correlation of leverage ratio with cash ratio as firms prefer to finance projects internally before turning to issuing debt (and equity) as per the pecking order theory, as well as the positive effect of profit on cash ratios - a consequence of sticky dividend policy firms choose to avoid negative signaling effects.

Confirming results in previous literature, we also find that firms which pay dividends have lower a cash ratio, consistent with the *agency motive*. This can be

driven by differences in shareholder protection rights, which in turn influence the dividend payout ratio, for given firm performance (Dittmar et al., 2003). Another important motive for cash holding that has gained much recent attention in the US is the *tax motive*, according to which firms residing in high corporate tax countries but having income abroad tend to keep higher cash ratios to avoid repatriating and paying taxes in the home country under a worldwide corporate income tax system.[10] Indeed, we find that the share of foreign sales (which may earned through exports or subsidiary income) has a strong positive effect on the consolidated firm's cash holding. The mechanism for foreign sales on corporate cash is, however, unclear: it could be that firms with more foreign sales are exporters and/or multi-nationals, who are need more internal financing to finance cross-border production value chains (Shin et al. 2014), or it could be because these global firms are precisely those who have the capacity to engage in profit shifting and hence tend to hoard cash with foreign affiliates to avoid costly repatriation (Foley et al. 2007). Finally, as working capital such as inventory, intermediate (especially commodity) inputs can serve as substitute for cash due to their relative liquid nature, it has been shown that as firms switch to lower inventory stocks following improvements in logistics and storage technology, their freed-up resources also contributed to raising the cash ratios in the US (Gao et al., 2013). We confirm this negative correlation in our broader sample as well. Overall, controlling for the aforementioned drivers lowers the estimated coefficient on the linear time trend by about half (columns 3 versus 4). As the flow of net lending (excess saving) is an important, though not the only, source for cash accumulation, we replace the dependent variable with the net lending ratio (in percent of sales) while keeping the same set of explanatory variables in column 5. Controlling for contemporaneous profits, higher foreign sales exposure and $R\&D$ intensity is also associated with higher excess saving, indicating that at least part of their positive effect on cash is realized through adjustments in corporate saving/retained earnings.

Results from Table 3 described so far are obtained from pooled regressions and

[10]For example, the *WSJ* on April 25th, 2016 reports that "S&P 500 companies including Pfizer, Apple Inc. and Microsoft Corp. indefinitely put away a record $2.3 trillion of cumulative foreign earnings by the end of 2015.".

represent correlations both across firms as well as within firms over time. Although we know from Figure 13 that average cash holdings have been primarily driven by changes among incumbent firms over time, regression so far could point to either changes key characteristics (such as higher profits, higher $R\&D$ etc) driving cash holding within the average firm, or reallocation of market shares toward firms with higher cash holding and similar characteristics over time. We explore in the following determinants within firms over time. Results using within-firm variation are reported in Table 4. The sign, statistical significance and magnitude of most coefficient estimates are the same as in the pooled regressions, suggesting that at least part of the correlation identified in the pooled regression is driven by correlation within firms. In particular, the effect of higher profits on cash ratio within firms is considerably higher than in the pooled estimation (0.12 to 0.2 compared to 0.05-0.06), indicating that dividend stickiness within firms may indeed play the main role in driving this correlation. In contrast, the estimated positive effect of foreign sales exposure seems to be driven by the cross-sectional correlation, with the within-firm correlation being not statistically significant, lending prima facie more support to the tax motive (whose strength arguably varies most across than within firms) than the exporter/GVC channel. We also confirm robustness of main results to using the natural logarithm of the cash ratio as dependent variable (often preferred for ratios to limit non-classical measurement errors) in column (2), as well as estimating the within-firm regression using first differences in column (4). One notable difference is the much weaker effect of cash-flow volatility in the first difference estimation, suggesting that the positive effect of industry-specific volatility on firm-level cash holding appears to only operate over time and not be reflected in contemporaneous increase in cash holding. Finally, we estimated both the within-firm and first-differenced regressions using the non-US sample as well (columns 3 and 5) and find that most coefficients estimates are not significantly different across subsamples with and without US firms, indicating broad-based validity of the determinants.

Regression results reported so far treated missing observations for $R\&D$ spending as zero, following the convention in the literature. To check if our results are driven

by such assumptions, we also rerun the main regressions using only the sub-sample of firm-year observations with non-missing $R\&D$ spending, as reported in Table 5. Although the number of observations is reduced by roughly a third compared to the full sample, the results are remarkably stable. One notable exception is the estimated positive effect of $R\&D$, which is now quantitatively smaller relative to both the pooled and within regression using the full sample (still strongly statistically significant), as it now only captures the effect of variation in intensive margin of innovation spending on cash holding, and not the extensive margin effect of becoming an innovator on firms' cash holding.

It has been often argued that the allocation of intangible capital, particularly intellectual property (IP), across affiliates of a multi-national group can be exploited to shift profit to low-tax jurisdictions, as surveyed in Johansson et al. (2017). The consistent positive effect of $R\&D$ spending that we find could therefore be driven by firms that report high $R\&D$ spending allocating much of the resulting IP assets with affiliates residing in jurisdictions with low tax rates or preferential tax treatment of IP-generated income, and hoard such income (derived from patent, royalties) in cash to defer repatriation. If this is the case, the effect of $R\&D$ and foreign sales exposure that we are estimating would then mainly capture the tax motive. To disentangle them in the following, we control directly for the effective tax rate (ETR) paid by a given firm, computed as *ETR=Sum of all taxes (domestic and foreign) paid/Pre-tax book income* as reported in the consolidated financial accounts. This measure of ETR has been commonly used in the literature - see e.g. Markle and Shackelford (2012) - to measure the tax burden of a firm at the consolidated level of the multinational firm. The identifying assumption is that, once key firm characteristics (such as size, industry, cash flow) are controlled for, variation in ETR particularly between multinational and domestic firms, but also within a multinational firm over time reflects the degree of profit shifting and tax-minimization strategies, particularly as conducted by large, publicly-listed firms as those in our dataset.[11] Results for pooled and within-firm

[11]This is admittedly only a crude measure of the ex-post outcome of tax strategies: they include current and deferred taxes that are reported in financial accounts, and changes in the ETR can be also driven by changes in statutory tax rates over time and/or in the definition of the tax base. That

regressions controlling for the ETR and using the non-missing $R\&D$ sample are summarized in Table 6.

The first result to note is that, conditional on other relevant observables, firms with lower effective tax rates indeed have higher cash ratios (column 1 of Table 6), consistent with the tax motive of cash hoarding. That said, this finding only indirectly supports the tax motive of cash holding, as the dependent variable is the cash ratio at the consolidated basis of the group (instead of unconsolidated foreign affiliates' cash holding), and the estimated correlation could also be due to lower taxes mechanically translating to higher cash ratios even among domestic firms if the tax saving is considered temporary and hence not distributed as dividend. More importantly, the positive effect of $R\&D$ spending as well as foreign sales exposure remain unchanged (compared to column 1 of Table 3), suggesting that such correlation is not primarily driven by tax minimization strategies. Not surprisingly, the positive effect of lower ETR on cash holding is weaker within firms (column 2), as most of the variation will come from different firms having differential capacity of engaging in strategic tax planning, rather than a given firm being able to vary such capacity over time. Conditional on the ETR, when a given firm increases its $R\&D$ spending, we still see its cash holding increase, while again increased foreign sale exposure is not systematically associated with higher cash. As before, we confirm the results' robustness when using the log cash ratio and limiting the sample to non-missing $R\&D$ sample only, with the coefficient estimate for $R\&D$ spending being very similar (if not somewhat higher) than in specifications without the ETR.

To further rule out that our results are driven by the tax motive, we limit the sample to firms with non-missing zero foreign assets (that is, firms without wholly owned foreign subsidiaries) in column 5 and re-run the baseline panel regression. For this sub-sample of domestic firms, tax-related profit shifting across worldwide affiliates are least likely to drive the overall cash holding. Despite the substantial reduction in observations, coefficient estimates remain very similar to those obtained

said, at least in the US, about two-third of the decline in the ETR over the sample period can be attributed to increased tax avoidance, see Zucman (2014).

in the baseline, while the coefficient estimate on the ETR variable is only weakly statistically significant as expected. In contrast, the positive effect of $R\&D$ is almost identical to the baseline estimate while the effect of foreign sales, here most likely driven by exports, is strengthened. While the exercise conducted so far does not serve to deny the tax motive for corporate cash holding among multinational firms, it provides consistent evidence that other forces were at work in shaping the demand for corporate cash at the same time, and that such forces were operating similarly across all major advanced economies (similar to findings in Pinkowitz et al. (2015)).

4.3 Drivers of corporate net lending

We have so far identified key drivers of corporate cash holding across major advanced economies, but have yet to confirm that these drivers were also influencing corporate excess saving (net lending) flows, which tend to co-move strongly with cash holding (as shown in Figure 9), in the same way. This need not be the case since firms may increase cash holding through various channel other than retaining earnings, including by issuing equity and/or debt. In the next step, we test if the same factors can also explain the behavior of net lending rates by replacing the dependent variable in all regressions with the firm-level measure of net lending (or excess saving/change in retained earnings), defined as follows to closely match the concept of corporate saving investment balance in aggregate flow of funds:

$$Net\ Lending = Net\ Income + Depreciation - Dividend\ paid - Capital\ Expenditure$$

Results of the net lending regressions are reported in Table 7. Column 1 shows that in the pooled regression, larger, more profitable firms, and those with foreign exposure, larger amount of working capital, and higher market valuation have higher net lending (or excess saving) rates. Such firms also tend to be less leveraged and pay less dividends, partly as a way to boost retained earnings/net lending. Importantly, firms with higher $R\&D$ intensity have higher net lending positions, consistent with the presumption that some of the higher cash associated with innovation intensity

is achieved with higher excess saving. However, the results in column 2 reveal that such long-run adjustment of corporate saving to innovation spending does not occur immediately, as the estimate of the contemporaneous $R\&D$ coefficient becomes insignificant in the within-firm regression. Instead, firms may boost saving over time to build up cash holding in anticipation of higher innovation spending in the future. Indeed, this is what we find when controlling for the one and two-year forward looking $R\&D$ spending intensity in the within-firm regression (columns 3-6): Conditional on current profits and balance sheet conditions, firms that expect to have higher $R\&D$ spending in 1-2 years time start increasing their retained earnings ahead of time. This result is more precisely estimated when we restrict the sample to firms with non-missing $R\&D$ spending, possibly due to smaller measurement error in their innovation spending. Finally, we expect firms to be more able to retain earnings for cash accumulation if they have higher earnings to begin with, as firms with low profitability naturally will have less internal capacity for cash accumulation. In columns 5-6 of Table 7, we restrict the net lending regression to firms with profit rates (measured by net margin in percent of revenues) above the median and above the 75th quintile, respectively. Consistent with our prior, more profitable firms retain more of their earnings 1-2 year prior to ramping up their $R\&D$ spending: For a firm in the upper quartile of the profitability distribution, an anticipated increase of 10 percent in $R\&D$ spending (as a share of sales) is associated with cumulatively 1 percent higher excess saving (also relative to sales) in the preceding 2 years as compared to only 0.4 percent for the average firm.

Stock repurchases are a common practice for firms to transfer accrued returns to shareholders, or to offset dilution incurred by employee stock option issuances, or in general to manipulate earning per share to boost investor confidence, see Dittmar (2000). It has also been documented that incidences of stock repurchases have increased in recent years, particularly among high-tech firms. As such repurchases are commonly financed by cash, the rise in cash, accumulated in part by running positive net lending positions, may well be at least in part driven by the desire to repurchase shares within a planning period of 1-2 years, and the correlation between $R\&D$ in-

tensity and cash ratio could spuriously be capturing this motive. An advantage of firm-level data, as opposed to aggregate flow of funds data, is that it allows us to construct good proxies for stock repurchases based on the number of shares outstanding in each year. Table 8 shows key regressions for cash holding and net lending as before, but in addition controls for a proxy for share repurchases. The variable is constructed as the year-on-year change in the number of shares outstanding (in percent) in years that see a decrease in public shares, and zero otherwise. The regression results for cash and net lending while controlling for buyback reveal interesting patterns: firms tend to hoard cash 1-2 years ahead of a buyback event and retain more earnings (i.e. increase net lending) in the year of the buyback. For a common volume of buyback (corresponding to 2 to 3 percent of shares outstanding), the estimates predict a net lending rate increase of roughly one tenth of the average rate. While these results support the prior that retained earnings have been used to finance buybacks, they do not overturn any of the previous results, and in particular, the coefficients on $R\&D$ intensity is largely unchanged.

Is the empirical model able to account for the broad-based trend in rising corporate net lending observed over the past 15 years? Figure 14 gives an answer to this question by comparing time trends extracted from a regression of firm-level net lending on country, firm and year fixed effects only, compared to those extracted from the full model (from Table 7) which controls for the determinants of cash holding. First of all, the (unconditional) rising trend in corporate net lending is strongly present in firm-level data (left panel in Figure 14), which shows that the average public firm in major advanced economies now has a 3 percent higher excess saving rate compared to the mid 1990's. This is true both for the within-firm trend as well as the cross-sectional average. Once we control for the explanatory variables in the cash regression, however, the remaining time trend is flat, suggesting the factors driving higher demand for cash do explain to a large extent the surge in corporate net lending, consistent with the unconditional correlation between cash and net lending from aggregate data as previously presented in Figure 9 and Table 1. More profitable firms saw their retained earnings increase more steeply (right panel in Figure 14), and up until the mid 2000's,

rising spending on $R\&D$ accounted for much of the rising propensity for corporate excess saving of the most profitable firms (see difference in residual time trend between the model with and without $R\&D$).

Of course, as the results in Table 7 show, apart from $R\&D$ spending, other firm characteristics have also significantly contributed toward raising corporate net lending. In fact, since the mid 2000, it is the combination of these other trends driving profitability and asset expansion that appear to contribute the most to higher corporate saving and net lending (residual time trends flat and statistically identical between both models with and without $R\&D$ in right panel of Figure 14). One way to illustrate the estimated magnitude of each empirical determinant is to decompose the average long-run change in corporate excess saving/net lending rate into predicted contributions from the different covariates. As most of the change comes from the within-firm dynamics, we can use the regression result in column 5 of Table 8 and apply the estimated coefficients to the long-run change in each explanatory variable over the sample period (1995-2012) to decompose the overall long-run change in the dependent variable (net lending rate) into estimated contributions from each explanatory variable (and an unexplained residual). This decomposition in presented in Figure 15. Consistent with the extracted time trend in Figure 14, the unconditional average corporate net lending rate in our sample increased by about 3.5 percent of total sales over the 16 year period. More than two-third of the overall change can be explained by the increase in size of the average (publicly listed) firm. In addition, a significant 40 percent of the total change can be explained by the average increase in $R\&D$ intensity.[12] Empirically, the expanding size and $R\&D$ spending of the average public firm can therefore account for most of the increase in the higher rate of excess saving we observe over this period. Among the remaining variables, the decline in average effective tax rates also played a significant role in boosting corporate net lending positions.

Almost all the underlying trends in explanatory variables are likely to be inter-

[12]We limit the decomposition exercise to firms with non-missing $R\&D$ spending at the start and end of the sample only, to avoid interpretation issues with missing data.

related. To go beyond the reduced-form relationship estimated here, one needs to understand the deeper underlying drivers or these observed trends. The positive effect of firm size, and the negative effect of leverage and ETR indicate that trends documented elsewhere, in particular industrial concentration and rising market power of large firms - Autor et al. (2017), De Loecker and Eeckhout (2017) - , associated rise in corporate profits (Barkai, 2016), lower cost of capital (Chen et al. (2017), Dao et al. (2017)) and increased incentives and capacity for tax minimization (Zucman, 2014) all have contributed to increasing corporate saving/net lending across advanced economies.

4.4 Discussion of mechanisms

This paper has established a consistent positive relationship between the intensity of innovation activity and the propensity to retain earnings and accumulate cash by large firms in major advanced economies. However, our analysis does not directly point to the channel through which $R\&D$ affects cash and saving. There is an emerging literature that has proposed different hypotheses for why intangible capital (accumulated among others through innovation) can imply higher cash demand: for example, Falato et al. (2013) argue the lack of collateralizability of intangible capital reduces external debt capacity of financially constrained firms, prompting higher cash holding to finance future investment opportunities. The nature of intangible capital in terms of its financing profile or its capitalizability can also have implications for cash holding of the innovating firm, see Döttling et al. (2016) and Ma et al. (2014)). What most studies take as given though, is the time-series evolution and cross-sectional variation in intangible capital and $R\&D$ intensity, prompting the question of whether there are structural forces that drive both the incentive to innovate and the demand for liquidity. Most likely, technology and/or globalization play an important role in this context. There is a rapidly evolving literature on the impact of globalization on innovation activity (Autor et al. (2016), Bloom et al. (2016)), and work by Adler et al. (2017) which shows that globalization, by boosting incentives to engage in risk-enhancing innovation, can jointly raise innovation activity and cash

holding particularly among export-oriented firms. However, technology and globalization likely are not the only drivers for the corporate saving trends documented in this paper.

If technology and globalization increase corporate profits and retained earnings through benign forces such as trade and intangible capital, then why are these profits not contested by new entrants but instead sustained over such a prolonged period of time? There is emerging evidence that profit shares have increased together with industrial concentration (see Autor et al. (2017), Barkai (2016)), consistent with our result that size is strongly correlated with profit/net lending rates and cash holding. What are the drivers of increasing concentration? Are they related to the innovation channel and if so, how? Has $R\&D$ and the nature of new technology enabled stronger concentration, or has policy action consolidating incumbent advantage led to inefficient concentration? Answering these questions will be crucial to understand drivers of the rise in concentration and corporate saving, and as shown in this paper, ultimately shed light on important, so far unexplored drivers of current accounts and external imbalances.

5 Conclusion

In this paper, we have combined various macro and micro level datasets on balance sheet positions and flows of funds of corporations to document the pervasive trend in rising corporate saving. This broad-based trend appears to be of structural nature and shows no sign of reversing. By and large, it is driven by increased ability of large, publicly listed firms across advanced economies to extract larger profits and expand in size over time while limiting payouts to shareholders and taxes. Moreover, such sustained gains in profitability have not spurred higher investment in new fixed capital, leaving firms instead with growing stocks of liquid assets on their balance sheets.

Similar firm-level characteristics and drivers are associated with rising cash positions and excess saving rates across advanced economies, with some important het-

erogeneity across countries. Most notably, firms that register the strongest increase in both cash and saving also saw the largest gains in profitability, market valuation and $R\&D$ spending. At the same time, these firms limited dividend payout in favor of share buybacks, reduced leverage and managed to reduce their effective tax rates. The evidence therefore points at a number of potential causes for rising corporate saving to be explored - with technology, globalization, governance and tax management strategies likely all playing a role.[13]

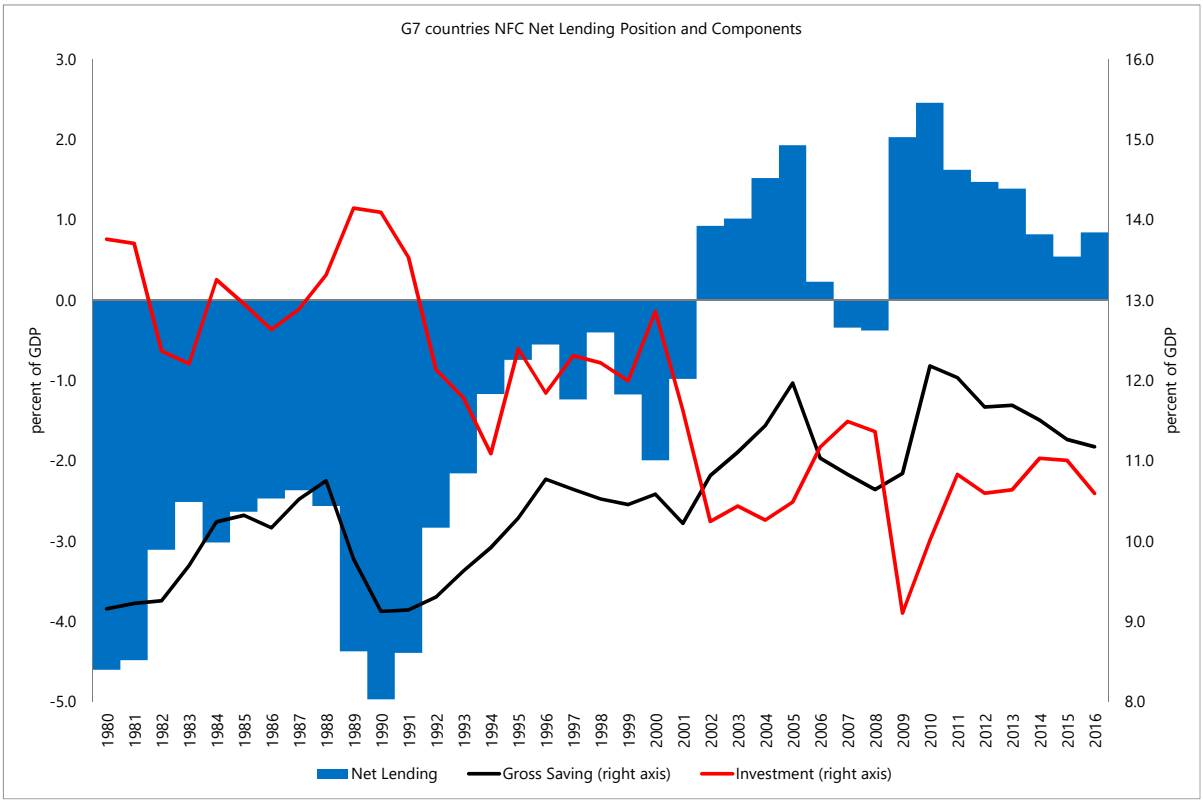
Among the questions that remain unaddressed is why the household sector does not "pierce the corporate veil" and at least partially offset the increased corporate saving rate (Poterba et al. (1987)). If anything, such a "veil" seems to have thickened over time in many advanced economies, allowing corporate saving investment imbalances be translated into persistent current account surpluses, most notably in Germany, Netherlands, Korea and Japan.[14] With capital income being much more concentrated among the population than labor income, reinforcing rising wealth inequality worldwide (see Zucman (2014)), it should not be surprising that higher corporate saving and net worth did not give rise to proportionately higher aggregate household consumption. As a result, the rise in corporate net lending may have contributed to larger current account surpluses in countries where wealth inequality is relatively high, and where the corporate profit share has risen at the expense of a declining labor income share (see Behringer and van Treeck (2018)). Addressing persistent global imbalances may therefore require policies that ensure competition and prevent inefficient concentration on the corporate side (antitrust, product market regulation), as well as policies that help alleviate income and wealth inequality on the household side (corporate income taxes, estate and wealth taxes).

[13] For example, weak corporate governance has been found to be correlated with high cash holdings in Japan, see Aoyagi and Ganelli (2014).

[14] In the US and UK on the other hand, the trend toward higher private (household and corporate) net lending has been offset by larger government net borrowing, leading to current account deficits on aggregate.

6 Figures

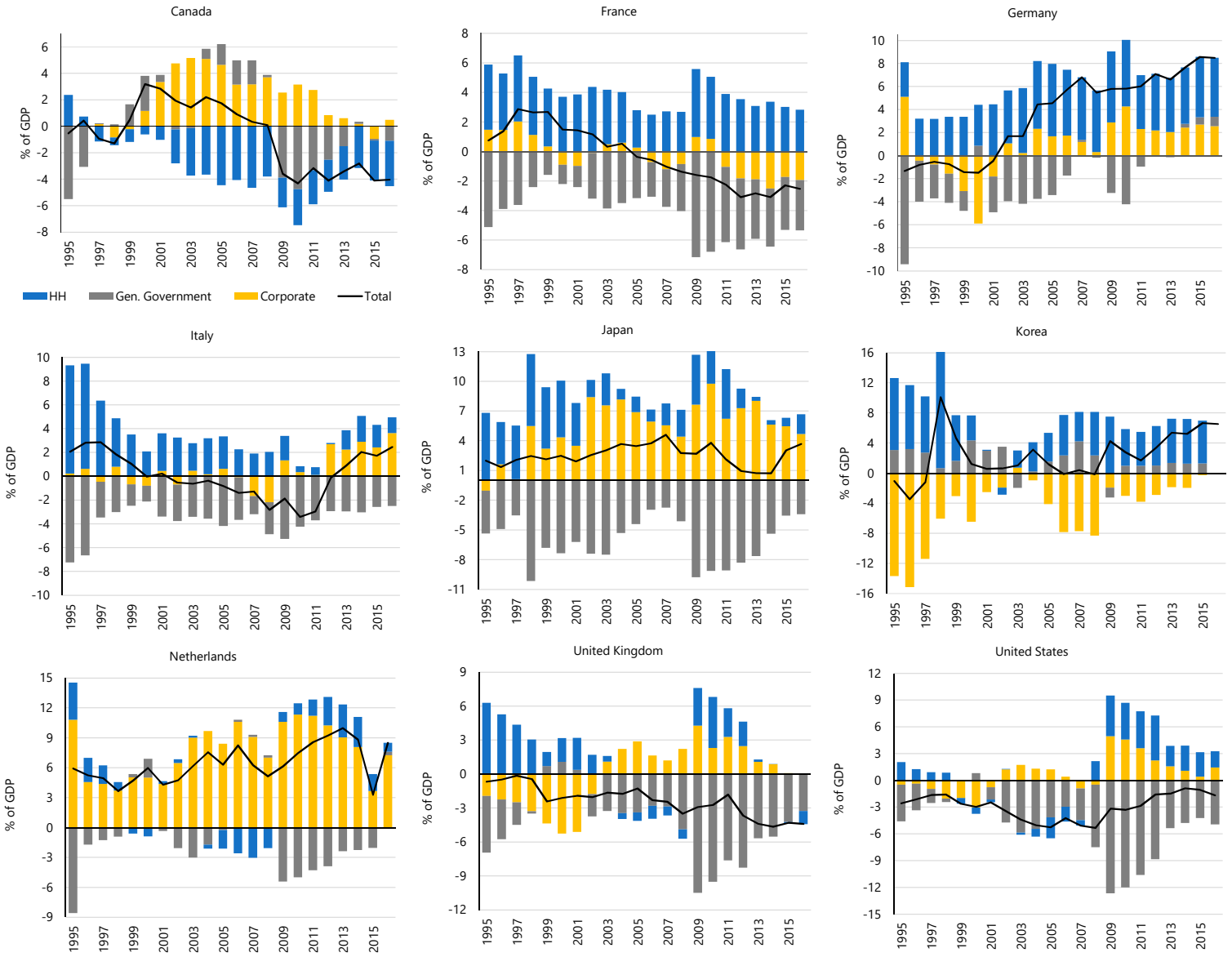
Figure 1: Net Lending, Gross Saving and Capital Expenditure of Non-Financial Corporations Aggregated Across Countries



Source: Eurostat, National Income Accounts and IMF Staff calculations.

