



## Estimates of Fundamental Equilibrium Exchange Rates, May 2015

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In contrast to the findings of recent issues in this series, new estimates of fundamental equilibrium exchange rates (FEERs) find emerging misalignments among the major currencies, with the US dollar now moderately overvalued and the euro and yen modestly undervalued.<sup>1</sup>

### INCREASED EXCHANGE RATE VOLATILITY

Plummeting oil prices combined with asymmetric phasing of quantitative easing (QE) in the United States versus the euro area and Japan has prompted unusually large changes in major exchange rates over the past year. Just over half of the 34 economies followed in this series experienced changes in real effective exchange rates (REERs) of about 6 percent or more from April

2014 to April 2015 (table 1).<sup>2</sup> The most important changes were the large effective appreciations by the US dollar (about 12 percent) and the Chinese yuan (about 12 percent), and the large effective depreciations of the euro (about 11 percent) and the yen (about 8 percent).<sup>3</sup> The pace of these changes accelerated in the second half of this period, with the change in REERs from October to April amounting to +8.1 percent for the dollar, +6.7 percent for the Chinese yuan, –7.3 percent for the euro, and –4.9 percent for the yen.

Figure 1 confirms that the past several months have been a period of unusually large movements in exchange rates. For five large advanced economies (the United States, euro area, Japan, the United Kingdom, and Canada) and five large emerging-market economies (China, India, Brazil, Russia, and Korea), the figure shows the weighted average coefficient of variation

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of monthly REERs for the six months ending in the month of the observation, weighting by 2014 GDP. Thus, for the five advanced economies, the coefficient of variation of the monthly REER was about 3 percent for the six months ending in April 2015.<sup>4</sup> The corresponding measure for the five emerging-market economies was also about 3 percent and had been as high as 4 percent for the six months ending in January. These were the highest levels for both groups since the height of the Great Recession in October 2008 to February 2009, when this measure reached a peak of about 5½ percent for both groups.

1. First introduced in Cline and Williamson (2008), the semiannual FEERs calculations examine the extent to which exchange rates need to change in order to curb any prospectively excessive current account imbalances back to a limit of ±3 percent of GDP. This target range is intended to be consistent with sustainability for deficit countries and global adding-up for surplus countries. The estimates apply the Symmetric Matrix Inversion Method (SMIM) model (Cline 2008). For a summary of the methodology, see Cline and Williamson (2012, appendix A), available at <http://www.piie.com/publications/pb/pb12-14.pdf>.

2. In addition, for Venezuela the REER of the official exchange rate (available only for essential imports) rose 81 percent, reflecting high domestic inflation.

3. Note that for Russia there was a steep decline of 28.8 percent from April 2014 to January 2015, followed by a rebound.

4. The coefficient of variation is the ratio of the standard deviation to the average.

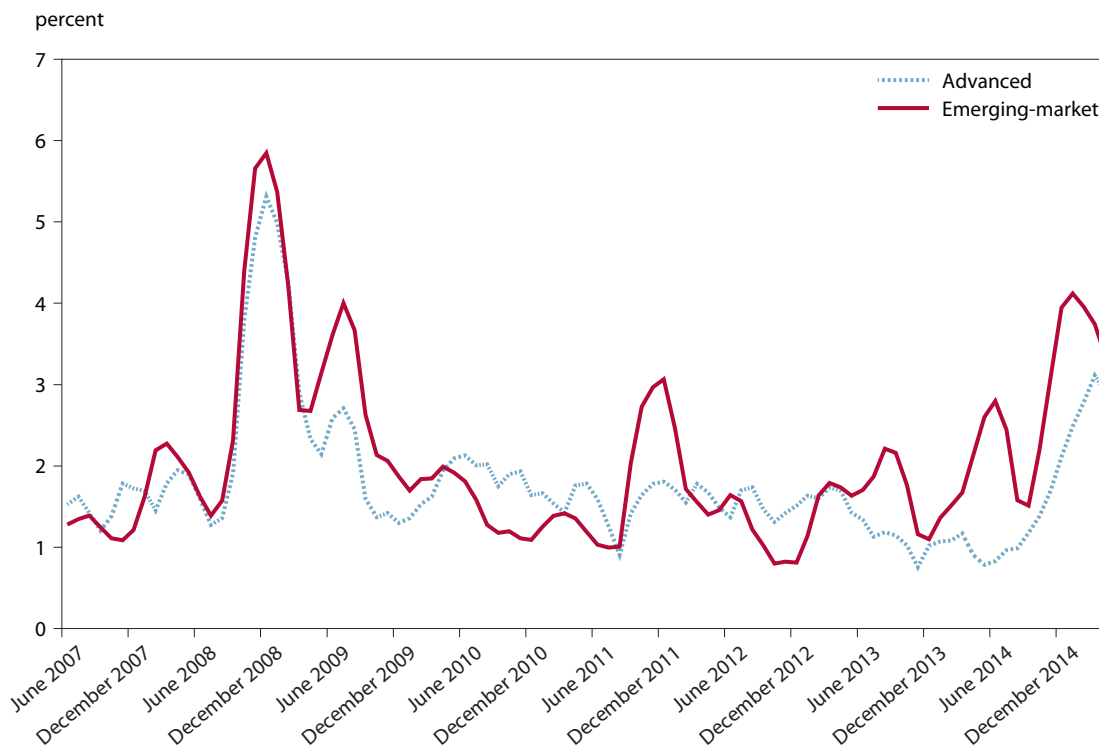
**Table 1 Economies with relatively large changes in REERs, April 2014–April 2015 (percent change)**