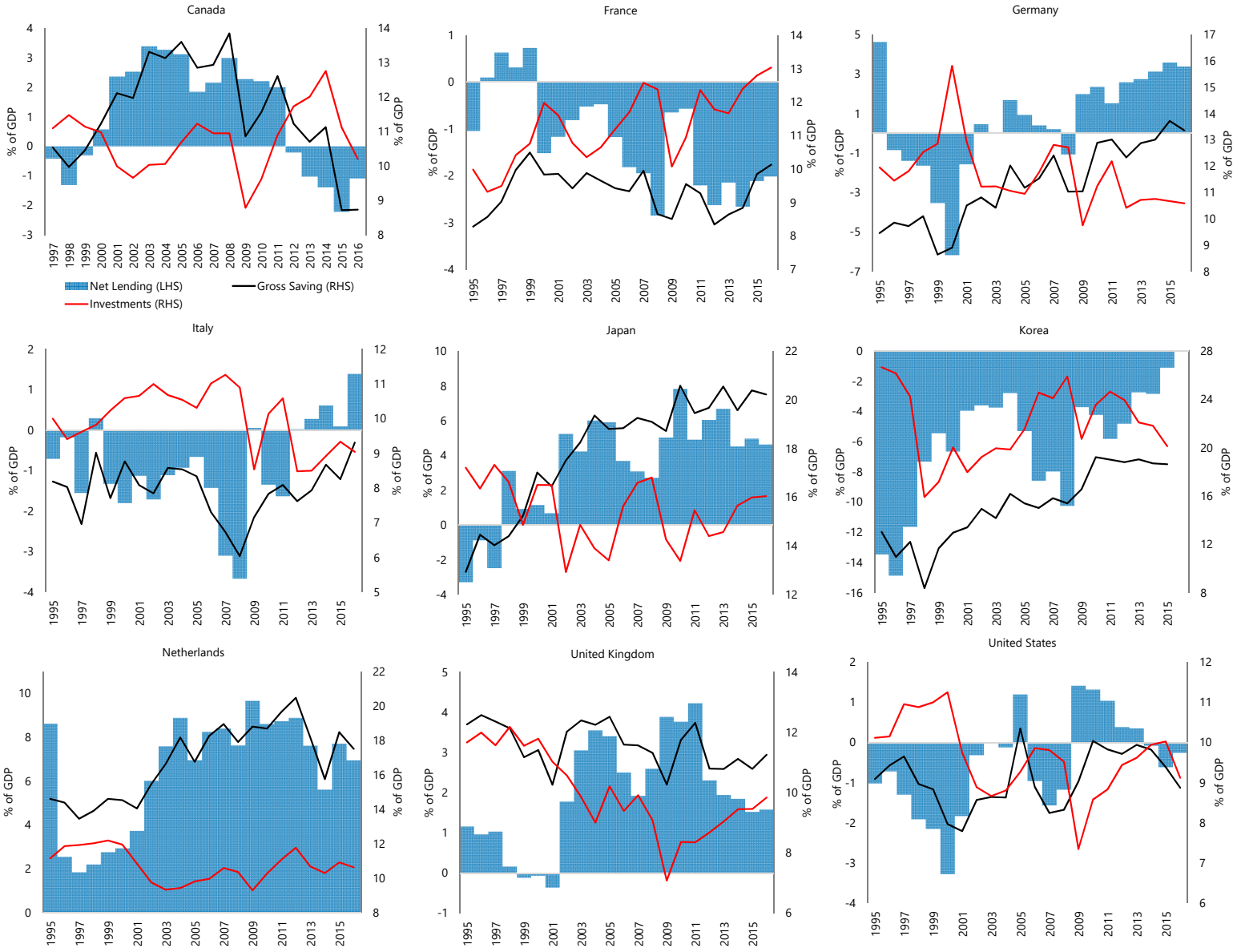
Note: Occasional discrepancies in Net Lending and its components are due to Capital Transfers. Net Lending, Gross saving and Investments are computed as GDP-weighted averages. Sectoral Data following SNA 2008 starts from 1995. For years prior to 1995, the investment and gross saving series are extended backwards using 2006 vintage that follows SNA 1993. Annual changes in investments and saving from SNA 1993 series are applied to current data to extend backwards until 1980, and net lending for this period is calculated as the balance of back-calculated gross saving over investments. SNA 1993 data is available for G6 countries, as it excludes Germany.

Figure 2: Decomposition of Aggregate Net Lending over GDP



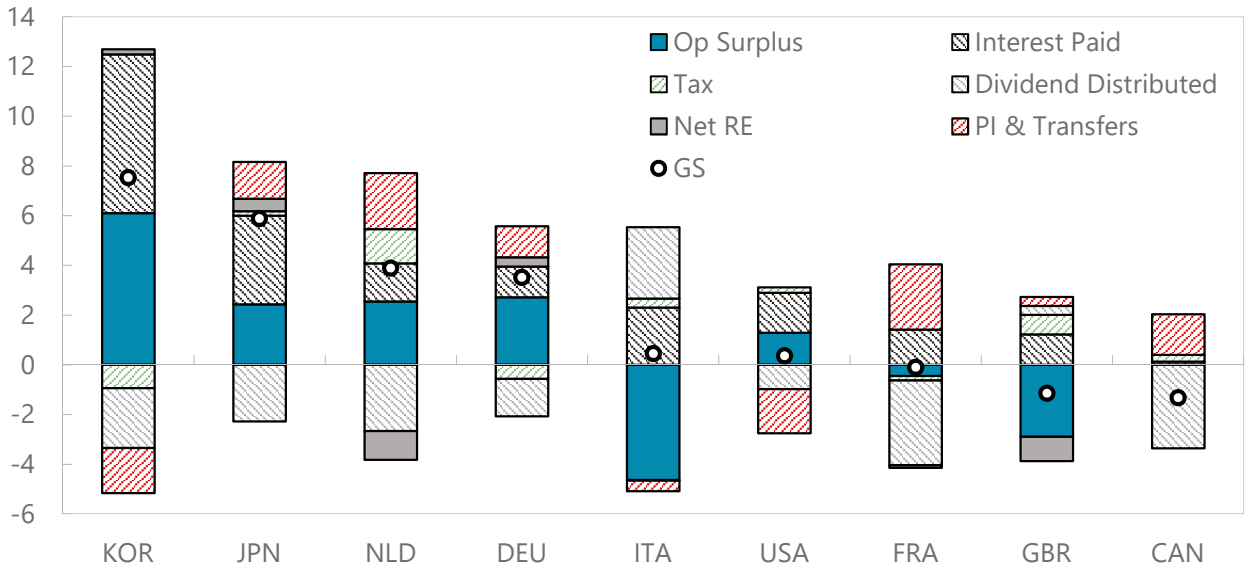
Source: Eurostat, National Sources and IMF Staff calculations

Figure 3: Overview of the Non-Financial Corporate Sector: Gross Saving, Capital Expenditure, Net Lending



Source: Eurostat, National Sources and IMF Staff calculations. Note: Investments include net acquisition of non-produced non-financial assets. Occasional discrepancy in Net Lending and its components is caused by Capital Transfers.

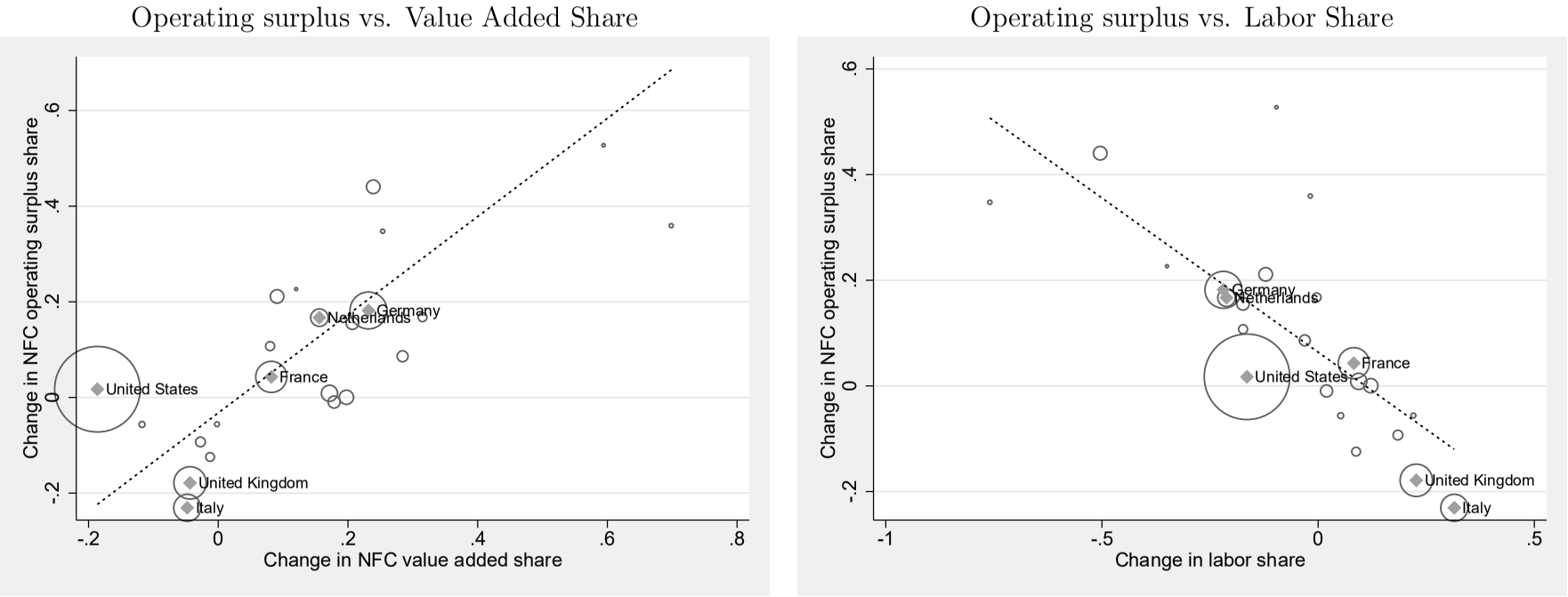
Figure 4: Decomposing change in gross saving rates into sources.



Note: Net RE is Net Retained Earnings on FDI. PI & Transfers is the sum of Net Property Income and Net Transfers, where Net Property Income includes all income receivable on financial assets and rent excluding Net RE, and Dividend receivable.

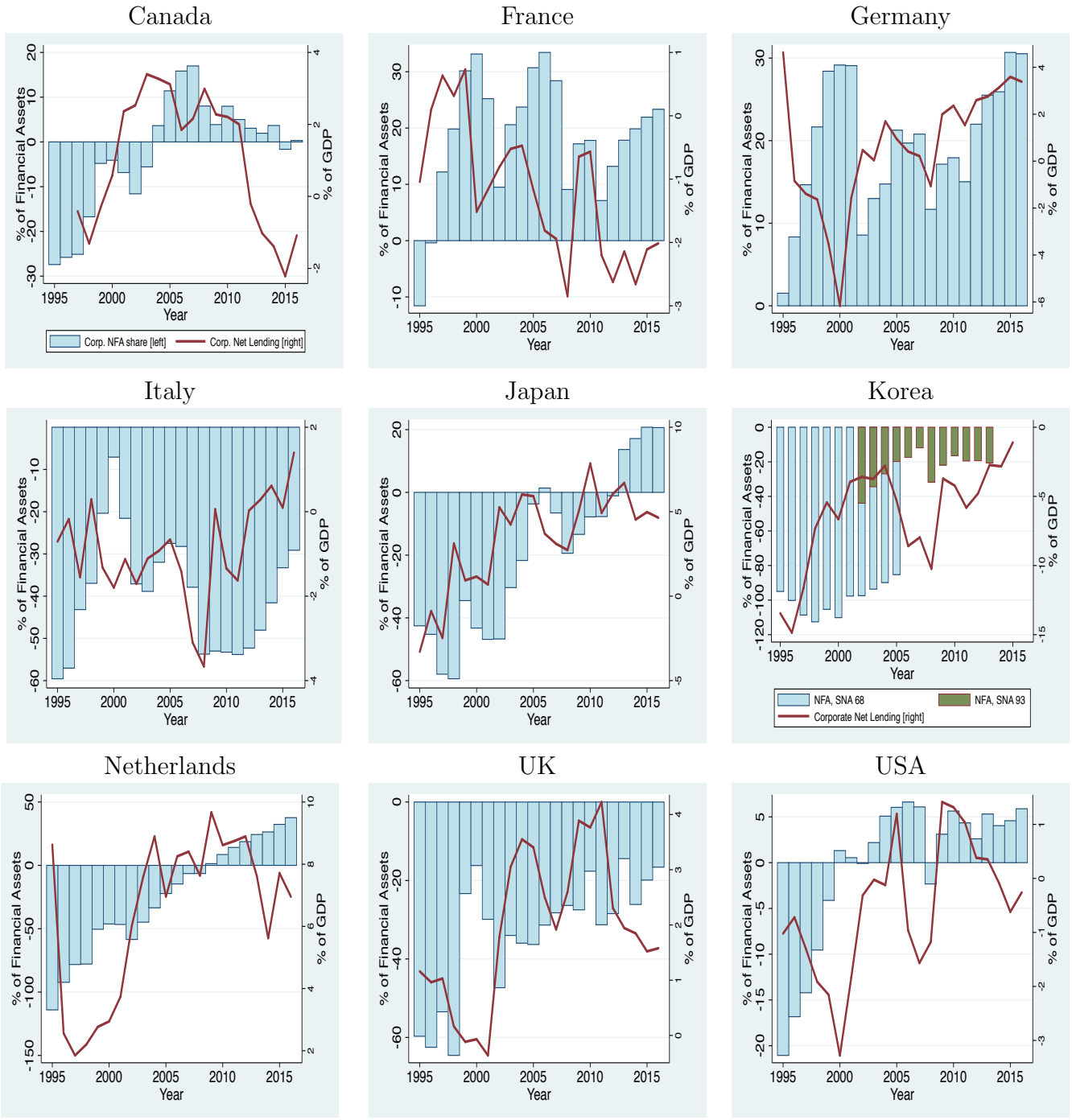
Source: OECD, National Sources and IMF Staff calculations. Data on changes for all countries are from 1995 to 2016, in percent of GDP.

Figure 5: Change in NFC operating surplus, main components



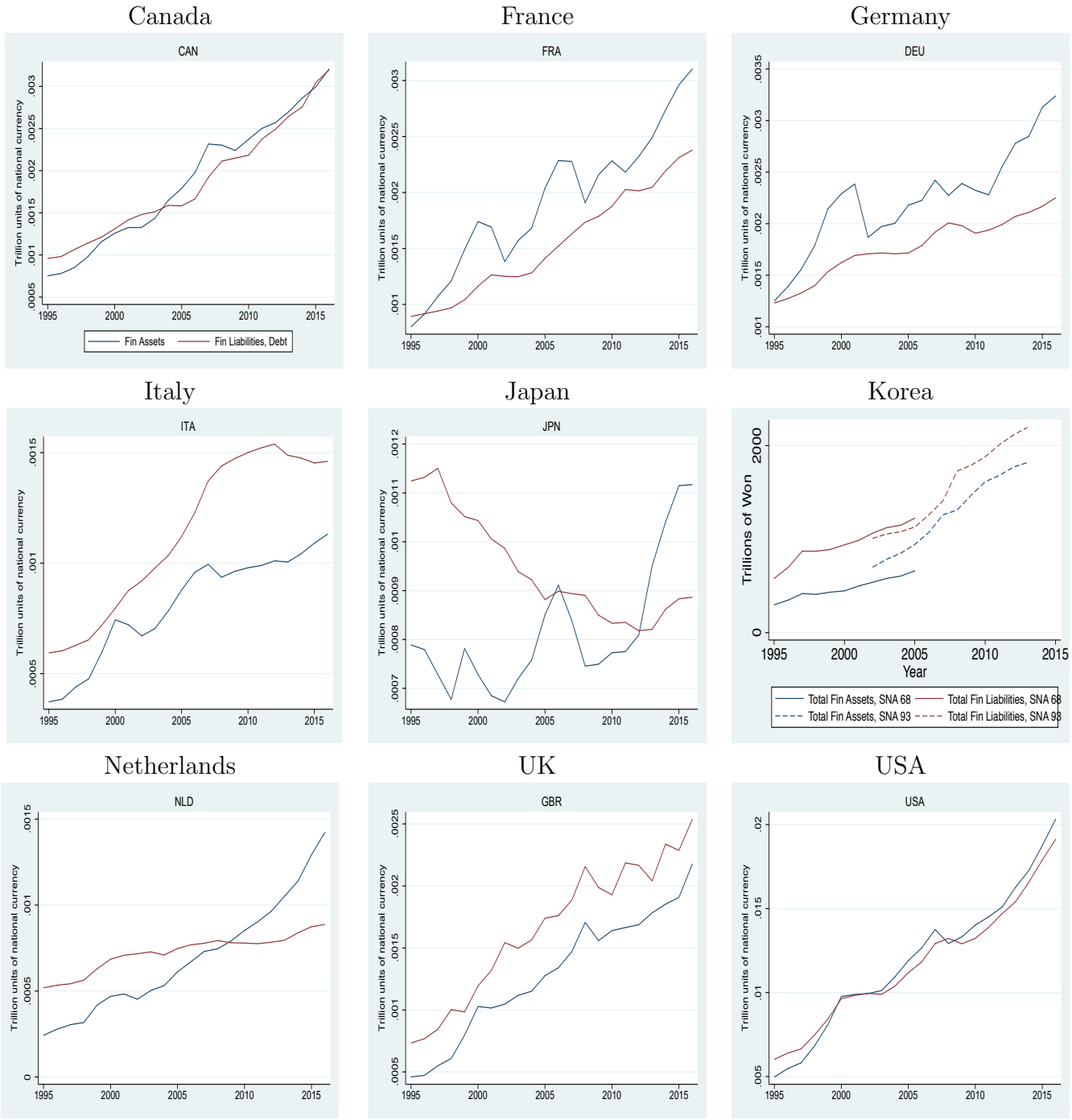
Source: OECD, national sources and IMF Staff calculations. Changes are yearly averages, taken over the entire sample period 1995-2016. Units are in percent of GDP. Bubbles size is proportional to nominal GDP in USD. G7+2 countries labeled.

Figure 6: Correlation between net lending and NFA position



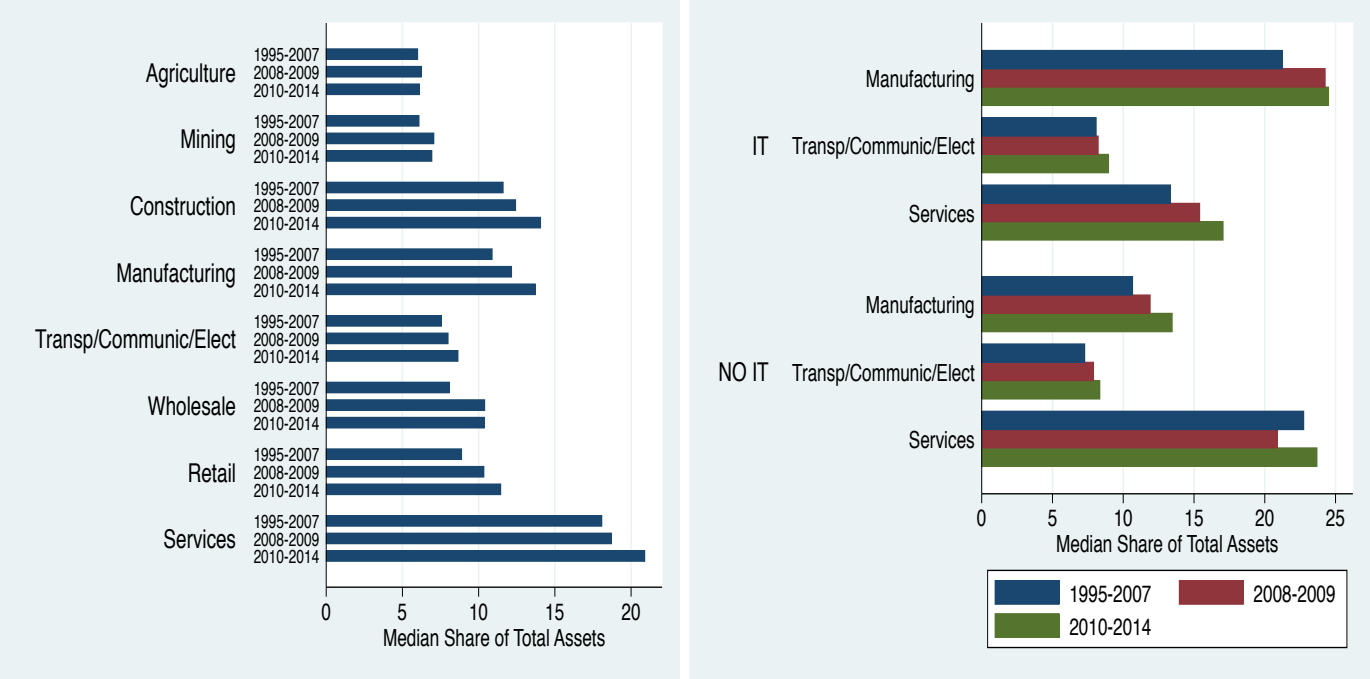
Source: Eurostat, National Sources and IMF Staff calculations

Figure 7: Decomposition of the NFA Position of Non-Financial Corporations to Asset vs. Debt



Source: Eurostat, National Sources and IMF Staff calculations

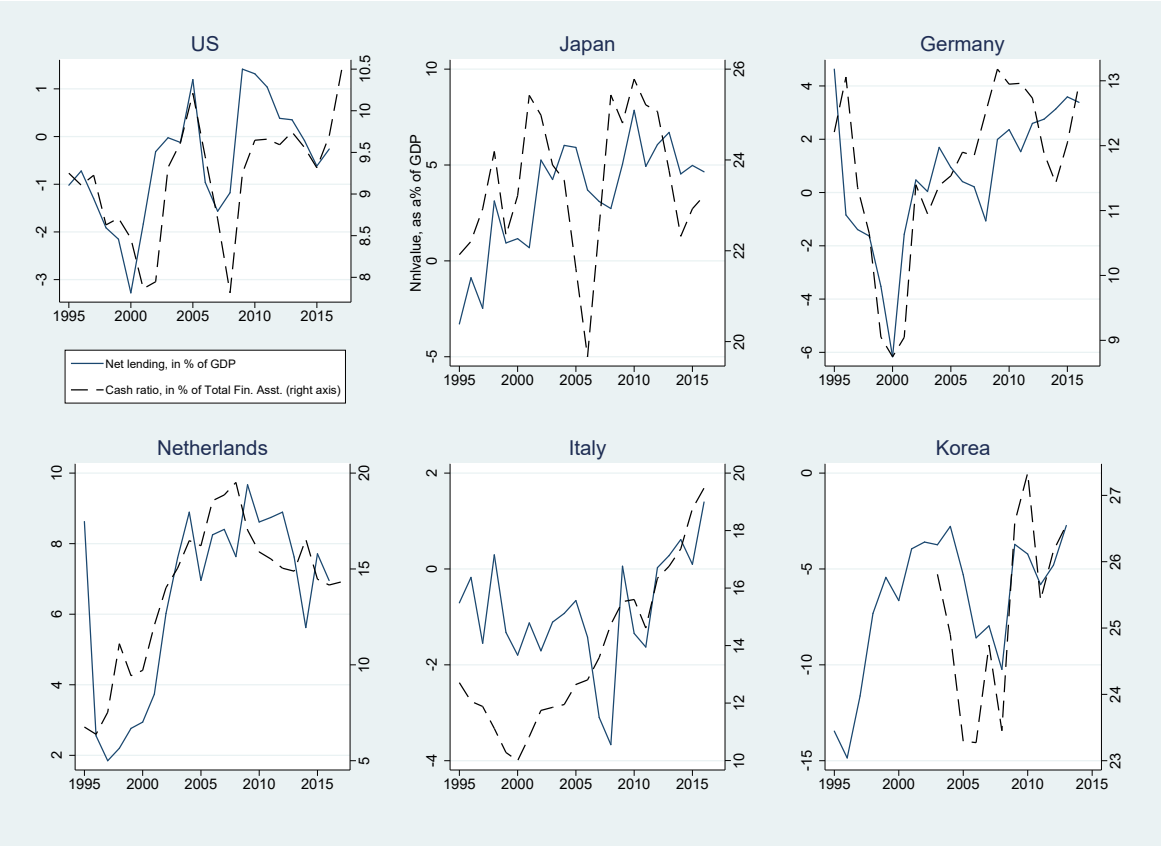
Figure 8: Median Share of Cash And Liquid Assets over Total Assets by Sector



Source: Thompson Worldscope database.