Economy	Appreciation	Economy	Depreciation
Argentina	21.2	Brazil	-14.2
China	12.3	Canada	-6.1
Hong Kong	9.7	Colombia	-12.6
Philippines	10.6	Euro area	-11.4
Saudi Arabia	11.7	Japan	-8.2
Switzerland	9.8	Mexico	-8.0
Thailand	7.1	Norway	-7.4
United Kingdom	6.7	Russia	-7.2
United States	11.7	Sweden	-7.8

REER = real effective exchange rate

Sources: Thomson Reuters Datastream and author's calculations.

**Figure 1 Coefficient of variation for REERs over six months: Large advanced and emerging-market economies**

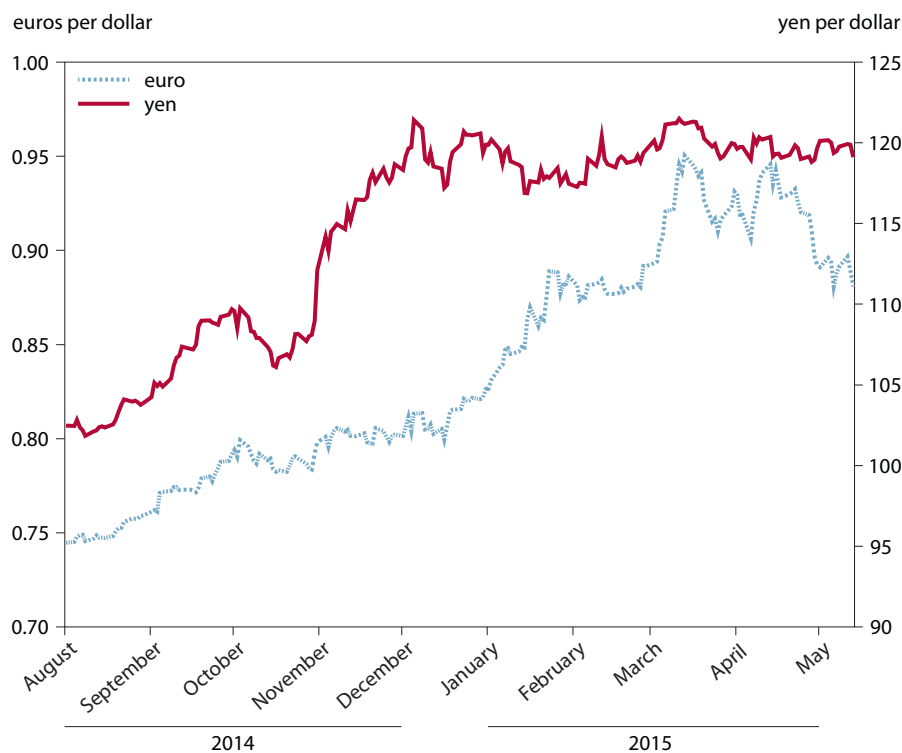


REER = real effective exchange rate

Advanced economies = Canada, euro area, Japan, United Kingdom, United States

Emerging-market economies = Brazil, China, India, Korea, Russia

Source: Author's calculations.

**Figure 2 Currency units per dollar: Euro and yen, August 2014–May 2015**

Source: Thomson Reuters Datastream.

## OUT-OF-PHASE QUANTITATIVE EASING AND THE DOLLAR

A driving force in the recent rise of the dollar relative to the euro and yen has been the unsynchronized timing of the respective QE programs of the three economies. Just as the May 2013 statement by then Federal Reserve chairman Ben Bernanke that the United States would begin phasing down QE caused the “taper tantrum” that boosted the dollar, the actual termination of QE in the United States has done so once again, especially because it has coincided with Japan’s expansion of QE and the European Central Bank’s (ECB) announcement and then implementation of QE. From a peak of \$85 billion in monthly large-scale asset purchases by the Federal Reserve in December 2013, the Fed reduced purchases in steps of \$10 billion each month, making its final purchases in October 2014. By late 2014 market expectations placed the beginning of increases in the federal funds rate in mid-2015.<sup>5</sup>

At the same time, there were growing expectations that the ECB would adopt QE, a move ECB chairman Mario Draghi had suggested in August 2014 as a possibility.<sup>6</sup> In January

2015, the ECB announced that it would launch a Public Sector Purchase Programme with monthly purchases of €60 billion in euro area sovereign bonds and European institution and national agency securities. Begun in March, the program is to last through September 2016 and is open-ended pending achievement of inflation rates close to 2 percent (Claeys, Leandro, and Mandra 2015). For its part, Japan had announced at the end of October 2014 a major escalation in its QE program, from an annual rate of purchases of ¥50 trillion to ¥80 trillion (see Cline 2014b, p. 11).

In more normal times, under floating exchange rates it would be no surprise for the currency of an economy with rising interest rates to strengthen against the currency of an economy with falling interest rates. Under zero-bound interest rate conditions, the expected analog would be a rise in the currency of the economy terminating QE against the currency of an economy initiating or expanding QE. The only caveat might be that QE works by reducing the interest rate term premium, and the “carry trade” might be less responsive to differences between long-term interest rates than to those between short-term rates. As it turned out, there were sharp moves in the expected directions. As shown in figure 2, from the beginning of August 2014,

5. See for example, Steve Liesman, “Fed on track to raise interest rates this summer: Survey,” *CNBC*, December 16, 2014.

6. See Gavyn Davies, “Draghi steals the show at Jackson Hole,” *Financial Times*, August 25, 2015. Angel Ubide noted at that time that market pricing of 1-year average inflation showed market participants did not expect inflation

to rise to the ECB target of 2 percent before 2022 (Angel Ubide, “Draghi Yields to Reality in Jackson Hole,” *RealTime Economic Issues Watch*, Peterson Institute for International Economics, August 29, 2014).

the euro fell 22 percent against the dollar by mid-March 2015 before rebounding about 10 percent by mid-May. From the beginning of August 2014 to early December the yen fell about 15 percent against the dollar and then remained close to that newly lower level through mid-May.

The rapid decline of the euro against the dollar prompted predictions that their rate would pass through parity, which last occurred in 2002.<sup>7</sup> However, it can be argued that the extent of the dollar's rise against the euro well exceeded what could be justified by the change in prospective interest rate differentials. Thus, if the expected medium-term interest rate differential rose by 200 basis points from mid-2014 to the second quarter of 2015 as a consequence of QE ending in the United States and beginning in the euro area, and if this new differential were expected to persist for five years, there would have been grounds for a 10 percent decline of the euro against the dollar (the amount needed to warrant the cumulative prospective interest rate differential).<sup>8</sup> The decline of the euro was considerably larger, however.<sup>9</sup> Similarly, the 15 percent decline of the yen against the dollar in this period seems like overshooting when gauged against changes in interest rate differentials with the United States. Although the euro recovered partially by early May, a key question is whether markets have already fully discounted the future divergence in monetary conditions or whether there is another shoe to drop in the decline of the euro and the yen against the dollar once the Federal Reserve actually begins to raise interest rates.

### IS A STRONG DOLLAR BENIGN OR MALIGN?

The sharp increase in the strength of the dollar raises the possibility that international imbalances are again widening and that a distortion warranting correction may be emerging for the world's most important currency. Jeffrey Frankel argues instead that the strong dollar is benign and reflects a "textbook" case of the response of a currency to strong economic performance (relative to partners) and anticipation of higher interest rates. In this view "the dollar's appreciation is fully justified by economic fundamentals."<sup>10</sup> This view suggests that the stronger dollar and

7. See for example, James Ramage, "Barclays Expects Euro Parity with Dollar by Year-End," *Wall Street Journal*, February 2, 2015.

8. Technically this proposition assumes uncovered interest rate parity with no overshooting.

9. From June 2014 to April 2015 the euro fell from \$1.36 to \$1.08, a decline of 21 percent (IMF 2015b). Over the same period the yield on the 10-year German bund fell from 140 basis points to 16 basis points, while the 10-year US Treasury yield eased from 269 basis points to 202 basis points. The differential widened from 129 basis points to 186 basis points. Federal Reserve (2015a) and Thomson Reuters Datastream.

10. Jeffrey Frankel, "A Strong Dollar Is a Sign of a Strong Economy," *New York Times*, March 23, 2015.

a larger US trade deficit are just what are needed for the international economy in the face of weak growth elsewhere, especially in the euro area.

However, it is not clear that the US economy has become sufficiently strong to justify this benign interpretation. Growth in the first quarter of 2015 was estimated at an annual rate of only 0.2 percent, following 2.2 percent in the fourth quarter of 2014 (BEA 2015a). At the mid-March meeting of the Federal Open Market Committee (FOMC), members observed that "export growth was slowing," a factor adding to severe winter weather in the slowdown (FOMC 2015). The Bank for International Settlements (BIS) has further raised the specter of stress on dollar-denominated corporate debt in emerging-market economies (EMEs) as a consequence of the strong dollar.<sup>11</sup>

### The sharp increase in the strength of the dollar raises the possibility that international imbalances are again widening and that a distortion warranting correction may be emerging for the world's most important currency.

The urgency of a boost to world demand from a wider US current account deficit should not be overstated, moreover. It turns out that in 2017–20 (after the 2-year exchange rate lag discussed below), prospective growth performances are not widely lower for the euro area and Japan than for the United States.<sup>12</sup> Furthermore, allowing a US deficit wider than the 3 percent of GDP limit in the FEERs target (discussed below) would result in modest increases in demand abroad and only about a 0.06 percent increase in the annual growth rate for the euro area.<sup>13</sup>

11. "The appreciation of the dollar against the backdrop of divergent monetary policies may, if persistent, have a profound impact on the global economy, in particular on EMEs. For example, it may expose financial vulnerabilities as many firms in emerging markets have large US dollar-denominated liabilities. A continued depreciation of the domestic currency against the dollar could reduce the creditworthiness of many firms, potentially inducing a tightening of financial conditions" (BIS 2014, p. 12).