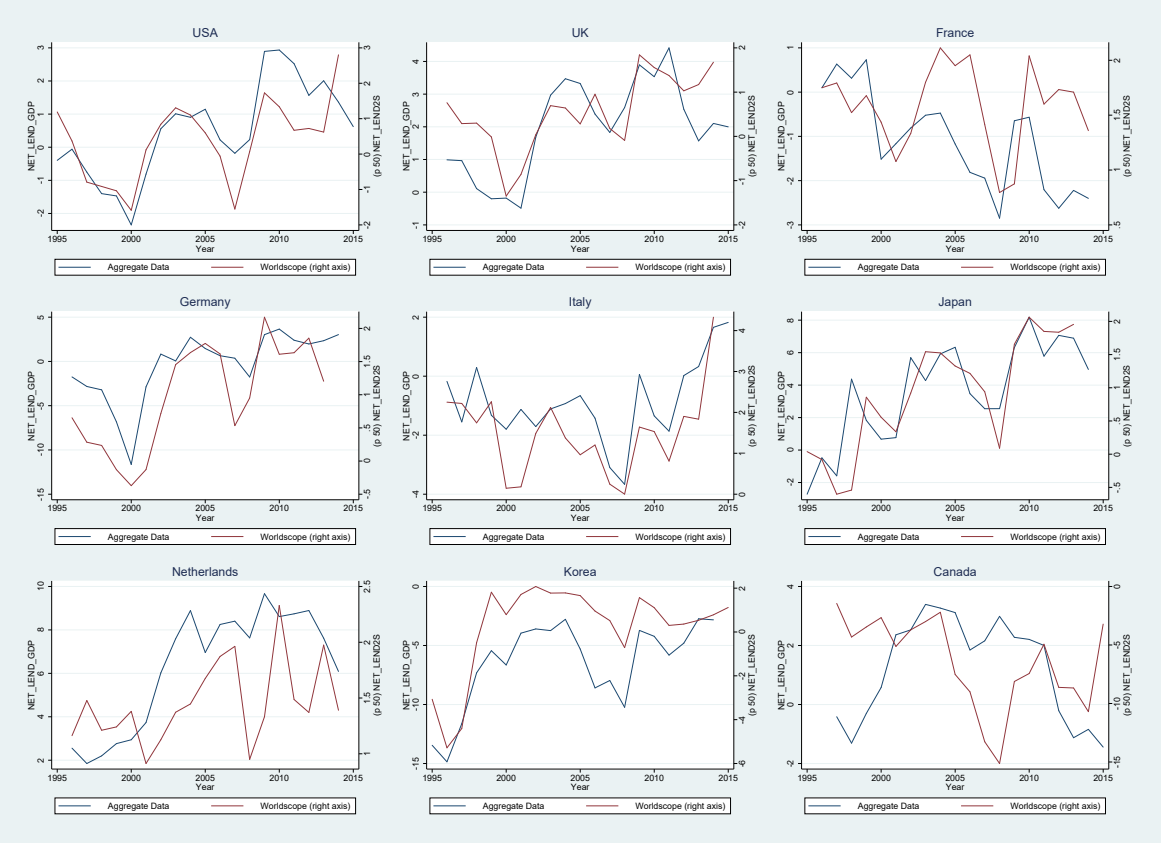
Note: the left panel computes the median cash ratio over total financial assets for listed non-financial firms in Worldscope. The median share is computed by sector and for three sub-periods. The right panel instead computes the median share by sector grouped into IT-intensive and non-IT-intensive industries with classification as described in the text [check with Chiara].

Figure 9: Co-movements between Net Lending rates and Cash ratios.



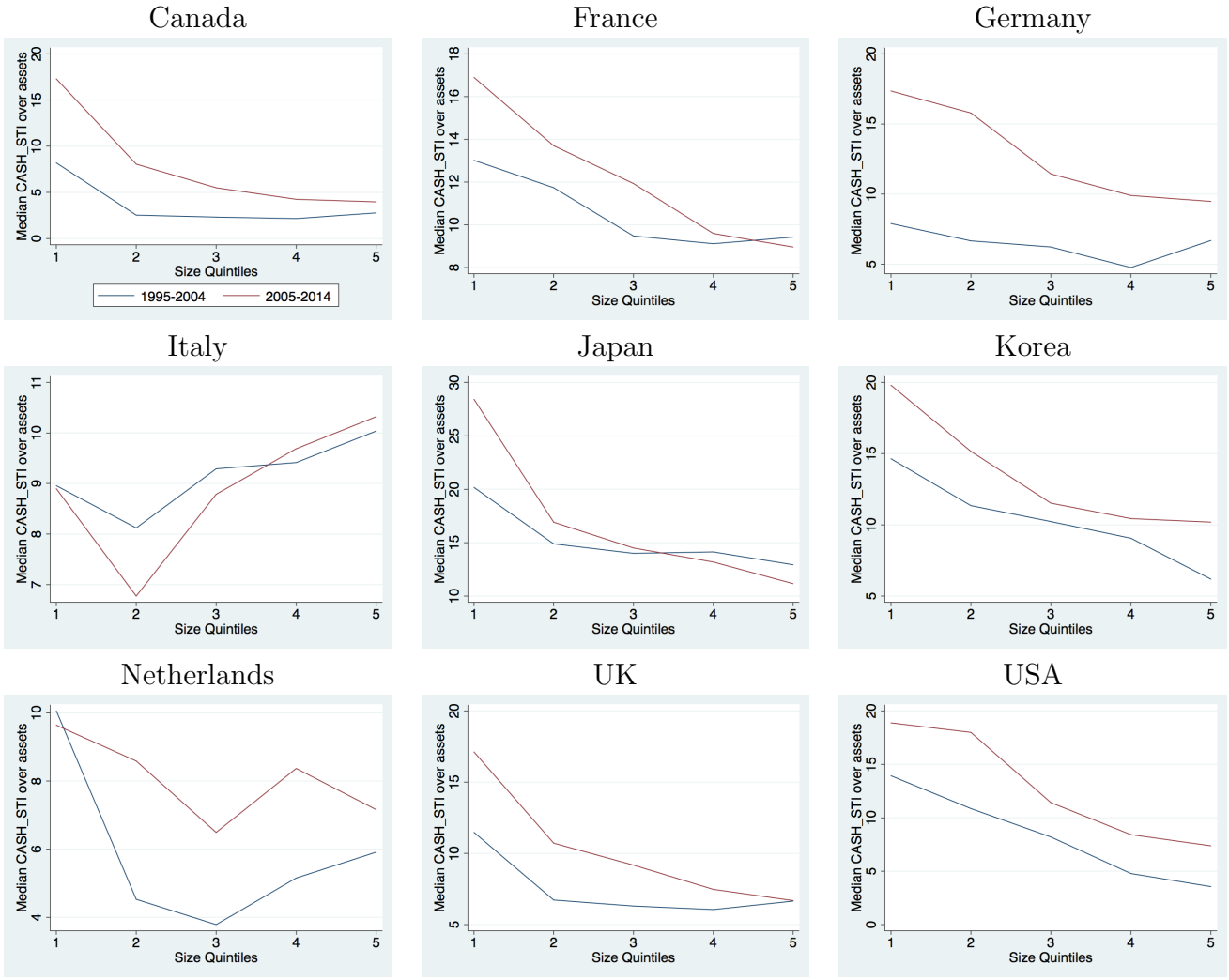
Source: Eurostat and National Sources

Figure 10: Aggregate NFC saving (in pct of GDP) and aggregated firm-level saving (in pct of sales).



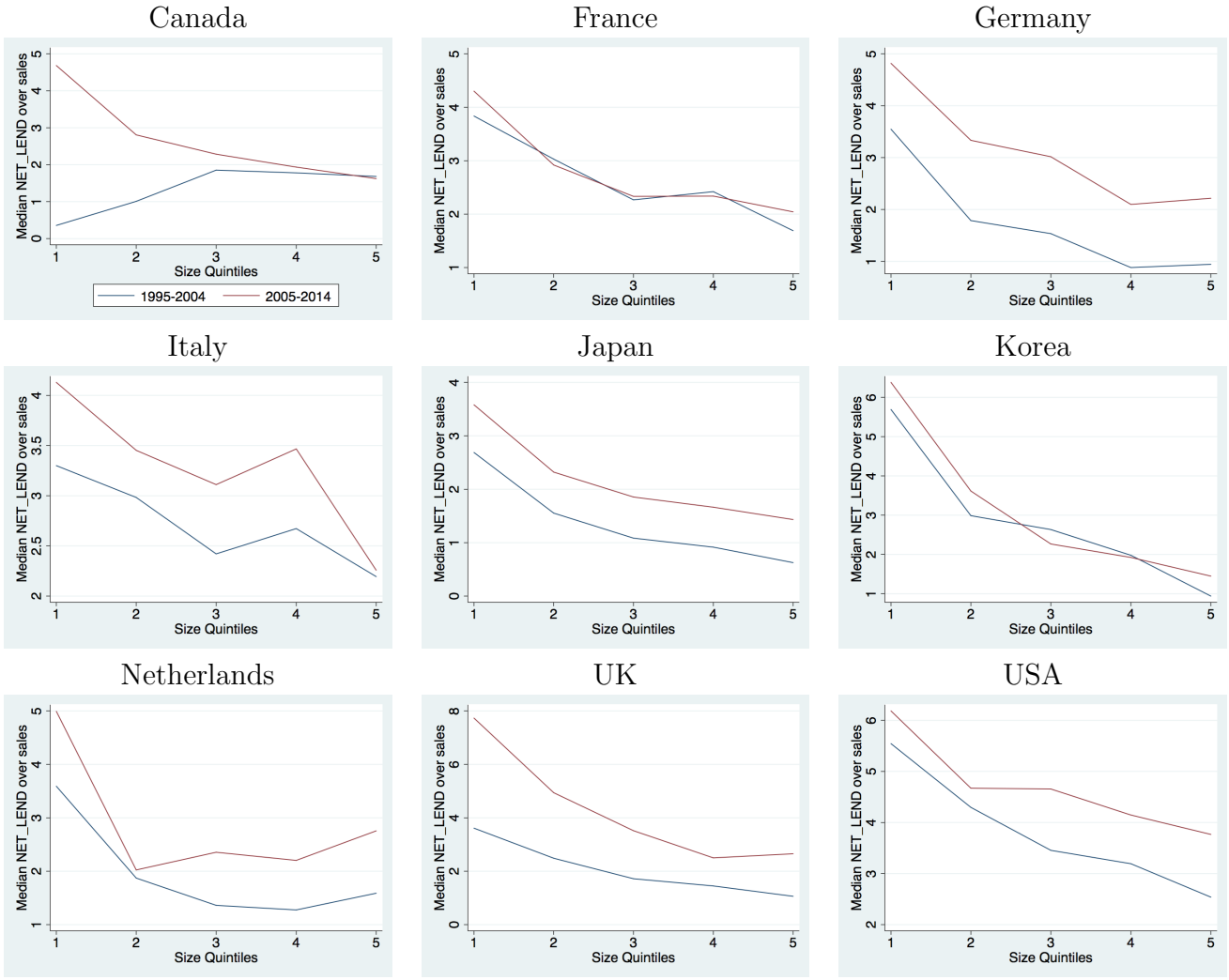
Source: Thomson Reuters Worldscope, Eurostat and National Sources. Aggregate NFC net lending (in percent of GDP) is from sectoral national accounts data. Aggregated firm-level excess saving rate (in percent of sales) is the median net lending rate among all firms (excluding finance and insurance) in each country for a given year.

Figure 11: Shifts in median cash ratios by size quintiles.



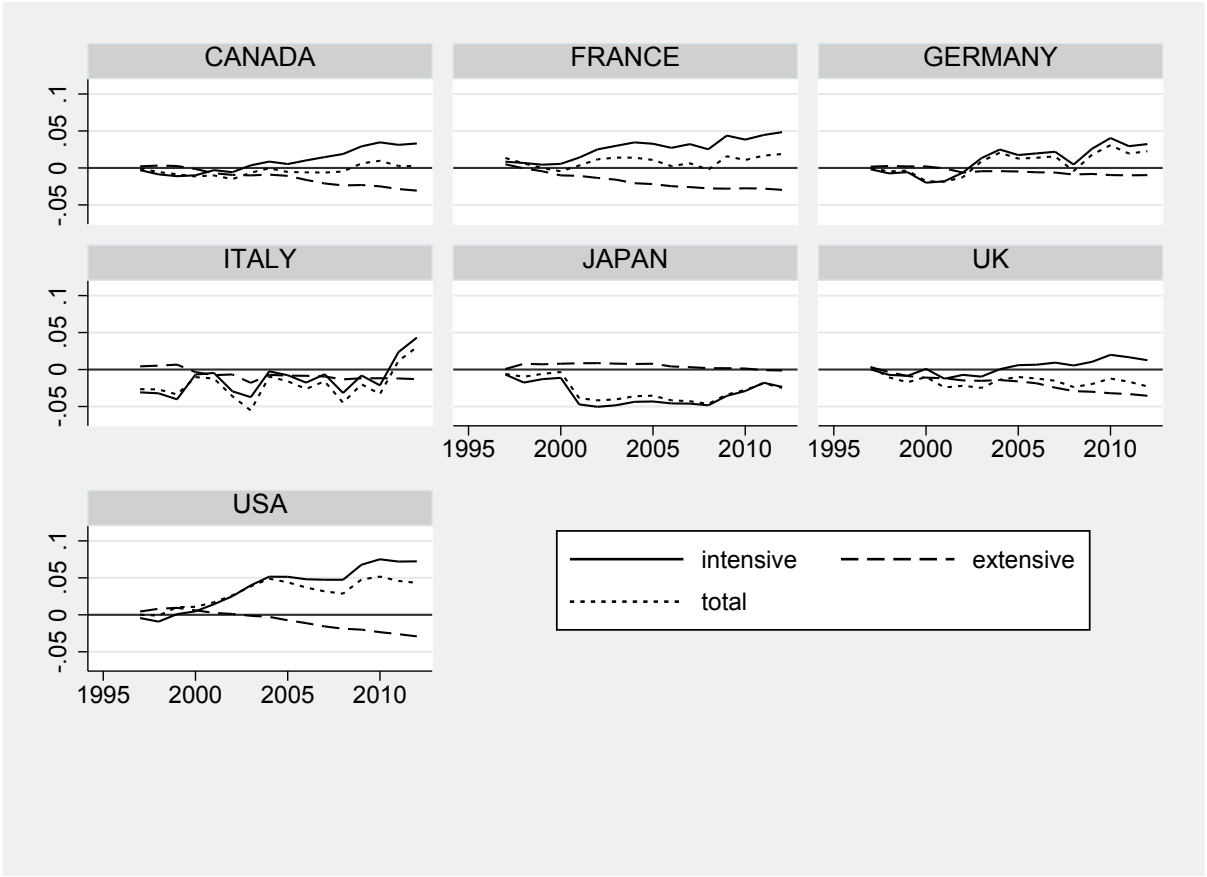
Source: Thompson Worldscope database and authors' calculations.

Figure 12: Shifts in median net lending rates by size quintiles.



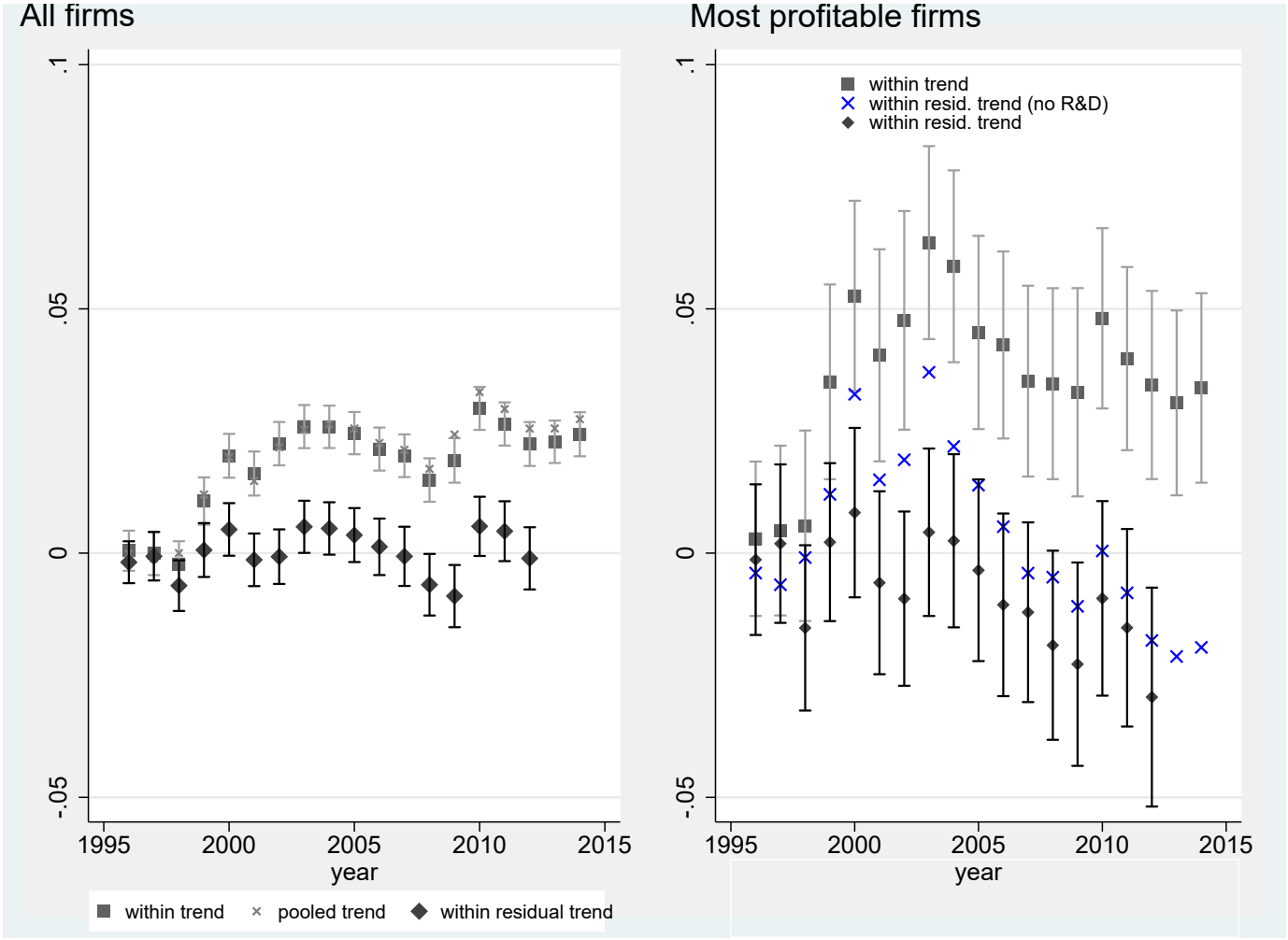
Source: Thompson Worldscope database and authors' calculations.

Figure 13: Decomposition of cumulative change in average cash ratio: intensive (within-sample) vs. extensive (composition) margin.



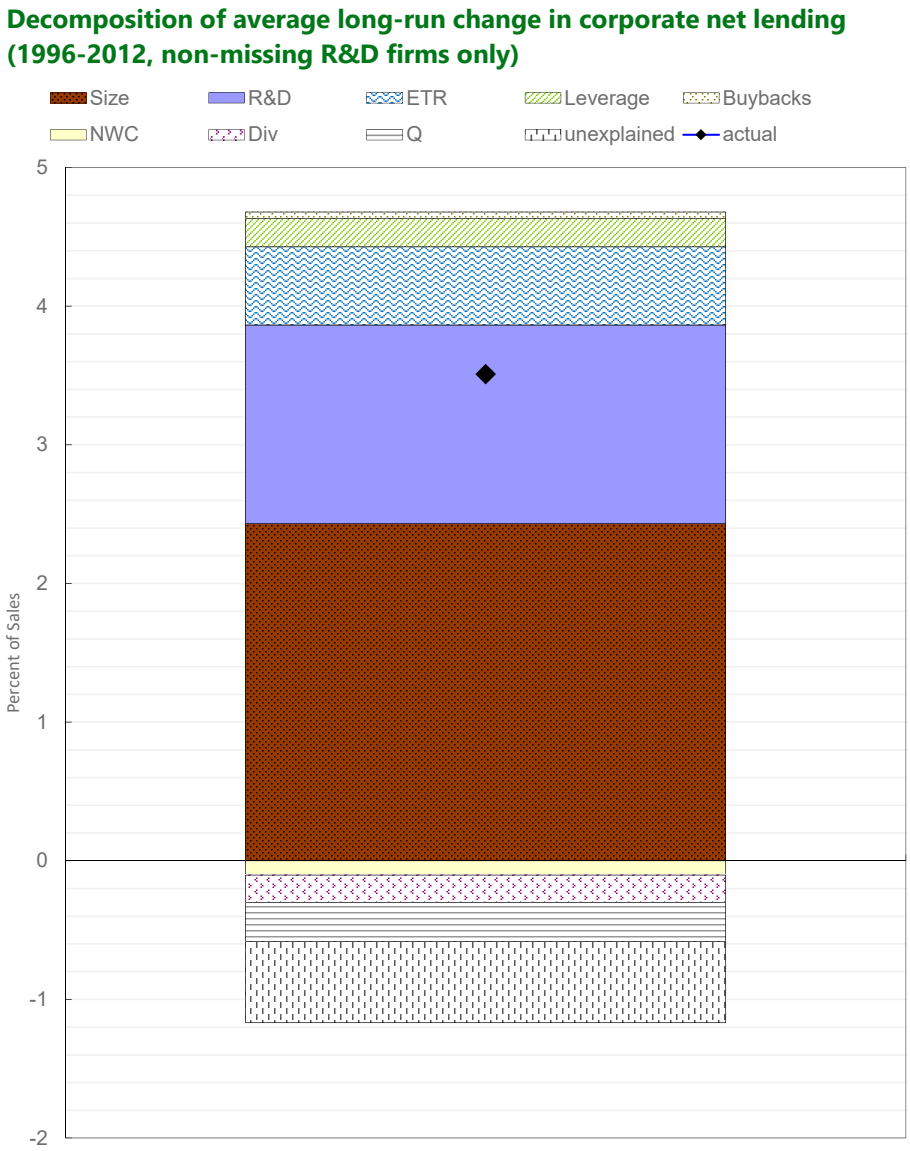
Source: Thompson Worldscope database. For each country, the contribution from firms' entry and exit (extensive margin) on the average cash ratio as well as the contribution from incumbent firms' cash ratio changes (intensive margin) on the average are shown. The decomposition is based on equation (6) in the text.

Figure 14: Time trends in corporate net lending



Source: Thompson Worldscope database and author's calculation. Pooled trend is extracted by regressing the firm-level net lending rate (in percent of total sales) in a country and year fixed effect (FE), the within trend controls also for firm fixed effects, and the resulting coefficients estimates and confidence bands for the time FE are plotted. The residual time trend shows the estimated time FE while controlling for all other explanatory variables in column 4 of Table 7. In all cases, only firms with at least 15 years of observations and non-missing *R&D* spending data are included. Right panel shows the subset of firms with profit rates (measured by net margin in percent of revenues) in the top quintile of the sample (as in column 6 of Table 7).

Figure 15: Explaining corporate excess saving.



Sources: Worldscope (Thomson Reuters), authors' calculations

Note: The decomposition is performed on the sample of firms in G7+2 countries over 1995-2012 for which $R\&D$ spending data is non-missing in the first and last year of the sample. The coefficients used to compute the contribution of each regressor are based on the regression result in column 5 of Table 8.

Table 1: Use of net lending from national accounts

	Dep. Var: Net lending (in % of GDP)			
	(1)	(2)	(3)	(4)
	Pooled	Within		
		Cosolidated		Unconsolidated
Cash ratio	0.134***	0.238***	0.240***	0.305***
	(0.032)	(0.055)	(0.078)	(0.098)
Equity assets	0.079*	0.213***	0.222***	0.177***
	(0.042)	(0.044)	(0.053)	(0.056)
Loan/Debt assets	0.357***	0.139**	0.124	0.159*
	(0.035)	(0.060)	(0.075)	(0.087)
Account receivables	0.348*	0.214*	0.139	0.247**
	(0.203)	(0.122)	(0.144)	(0.098)
Debt repayment	0.200***	0.166***	0.118*	0.121*
	(0.042)	(0.043)	(0.062)	(0.073)
Share buyback	0.196***	0.175***	0.111*	0.061
	(0.056)	(0.048)	(0.063)	(0.062)
Country FE	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes
N	105	105	105	155
R-sq	0.636	0.476	0.543	0.464

Notes: Column 1 is pooled, column 2-4 within-country regression. Cash, equity and loan/debt assets are in percent of total financial assets. Debt repayment and share buyback are net negative transactions in debt and equity liability, in percent of total financial assets. Column 1-4 use consolidated balance sheet data, column 5 uses unconsolidated balance sheet data (preferred method in system of national accounts and available for wider sample). Countries in the sample include: Germany, Netherlands, Kora, Japan, France, US, UK, Canada 1995-2016 (except Korea only 2008-2016). Source: OECD National Accounts and national sources.

Table 2: Coverage in Worldscope relative to sectoral national accounts (in percent, 1999-2014 average).

country	Gross operating surplus	Gross saving	Capital expenditure
Italy	27.7	34.3	25.1
Germany	33.4	41.1	39.6
Canada	43.8	43.4	68.1
Japan	44.3	36.8	39.7
Korea	56.5	59.2	46.1
United States	64.4	58.5	50.0
Netherlands	67.4	49.8	69.2
France	68.8	58.7	47.1
United Kingdom	99.6	74.9	79.9
average	56.2	50.7	51.7

Note: For each country and variable, the average ratio of the aggregated value from Worldscope data relative to the corresponding value recorded in the income accounts of the non-financial corporate sector as part of the system of national accounts over 1999-2014 is given (in percent). Gross operating profits are measured as earnings before interest, tax, amortization and depreciation at the firm level. Gross saving refers to undistributed gross profits and is defined as in equation (3) in the text.

Table 3: Pooled firm-level regressions

	(1)	(2)	(3)	(4)	(5)
	Cash ratio				Net lending rate
trend			0.088***	0.145***	0.038**
			(0.026)	(0.026)	(0.017)
nwc	-0.212***	-0.212***	-0.212***		0.020***
	(0.013)	(0.013)	(0.013)		(0.006)
size	-0.009***	-0.009***	-0.009***		0.002***
	(0.001)	(0.001)	(0.001)		(0.001)
leverage	-0.362***	-0.362***	-0.361***		-0.068***
	(0.013)	(0.014)	(0.013)		(0.009)
div. status	-0.024***	-0.025***	-0.025***		-0.024***
	(0.004)	(0.004)	(0.004)		(0.003)
profit	0.048***	0.048***	0.050***		0.062***
	(0.017)	(0.017)	(0.017)		(0.021)
Tobin's Q	0.010***	0.011***	0.010***		0.010***
	(0.004)	(0.004)	(0.004)		(0.001)
CF vol.	0.368***	0.368***	0.371***		0.049
	(0.054)	(0.054)	(0.054)		(0.043)
EPU index	0.006***	-0.016***	0.002		0.002
	(0.002)	(0.005)	(0.002)		(0.002)
Share of foreign sales	0.070***	0.069***	0.069***		0.012***
	(0.006)	(0.006)	(0.006)		(0.004)
R&D intensity	0.122***	0.122***	0.122***		0.221***
	(0.010)	(0.010)	(0.010)		(0.033)
IPO year	0.012***	0.012***	0.012***		0.001
	(0.003)	(0.003)	(0.003)		(0.003)
Country FE	Y	Y	Y	Y	Y
Year FE	N	Y	N	N	N
N	37424	37424	37424	37424	30211
R-sq	0.422	0.424	0.422	0.025	0.118

Notes: The dependent variable in columns 1-4 is the cash and short-term investment to book asset ratio, in column 5 is the net lending to sales ratio, defined as net income gross of depreciation, minus dividends paid, in percent of sales. Both variables are winsorized at 1 percent. Standard errors in parenthesis are clustered at the firm level. Source: Thompson Reuters Worldscope.

Table 4: Within-firm and first-difference regressions

	(1)	(2)	(3)	(4)	(5)
	Dep. Var: Cash ratio				
	level	log	level: w/o US	FD	FD: w/o US
$R\&D$ intensity	0.047***	0.106***	0.066***	0.026***	0.037**
	(0.007)	(0.023)	(0.019)	(0.007)	(0.015)
size	-0.018***	-0.097***	-0.020***	-0.000*	-0.001***
	(0.003)	(0.024)	(0.005)	(0.000)	(0.000)
nwc	-0.256***	-1.679***	-0.221***	-0.240***	-0.196***
	(0.014)	(0.105)	(0.015)	(0.012)	(0.014)
profit	0.123***	0.907***	0.147***	0.171***	0.204***
	(0.012)	(0.089)	(0.017)	(0.010)	(0.013)
leverage	-0.193***	-1.698***	-0.174***	-0.094***	-0.061***
	(0.014)	(0.103)	(0.017)	(0.012)	(0.016)
div. status	0.004	-0.043*	0.004	-0.003*	-0.002
	(0.003)	(0.025)	(0.003)	(0.002)	(0.002)
Foreign sales shr	0.007	0.070**	0.009	-0.008	-0.006
	(0.005)	(0.029)	(0.006)	(0.005)	(0.006)
Tobin's Q	0.005***	0.038***	0.007***	0.003*	0.005***
	(0.001)	(0.007)	(0.002)	(0.001)	(0.002)
CF vol.	0.125***	0.802***	0.128***	0.031	0.084***
	(0.033)	(0.199)	(0.049)	(0.040)	(0.030)
EPU	-0.019***	-0.127***	-0.013***	0.003	0.006**
	(0.004)	(0.042)	(0.004)	(0.003)	(0.003)
cons	0.672***	0.714	0.675***	0.015***	0.011**
	(0.079)	(0.554)	(0.108)	(0.005)	(0.005)
Firm FE	Y	Y	Y	N	N
N	37424	37194	21471	32757	18541
R-sq	0.145	0.116	0.151	0.147	0.165

Notes: The dependent variable is the 1 percent winsorized (Cash + Short-Term Investment)/Asset ratio in level, log, and first difference (FD). Columns 3 and 5 excludes US firms. All regressions include country and year fixed effects, in addition to firm fixed effects in columns 1-3. Standard errors in parenthesis are clustered at the firm level. Profit is defined as cash flow in percent of total assets and nws stands for net working capital. Source: Thompson Reuters Worldscope.

Table 5: Non-missing *R&D* sample only

	(1)	(2)	(3)	(4)
	Dep. Var: Cash/Asset			
	Pooled	Within		FD
		level	log	
R&D intensity	0.030***	0.016***	0.031***	0.010***
	(0.003)	(0.003)	(0.008)	(0.003)
size	-0.011***	-0.015***	-0.080***	-0.000
	(0.001)	(0.005)	(0.026)	(0.000)
IPO year	0.017***			-0.002**
	(0.005)			(0.001)
nwc	-0.295***	-0.298***	-1.798***	-0.274***
	(0.017)	(0.019)	(0.116)	(0.015)
profit	0.002	0.127***	0.763***	0.174***
	(0.021)	(0.015)	(0.096)	(0.012)
leverage	-0.419***	-0.202***	-1.662***	-0.095***
	(0.017)	(0.018)	(0.115)	(0.016)
div	-0.035***	0.003	-0.044	-0.002
	(0.005)	(0.003)	(0.029)	(0.002)
Foreign sales shr	0.075***	0.001	0.019	-0.015***
	(0.009)	(0.006)	(0.037)	(0.006)
Tobin's Q	0.010***	0.005***	0.034***	0.003
	(0.004)	(0.002)	(0.008)	(0.002)
CF vol.	0.432***	0.137***	0.447**	0.002
	(0.057)	(0.040)	(0.181)	(0.052)
EPU	0.004	-0.030***	-0.171***	0.008*
	(0.003)	(0.006)	(0.054)	(0.004)
trend	0.067*			
	(0.035)			
cons	-33.832***	0.703***	0.833	3.679**
	(8.987)	(0.107)	(0.610)	(1.749)
Firm FE	N	Y	Y	N
N	24402	24402	24299	20928
R-sq	0.439	0.148	0.140	0.153

Notes: The dependent variable is the 1 percent winsorized (Cash + Short-Term Investment)/Asset ratio in level, log, and first difference (FD). Only observations with non-missing, non-negative *R&D* expenditure are included in the regressions. All regressions include country and year fixed effects, in addition to firm fixed effects in columns 2-3. Profit is defined as cash flow in percent of total assets and nws stands for net working capital. Standard errors in parenthesis are clustered at the firm level. Source: Thompson Reuters Worldscope.

Table 6: Controlling for tax motive

	(1) Pooled	(2)	(3)	(4)	
		Within			
			Dep. Var: Cash ratio in		
	level	level	log	level: non-missing R&D	level: no foreign asset
R&D intensity	**0.325*** **	**0.039** **	**0.174*** **	**0.018*** **	**0.041** **
	(0.054)	(0.016)	(0.062)	(0.006)	(0.018)
size	-0.010***	-0.021***	-0.117***	-0.025***	-0.003
	(0.001)	(0.003)	(0.024)	(0.004)	(0.006)
IPO year	0.009***				
	(0.003)				
nwc	-0.201***	-0.280***	-1.799***	-0.333***	-0.333***
	(0.013)	(0.015)	(0.108)	(0.019)	(0.036)
profit	0.058***	0.138***	1.301***	0.143***	0.073***
	(0.021)	(0.013)	(0.102)	(0.016)	(0.023)
leverage	-0.344***	-0.180***	-1.680***	-0.186***	-0.239***
	(0.012)	(0.011)	(0.098)	(0.015)	(0.021)
div. status	-0.014***	0.003	-0.019	0.003	-0.006
	(0.004)	(0.003)	(0.026)	(0.004)	(0.005)
Share of foreign sales	0.067***	0.007	0.110**	0.006	0.067***
	(0.006)	(0.006)	(0.047)	(0.007)	(0.024)
ETR	**-0.018*** **	**-0.008** **	**-0.058** **	**-0.007**	**-0.013** **
	(0.006)	(0.004)	(0.033)	(0.005)	(0.008)
Tobin's Q	0.015***	0.005***	0.041***	0.004**	0.002
	(0.002)	(0.001)	(0.007)	(0.002)	(0.002)
CF vol.	0.509***	0.164***	1.244***	0.157***	0.128**
	(0.058)	(0.035)	(0.301)	(0.042)	(0.054)
EPU index	0.011***	-0.018***	-0.157***	-0.026***	-0.009
	(0.002)	(0.004)	(0.039)	(0.006)	(0.009)
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Firm FE	N	Y	Y	Y	Y
N	29712	38430	38176	24273	10817
R-sq	0.400	0.152	0.128	0.158	0.156

Notes: The dependent variable is the 1 percent winsorized (Cash + Short-Term Investment)/Asset ratio in level or log. Only observations with non-missing, non-negative *R&D* expenditure are included in column 4, and only firm-year observations with zero foreign assets are included in column 5. ETR stands for the effective tax rate in percent of as described in the text. Profit is defined as cash flow in percent of total assets and nws stands for net working capital. Standard errors in parenthesis are clustered at the firm level. Source: Thompson Reuters Worldscope.

Table 7: Net lending regressions

	Pooled	*Within-firm*				
				non-missing R & D sample		
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Net Lending/Sales					
$R\&D$ intensity$_t$	**0.219*** **	**-0.032**				
	(0.033)	(0.059)				
$R\&D$ intensity$_{t+1}$			**0.008**	**0.012**	**0.039*** **	**0.048*** **
			(0.021)	(0.010)	(0.011)	(0.007)
$R\&D$ intensity$_{t+2}$			**0.034***	**0.027*** **	**0.032** **	**0.050** **
			(0.020)	(0.010)	(0.014)	(0.022)
size	0.002***	0.003	0.002	0.023***	0.029***	0.044***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.004)	(0.007)
IPO year	0.001					
	(0.003)					
nwc	0.020***	0.024***	-0.000	0.030***	0.042**	0.063**
	(0.006)	(0.009)	(0.009)	(0.009)	(0.017)	(0.027)
profit	0.062***	0.148***	-0.005	0.166***	0.197***	0.214***
	(0.021)	(0.020)	(0.003)	(0.014)	(0.022)	(0.031)
leverage	-0.068***	-0.059***	-0.092***	-0.065***	-0.080***	-0.075***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.016)	(0.024)
div. status	-0.024***	-0.034***	-0.034***	-0.033***	-0.046***	-0.052***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.010)
Share of foreign sales	0.014***	0.004	0.006	-0.001	-0.009	-0.007
	(0.005)	(0.007)	(0.008)	(0.006)	(0.009)	(0.016)
Tobin's Q	0.010***	0.003***	0.004***	0.003***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CF vol.	0.047	0.005	-0.002***	0.051	-0.007	0.010
	(0.043)	(0.039)	(0.001)	(0.031)	(0.042)	(0.040)
EPU index	0.003	0.003				
	(0.004)	(0.003)				
ETR				-0.080***	-0.165***	-0.195***
				(0.004)	(0.013)	(0.023)
Country FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	N	Y	Y	Y	Y	Y
N	30144	39019	36796	21722	10869	5578
R-sq	0.121	0.037	0.026	0.105	0.107	0.110

Notes: The dependent variable is the 1 percent winsorized Net Lending/Sales ratio where Net Lending is defined as
$Net\ Lending = Net\ Income + Depreciation - Dividend\ paid - Capital\ Expenditure$. Only observations with non-missing, non-negative $R\&D$ expenditure are included in columns 4-6. Col. 5-6 includes firms in the top half and top quintile of profitability (net margin) respectively. ETR stands for the effective tax rate as described in the text. Profit is defined as cash flow in percent of total assets and nws stands for net working capital. Standard errors in parenthesis are clustered at the firm level. Source: Thompson Reuters Worldscope.

Table 8: Controlling for share buyback

	(1)	(2)	(3)	(4)	(5)	(6)
		Cash ratio			Net lending	
	Pooled	Within		Pooled	Within	
$R\&D$ intensity$_t$	**0.324*** **	**0.018*** **	**0.018** **	**0.206*** **		
	(0.054)	(0.006)	(0.009)	(0.034)		
$R\&D$ intensity$_{t+1}$					**0.013**	**0.047*** **
					(0.011)	(0.008)
$R\&D$ intensity$_{t+2}$					**0.026** **	**0.049** **
					(0.011)	(0.022)
size	-0.010***	-0.025***	-0.024***	0.002***	0.023***	0.046***
	(0.001)	(0.004)	(0.005)	(0.001)	(0.003)	(0.008)
IPO year	0.009***			0.001		
	(0.003)			(0.003)		
nwc	-0.201***	-0.333***	-0.332***	0.023***	0.032***	0.064**
	(0.013)	(0.019)	(0.021)	(0.006)	(0.009)	(0.027)
profit	0.053**	0.143***	0.144***	0.068***	0.167***	0.213***
	(0.021)	(0.016)	(0.016)	(0.022)	(0.014)	(0.032)
leverage	-0.344***	-0.186***	-0.168***	-0.066***	-0.069***	-0.087***
	(0.012)	(0.016)	(0.017)	(0.009)	(0.010)	(0.025)
div. status	-0.014***	0.003	0.003	-0.021***	-0.033***	-0.053***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.010)
Share of foreign sales	0.067***	0.006	-0.000	0.012**	-0.001	-0.006
	(0.006)	(0.007)	(0.009)	(0.005)	(0.006)	(0.016)
ETR	-0.018***	-0.007	-0.004	-0.073***	-0.079***	-0.187***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.004)	(0.023)
Tobin's Q	0.016***	0.004**	0.005***	0.010***	0.004***	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
CF vol.	0.508***	0.157***	0.155***	0.021	0.045	0.011
	(0.058)	(0.042)	(0.048)	(0.040)	(0.035)	(0.043)
EPU index	0.011***	-0.025***	-0.023***	0.004		
	(0.002)	(0.006)	(0.006)	(0.004)		
buyback$_t$	**0.146*** **	**-0.004**	**0.001**	**0.135*** **	**0.046** **	**0.115*** **
	(0.031)	(0.036)	(0.036)	(0.026)	(0.019)	(0.039)
buyback$_{t+1}$			**0.117*** **		**0.032** **	**-0.016**
			(0.034)		(0.016)	(0.040)
buyback$_{t+2}$			**0.060** **		**0.025***	**0.026**
			(0.023)		(0.013)	(0.033)
N	29708	24269	19929	29654	21547	5529
R-sq	0.401	0.158	0.159	0.142	0.108	0.112

Notes: The variables are defined as in Tables 3 to 7. The new variable *buyback* is defined as the percent change in the amount of ordinary shares outstanding when there was a reduction and zero otherwise. All regressions include country and year fixed effects. Except for columns 1 and 4, all regressions include firm fixed effects. The within regressions only include firms with non-missing R&D spending. Column 6 is run on sub-sample of firms with the highest profitability, i.e. net margin above 9 percent (corresponding to 75 percentile). Profit is defined as cash flow in percent of total assets and nws stands for net working capital.

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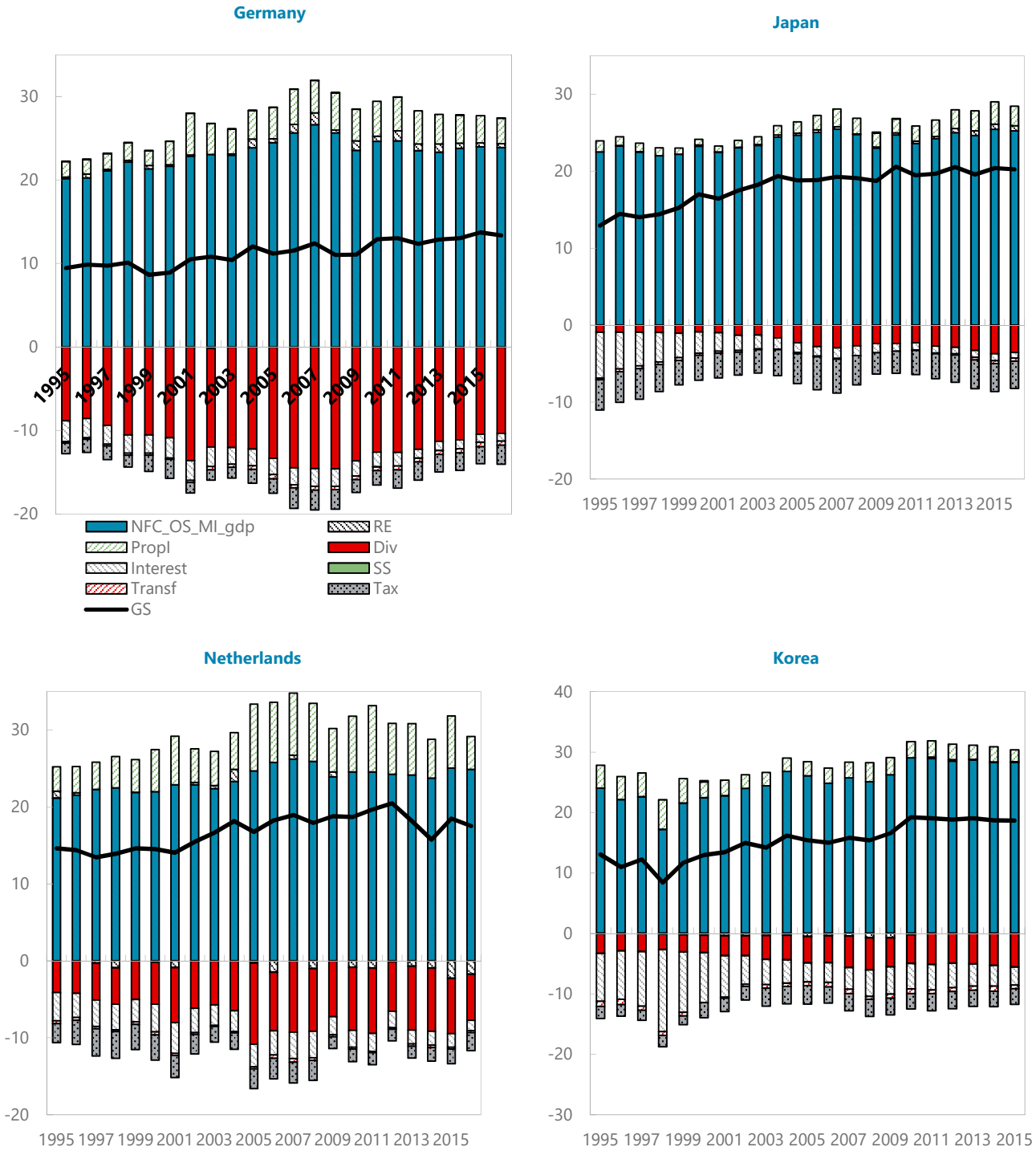
Appendix A - Figures

Figure 16: Decomposing change in gross saving rates into sources - year by year.



Source: OECD, National Sources and IMF Staff calculations.

Appendix B - Worldscope Data Description

Table 9: Count of Unique Firm ID by Sector in Each Country

Sector	**Canada**	**France**	**Germany**	**Japan**	**Italy**	**Korea**	**Netherlands**	**UK**	**USA**
Agriculture	16	13	6	1	11	1	9	23	37
Mining	745	19	15	6	17	9	7	166	501
Construction	27	25	29	9	356	21	90	97	133
Manufacturing	482	566	574	208	2079	116	1481	853	3250
Transp., Communic., Elect.	106	66	55	42	218	20	59	157	564
Wholesale	60	81	61	12	412	27	78	140	350
Retail	74	81	53	14	573	16	43	256	613
Services	299	373	279	52	963	73	244	850	2198

Appendix C - Macro Data Sources

The Appendix describes the sources of macro data used in the analysis.

Aggregate Data

To build the aggregate dataset we combined different sources.

Income Accounts

Data on Net Lending, Gross saving and Capital Expenditure by institutional sectors are gathered from the following sources:

- **Canada:** Data come from Statistics Canada, the Canadian Statistical Office. We used the information contained in the Current and Capital Account by Sector, with particular reference to sectoral gross saving and net lending. http://www5.statcan.gc.ca/cansim/a45?lang=eng&childId=37641032&CORId=3764&preState=1&childIds=37641044;37641053;37641054;37641055;37641058;37641055;37641054;37641053;37641053;37641059;37641045;37641047;37641032;37641033;37641035;37641036;37641037;37641034;37641034;37641035;37641037;37641036;37641033;37641054;37641048;37641049;37641047;37641055;37641045;37641044;
- **Japan:** Data come from the National Accounts of Japan - Income and Outlay Accounts classified by Institutional Sectors as gathered by the Japanese Cabinet Office. http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2014/28annual_report_e.html#c1
- **South Korea:** Data come from the National Account - Production, Income and Capital Accounts - Income Accounts by Institutional Sectors provided by the Bank of Korea. http://ecos.bok.or.kr/flex/EasySearch_e.jsp
- **USA:** Data come from the Financial Accounts of the USA, as gathered by the Federal Reserve. http://www.federalreserve.gov/datadownload/Review.aspx?rel=Z1&series=bf046beec7d1eaa3609bed122971a339&lastobs=&from=01/01/1970&to=12/31/2016&filetype=csv&label=include&layout=seriescolumn
- **France, Germany, Italy, Netherlands, UK:** Data come from Eurostat, Quarterly Sector Accounts; Non-financial transactions. http://ec.europa.eu/eurostat/data/database.

Whenever possible, we provide a decomposition of Gross saving in Profits and Distributed Income. Moreover, we further decompose Profits in Gross Operating Surplus, Interest, Rent, Taxes, Other Transfers. The most detailed account of these variables is provided by the OECD in the Detailed National Accounts, SNA 2008: Non-financial accounts by sectors, annual (Edition 2015), which comprises statistics on the whole set of financial accounts in terms of production accounts, generation of income accounts, allocation of primary income accounts, use of disposable income account,

change in net worth due to saving and capital transfer accounts and acquisitions of non-financial assets accounts. Data is expressed in national currency current prices.

Flow of Funds Data

We refer to the Financial Account to collect information on how the surplus or deficit of the capital account is financed by transactions in financial assets and liabilities. The financial account indicates how net borrowing sectors obtain resources by incurring liabilities or reducing assets, and how net lending sectors allocate their surpluses by acquiring assets or reducing liabilities. Financial flows represent the difference between the opening financial balance sheet at the start of the year and the closing balance sheet at the end of the year. Financial stocks, as registered in balance sheets at a given point in time, are the result of the accumulation of financial flows over time. We focus on the Financial Stocks. Our balance-sheet data are provided by:

- Statistics Canada: National Balance Sheet Accounts by Sector, available at http://www5.statcan.gc.ca/cansim/a45?lang=eng&childId=37641025&CORId=3764&preState=1&childIds=37641023;
- Eurostat: ("Financial flows and stocks" - France, Germany, Italy, Netherlands, UK) http://ec.europa.eu/eurostat/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_nPqeVbPXRmWQ&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1
- the Federal Reserve: we downloaded the balance sheet data on nonfinancial corporations as described in the table $B103$ at the following link: http://www.federalreserve.gov/releases/Z1/current/z1.pdf. Data are downloaded from this link: http://www.federalreserve.gov/datadownload/Choose.aspx?rel=Z1.
- the Bank of Korea: http://ecos.bok.or.kr/flex/EasySearch_e.jsp
- the Bank of Japan: http://www.stat-search.boj.or.jp/ssi/cgi-bin/famecgi2?cgi=$nme_a000_en&lstSelection=11$1

We construct variables as follows:

- **Liquid Assets**
  - Canada
    - Currency and deposits
    - Short-term debt securities
    - Investment fund shares
  - Countries in Eurostat
    - Currency and deposits (F2)
    - Short-term debt securities (F31)

    - Investment fund shares (F52)
  - Japan
    - Currency and deposits
      - Currency
      - Transferable deposits
      - Time and saving deposits
      - Certificates of deposits
      - Foreign currency deposits
    - Short-term debt
      - Treasure discount bills
      - Central government securities and FILP bonds
      - Local government securities
      - Public corporation securities
      - Bank debentures
      - Industrial securities
      - External securities issued by residents
      - Commercial paper
      - Investment trust beneficiary certificates
      - Trust beneficiary rights
      - Structured-financing instruments
    - Short-term loans
      - Repurchase agreements and securities lending transactions (liquid sub-category of loans)
      - Call loans and bills (liquid sub-category of loans)
  - Korea
    - Currency and deposits
    - Short-term debt
      - Government bonds
      - Financial debentures
      - Commercial papers
  - USA
    - Currency and Deposits
    - Short-term debt: "Nonfinancial corporate business; debt securities; asset"
    - Liquid Shares
      - Money market fund shares
      - Repo

- **Accounts Receivables**

  - Countries in Eurostat
    * Accounts receivables (F8): Trade credits and advances and other accounts receivables
  - Japan
    * Trade credits and foreign trade credits
  - Korea
    * Trade credits
  - USA
    * Trade receivables

- **Financial Debt**
  - We subtract the value of equity liabilities from the value of Total Financial Liabilities.