12. In 2017–20 average annual growth is projected at 2.27 percent for the United States, 1.56 percent for the euro area, and 0.59 percent for Japan (IMF 2015a). Annual labor force growth rates are projected at 0.7 percent, –0.2 percent, and –0.5 percent, respectively (Cline 2014c; OECD 2014). So annual growth per labor force would average 1.57 percent in the United States, 1.77 percent in the euro area, and 1.09 percent in Japan. Output gaps are slightly positive in this period for the United States (+0.1 percent) and Japan (+0.04 percent), and only moderately negative even for the euro area (–0.71 percent; IMF 2015a).

13. In the projections of appendix table A.2, in 2017–20 the US current account deficit is an average of 4.2 percent of GDP. Cutting the deficit back

On balance, although the estimates below find that the dollar has risen somewhat above its FEER, it is too early to conclude that any adverse effects of the stronger dollar outweigh benefits associated with stimulus to global growth from additional QE in the euro area and Japan. However, if the dollar were to continue along a path of further strengthening, at some point the associated distortions could begin to prove counterproductive for both the United States and the world economy.

## PROSPECTS FOR EXTERNAL BALANCES

The estimates of FEERs in this series are anchored in the medium-term projections of current account balances provided by the semiannual *World Economic Outlook* (WEO) of the IMF. As discussed in appendices A and B, because exchange rates have moved so much in recent months, and considering that IMF current account projections have tended to show inertia that may understate prospective changes in view of new exchange rate alignments, special adjustments are made to the WEO projections in this issue.<sup>14</sup> For the United States, a separate model is applied to arrive at an independent estimate of the medium-term current account balance (appendix A). For other nonoil economies, one-half weight is given to the April 2015 WEO projections (IMF 2015a), but one-half weight is also given to an alternative set of estimates developed in appendix B. Those alternatives assume that the October 2014 WEO (IMF 2014b) medium-term projections were accurate and then adjust them for changes that would have been expected in view of changes in exchange rates, oil prices, and projected domestic and foreign growth paths.

For the *United States*, a new statistical test in appendix A shows a clear influence of the exchange rate, lagged two years, on the current account. A 1 percent increase in the dollar's REER has a subsequent impact amounting to a reduction of 0.127 percent of GDP in the balance on nonoil goods and services. After incorporating the cumulative effects of induced changes in capital services, from a lower dollar translation of equity assets abroad as well as cumulative changes in net liabilities from a wider current account deficit, the model in appendix A finds that the total impact of a 1 percent rise in the REER is a medium-term reduction of 0.165 percent of GDP in the current account. This impact is somewhat smaller than

to 3 percent would reduce it by an average of \$216 billion per year. Applying the recent euro area share of 15 percent in US imports of goods and services (BEA 2015f), the euro area's export gains would amount to only \$32 billion per year, or 0.24 percent for the level of GDP and 0.06 percent for the annual growth rate (IMF 2015a).

14. For example, following sizable depreciation of the South African and Chilean currencies in the "taper tantrum" in mid-2013, the October 2013 WEO (IMF 2013b) left the two countries' projected medium-term current account deficits almost unchanged from the previous forecast (IMF 2013a), but by the time of the April 2014 WEO the projections showed significant narrowing in the medium-term imbalances (IMF 2014c).

the "gamma" impact parameter used in recent applications of the SMIM model, which amounts to a 0.21 percent of GDP impact. The new estimate is however highly consistent with the IMF's "semi-elasticity" for the United States in its *External Balance Assessment* (EBA) report (IMF 2014a), indicating a 0.13 percent of GDP change in the goods and services balance (i.e. excluding induced capital services effects) for a 1 percent rise in the REER. As discussed in appendix A, however, the estimates for the United States in the April WEO imply the use of an impact parameter that is far smaller than the EBA parameter. The estimates developed in appendix A also explicitly take account of the most recent available projections of the US trade balance in oil and incorporate the influence of projected differences between US and foreign growth.

## A new statistical test shows ... that the total impact of a 1 percent rise in the REER [of the dollar] is a medium-term reduction of 0.165 percent of GDP in the current account.

The bottom line for the United States is that whereas the April 2015 WEO projected a slight *decline* in the medium-term US current account deficit (from 2.8 percent of GDP in the October 2014 WEO to 2.6 percent), the projections of appendix A instead show a significant *widening* of the current account deficit (to 4.3 percent of GDP). Given that 3 percent of GDP is the acceptable limit to the deficit in the FEERs methodology, the consequence is to shift the judgment from no misalignment if the WEO projection were used to a diagnosis of overvaluation using the alternative projection prepared here.

For other countries, the direct estimates of alternative medium-term current account balances in appendix B yield differences from the WEO projections of more than 1 percent of GDP for 19 out of the 30 nonoil economies covered. Notable differences include a lower surplus for China (reflecting its strong real appreciation), a higher surplus for the euro area and Japan (reflecting the depreciations of the euro and yen), and a lower deficit for Brazil (reflecting substantial depreciation).<sup>15</sup>

## FEERS ESTIMATES

Table 2 reports the April WEO estimates of the current account balances in 2015 and 2020, as well as its projections of GDP in 2020. The fourth column shows the adjusted current account

15. For Canada and Mexico, the sizable differences from the WEO projections primarily reflect the allocation of the trade-partner counterpart of the considerably wider US deficit than that projected in the WEO; see appendix B.