IMF Workshop on Assessing Global Imbalances on December 6, 2018

Comments on "The Rise in Corporate Saving and Cash Holding in Advanced Economies: Aggregate and Firm Level Trends" by Mai Chi Dao and Chiara Maggi[1]

Review of Paper by Joe Gruber

I thank the organizers of this seminar for inviting me and allowing to discuss this interesting and timely paper. The paper documents trends in non-financial corporate (NFC) net lending, saving, and cash holdings at both the aggregate national level the firm level. The paper presents a rich set of empirical results and identifies a number of interesting, and possibly important, trends and correlations. The authors maintain a fairly broad assessment of possible drivers and explanations for the patterns that their empirical analysis reveals.

I'll start by reviewing some of the key empirical observations from the paper, including, first and foremost, the sharp increase in NFC net lending over the past two decades in the G7 economies. The non-financial corporate sector has flipped from being a large net borrower of funds from the rest of the economy to being a large net lender. This change reflects both a decline in NFC investment rates as well as an increase in NFC gross saving.

The authors point out the lack of correlation between the level of NFC net lending and current account balances across countries. However, looking at changes they conjecture that increases in NFC net lending have been associated with increases in current account surpluses (perhaps unsurprisingly given the steep fall off in investment in the G7 post-crisis that coincided with a general improvement in G7 current account balances). Also, those countries with the largest increase in NFC saving are those that have been running the most persistent current account surpluses (Germany, the Netherlands, Japan, and Korea).

In explaining the increase in NFC net lending the authors focus primarily on examining the increase in saving. Decomposing the higher saving rate, they identify higher profit rates (on account of a decline in labor share and a higher corporate share of GDP) combined with lower interest expenses and relatively muted increases in dividends as the main factors behind the increase in saving.

The authors then turn to an examination of what firms have been doing with their higher saving. They abstract from the consideration of equity buybacks, and instead look at the evolution of financial assets and liabilities. They find that firms have generally not been paying off their liabilities (with the exception of those in Japan) and instead have been amassing assets, in particular increasing their holdings of cash.

Having established the link between increased net lending and increased cash holdings in the aggregate data, the authors then examine firm-level data to try explain the increased corporate demand for cash holdings. They review a wide set of possible explanations. They find that the most important determinants of cash holdings across firms are the size of the firm, with cash increasing with firm size, and the importance of R&D spending.

Having summarized the papers main results, I will now offer some comments, referencing some of my own work that has examined the changing pattern of corporate net lending.

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[1] The author is a Senior Associate Director in the International Finance Division, Board of Governors of the Federal Reserve System, Washington DC 20551 U.S.A. joseph.w.gruber@frb.gov. The views in this discussion are solely the responsibility of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

The Falloff in Investment and the Increase in Corporate Saving

In particular, Mai and Chiara's paper focuses its attention primarily on how increased NFC gross saving has boosted the sector's net lending. But it is also true that a fall-off in NFC investment is an important factor behind the increase in NFC net lending. This is particular true in the United States, where much of the variation in net lending lines up with shifts in the aggregate investment rate, but is also apparent for the Germany, Korea, Japan, and the United Kingdom.

This fall in NFC investment is particularly surprising given the increase in corporate profits over most of the period, as discussed by Mai and Chiara. In a paper that provides a good complement to the paper being discussed, Gruber and Kamin (2016) looks at the recent behavior of investment in the advanced economies. In our paper we were interested in whether firms were depressing investment in a desire to hoard cash. To address this question, we estimated out-of-sample forecasts to investigate whether investment was lower than might be expected given the state of the economy, cost of capital, the level of firm profitability, and other standard determinants of investment.

Overall, we found some indication that investment has been depressed since the Global Financial Crisis (GFC), even after controlling for the state of the economy and other factors. The evidence of an investment shortfall was most compelling in the euro area and Japan, suggesting that depressed investment has been behind the recent surge in NFC net lending in at least some countries.

Another question we were interested in asking is whether firms were holding back on investment in order to increase equity buybacks and dividends. Here we did not find much supporting evidence. Looking across OECD countries, the shortfall in investment relative to its predicted value was not correlated with an increase in buybacks or dividend payouts (see Gruber and Kamin 2017).

Is Corporate Gross Saving a Meaningful Analytical Concept?

One issue I have struggled with in my study of NFC net lending and saving is how to interpret equity buybacks. Mai and Chiara move fairly quickly to abstract from buybacks in their study, which, very likely, was a wise choice. The problem I have had is how to think about the different treatment of buybacks and dividends (two ways in which firms return profits to shareholders) in determination of corporate saving in the national accounts data. Particularly, in the accounts, a dividend payout decreases NFC saving while an equity buyback, considered as the retirement of a liability, does not. As such, a switch in corporate preferences towards buybacks and away from dividends would boost NFC saving without much true economic consequence.

In earlier work, Gruber and Kamin (2015), our solution to this problem was a reordering of the national accounts to create a new category "payouts" which combined buybacks and dividends. In the traditional accounts profits are either invested or saved, while in our reordering profits were either invested, paid out in dividends and buybacks, or added to the stock of financial assets. In effect we broke up the standard definition of corporate saving in order to group dividends and buybacks similarly.

In our work, we found that if equity buybacks are no longer counted as saving, the increase in NFC saving post-crisis has been much more subdued, particularly in the United States, but also in many other OECD countries.

NFC Net Lending and Global Imbalances: Why Should we Care?

Looking at global imbalances, across countries there is a clear relationship between an increase in

NFC net lending and an increase in the current account surplus.[2] In thinking about this relationship, and what to make of it, it is useful to review why policymakers are interested in imbalances to begin with.

Despite a large academic literature that argues that imbalances resulting from intertemporal optimization are a good thing and not a problem, policymakers have consistently expressed concern about large imbalances. Why do policymakers care? I group policymaker concerns into two main groups. The first set of concerns involve the distribution of current demand. In particular, whether the pattern of global demand is consistent with a global economy that is growing at potential. In this framework, a large surplus could be representative of a cyclical leakage from global demand, with excess saving in surplus countries creating a "paradox of thrift" externality that depresses global growth. Within any particular economy, policymakers have over time developed the tools to address the externality of excessive thriftiness, both in terms of monetary policy and fiscal policy. However, in the international system there are no equivalent mechanisms, and policymakers are reduced to discussion and moral suasion in order promote appropriate domestic policies.

The second set of concerns involve the distribution of intertemporal demand, which is to say financial stability. Any number of configurations of intertemporal trade can support global growth at potential, however, some patterns are more sustainable than others and some could be decidedly unstable.

Identifying the determinants of imbalances, such as the IMF does in its EBA exercise, allows for a discussion of policies to mitigate the externalities associated with imbalances, both in regard to an uneven pattern of current demand as well as to financial stability.

The EBA methodology goes through great effort to identify current account "norms", that is the imbalance that can be attributed to fundamentals, and excess imbalances, or the current account gap. Implicit is the idea that imbalances related to "norms" are not as problematic. However, it is worthwhile pointing out that the externalities arising from imbalances are apparent regardless of the source of the imbalance, whether within the norm or outside the norm. For example, an imbalance that results from demographics is no less or more harmful to financial stability than one resulting from currency manipulation.

Where the separation of imbalances into "norms" relative to excesses is meaningful is in the search for policy prescriptions to address the problems associated with imbalances. Current account balances associated with "norms", such as demographics, are implicitly assumed to be less amendable to policy, or, perhaps, could only be addressed in conflict with some other competing policy goal. For example, adopting policies to discouraging saving by the elderly could narrow a large current account surplus, but perhaps at too high cost regarding other societal goals.

Where does that leave us regarding policy prescriptions for dealing with global imbalances? The current discussion has run out of steam, particularly as imbalances have shifted from interveners (where the policy advice was fairly clear) to economies with floating exchange rate (where the policy advice is more complicated). Further discussions of demographics and fiscal policy will likely not take us much further.

This lack of momentum likely explains some of the interest in examining the role of corporate saving in determining imbalances, up to now fairly underdeveloped territory. Bringing the corporate

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[2] One example of the importance of corporate saving behavior for imbalances is examining the response of the U.S. current account deficit to recent changes in fiscal policy. In the Integrated Macroeconomic Accounts for the United States, net lending by the federal government decreased $306 billion from 2017:Q2 to 2018:Q3. Over the same period, the U.S. current account deficit was roughly unchanged, in part as the decline in federal saving was offset by a $160 billion increase in net saving by the non-financial corporate sector.

sector into the discussion opens up a whole new range of policies to be examined and discussed. For example, competition policy or corporate tax policy would now be fair game in the discussion of imbalances. In conclusion, introducing corporate saving into the study of current accounts provides an opportunity to reinvigorate the policy discussion around imbalances.

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Trade Costs and Imbalances: Can Services Trade Policy Affect Global Imbalances?*

Mark Joy[+], Noëmie Lisack[◊], Simon Lloyd[+], Dennis Reinhardt[+], Rana Sajedi[+,♦] and Simon Whitaker[+]

October 2019

Introduction

There is substantial evidence that trade openness raises economic growth and boosts living standards (e.g. Frankel and Romer, 1999; Alcalá and Ciccone, 2004). But trade liberalisation has been asymmetric, with greater liberalisation being achieved in goods rather than services trade (**Figure 1**). This chapter draws on Joy *et al.* (2018) to explore how this asymmetric liberalisation may have contributed to the opening up of global current account imbalances.

The decline in goods trade barriers may have favoured countries specialising in goods—like China, Germany and Japan—allowing them to increase exports relative to imports, and contributing to their persistent current account surpluses (Barattieri, 2014). By contrast, countries like the United States and the United Kingdom, who specialise in the services sector where trade is more restricted, have been running persistent deficits (**Figure 2**).

Asymmetric trade liberalisation could be one explanation for global imbalances that has been overlooked to date. We demonstrate how realistic additions to textbook economic models allow for trade policy to have persistent effects on current account imbalances. We also find empirical support for significant quantitative effects. Our results suggest that liberalising services trade, as much as has occurred for goods trade, could reduce excess global imbalances by around 40%. This is in addition to the wider benefits of services trade liberalisation, such as contributing to higher and more inclusive global growth, for instance by boosting productivity in manufacturing sectors (Beverelli *et al.*, 2017).

Trade policy in a textbook model

The idea that trade policy can affect the current account seems an intuitive one. If countries agree to reduce tariffs in one particular sector, exports from countries with a comparative advantage in that sector should rise more than in other countries. This asymmetric effect could lead to a widening of global imbalances.

However, this intuition does not necessarily hold in general equilibrium textbook models (e.g. Obstfeld and Rogoff, 1996). Within these models, the current account is defined as a country's net foreign lending—domestic saving minus domestic investment. Therefore, for any policy to affect current accounts, it must affect intertemporal decisions. A permanent change in trade policy, which permanently raises a country's income path, will cause an equal permanent increase in its spending path and thus have no effect on net saving. The positive shock to demand for domestic relative to foreign goods would shift relative prices, appreciating the real exchange rate, but leaving net exports unchanged.

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* This draws on a previous *Bank of England Financial Stability Paper* by the same authors entitled "Mind the (current account) gap". The views in this paper are those of the authors, and are not necessarily those of the Bank of England or Banque de France. Lisack was affiliated to the Bank of England when writing the previous Financial Stability Paper.

+ Bank of England

◊ Banque de France

♦ Corresponding author
rana.sajedi@bankofengland.co.uk

foreign goods would shift relative prices, appreciating the real exchange rate, but leaving net exports unchanged.

But this textbook theory is based on strict assumptions on the intertemporal decisions of households and firms. We show that relaxing some of these assumptions—for example by allowing habit formation in consumption, or the inclusion of capital as a production input—implies that current account positions can be persistently affected by trade liberalisation.

We use an illustrative theoretical model comprising of two countries, each producing two types of output—'goods' and 'services'. We label one country a 'goods specialist', and the other a 'services specialist', endowing them with different comparative advantages. Private agents in each country consume goods and services produced in both countries. We add trade barriers in the form of import tariffs, which can differ for goods and services. We consider trade liberalisation in a given sector to refer to a simultaneous reduction in the tariff applied to imports in both countries, reflecting bilateral trade agreements applied to a given sector, rather than unilateral changes in domestic tariffs.

This baseline model is in line with 'textbook' theory described above. **Figure 3** shows the current account response of the services specialist to a permanent reduction in global services trade barriers. The flat blue line represents the baseline case, where permanent trade liberalisation has no current account impact.

To generate current account responses to trade liberalisation, we consider two types of extensions to the intertemporal structure of the economy.

Extending the household sector

In the first extension, we assume that households prefer to maintain a certain level of consumption and dislike major changes in it, being influenced by 'habits'. Recognising this in the model prevents consumption from fully responding to trade liberalisation on impact, hence implying that a change in permanent income affects savings in the short and medium run.

The purple line in **Figure 3** shows that following services trade liberalisation, with habits, as consumption in the services specialist rises more gradually than its income, there is a period of higher domestic saving and hence a persistent current account surplus.

Extending the production sector

Current accounts will also respond to trade liberalisation when the production sector is extended to include capital as an input. Capital requires investment, in advance. Reducing services import tariffs renders imported services cheaper. Since both countries use foreign-produced services, their lower price raises incentives to invest. As shown in the green line in **Figure 3**, given its comparative advantage, the service specialist's income gain is more than sufficient to finance its extra investment, generating a persistent current account surplus.

Quantifying the effects of trade liberalisation

We have seen that trade policy can, in theory, affect current accounts of countries depending on their comparative advantage. We now turn to whether this effect is quantitatively significant.

Empirically, we first assess how goods trade liberalisation, over the last 20 years, has affected current account imbalances depending on whether a country's comparative advantage is in goods or services.

To do this, we build on the IMF's External Balance Assessment regression framework, where current account balances are regressed on a battery of explanatory variables covering economic fundamentals (e.g. demographic factors and level of development) and policy variables (e.g. health spending, fiscal balance, capital controls). We add to this battery of variables one that captures asymmetric trade liberalisation, enabling us to assess the marginal impact of trade policies on current accounts.

We proxy asymmetric trade liberalisation with the long-term decline in the world average tariff rate for goods (**Figure 2**). We find that global goods trade liberalisation has been associated with higher current account balances for countries specialising in goods, and lower current account balances for countries with a comparative advantage in services. Our results are presented in **Table 1**. To illustrate their qualitative implications, consider China and the United States—two countries with comparative advantages in goods and services, respectively. A 3 percentage point lower average tariff rate on goods, similar to the reduction seen since 1995, is associated with a Chinese current account increase of 1.1% of GDP, and a US current account reduction of 0.2% of GDP.

With this in hand, we then ask how much trade liberalisation in services could lower global imbalances. Considering a scenario where the cost of trade in services fell by as much as the decline in goods tariffs indicates that around 40% of the unexplained "excess" current account imbalances in the IMF's EBA could be closed through services trade liberalisation.

We next assess empirically by how much global imbalances might be reduced if the countries with the highest service trade restrictions were to liberalise. Using country-specific data from the OECD (2015) on services trade restrictiveness, we find that countries with higher restrictions on services trade tend to have higher current accounts (**Table 2**). If they liberalise, opening their service sectors to imports or making it easier for foreign firms to establish a presence in their local markets, it should allow countries with more competitive service sectors to export more.

For instance, we estimate that the US current account deficit would be about 0.3 percent of GDP narrower if all countries reduced their services trade restrictions to the level of the least restrictive country. For the UK, the current account deficit could be around 0.7 percent of GDP narrower. In total, this could reduce unexplained "excess" current account imbalances by around 40%, a similar magnitude to the calibration for the previous exercise.

Conclusions

Current account imbalances have risen up the international policy agenda. While the absolute scale of imbalances has declined since the global financial crisis, a pattern of excessive surpluses and deficits in the same key countries has persisted. This paper suggests that asymmetric trade liberalisation—which saw barriers to goods trade fall sharply relative to those for services trade—is one, previously overlooked, explanation. Trade policy can have persistent effects on current account imbalances when realistic assumptions are added to textbook economic models, and empirical results suggest significant quantitative effects. Simple calibrations suggest that liberalising services trade could reduce unexplained "excess" current account imbalances by around 40%. These results suggest that liberalising services trade to the extent previously seen in goods trade, could make a significant contribution to reducing excess global imbalances. While not easy to achieve, that could also make global growth stronger and more inclusive.

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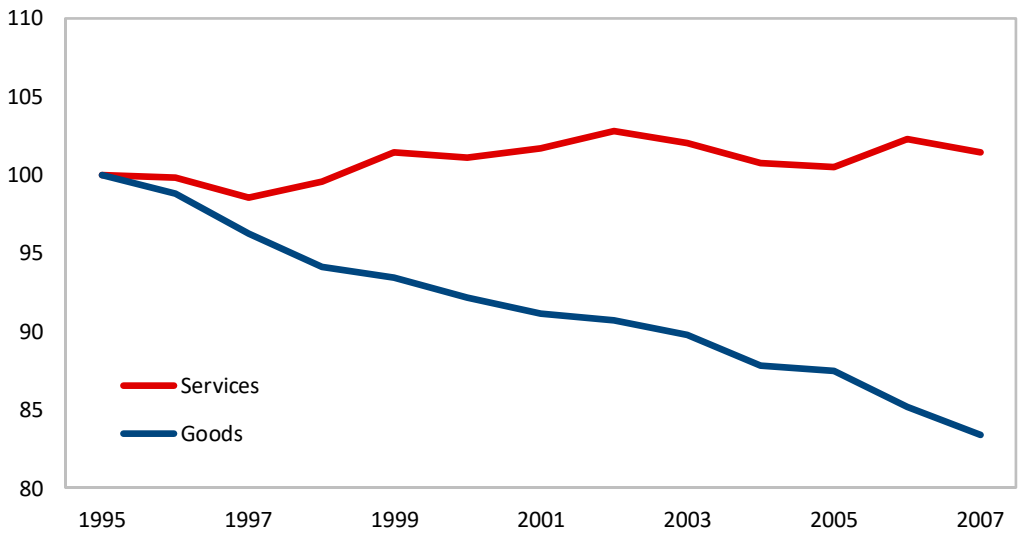
Figure 1. Trade liberalisation has focused on goods, not services

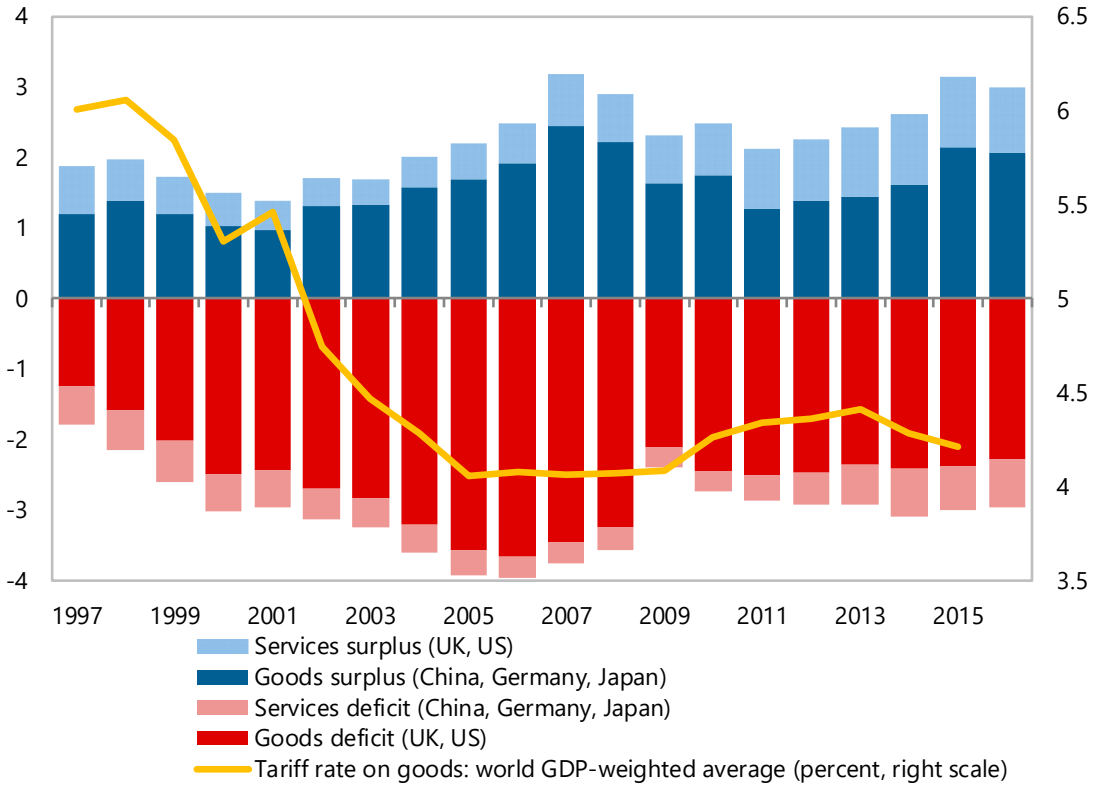
(Trade costs index, 1995=100)



Source: Miroudot, Sauvage and Shephard (2013).

Figure 2. Global imbalances have risen since mid-1990s

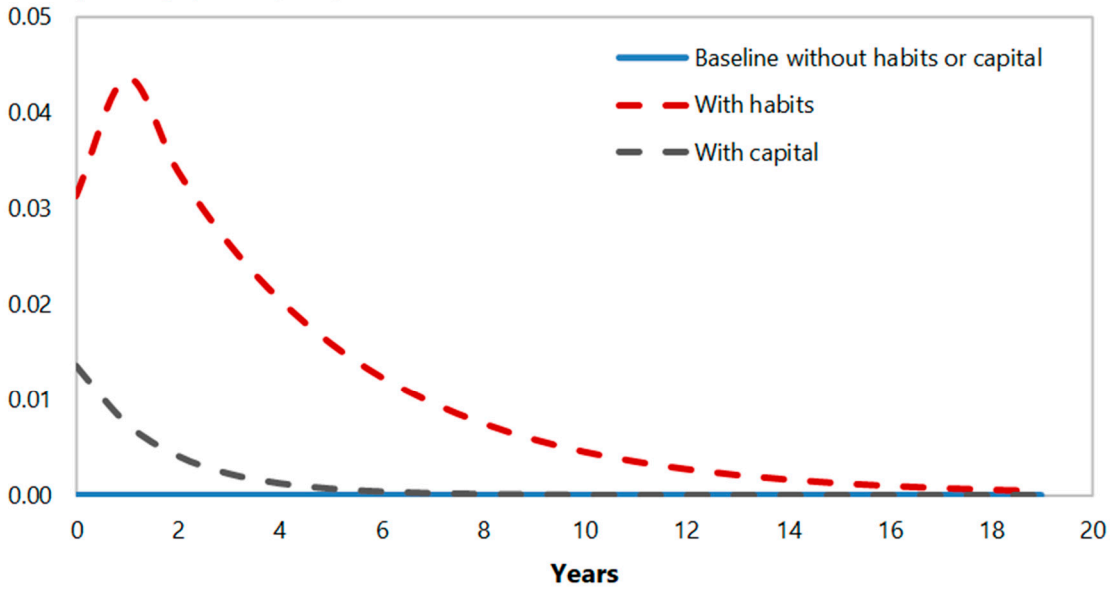
(Percent of sample GDP)



Sources: IMF, World Bank, and Bank of England calculations.

Figure 3. Response of services specialist current account to permanent 10 percentage point reduction in services import tariffs

(pecentage points of GDP)



Source: Bank of England calculations from illustrative symmetric model.

Table 1. Current Account Imbalances, Global Trade Liberalisation and Country Comparative Advantage

	(1)	(2)
Tariffs on goods (world average)	-0.635**	-0.772**
Revealed comparative advantage in services in 1995	-0.038***	-0.049***
Interaction	0.486**	0.623***
Other EBA variables	Yes	Yes
Observations	1,069	628
R-squared	0.601	0.618
Number of countries	49	49
Sample	1995-2016	1995-2007

Notes: The dependent variable is the current account to GDP ratio. Regression setup is from IMF EBA, with 22 regressors (not shown). Reported coefficients are for additional explanatory variables. 'World average goods tariffs' are from the World Bank's WDI database. 'Revealed comparative advantage in services' is an index of comparative export specialisation, where a value above 1 indicates a revealed comparative advantage in services.

Table 2. Current Account Imbalances and Country Trade Restrictiveness Relative to World Average

	(1)
Services restrictions relative to world average	0.105**
Other EBA variables	Yes
Observations	808
R-squared	0.649
Number of countries	37
Sample	1995-

Notes: The dependent variable is current account as a share of GDP. As in Table 1, we do not report the other 22 control variables used as standard in the IMF's EBA specification, but which are included in the estimation. Services restrictions relative to the world average are calculated using the OECD's composite Services Trade Restrictiveness Indices, which, for national service sectors, aim to quantify "restrictions on foreign entry and the movement of people, barriers to competition, regulatory transparency and other discriminatory measures that impact the ease of doing business."

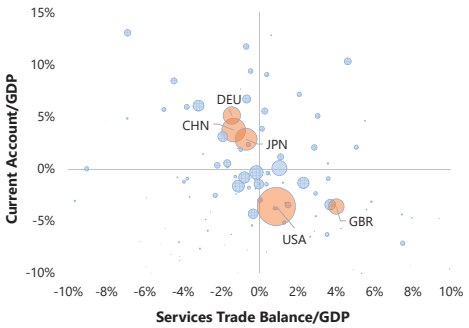
Discussion of "Mind the (Current Account) Gap"

Discussant: Nan Li
International Monetary Fund

Workshop on Assessing Global Imbalances, IMF
Dec 6, 2018

Overview

- A timely paper raising undoubtedly an important question



Notes: Bubble sizes are proportional to countries' average USD GDP, 2001–2017.

Overview

- Theories show that the effect of trade barriers on the CA is model/calibration specific, depending on duration, production adjustment, preferences, etc.
  (Sevensson and Razin, 1983, Engel and Kletzer, 1986, Ostry, 1988 1991, Gavin 1991, Obsfeld and Rogoff 2000, Barattieri 2014, Reyes-Heroles, 2016, Erceg et al. 2017)

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- Contribution: An *empirical* evaluation on how *asymmetric trade integration (in goods vs. services) interacted with comparative advantage* affected CA imbalances in the past two decades
  - Finding: significant quantitative effect.
  - Policy conclusion: further liberalization of services trade.

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  - **Finding: significant quantitative effect.**
  - Policy conclusion: further liberalization of services trade. ✓

Table A Current account imbalances, global trade liberalisation and country comparative advantage[a]

	(1)	(2)
[A] Tariffs on goods (world average)	-0.635**	-0.772**
	(0.034)	(0.016)
[B] Revealed comparative advantage in services in 1995	-0.038***	-0.049***
	(0.001)	(0.000)
[A]*[B]	0.486**	0.623***
	(0.025)	(0.006)
Other EBA variables	Yes	Yes
Observations	1,069	628
R-squared	0.601	0.618
Number of countries	49	49
Sample	1995–2016	1995–2007

Table B Current account imbalances and country trade restrictiveness relative to world average[a]

	(1)
Services restrictions relative to world average	0.105**
	(0.011)
Other EBA variables	Yes
Observations	808
R-squared	0.649
Number of countries	37
Sample	1995–2016

Comments

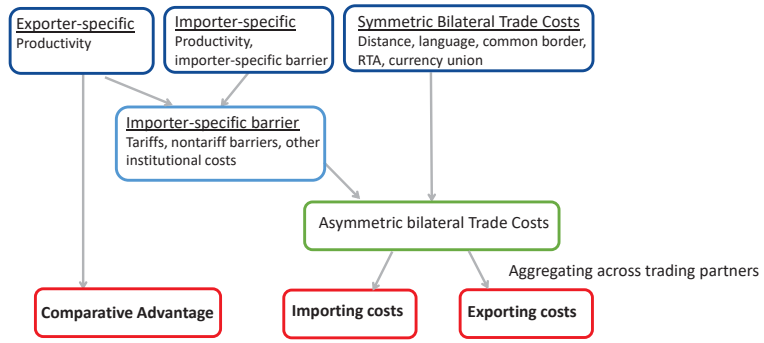
- Issues related to measurement and analysis:
  1. World average goods tariffs ⇒ Country-specific estimates of trade barriers to include nontariff barriers, distinguish exporting vs importing barriers, separately estimated for manufacturing, agriculture and services
  2. Balassa revealed comparative advantage ⇒ Time varying underlying (Ricardian) comparative advantage
  3. Augmenting the EBA regression ⇒ Relative to the rest of the world

- Issues related to interpretation: causal relationship

Boz, Li and Zhang (2018, IMF WP)

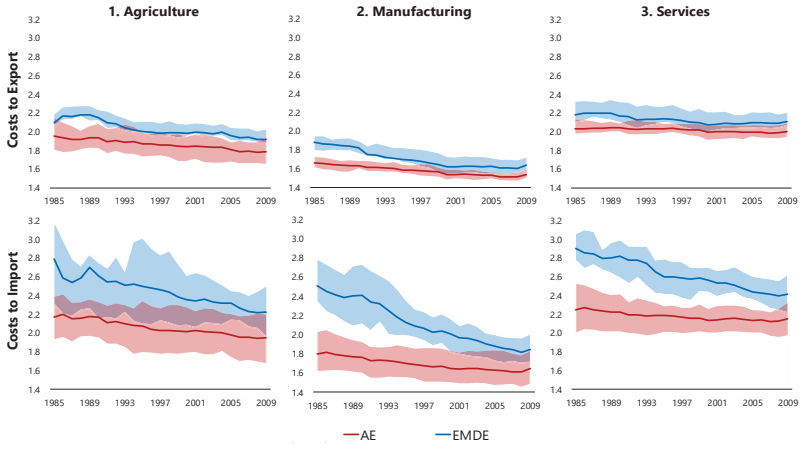
Gravity-based estimates: Relate bilateral trade flow by sector to several factors (Eaton and Kortum, 2002)

(sectors: agriculture, manufacturing, services. 40 countries, 45 years)



Ultimately, construct "**effective trade costs**": comparative advantage weighted average importing/export costs

Estimated Trade Costs



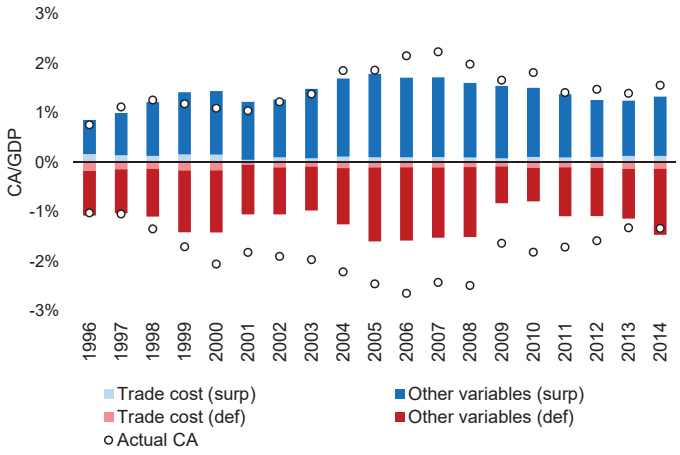
Effective Trade Costs Have Limited Effects

Table: Augmented EBA

	Lagged trade weights			Frictionless trade weights		
	(1)	(2)	(3)	(4)	(5)	(6)
Period: 1986-2009						
Effective exporting cost	-0.050***		-0.049***	-0.082***		-0.081***
	(0.000)		(0.000)	(0.000)		(0.000)
Effective importing cost		-0.008	0.001		-0.007	-0.004
		(0.359)	(0.945)		(0.408)	(0.606)
Observations	761	761	761	761	761	761
R^2	0.643	0.622	0.647	0.651	0.619	0.656
Period: 2001-2014						
Effective exporting cost	-0.024**		-0.020*	-0.035**		-0.034**
	(0.019)		(0.079)	(0.011)		(0.012)
Effective importing cost		-0.020*	-0.012		-0.021*	-0.019*
		(0.059)	(0.333)		(0.053)	(0.090)
Observations	434	434	434	465	465	465
R^2	0.753	0.762	0.763	0.746	0.754	0.758

Results are robust to including lagged effects, considering exporter-specific barriers, alternative weight to construct effective trade costs, etc.

Limited Contribution to Global Imbalances



In short,

- Interesting work asking a first-order important policy question
- Contrary to this paper, Boz et al. (2018) find limited contribution of effective trade costs to CA and global imbalances
- Agree with the policy recommendation of reducing service trade costs (especially other behind-the-border barriers), but not necessarily because of its effect on rebalancing CA imbalances.

Global Trade and the Dollar

Emine Boz
IMF

Gita Gopinath
Harvard

Mikkel Plagborg-Møller
Princeton

December 6, 2018

Workshop on Assessing Global Imbalances
IMF Research Department

Motivation

- Producer currency pricing (PCP)
  - Nominal depreciation increases imported good prices and worsens the terms of trade.
  - Law of one price holds.
- Local currency pricing (LCP)
  - Imported good prices unaltered by the exchange rate.
  - Nominal depreciation increases export prices in local currency and improves the terms of trade.
- Alternative view: dominant currency paradigm (DCP)
  - For many countries, majority of trade is invoiced in USD.
    - Imports: ARG 88%, AUS 53%, IND 86%, JPN 71%, TUR 59%.
  - Prices tend to be sticky in the currency of invoicing.
- Which paradigm does the data support?

Our contributions and findings

- Results from new global data set on bilateral trade prices+volumes.
  1. Bilateral non-commodities TOT uncorrelated with bilateral ER.
  2. USD dominates bilateral ER in ERPT and trade elasticity regressions.
  3. Large effects of USD ER on ROW trade and PPI/CPI inflation.
  4. Trade flows involving the U.S. are special.
  5. USD invoicing share important for explaining cross-sec'l heterogeneity.

Conclusion: Dominant currency paradigm more relevant benchmark than PCP/LCP.

- Model: Asymmetric monetary policy spillovers due to DCP.

Implications of currency of invoicing under sticky prices

$$p_{ij} = p_{ij}^{i} + e_{ij} = p_{ij}^{\$} + e_{\$j}$$

$$tot_{ij} = p_{ij} - (p_{ji} + e_{ij}) = p_{ij}^{\$} - p_{ji}^{\$}$$

	$\Delta e_{ij} = 1$		$\Delta e_{\$j} = 1$	
	Δp_{ij}	Δtot_{ij}	Δp_{ij}	Δtot_{ij}
PCP	1	1	0	0
LCP	0	-1	0	0
DCP	0	0	1	0

Outline

1. Conceptual framework
2. Data
3. Bilateral terms of trade and pass-through
4. Conclusions

Components of data set

1. Newly constructed Comtrade bilateral trade indices. Unit value and volume, non-commodities. Boz & Cerutti ('17)
2. Country-level import invoicing currency shares.
   Kamps ('06); Goldberg & Tille ('08); Chinn & Ito ('14); Gopinath ('15)
3. Country-level/global macro data: WDI, FRED.

- Annual, 1989–2015.
- 55 countries (31 advanced). Account for 91% of world's goods imports and exports in 2015.
- 2,807 dyads (country pairs) in largest specification.
- USD import invoicing share for 38 countries.

New bilateral price/volume indices

- UN Comtrade customs data: Boz & Cerutti ('17)
  - Value, quantity, weight. HS 6-digit level.
  - Remove outliers in cross section and time dimensions.
  - Infer unit values, then aggregate to dyad-level Fisher index.
- We focus on non-commodities data.
  - Remove animal, vegetable, food, mineral, metal products.
- Use importer-reported data.
- Broadly consistent with BLS IPIs for U.S. by origin.

Outline

Terms of trade and bilateral exchange rates

Result 1: Bilateral TOT essentially uncorrelated with bilateral ER.

- Regress change in log TOT (unitless) on lags of bilateral log ER changes.
- Controls: lags of change in log relative PPI (unitless), dyad fixed effects, time fixed effects.
- S.e. clustered by dyad.

Terms of trade and bilateral exchange rates

	unweighted		trade-weighted	
	(1)	(2)	(3)	(4)
VARIABLES	$\Delta tot_{ij,t}$	$\Delta tot_{ij,t}$	$\Delta tot_{ij,t}$	$\Delta tot_{ij,t}$
$\Delta e_{ij,t}$	0.0369***	-0.00938	0.0813***	0.0218
	(0.00863)	(0.0130)	(0.0235)	(0.0317)
ΔER lags	2	2	2	2
PPI	no	yes	no	yes
R-squared	0.008	0.011	0.028	0.042
Observations	24,270	19,847	24,270	19,847
Dyads	1,347	1,200	1,347	1,200

- Conclusion true across emerging/advanced country flows.

Exchange rate pass-through into prices

Result 2: USD dominates bilateral ER in ERPT regressions.

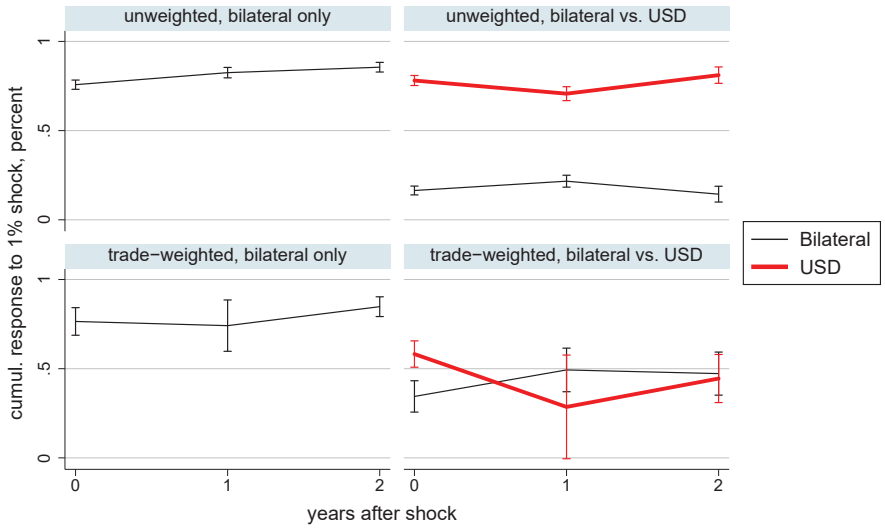
- Standard reduced-form ERPT regressions, except we include importer-USD ER. Burstein & Gopinath ('14); Casas et al. ('16)
- Regress $\Delta p_{ij,t}$ (importer currency) on lags of ER changes.
- ER changes are not collinear (small s.e.).
- Also consider specifications which interact ERs with the importer's USD invoicing share.
- Controls: lags of exporter PPI, dyad fixed effects, time fixed effects.

Exchange rate pass-through into prices

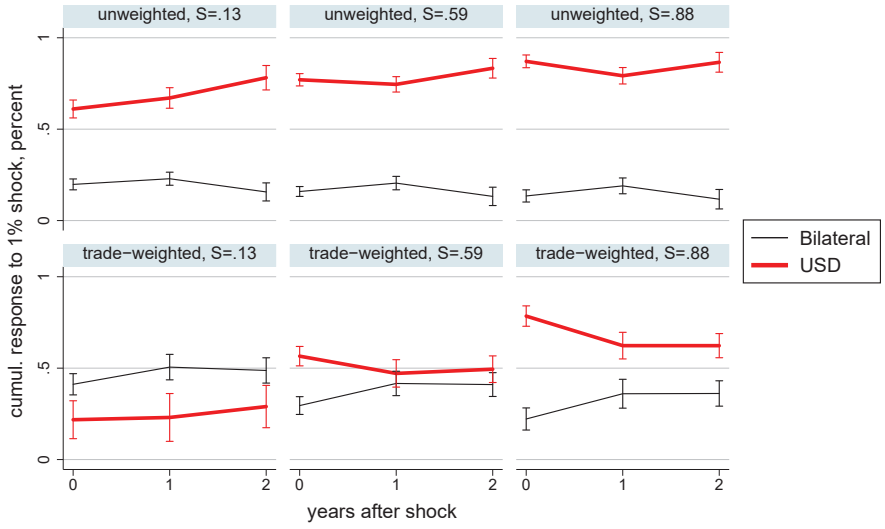
	unweighted			trade-weighted		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$\Delta p_{ij,t}$	$\Delta p_{ij,t}$	$\Delta p_{ij,t}$	$\Delta p_{ij,t}$	$\Delta p_{ij,t}$	$\Delta p_{ij,t}$
$\Delta e_{ij,t}$	0.757***	0.164***	0.209***	0.765***	0.345***	0.445***
	(0.0132)	(0.0126)	(0.0169)	(0.0395)	(0.0449)	(0.0336)
$\Delta e_{ij,t} \times S_j$			-0.0841***			-0.253***
			(0.0240)			(0.0482)
$\Delta e_{\$j,t}$		0.781***	0.565***		0.582***	0.120*
		(0.0143)	(0.0283)		(0.0377)	(0.0622)
$\Delta e_{\$j,t} \times S_j$			0.348***			0.756***
			(0.0326)			(0.0796)
ΔER lags	2	2	2	2	2	2
R-squared	0.356	0.398	0.515	0.339	0.371	0.644
Observations	46,820	46,820	34,513	46,820	46,820	34,513
Dyads	2,647	2,647	1,900	2,647	2,647	1,900

- USD PT strongest for EM→EM flows, but high everywhere.

Exchange rate pass-through into prices



Exchange rate pass-through into prices

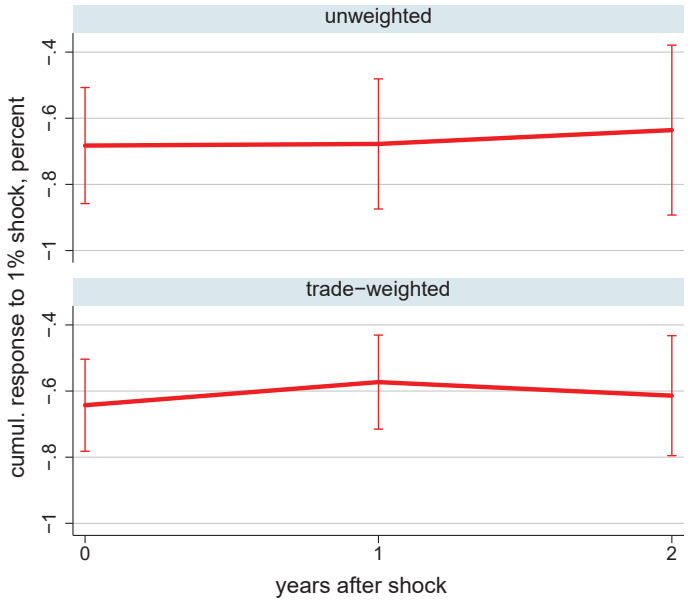


Trade volume elasticity

Result 3: USD dominates bilateral ER in forecasting trade volumes. Large implied effect of USD appreciation on rest-of-world trade.

- Regress $\Delta y_{ij,t}$ on lags of log ER changes and controls.
- Aggregate up from bilateral regressions to compute effect of USD appreciation on rest-of-world non-commodity trade volume.
  - Hold constant other ERs and global business cycle.

Effect of dollar appreciation on rest-of-world trade

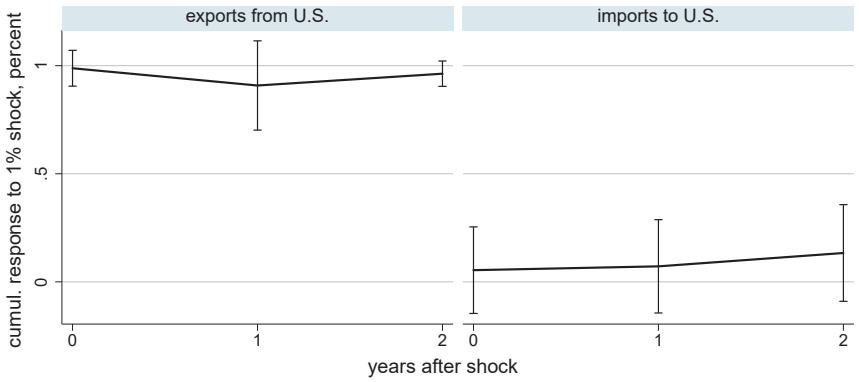


Trade flows to/from the U.S.

Result 4: Trade flows involving the U.S. are special.

- USD invoicing share for U.S.: exports 97%, imports 93%.
- Run ERPT regressions where importer/exporter = U.S.
- Run trade elasticity regressions with dummy for importer = U.S.

Trade flows to/from U.S.: bilateral pass-through



S.e. corrected for small no. of clusters (countries).

U.S. imports: trade elasticity

VARIABLES	unweighted (1) $\Delta y_{ij,t}$	trade-weighted (2) $\Delta y_{ij,t}$
$\Delta e_{ij,t}$	-0.121***	-0.107***
	(0.0141)	(0.0194)
$\Delta e_{ij,t} \times$ ImpUS	0.124***	0.117***
	(0.0329)	(0.0318)
ΔER lags	2	2
Imp. GDP x ImpUS	yes	yes
Time x ImpUS FE	yes	yes
R-squared	0.069	0.180
Observations	52,272	52,272
Dyads	2,807	2,807

Outline

1. Conceptual framework
2. Data
3. Bilateral terms of trade and pass-through
4. Conclusions

Conclusions

- First evidence on DCP using global, bilateral data set.
  1. Non-commodities TOT uncorrelated with bilateral ER.
  2. USD ER movements quantitatively more important for predicting bilateral prices+volumes than bilateral ER.
  3. Large effect of USD on ROW trade and CPI/PPI inflation.
  4. Trade flows involving the U.S. are special.
  5. USD invoicing important for explaining cross-dyad ERPT heterog'y.
- Model: Asymmetric monetary policy spillovers due to DCP. Dominant currency country MP affects ROW trade.

Conclusions

- Strength of USD is important for global trade and inflation.
  - Inflation sensitivity to EXR fluctuations depends on fraction of imports invoiced in foreign currency.
- TB adjustment through imports (except for U.S.). Nominal depreciation vis-á-vis dominant currency:
  - $P^m \uparrow$ and $P^x \uparrow$ in local currency
  - $Q^m \downarrow$ and $Q^x \leftrightarrow$
  - Contrast with PCP and LCP in the case of bilateral EXR depreciation:
    - PCP: $P^m \uparrow$; $P^x \leftrightarrow$; $Q^m \downarrow$; $Q^x \uparrow$
    - LCP: $P^m \leftrightarrow$; $P^x \uparrow$; $Q^m \leftrightarrow$; $Q^x \leftrightarrow$;

Thank you!

11.10.2019

Discussion of the implications of dollar currency pricing for global imbalances[1] by Michele Ca'Zorzi, Adam Cap, Roberta Colavecchio and Massimo Ferrari

The paper by Boz et al. (2017), *"Global Trade and the US dollar"*, steps out of the standard debate on global imbalances to evaluate the implications of US dollar invoicing for global economic adjustments. The analysis starts from the conceptual framework of Casas et al. (2016), who argued that export and import prices are not sticky in the currency of exporters (*"producer currency pricing"*) or importers *("local currency pricing"*), but in a dominant currency. In the literature this hypothesis has developed into what is known as the "dominant currency paradigm" **(DCP**), since it significantly changes the way we should think about world trade, exchange rate pass-through and global spillovers.

The contribution of this new paper is welcome, as it tests many of the predictions of DCP empirically on the basis of a disaggregated large dataset of harmonized annual bilateral import and export unit value and volume indices for 55 countries. Supporting the new paradigm, this study confirms that exchange rate pass-through is much smaller for non-dominant currencies, terms-of-trade are largely unresponsive to exchange rates, and the volume of global trade is negatively affected by dollar appreciations. The paper does not, however, explicitly discuss whether this new pricing paradigm could undermine the way the IMF assesses exchange rate and current account imbalances. This is particularly important given the institutional mandate of the IMF and is the main theme that we have been asked to explore in this discussion. To connect the dots between the insights of this paper and today's debate on imbalances we have asked ourselves three questions:

1. Are equilibrium exchange rate estimates, derived using standard real effective exchange rate regressions, still meaningful in a world characterized by DCP?
2. Should we modify the equilibrium exchange rate estimates derived on the basis of current account disequilibria?
3. Can the analysis of global imbalances be improved by accounting for the dominant role of the US dollar in global trade?

On the first question, the result that exchange rate movements do not affect terms-of-trade is thought-provoking. Does this mean that a large depreciation of the exchange rate is irrelevant?

To get further insights on the importance of exchange rate fluctuations, we have assessed the evidence in trade-weighted terms, starting with data for the euro area and later switched to a panel dataset. For the euro area we have estimated the following three regressions:

$$\Delta tot_t = \alpha_0 + \alpha_1 \Delta neer_t + \epsilon_t \quad (1)$$

$$\Delta reer_t = \beta_0 + \beta_1 \Delta neer_t + \epsilon_t \quad (2)$$

$$\Delta tot_t = \gamma_0 + \gamma_1 \Delta reer_t + \gamma_2 (tot_{t-1} - reer_{t-1}) + \epsilon_t \quad (3)$$

[1] This discussion was written by Michele Ca' Zorzi, Adam Cap, Roberta Colavecchio and Massimo Ferrari. The views here expressed do not necessarily represent those of the ECB. We thank L. Stracca, G. Georgiadis and M. Rubaszek for their comments.

Equation (1) evaluates the link between the nominal effective exchange rate (NEER) and the (non-commodities) terms-of-trade (tot) in trade-weighted terms. The aim is to evaluate if the feeble link between the two is found also in effective terms. Equation (2) evaluates if the NEER has, on the other hand, a strong impact on the real effective exchange rate (REER) of the euro. Finally, equation (3) is a simple Error Correction Model specification aimed at establishing whether terms-of-trade eventually adjust to exchange rate movements. The results are presented in Table 1. As shown in the left-hand panel of Table 1, our estimates of equations (1) confirm the key finding of Boz et al. (2017) that exchange rate changes have a feeble impact on the (non-commodities) terms-of-trade. Our estimates of equation (2) also establish that the NEER has a one-to-one impact on the REER of the euro since relative price indices (CPI) change very slowly.