**Table 2 Target current accounts (CA) for 2020**

<b>Country</b>	<b>IMF projection of 2015 CA (percent of GDP)</b>	<b>IMF 2020 GDP forecast (billions of US dollars)</b>	<b>IMF 2020 CA forecast (percent of GDP)</b>	<b>Adjusted 2020 CA (percent of GDP)</b>	<b>Target CA (percent of GDP)</b>
<b>Pacific</b>					
Australia	-4.0	1,491	-3.4	-2.6	-2.6
New Zealand	-4.8	240	-4.6	-4.9	-3.0
<b>Asia</b>					
China	3.2	16,157	3.0	2.5	2.5
Hong Kong	2.0	438	3.1	1.6	1.6
India	-1.3	3,640	-2.5	-2.7	-2.7
Indonesia	-3.0	1,307	-2.6	-2.3	-2.3
Japan	1.9	4,933	2.3	3.4	3.0
Korea	7.1	2,012	3.6	4.8	3.0
Malaysia	2.1	538	1.4	4.9	3.0
Philippines	5.5	510	3.0	1.5	1.5
Singapore	20.7	390	14.5	15.5	3.0
Taiwan	12.4	776	9.9	10.8	3.0
Thailand	4.4	504	0.7	0.2	0.2
<b>Middle East/Africa</b>					
Israel	4.5	315	3.8	4.5	3.0
Saudi Arabia	-1.0	902	5.4	5.9	5.9
South Africa	-4.6	409	-4.2	-3.5	-3.0
<b>Europe</b>					
Czech Republic	1.6	203	-0.7	0.2	0.2
Euro area	3.3	14,160	2.5	3.8	3.0
Hungary	4.8	165	1.2	-0.4	-0.4
Norway	7.6	502	4.8	5.2	5.2
Poland	-1.8	673	-3.5	-3.1	-3.0
Russia	5.4	2,081	4.3	1.5	1.5
Sweden	6.3	677	5.6	6.9	3.0
Switzerland	5.8	769	5.3	3.7	3.0
Turkey	-4.2	1,012	-5.0	-5.1	-3.0
United Kingdom	-4.8	3,731	-3.3	-2.3	-2.3
<b>Western Hemisphere</b>					
Argentina	-1.7	631	-1.5	-2.6	-2.6
Brazil	-3.7	2,354	-3.2	-1.9	-1.9
Canada	-2.6	2,044	-1.8	1.0	1.0
Chile	-1.2	325	-2.4	-1.6	-1.6
Colombia	-5.8	483	-3.6	-2.2	-2.2
Mexico	-2.2	1,653	-2.3	1.0	1.0
United States	-2.3	22,489	-2.6	-4.3	-3.0
Venezuela	-4.7	274	1.4	2.3	2.3

IMF = International Monetary Fund

Sources: IMF (2015a) and author's calculations.

estimates for 2020, developed in appendix A for the United States and appendix B for other nonoil economies. The oil exporting countries' medium-term current accounts are set at the levels projected by the April WEO. The final column sets the target current account either at the (adjusted) projected level, if it is within the allowed  $\pm 3$  percent of GDP band, or at the  $\pm 3$  percent limit otherwise.<sup>16</sup>

Eight countries continue their chronic patterns of sizable divergences from the 3 percent limit. Once again Singapore and Taiwan show the largest surpluses, both in double digits. The other persistent and familiar divergences are for New Zealand, South Africa, and Turkey, on the deficit side; and for Malaysia, Sweden, and Switzerland on the surplus side. Even so, the imbalances are considerably narrower than before for South Africa and Switzerland.<sup>17</sup>

### The medium-term surplus for China remains well within the 3 percent band.

A new and disturbing pattern in the estimates of table 2 is the appearance of excessive imbalances in three of the largest economies: the United States (excessive deficit), and the euro area and Japan (excessive surplus). With a prospective deficit of 4.3 percent of GDP, the United States is on a path toward a larger imbalance than that of Japan (surplus of 3.4 percent) or the euro area (surplus of 3.8 percent). However, if the unadjusted WEO projections had been used, all three economies would be judged comfortably within the permitted imbalance range, at about 2½ percent of GDP deficit (United States) or surplus (euro area, Japan). Another important economy, Korea, continues on a path of excessive surplus (4.8 percent of GDP). China, Australia, and Brazil are important exceptions to this pattern of large-country imbalances. The medium-term surplus for China remains well within the 3 percent band. In both Australia and Brazil, the projected deficits have narrowed sufficiently that they are now within this band as well.<sup>18</sup>

16. Oil-exporting economies (Norway, Russia, Saudi Arabia, and Venezuela) are exceptions to the ceiling, because their larger surpluses represent transformation of natural resource wealth into financial wealth.