Table 1. Euro Area

VARIABLES	(1) Δtot_t Coef	(2) $\Delta reer_t$ Coef
$\Delta neer_t$	0.07**	1.01***
Constant	0.00	0.00***
Observations	223	223
R-squared	0.01	0.92

VARIABLES	(3) Δtot_t Coef
$\Delta reer_t$	0.06**
$(tot\text{-}reer)_{t-1}$	-0.01*
Constant	-0.06*
Observations	223
R-squared	0.03

Sources: Eurostat and BIS.
*Notes: The coefficients were estimated using an OLS regression. The p-values were calculated based on heteroscedasticity robust standard errors. Sample period is Jan-2000–Aug-/2018 (monthly data). Neer (reer) refers to the BIS broad nominal/real effective exchange rates. An increase in the neer (reer) implies an appreciation of the domestic currency. Tot is the defined as non-commodity export prices divided by non-commodity import prices.***, ** and * denote statistical significance at the 1 percent, 5 percent and 10 percent level.*

More interesting, and at odds with the hypothesis of DCP as a long-run proposition, we find that terms-of-trade adjust, even if the pace of adjustment is relatively slow. This can be seen on the right hand panel in Table 1, where the short-term response of terms-of-trade to real exchange rate changes remains weak, while the disequilibrium adjustment coefficient γ_2 is negative but fairly small. We generalize our findings by extending the analysis to a quarterly panel of 28 advanced economies. The left-hand panel of Table 2 confirms that, also in this broader quarterly dataset, nominal effective exchange rates have no impact on the terms-of-trade, but they have an almost one-to-one effect on price-competiveness as proxied by real effective exchange rates. The right-hand panel shows that terms-of-trade, even after controlling for the different frequency, adjust faster in this case.

All in all, our data validates one of the key takeaways of Boz e al. (2017), i.e. that the short-run terms-of-trade response to a nominal exchange rate movement differs substantially from what is traditionally suggested by the Mundell-Fleming model (and more generally by other models based on producer currency pricing).

Table 2. Panel of 30 Major Advanced Countries

VARIABLES	(1) Δtot_t Coef	(2) $\Delta reer_t$ Coef	VARIABLES	(3) Δtot_t Coef
$\Delta neer_t$	0.07	0.94***	$\Delta reer_t$	0.15*
			$(tot\text{-}reer)_{t-1}$	-0.21***
Constant	0.00	0.01***	Constant	-0.02*
Observations	2558	2732	Observations	2760
R-squared	0.5	0.92	R-squared	0.23

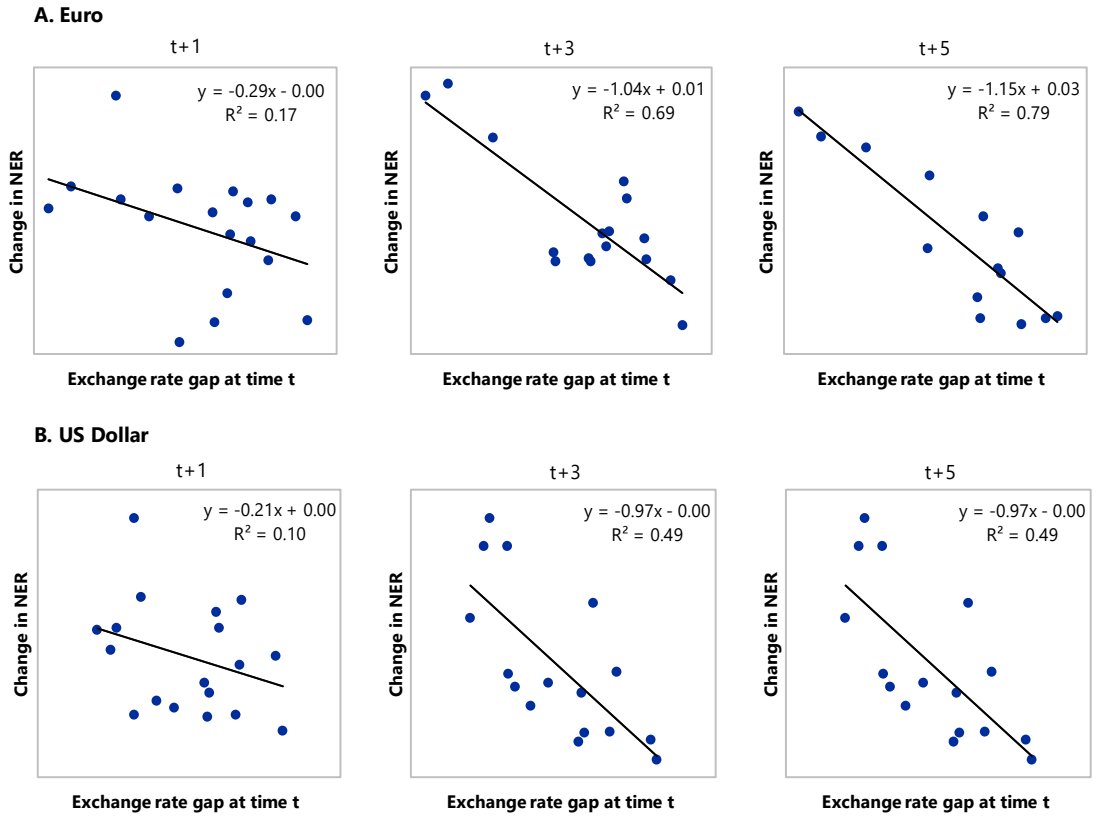
Sources: OECD and BIS.
*Notes: The coefficients were estimated using an OLS regression with country and time fixed effects. The p-values were calculated based on standard errors clustered by country. R2 between is reported. The sample consists of 28 OECD member countries. Sample period is 1994Q1-2018Q2 (quarterly data). Neer (reer) refers to the BIS broad nominal/real effective exchange rates. An increase in the neer (reer) implies an appreciation of the domestic currency. Tot is the non-commodity goods terms of trade defined as export prices divided by import prices. ***, ** and * denote statistical significance at the 1 percent, 5 percent and 10 percent level.*

However, such models may still characterize on the whole correctly the terms-of-trade adjustment in the medium-run, i.e. for the more relevant time horizon when analyzing imbalances. Moreover, irrespective of the importance of the export-currency pricing assumption, large exchange rate movements are still relevant either for their impact on firms' profit margins and/or for that on export and import volumes. As a result, the EBA approach, which foresees calculating equilibrium exchange rates by running real exchange rate panel regressions with a set of macroeconomic and policy variables, may well provide meaningful measures of exchange rate disequilibria (or "gaps"). In this respect, it is reassuring to note that over the medium term exchange rates tend to unwind their initially gaps and hence play an important shock-absorbing role. Figure 1A and Figure 1B reveal that, at horizons greater than 3 years, the effective exchange rate of the euro and the US dollar adjust to close existing exchange rate gaps. Such measures are hence useful as they signal the direction of the future adjustment process of these currencies.[2]

With the second question, we ask ourselves whether the switch to DCP has important repercussions to the way we calculate equilibrium exchange rates on the basis of the current account position of any given country. In this framework, which is widely used also at the IMF and in academic literature, equilibrium exchange rates estimates are calculated as the theoretical exchange rates that bring current accounts back to their "norm" (i.e. the equilibrium level under the assumption of adequate economic policies). This analysis is traditionally implemented under the assumption of producer currency pricing, implying that an exchange rate movement triggers an expenditure switching effect both via the export and import sector. The prevailing pricing paradigm obviously affects the "exchange rate responsiveness" of trade volumes and of the terms of trade – and hence the size of the current account adjustment. This means that equilibrium exchange rates are sensitive to the estimated current account norm but also to the choice of the pricing paradigm. From a practitioner perspective, the more fundamental problem is that the shock-absorbing role of the exchange rate is only one of the many, not well understood, factors driving the current account. The challenge with

[2] See Ca'Zorzi and Rubaszek (2018) and Ca'Zorzi et al. (2020) for an out-of-sample extension of this analysis.

Figure 1. Shock-absorbing Role of Exchange Rate at Different Horizons 1/



Sources: BIS and ECB staff calculations.
1/ NER refers to the BIS Nominal Broad Index. Sample period is 1999-2017 (annual data – end of period). Exchange rate gaps are calculated as deviations of the observed effective exchange rates from their equilibrium values, as estimated using the ECB version of the EBA model of the IMF.

existing equilibrium exchange rate models is that a currency movement is often not followed by a substantial change in the deviation of the current account from its norm (i.e. the current account gap). Consequently, the equilibrium exchange rate is by and large revised almost as much as the exchange rate. This unpleasant feature, closely connected to the persistence of current accounts (and current account norms), constitutes a major challenge for extrapolating equilibrium exchange rates from current account imbalances.[3]

With the third question, we ask ourselves whether the role of the US dollar and other major currencies is adequately accounted for when we evaluate current account imbalances. In this regard, one well-known challenge faced by the EBA methodology is that current account regressions have large residuals, i.e. a remarkably high fraction of current account deficits and surpluses is left unexplained. Since the DCP has, in principle, an important bearing on current account dynamics, one might wonder if accounting for the role of dominant currencies could improve the performance of the EBA regressions (i.e. reduce their residuals). In general, a dollar appreciation should lead to a decline in bilateral exports and imports (among countries whose goods are priced in US dollars) and hence have a limited impact on the trade balance. An asymmetry in the export-imports share of invoicing should, in theory, help one establish a link between changes in the current account and dollar fluctuations.[4] Preliminary analysis on the basis of the ECB version of the EBA

[3] For a more extensive discussion see Ca' Zorzi et al. (2020).
[4] For example, Georgiadis and Schumann (2019) document that output spillovers from a multilateral US dollar appreciation will decline in countries in which this asymmetry is larger.

model, suggests that it is difficult to exploit the information on the share of invoicing to improve the fit of the model and at the same time get intuitive results. An alternative approach to be explored further is whether the goodness of fit of current account regressions would improve by adding "invoicing shares" to the list of fundamentals.

It is worth noting that the policy debate on global imbalances has also recently shifted to stock imbalances. From this perspective, the international finance literature has since long recognized that the US dollar plays an important role for the evolution of the US net international investment position in view of the "exorbitant privilege" and "exorbitant duty" of the US dollar in calm times and in times of global financial tensions, respectively. The debate has recently been revisited in view of the relatively contained current account deficits in the US accompanied by a substantial worsening of the net international investment position, pointing to large negative valuation effects prevailing in the US over the past decade. The debate on whether current account deficits in the US are problematic from the perspective of the international role of the dollar remains unresolved in the literature.

To conclude, this insightful paper highlights the importance of dominant currencies for the international transmission of shocks. It clearly encourages us to reflect more on what role those currencies play in the context of our discussions on global imbalances and exchange rate valuations, since such dominance has major implications for the dynamics of the terms-of-trade and trade volumes, and ultimately of the current account. There are, in our mind, at least three open questions. First, we have argued that equilibrium exchange rates based on real effective exchange rates are useful and have some predictive power, irrespective of the role of the US dollar. Should we nonetheless consider increasing the weights assigned to dominant currencies when calculating effective exchange rates? Or rather additionally calculate (bilateral) equilibrium exchange rates vis-à-vis the dominant currencies? Second, the current account responsiveness to exchange rates movements is affected by the pricing paradigm and this hence affects our equilibria exchange rate estimates. The really problematic aspect of this methodology is that, because of other confounding factors, the estimated current account gaps do not respond much to exchange rate changes. Hence extrapolating equilibrium exchange rates using current account data could be in many cases misleading. Should we then disregard altogether equilibrium estimates based on this methodology or just remind ourselves of their limitations and more normative interpretation? Finally, how can we improve the analysis on current account and stock imbalances taking account of the role of dominant currencies?

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Capital flows: Uphill or downhill?

Peter Bofinger

University of Wuerzburg, German Council of Economic Experts and CEPR

The External Balance Assessment (EBA) is based on the standard assumption that capital will flow from higher- to lower-productivity economies, according to the extent to which an economy is "behind the economy at the frontier" of highest productivity (Phillips et al. 2013). This reflects the core insights of the standard neoclassical intertemporal trade model.

The single good world of the intertemporal theory of trade

This theory is based on the model of single good world (Obstfeld and Rogoff 1996). This simplification allows modeling all trade as intertemporal trade. Implicitly, the theory assumes that the single good can be used interchangeably in three different functions:

- It can be used as a **consumption good.**
- If it is saved, it becomes available as supply of funds, i.e. a **financial asset** ("financial capital") that can be transferred internationally.
- The investor who demands the funds can use the single good directly as an **investment good**, in this context it can be regarded e.g. as a machine ("real capital").

In addition to the single good the neoclassical model also requires some form of IOU (denominated in units of the single good) for which the single good is exchanged at an interest rate, which is denominated in units of the single good, as well. However, in the standard presentation this feature is not explicitly mentioned. All trade flows consist of the single good in its nature as an investment good. Therefore, trade is always one-directional. At the same time, all financial flows (capital flows) consist of the single good in its nature as a financial asset.

As the single good is only transferred in its dual nature as both financial asset and investment asset, trade must necessarily be determined by differences in the marginal product of capital. Thus, in this paradigm financial flows are identical with real flows and **financial decisions are identical with real decisions**.

- The decision to consume, which is the mirror image of the decision to save, is identical with the decision to supply funds at the financial market.
- The decision to invest is identical with the decision to demand funds at the financial market.

This leads to the assumption that advanced economies exhibit positive current account balances, while developing and emerging market economies exhibit negative current account balances. In this way, "capital" in its nature as an investment good would flow downhill from higher- to lower-productivity economies.

Since decades, this basic assumption is challenged by the empirical fact that "capital" is flowing uphill. This is the so-called "**Lucas puzzle**" or "Lucas paradox" which goes back to a paper by Robert Lucas (1990), in which he describes his observation that flows of "capital" from the United States to India were considerably lower than flows predicted by the neoclassical theory. In the years 2000-08 the "uphill flows" of capital in the global economy magnified (Prasad et al. 2007). Even within the group of emerging market and developing economies, capital flows did not necessarily favor countries with relatively higher productivity growth (Gourinchas and Jeanne 2013). While the uphill flows slowed during the Global Crisis and reversed more recently (Boz et al. 2017) the question remains how this serious and persistent paradox can be reconciled with economic theory.

Puzzles as indicators of anomalies

As Thomas Kuhn (1970) has shown, persistent puzzles could be an indication of an anomaly of a theoretical paradigm. Thus, one could ask whether the Lucas puzzle together with the equally tenacious Feldstein-Horioka puzzle (Feldstein and Horioka 1980) could be related to an anomaly of the neoclassical paradigm for intertemporal trade.

The fundamental problem of this paradigm is based in the fact that it tries to explain the intertemporal exchange without an explicit role for money. This feature was already mentioned by Joseph Schumpeter (1954) who speaks of a "**real analysis**":

"Real Analysis proceeds from the principle that all the essential phenomena of economic life are capable of being described in terms of goods and services, of decisions about them, and of relations between them."

In his view the alternative is a "**monetary analysis**":

"Monetary Analysis introduces the element of money on the very ground floor of our analytic structure and abandons the idea that all essential features of economic life can be represented by a barter-economy model."

A widely accepted model which is fully in line with the Schumpeter's view of a monetary analysis is the standard IS/LM textbook model.

Intertemporal trade in a monetary analysis

What does this imply for the theory of intertemporal trade? In short, in a world with money as financial asset, **financing** is no longer the provision of a standard commodity which becomes available by acts of saving. Financing is the provision of money balances held with banks. Such balances are created through the autonomous provision of bank loans (McLeay et al. 2014). In the monetary analysis there is no need for banks to collect deposits as funds for lending. Financing can also be provided by the capital markets which redistribute existing money balances through the through the emission and purchase of bonds. Therefore, in the monetary analysis financing is completely disconnected from contemporaneous saving.

Consequently, **financial transactions**, i.e. the provision of money balances by the act of lending, are separate from **real transactions**, i.e. the purchase of goods that are paid with money. In addition, in a world where money is used a means of finance the fiction of a single good is no longer required. In the real analysis this fiction is essential in order to guarantee the double coincidence of wants in intertemporal trade in an economy without money. Thus, in the monetary analysis consumption goods coexist with investment goods and money as financial asset and there is no possibility to convert them into each other.

Assets in the real analysis and the monetary analysis

Assets	**Real analysis**	**Monetary Analysis**
Consumption good	Single good in its nature as consumption good	Consumption good
Financial asset which makes up the flow of funds	Single good in its nature as (financial) "capital"	Money balances held with banks
Investment good	Single good in its nature as (real) "capital", e.g. machines, equipment	Investment good
IOU	Implicit IOU	Bonds

In such monetary framework, the current account surplus of China and the current account deficit of the United States in the 2000s can be explained as follows.

The starting point are **real transactions**, i.e. the purchase of Chinese goods by Americans. With the strong domestic demand in the United States and the opening of the Chinese market through China's WTO membership US, imports from China increased substantially: From 2001 to 2007, US imports from China more than trebled. The US importers paid for the Chinese goods by transferring US-dollar denominated bank deposits held at US banks to the Chinese exporters.

The **financing transactions** followed the real transactions. The Chinese exporters had to exchange the US bank deposits into deposits with Chinese banks. The banks had to transfer the dollar balances to the Chinese central bank in exchange for central bank reserves. The genuine financing transaction is the purchase of US Treasuries by the Chinese central bank in exchange for US-bank deposits. In the balance of payments statistic this is recorded as a capital export of China.

In short, there are two separate transactions:

- Real transaction: a flow of goods from China to the United States paid with a flow of US bank deposits form the United States to China.
- Financial transaction: the reflux of US bank deposits ("capital flow") from China to the United States to China in exchange for US treasuries.

Thus, in the monetary analysis the "capital flow" is not a flow of the single good in its nature as machines or equipment from China to the United States. It is rather the reflux of US bank deposits from China in exchange for US treasuries. In the monetary analysis, "capital flows" are money flows. "Capital exports" are flows of bank deposits.

In addition, the capital account deficit of the United States is not an indication that "capital goods" had been flowing from China to the United States. It is mainly due to a flow of consumption goods to US consumers, while Chinese firms were able to buy US machines with revenues from these exports. The puzzle disappears.

In the monetary analysis there is no need for emerging market or developing economies to run a current account deficit for importing "capital" in the form of machines and structures. As this paradigm does not need the fiction of a single good, trade is no longer one-directional. In a world with consumption goods, low and high technology goods a two-trade is possible where developing and emerging market economies pay for high technology goods by exporting consumption and low technology goods. The "Lucas paradox" shows that this is exactly what is happening in the real world.

Therefore, the persistence of a paradox, which implies that the developments of the real world contradict a theoretical paradigm should not be taken lightly. The IMF should consider whether is appropriate to presuppose in its External Balance Assessment that developing and emerging market economies should "naturally" exhibit current account deficits. Especially if such balances have to be financed in foreign currency, over time developing and emerging market economies become dependent on exchange rate and interest rate shocks emanating from the monetary policy of the United States or the European Central Bank.

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Assessing Global Imbalances at the IMF:
Lessons and Challenges

Joseph E. Gagnon[1]

Current account imbalances are driven primarily by net financial flows between countries. Both domestic and international financial markets are characterized by excessive swings of exuberance and pessimism. A familiar cycle is that of investment euphoria—perhaps following a major policy regime shift or a technological innovation—that leads to over-investment and falling profits, which engender a panicked rout as investors try to exit in a rush. A newer phenomenon (though it has an old pedigree) is that of excess saving and insufficient aggregate demand, or secular stagnation.[2] According to Lawrence Summers, "Deflation and stagnation are the threats of our times."[3] Secular stagnation may tempt policymakers to depreciate their currencies to obtain economic growth through current account surpluses at the expense of their trading partners.

The International Monetary Fund (IMF) was established to manage both of these drivers of global current account imbalances. The IMF has made a sustained effort over the past 25 years to improve its assessment of global imbalances (IMF 2006). Starting in 2012, it has published annual *External Sector Reports* (ESRs) summarizing its views on the desirability and sustainability of current account balances and real effective exchange rates of 30 major advanced and developing economies (IMF 2018a). At the core of the ESRs are the External Balance Assessment (EBA) models of current accounts, net foreign assets, and real effective exchange rates (IMF 2018b). This paper focuses on the EBA model of the current account, both because current account imbalances are fundamentally of greater interest to macroeconomic policy and because the uncertainties surrounding models of net foreign assets and real effective exchange rates are considerably larger than those associated with models of the current account.

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[1] Senior fellow at the Peterson Institute for International Economics. I thank Chris Collins for capable research assistance. All views expressed here, and any mistakes, are those of the author and do not necessarily reflect the views of the Peterson Institute, its board of directors, or other members of its research staff.

[2] Timothy Taylor has a nice discussion of Alvin Hansen's 1938 speech on secular stagnation on his blog, Conversable Economist, at http://conversableeconomist.blogspot.com/2013/12/secular-stagnation-back-to-alvin-hanson.html.

[3] *The Telegraph* (London) January 22, 2016.

As discussed below, the EBA model has improved in important ways since 2012. Nevertheless, a key conclusion is that the EBA model and the ESR process continue to underestimate the importance of official exchange rate policy, including in the form of sovereign wealth funds, as a driver of global imbalances.

Much Progress in EBA and ESR

Because current account balances must add up across countries, and each country's exchange rate can rise only to the extent that some other country's exchange rate must fall, it makes sense to analyze exchange rates and imbalances in a framework that accounts for all major economies. The IMF began such work in the 1990s with the Consultative Group on Exchange Rates (CGER) (IMF 2006). As its name implies, CGER was focused on understanding exchange rates, but it based its conclusions on three separate approaches, a division that continues to this day. The first approach examines deviations of current account balances from estimated equilibrium values; exchange rates are then projected as needed to gradually return balances to their long-run levels. The second approach models exchange rates directly in order to identify disequilibria that would be expected to shrink over time. The third approach is a variant of the first approach that identifies the exchange rate needed to stabilize a country's ratio of net foreign assets to GDP.

In 2012, the CGER models and process were replaced by the EBA models and the ESR process. Although the EBA models retain the three distinct approaches of CGER, the rest of this paper focuses entirely on the current account model, which continues to take pride of place, correctly in my view.[4]

The initial EBA model improved on CGER by adding more countries and more variables, with greater focus on policy variables and cyclical effects. Of particular note was the construction of cyclically adjusted current account norms based on desirable policies. This development laid the foundation for policy recommendations in the ESR process.

[4] As noted in IMF (2018a, 9) "greater weight continues to be given to the current account model, because real exchange rates tend to be more volatile and difficult to explain econometrically."

The 2018 version of the EBA model reflects improvements on several fronts. Forward positions are added to measures of foreign exchange intervention and better instruments are used to control for feedback of trade balances on intervention which can bias the estimated effect. There is a richer analysis of demographic effects on saving and investment, and thus current account balances. An ad hoc dummy variable for financial centers was replaced by a more sensible correction for measurement issues related to differences in inflation rates and differences in the treatment of retained earnings in direct and portfolio investment.

For the G-20 economies (with the exception of Korea to a minor extent) the ESR norms for current account balances are reasonable. The policy recommendations for these economies are also sensible. For example, China should take steps to increase consumption, including by strengthening the social safety net; the euro area should encourage investment by increasing the resiliency of the currency union and it should adopt more growth-friendly fiscal policies; and the United States should focus on fiscal consolidation while improving export capacity through education, training, and infrastructure. However, the policy recommendations are unnecessarily silent on exchange rate policies, including foreign exchange intervention and capital flow measures, in part because of underestimation of the effects of intervention in countries with open financial markets and in part because of a general reluctance to recommend capital flow measures except as last resorts.

Underestimation of the Effect of Foreign Exchange Intervention

For a number of small and medium-sized economies with large surpluses, the ESR norms appear skewed towards ratifying those surpluses. Examples include Hong Kong, Norway, Singapore, Switzerland, Thailand and, to a lesser extent, Korea. Some economies with large surpluses are excluded from the ESR process, including Taiwan and the Gulf oil exporters. The common thread in all of these surplus economies is large official purchases of foreign-currency assets.

The EBA model does not recognize the importance of this common thread because it restricts the effect of foreign exchange intervention to be zero for economies with the fewest restrictions on capital mobility. The model also excludes official flows from sovereign wealth funds.

The solid line in figure 1 displays the effect of foreign exchange intervention in the EBA model as a function of capital flow restrictions. The effect is constrained to be zero when capital flow restrictions are at a minimum and rises to a value of 0.75 when restrictions are at a maximum, implying that the current account increases by $0.75 for each $1 of intervention in these economies. For comparison, the effect estimated in Gagnon (2017) is shown as a dashed line. This effect is not constrained to be zero when capital flow restrictions are at a minimum and it does not rise as steeply as restrictions increase. The estimates from EBA and Gagnon are roughly equal for economies with a median level of capital flow restrictions. It is possible that the EBA estimate is overstated for economies with the most restrictions, as a steep slope is the only way to yield an estimate that fits well for economies that lie in the middle of the range of capital mobility. Gagnon (2017) shows that the constraint of a zero effect with minimum capital flow restrictions is strongly rejected in his data. Based on private communications with EBA economists, it appears that this constraint is not rejected in the EBA data. This difference likely reflects the omission of sovereign wealth fund flows in economies such as Norway and Singapore, which have few capital flow restrictions and large current account surpluses. Figure 2 shows that the model in Gagnon (2017) explains Norway's current account balance as a function of government policy far more closely than the EBA model.

The EBA model includes oil exports (interacted by remaining years of production) and commodity terms of trade as factors behind current account surpluses. However, as table 1 shows, economies with large net energy exports tend to have current account surpluses only when the government actively saves the oil revenues through a sovereign wealth fund. This is an important omission of the EBA model.

The evidence from Singapore and the oil exporters strongly suggests that official foreign currency purchases can have a large effect on the current account, even in economies with few capital flow restrictions. Because it omits this effect, EBA has allowed the IMF to overlook the massive effect of Swiss foreign exchange intervention. As shown in figure 3, the Swiss current account surplus grew sharply in the late 1990s as its real effective exchange rate fell, reflecting the desire of private financial market participants to invest abroad. During and shortly after the Great Recession of 2009, private investors ceased to invest abroad on net, pushing up the Swiss exchange rate. If the Swiss National Bank (SNB) had not intervened, the exchange rate likely would have appreciated even more than it did and the current account would have narrowed. However, the SNB essentially purchased all of the net private inflows, preventing a larger appreciation and keeping the current account from declining much.[5] On average, since 2009, the SNB has financed roughly 100 percent of the Swiss current account surplus! If this is not an example of "manipulating the exchange rate to prevent effective balance of payments adjustment," then that phrase from the IMF's Article IV has no useful meaning.