17. In the previous round of FEERs estimates, the medium-term current account deficit for South Africa was estimated at 4.5 percent of GDP and the medium-term surplus for Switzerland at 6.3 percent of GDP. The new estimates are trimmed to a deficit of 3.5 percent and surplus of 3.7 percent, respectively. Note that because Switzerland has revised its balance of payments statistics, it is no longer necessary to make the special adjustment to the Swiss current account estimate incorporated in previous issues in this series.

18. The medium-term deficits have fallen from 3.5 percent of GDP in Australia and 3.3 percent in Brazil, as reported in the November 2014 issue in this series, to 2.6 percent and 1.9 percent respectively in table 2.

Table 3 shows the results of the SMIM model simulations to obtain FEERs. The first column shows the target change in the current account, obtained as the difference between the last two columns of table 2. The third column of the table translates the target change in the current account to the corresponding target change in the REER, obtained by dividing the current account change by the impact parameter  $\gamma$ . For this calculation, the US impact parameter is changed from the value used in past estimates to the new value estimated in appendix A.<sup>19</sup> The result is that to reduce the medium-term current account deficit from 4.3 percent of GDP to 3.0 percent, the REER of the dollar needs to depreciate by 7.9 percent. Because not every country can reach its target exactly and consistency needs to be maintained in overall adding-up, the simulation results are slightly different from the targets. Thus, the REER depreciates by 8.0 percent for the United States in the simulation.<sup>20</sup>

The simulation also finds significant REER depreciations are needed for New Zealand (about 7 percent), Turkey (almost 9 percent), and South Africa (about 2 percent).<sup>21</sup> The REER appreciations called for include large increases for Singapore (25 percent) and Taiwan (17.5 percent), and sizable increases of about 10 percent for Sweden, 5 percent for Israel, 4 percent for Korea and Malaysia, and about 3 percent for both the euro area and Japan.

Because of the sizes of the economies, the most important misalignments are those of the moderately overvalued dollar and the more modestly undervalued euro and yen. No change is called for in the REER of China.

Because the most important correction is a rollback in the sharp appreciation of the dollar, as a consequence there is a broad pattern of needed *bilateral* currency appreciations against the dollar. Since the REER for the dollar needs to decline by 8 percent, bilateral exchange rates against the dollar tend to rise by about this amount, or somewhat less in Latin America where trade shares with the United States are greater and somewhat more in Asia and Europe where trade shares with the United States are smaller.

The bilateral FEER of the euro turns out to be \$1.20 per euro; that of the yen, ¥107 per dollar. By mid-May a partial rebound in the euro (from \$1.08 in April to \$1.14) had brought it back closer to this bilateral FEER level than one might have anticipated; the yen remained more distant (at ¥119).<sup>22</sup> Although the bilateral FEER rate for the Chinese yuan is esti-

19. The change is from  $-0.21$  to  $-0.165$ .

20. Similarly, the euro appreciates by 3.1 percent in the simulation versus 3.2 percent to meet the target current account change exactly.

21. Other depreciations, all by 0.1 percent, are an artifact of the model's approximation process for adding-up consistency.

22. Bloomberg.

**Table 3 Results of the simulation: FEERs estimates**

Country	Changes in current account as percentage of GDP		Change in REER (percent)		Dollar exchange rate		FEER- consistent dollar rate
	Target change	Change in simulation	Target change	Change in simulation	Actual April 2015	Percentage change	
<b>Pacific</b>							
Australia*	0.0	0.0	0.0	-0.1	0.77	10.1	0.85
New Zealand*	1.9	1.9	-7.2	-7.2	0.76	2.1	0.77
<b>Asia</b>							
China	0.0	0.0	0.0	-0.1	6.20	8.9	5.69
Hong Kong	0.0	0.0	0.0	0.0	7.75	10.6	7.01
India	0.0	0.0	0.0	-0.1	62.7	7.9	58.2
Indonesia	0.0	0.0	0.0	-0.1	12946	12.5	11505
Japan	-0.4	-0.4	2.7	2.7	120	11.9	107
Korea	-1.8	-1.8	4.2	4.1	1086	13.0	961
Malaysia	-1.9	-1.9	3.8	3.7	3.63	16.2	3.13
Philippines	0.0	0.0	0.0	-0.1	44.4	11.9	39.7
Singapore	-12.5	-12.5	25.1	25.0	1.35	35.1	1.00
Taiwan	-7.8	-7.8	17.6	17.5	31.0	27.4	24.4
Thailand	0.0	0.0	0.0	-0.1	32.5	10.1	29.6
<b>Middle East/Africa</b>							
Israel	-1.5	-1.5	5.0	4.9	3.93	12.0	3.51
Saudi Arabia	0.0	0.0	0.0	0.0	3.75	9.4	3.43
South Africa	0.5	0.6	-2.2	-2.2	11.99	5.9	11.33
<b>Europe</b>							
Czech Republic	0.0	0.0	0.0	0.0	25.4	9.9	23.1
Euro area*	-0.8	-0.7	3.2	3.1	1.08	10.9	1.20
Hungary	0.0	0.0	0.0	0.0	277	9.3	253
Norway	0.0	0.0	0.0	0.0	7.88	9.6	7.19
Poland	0.1	0.1	-0.3	-0.4	3.72	9.2	3.41
Russia	0.0	0.0	0.0	0.0	53.0	7.5	49.3
Sweden	-3.9	-3.8	10.2	10.1	8.63	18.9	7.26
Switzerland	-0.7	-0.7	1.7	1.6	0.96	11.1	0.86
Turkey	2.1	2.1	-8.7	-8.8	2.65	-1.1	2.68
United Kingdom*	0.0	0.0	0.0	-0.1	1.50	8.7	1.63
<b>Western Hemisphere</b>							
Argentina	0.0	0.0	0.0	-0.1	8.86	6.9	8.29
Brazil	0.0	0.0	0.0	-0.1	3.05	7.4	2.84
Canada	0.0	0.0	0.0	0.0	1.23	3.4	1.19
Chile	0.0	0.0	0.0	-0.1	614	7.3	572
Colombia	0.0	0.0	0.0	-0.1	2493	4.9	2377
Mexico	0.0	0.0	0.0	0.0	15.2	3.4	14.7
United States	1.3	1.3	-7.9	-8.0	1.00	0.0	1.00
Venezuela	0.0	0.0	0.0	0.0	6.29	4.6	6.01