Interpretation of Some Other Coefficients

Two coefficients in the EBA model that reflect the importance of foreign exchange intervention should be included in the policy discussion in the ESR process.

First, there is a small but significant positive effect of net foreign assets on the current account. For many countries, foreign exchange reserves, sovereign wealth fund assets, and official development loans (in foreign currencies) constitute a large share of net foreign assets.[6] These assets are the result of official policy and the ESR should acknowledge their effects as the lagged effect of past official financial flows.

[5] The SNB's intervention responded to capital flows, an example of endogenous intervention that would bias the estimated effect of intervention on the current account downward in the absence of appropriate instrumental variables. The results in Gagnon (2017) strongly suggest that the Swiss franc would have appreciated further, and the Swiss current account would have declined substantially, if the SNB had not intervened.

[6] Official development loans in foreign currencies are a liability and thus subtract from net official foreign assets.

Second, the share of a country's currency in global foreign exchange reserves is estimated to have a significant effect on its current account. This effect is mainly limited to the United States and the euro area, which jointly account for roughly 85 percent of global reserves. For the United States, the coefficient implies a reduction in the current account balance of roughly 2 percent of GDP. It would be useful to model this effect as a function of annual reserve accumulation rather than a simple constant over time. Moreover, to the extent that reserve accumulation in other countries is a policy variable, which may be excessive at times, this effect also should be included as a policy effect in the ESR analysis.

Conclusion

The IMF has steadily improved its analysis of global current account imbalances over the past 25 years. The latest improvements, embodied in the 2018 ESR and EBA revisions, continue that progress. The 2018 ESR proposes broadly reasonable current account norms and policy assessments for the largest (G-20) economies. However, some unfortunate data and methodological choices have led to a blind spot in the EBA model with respect to official purchases of foreign-currency assets. By excluding important data on such purchases and restricting the estimates of their effects unnecessarily, the EBA significantly underestimates their importance in driving global current account imbalances. The result is that the ESR is less concerned than it ought to be about the extremely large and persistent current account surpluses of a number of small and medium-sized economies that conduct large official purchases of foreign-currency assets. Together, these economies had a current account surplus in excess of $400 billion in 2017, roughly equal to the entire deficit of the United States.[7]

A more thorough consideration of the effects of official foreign-currency purchases, including through the lagged stock of such assets as well as the effects of purchases in the rest of the world, would greatly increase the scope for policy both as an explanator for imbalances and as a potential tool to narrow imbalances.

[7] According to the *World Economic Outlook* database (October 2018), Hong Kong, Korea, Kuwait, Norway, Saudi Arabia, Singapore, Switzerland, Taiwan, Thailand, and the United Arab Emirates had a current account surplus of $426 billion and the United States had a current account deficit of $449 billion in 2017.

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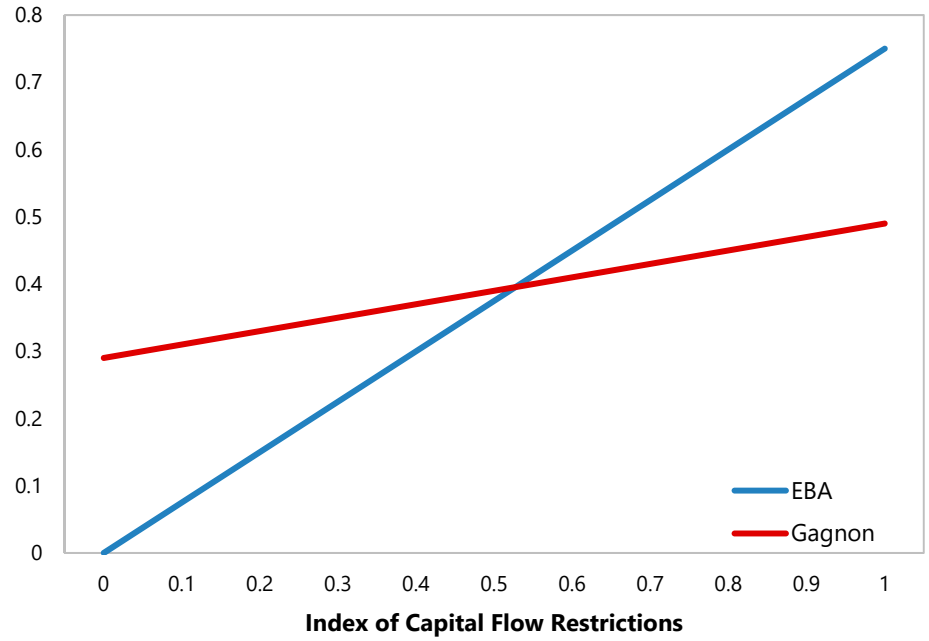
Table 1. Largest Net Energy Exporters, 2012

	Net Energy Exports (percent of GDP)	Current Account (percent of net energy exports)	Official Financing (percent of net energy exports)
Kuwait	64	71	48
Norway	21	59	67
Qatar*	63	51	36
Saudi Arabia	47	48	34
U.A.E.*	48	42	44
Libya	70	41	33
Angola	58	21	4
Nigeria	21	21	4
Algeria	31	19	18
Russia	17	19	0
Venezuela	29	3	4
Canada	4	-100	3

*For these exporters, official financing flows are based on outside estimates of the change in sovereign wealth fund holdings.
Source: Dataset accompanying Gagnon (2017).

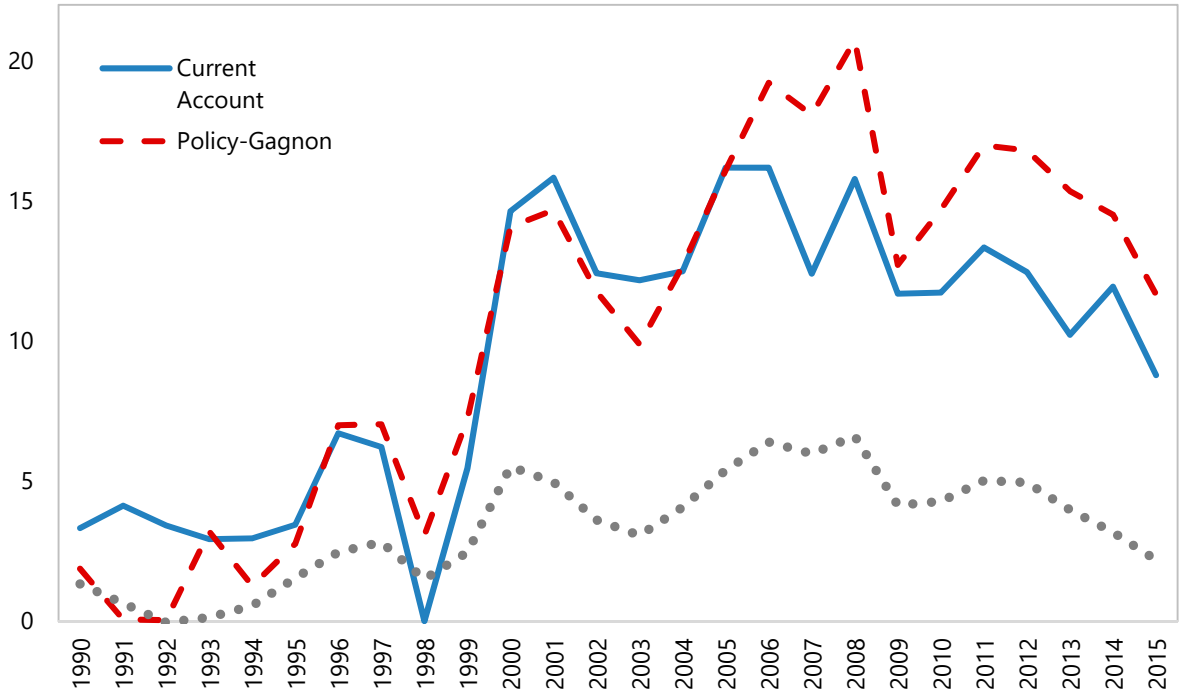
Figure 1. Coefficient on Foreign Exchange Intervention



Sources: Gagnon (2017), IMF (2018b) and author's calculations.

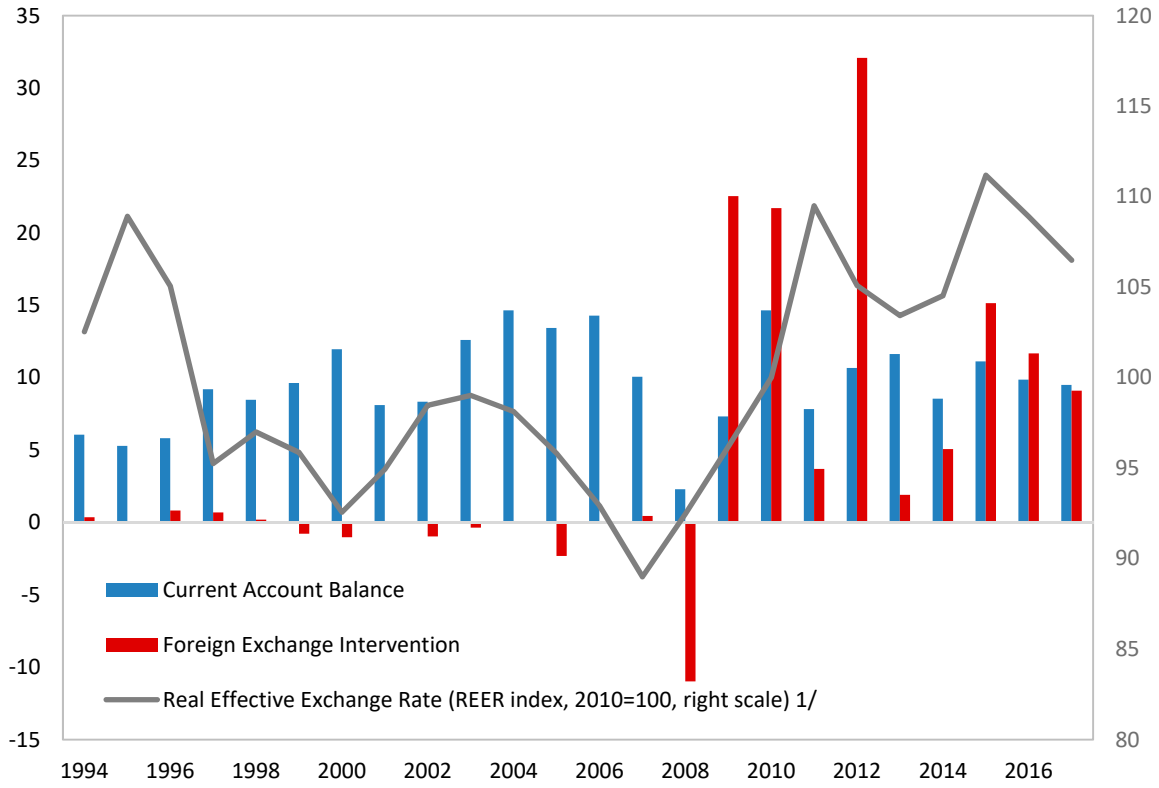
Figure 2. Policy Effects on Norwegian Current Account

(Percent of GDP)



Sources: Gagnon(2017), IMF(2018b) and Author's Calculations.

Figure 3. Swiss Extrnal Accounts
(Percent of GDP)



Sources: Bank of International Settlements, IMF Balance of Payments database, and Swiss National Bank.
1/ Real effective exchange rate is BIS broad real index.

The IMF's EBA methodology and External Sector Report

Olivier Jeanne (JHU)

Panel at IMF Workshop on Assessing Global Imbalances: Lessons and Challenges
December 6 2018

Introduction

- "*external imbalances can point to macroeconomic and financial stress—both for individual countries and for the world economy*" (Obstfeld 2017).
- Are current account balances the most interesting variable to look at in the modern financial environment?
  - as opposed to gross flows, fiscal deficits or the credit cycle?
- It is in the IMF's DNA to look at current accounts: What's the most useful way of doing it?

1. Overview of EBA methodology
2. Comments

EBA methodology

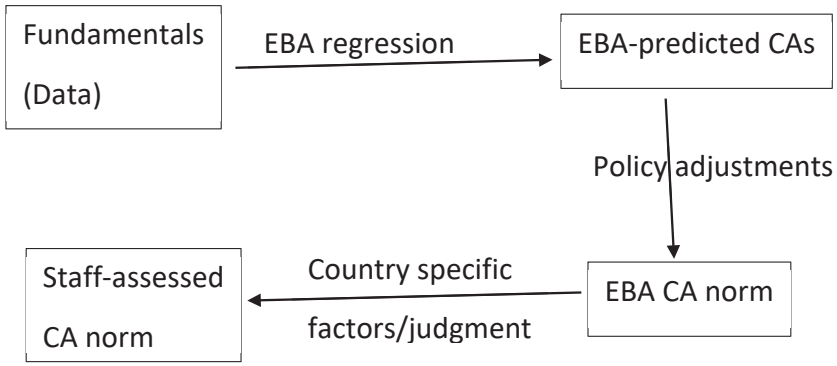


Figure: Three steps of EBA methodology

"CA gap"=observed CA - CA norm

EBA methodology

Step 1: The EBA regression

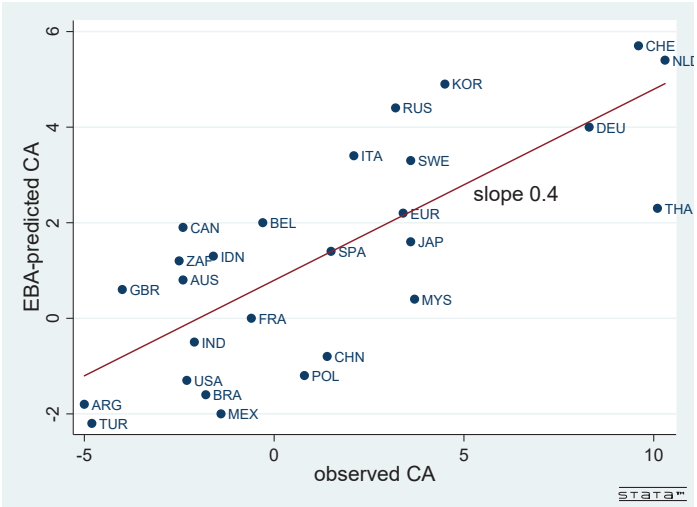


Figure: EBA predicted CA vs. observed CA

EBA methodology

Step 2: Policy adjustments reduce imbalances on average (a little)

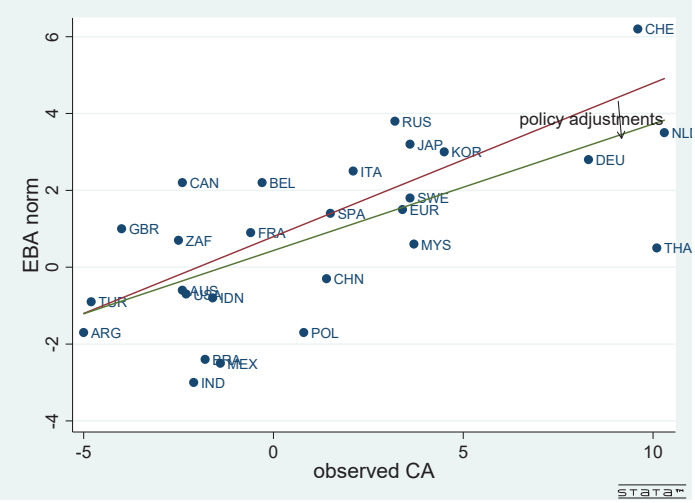


Figure: EBA CA norm vs. observed CA

EBA methodology

Policy adjustments involve mostly fiscal and credit policies

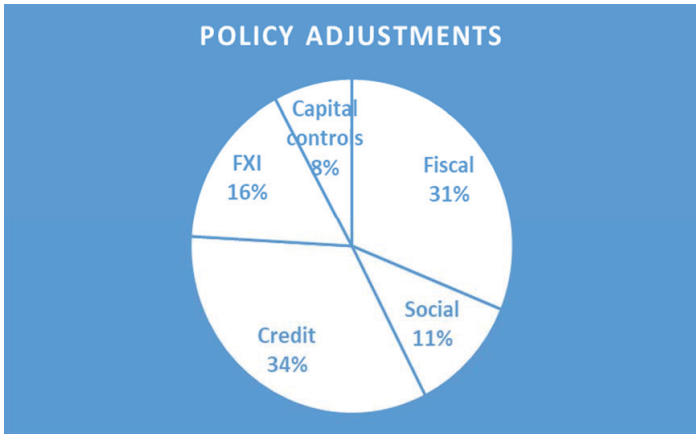


Figure: Share in CA adjustments (absolute values)

EBA methodology

Step 3: country specific factors explain model residuals (a little)

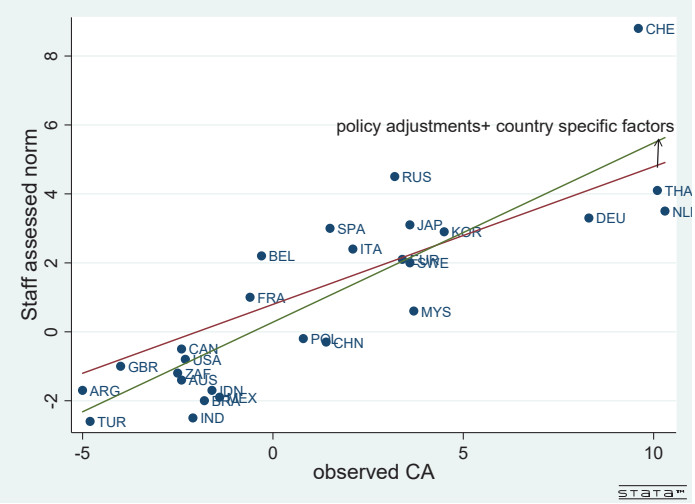


Figure: Staff-assessed CA norm vs. observed CA

Comments

- Does the EBA methodology identify CA imbalances that we would miss by eyeballing the raw data?

Excessively high CAs (substantially stronger than warranted by fundamentals)

EBA	Germany, the Netherlands, Thailand
3 highest CA	Germany, the Netherlands, Thailand
3 highest resid. in EBA reg.	Germany, the Netherlands, Thailand

Excessively low CAs (weaker than warranted by fundamentals)

EBA	Argentina, Belgium, Turkey, UK
4 lowest CA	Argentina, Turkey, UK, South Africa
4 lowest resid. in EBA reg.	Argentina, UK, Canada, South Africa

Comments

Why are the results so close?

- The staff-assessed "CA gap" reflects mostly prediction errors of the EBA model
- The EBA model underpredicts the size of CAs, and so the model predictions errors are correlated with the CA levels
- The EBA methodology tends to identify the same outliers as looking at the CA levels would

Are the differences interesting? (Belgium)

Comments

- Perhaps the ESR should focus more on the "obvious suspects" identified on the basis of large surpluses and deficits
- Dedicate more research to explain the model residual for these countries
  - research progress would make the report less repetitive across years
- Say more about the financial vulnerabilities associated with the large imbalances
- Incorporate lessons of recent research on the role of exchange rates in international adjustment (eg DCP)

Conclusions

THANK YOU

Dec 6, 2018 IMF Conference on Global Imbalances

Surplus Countries and Excess Savings: Why It Matters by Meg Lundsager

Presentations today have reminded me of the importance of maintaining IMF leadership on assessing exchange rate policies and practices and their impact on global imbalances. I welcome the decision to formalize the annual External Sector Report (ESR) as a flagship publication, and recommend that it be published twice a year, which would empower the IMF to comment in a more timely fashion on member policies and practices.

It is nonetheless discouraging to note that it appears unlikely that global imbalances will be reduced through appropriate policy changes, particularly in surplus countries given that deficit countries cannot adjust without surplus countries adjusting as well. The onus of adjustment remains on current account deficit countries, despite IMF calling out particular surplus countries to support global demand and thereby help reduce global imbalances.

Let me note as a personal aside, while serving as the US Executive Director for many years, I did not hear complaints about the US current account deficit. Rather, other countries appeared content to let the United States drive global aggregate demand, supporting their export led growth and reducing the need for them to generate stronger domestic demand in their own economy. And as Brad Setser pointed out, these countries are happy to continue financing the US current account deficit.

Therefore, adjustment may only come through painful crisis or near crisis effects transmitted through trade and financial market channels.

In the meantime, what can the IMF do? I will focus on how IMF information is used and pick up on Professor Menzie's point on messaging. In addition, the IMF should be more outspoken on spillovers.

Merge IMF work on country/government balances sheets with ongoing balance of payments analysis. The goal would be to be able to show persistent surplus countries the extent to which they are dependent on economic growth in countries where external surpluses are invested.

a) One reason for running surpluses and accumulating external assets is to provide future income, perhaps for time when an aging population produces less, or when a currently bountiful natural resource is depleted. At least that is what I read many times in IMF Article IV reports—explaining a surplus country's external 'norm.'

b) Those external assets are only going to produce *real* value in terms of future usable goods and services if the deficit countries receiving the capital inflows are translating those inflows into productive investments to enable future reversals of capital flows. Joe Gagnon made this point when he discussed inter-temporal trade. It is doubtful that those deficit countries are going to be willing to significantly reduce their own living standards to transmit real value abroad. There are very few countries like Yugoslavia in the 1980s that voluntarily paid off external debts at the cost of domestic economic contraction.

c) How can persistent surplus countries promote sound real investment in deficit countries? Do we have real world examples of successful influence on the host country? An obvious place for the IMF to start looking is within Euro area. This shows the high likelihood that surplus

countries are *not* going to effectively promote real economic changes that will generate those future returns from deficit countries. The Euro area and EU more generally have *not* been successful in promoting the structural changes that would enable the weaker economies to thrive and become future providers of real goods and services. The surplus countries do not see as their responsibility providing economic stimulus to generate demand within the Euro area. They expect deficit countries to adjust and export outside Europe, not to stronger (northern) Europe. "Distortions are elsewhere" is a common refrain in surplus EU countries, as Pau Rabanal noted.

d) Finally, the IMF has long urged more fiscal union within Europe—more centralized revenues and more centralized expenditures—also known as transfers. But if some countries are going to be permanently slow growing and others performing much better, transfers of one sort or another are inevitable. Why not establish that and make clear the reality? IMF should be more explicit, one way or another that transfers will occur. For example, this might bring about more upfront action on Greek debt—help reduce the debt overhang that stifles growth even more. Greece's creditors may not truly expect to be repaid over the long term, but the debt overhang impedes domestic and foreign investment in Greece. But will there be more explicit transfers within Europe? That is extremely unlikely for the foreseeable future.

e) Another conclusion I drew from many years at the IMF is that persistent surplus countries are not really focused on accumulating external assets for future consumption but rather running surpluses for more immediate domestic employment and growth reasons. The 2017 ESR mentioned that fundamentals such as demographics pay only a partial role in explaining persistent current account surpluses, which reinforces this impression.

Further suggestions for IMF surveillance:

The IMF should start asking officials in persistent surplus countries how they see their accumulating assets being productive in the future: which countries appear to use inflows effectively, how will investments generate future real returns, how likely is it that surplus countries will be able to withdraw those assets and consume them as real goods and services?

If nothing else, this would *reveal motivation*—are authorities/corporates—those doing the lending or investing—thinking about future utilization beyond the next few months or year? Do the officials see enough productive application of their investments or loans that there is a future payoff? The 2018 Article IV report on Germany cites country officials as seeing risks to the economy arising from 'external factors.' Is there any sense that factors internal to Germany limit growth in the Euro Area and thus growth in the weaker countries, with implications for the viability of the entire Euro Zone? Why is that not enough of an incentive to form a tighter union with more effective rules and more explicit transfers?

Another interesting discussion within the Euro Zone could be the meaning of *Target 2 balances* indicating 'creditor' and 'debtor' positions of member central banks in the ECB. One official told me the national central banks want to keep track of this so if the Euro area ever falls apart they know what amounts countries will owe each other. If that happens, will countries with negative balances pay off these 'debts' given that their new currency likely has suffered a major devaluation? Probably not.

IMF staff could ask pension funds, insurance companies and sovereign wealth funds with long term horizons about their expectations for future real returns. Do they feel their investments are productivity-enhancing in terms of generating future real returns? How do these funds evaluate infrastructure investment with a very long-term horizon?

IMF staff could usefully pursue more analysis of reasons for *high private savings* in surplus countries, which was discussed in the 2017 ESR. Knowing motivations could help point to a way to encourage more adjustment before a balance of payments crisis erupts. Why are corporates holding case or buying back stock and governments accumulating reserves? Are corporates holding excess cash because they do not see ultimate final demand growing enough to generate future returns on real investment now, as Peter Bofinger noted?

The IMF should highlight clearly its *spillover* analysis, which seems to have disappeared, compared to the overall single report produced a few years ago. Ideally, the IMF could show how current account deficit countries need some external stimulus to help them adjust. Otherwise adjustment could come through a large currency depreciation, meaning that surplus countries' currencies would appreciate, likely reducing their exports.

IMF staff should continue work on *debt,* including looking at which entities hold debt instruments. How knowledgeable are they about risks/returns? Will they cooperate in an IMF 'encouraged' restructuring or re-profiling, as called for in the Fund's exceptional access policies in risky country situations?

In sum, IMF leadership is paramount in order to keep the globally consistent focus of the ESR. Therefore, transparency remains important as a means of validating the work and maintaining all members' focus on avoiding imbalances that can lead to country crises spilling over to global markets.