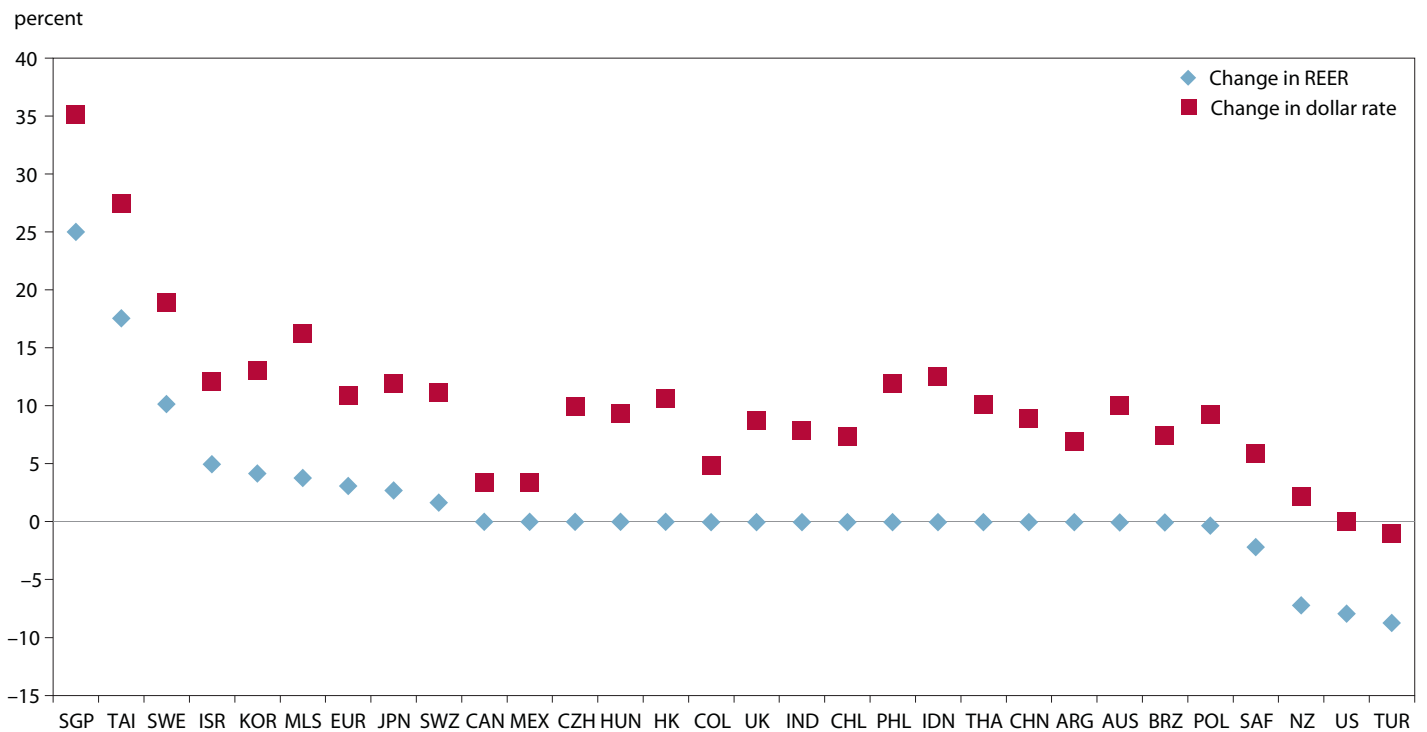
FEER = fundamental equilibrium exchange rate; REER = real effective exchange rate

\* The currencies of these countries are expressed as dollars per currency. All other currencies are expressed as currency per dollar.

Sources: IMF (2015a) and author's calculations.



**Figure 3 Changes needed to reach FEERs (percent)**



FEER = fundamental equilibrium exchange rate; REER = real effective exchange rate

SGP = Singapore, TAI = Taiwan, SWE = Sweden, ISR = Israel, KOR = Korea, MLS = Malaysia, EUR = Euro area, JPN = Japan, SWZ = Switzerland, CAN = Canada, MEX = Mexico, CZH = Czech Republic, HUN = Hungary, HK = Hong Kong, COL = Colombia, UK = United Kingdom, IND = India, CHL = Chile, PHL = Philippines, IDN = Indonesia, THA = Thailand, CHN = China, ARG = Argentina, AUS = Australia, BRZ = Brazil, POL = Poland, SAF = South Africa, NZ = New Zealand, US = United States, TUR = Turkey

Source: Author's calculations.

mated at 5.69 per dollar, that level would presume substantial appreciation against the dollar by such regional trading partners as Singapore, Taiwan, Japan, and Korea.<sup>23</sup> Figure 3 shows the percent changes needed in both REERs and bilateral rates against the dollar to reach the FEERs indicated in table 3. In contrast to the typical pattern of recent estimates in this series, there is considerable divergence between the needed changes for the REER and for bilateral exchange rates against the dollar. This gap is driven by the new finding of a meaningful overvaluation of the dollar, and hence a need for the dollar to decline against all other currencies covered (except, as it turns out, the Turkish lira).<sup>24</sup>

23. Note further that because the baseline medium-term surplus for China after its recent appreciation is 2.5 percent of GDP rather than the previous 3 percent, the new "target" current account becomes 2.5 percent, which corresponds to a somewhat stronger REER than before.

24. Needed appreciation against the dollar is estimated even for South Africa and New Zealand, despite their need for REER depreciations.

### CONCLUSION

Divergent phases of quantitative easing have caused the dollar to become somewhat overvalued and the euro and yen somewhat undervalued. This set of estimates is the first in this series since mid-2009 to find that all three major currencies are misaligned. In addition, for the first time China's currency is not found to be undervalued.<sup>25</sup> A qualification of these findings is that so far the misalignments of the three major currencies are moderate for the dollar (about 8 percent overvalued) and mild for the euro and yen (about 3 percent undervalued). In contrast, in June 2009 the estimate of dollar overvaluation reached about 18 percent, reflecting an extremely strong level associated with safe-haven effects at the height of the financial crisis (Cline and Williamson 2009). It should also be reiterated that a caveat on the estimates is that if the medium-term projections of the April WEO were accepted without adjustments, the diagnosis would be that none of the three major currencies is misaligned.

25. Successive issues in this series placed the Chinese yuan below its FEER, in the range of 20 percent in 2008–09, about 15 percent in 2010–11, and a range of 2 to 5 percent in 2012–14. See interactive FEERs map, available at <http://www.piie.com/interact/feers/map.html>.

A central question is whether financial markets will begin to reduce these misalignments. By May 15 the euro had risen 6 percent against the dollar from its April average, although the yen had remained virtually unchanged. Weaker growth in the first quarter than expected in the United States and stronger growth than expected in the euro area, as well as a sizable rebound in euro area interest rates, contributed to the rise in the euro.<sup>26</sup> A key to the question of realignment will be whether there is a second phase of upward movement in the dollar once the Federal Reserve actually begins raising interest rates.

26. From a low point of 8 basis points on April 20, the yield on the 10-year German bund rebounded to about 70 basis points by mid-May (Thomson Reuters Datastream).

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## APPENDIX A

## PROJECTING THE US CURRENT ACCOUNT DEFICIT

The sharp rise in the dollar and the major decline in oil prices make it particularly important at this time to examine the implications for the medium-term current account balance of the United States. This appendix presents projections through 2020 based on a simple estimated model of the relationship of the nonoil trade balance (goods and services) to the exchange rate and growth, projections of oil trade based on the Energy Information Administration (EIA 2015), and projections of the capital services account using the framework developed in Cline (2005).

**Nonoil Goods and Services** As shown in figure A.1, over the past 25 years there has been a meaningful relationship between the level of the real effective exchange rate (REER) and the size of the US nonoil deficit on goods and services as a percent of GDP. The figure shows that this balance (blue diamonds) was at its low point, a deficit of about 3½ percent of GDP, in 2004–06. The real effective exchange rate, as measured by the broad index of the Federal Reserve (2015b), reached a peak at about 110 in 2001–02.<sup>27</sup> In figure A.1 this REER is shown with a two-year lag. The low period for the nonoil goods and services balance is approximately the same as the high period for the lagged exchange rate.

A simple regression model relating this trade balance to the lagged REER and growth can be estimated for 1990–2014 as follows:<sup>28</sup>

$$A.1) z_t = 10.76 - 0.119 R_{t-2}^* - 0.326 gdiff_{t-1} - 0.1046 T; R^2_{adj} = 0.91$$

(11.6)    (-12.3)            (-4.6)            (-9.6)

The dependent variable,  $z$ , is the nonoil trade balance for goods and services as a percent of GDP. The first explanatory variable,  $R^*$ , is the lagged REER. The second variable,  $gdiff$ , is the US growth rate minus the world growth rate at constant prices and market exchange rates, as estimated by the International Monetary Fund (IMF 2015a), both in percentage terms and for the previous year. The final variable,  $T$ , is time, rising from 1 in 1990 to 25 in 2014.

The average value for the REER index (lagged) is 93.9, so the estimated coefficient of  $-0.119$  means that a 1 percent rise in the REER causes an increase in the nonoil goods and services deficit by 0.127 percentage point.<sup>29</sup> This elasticity turns out to be the same as the “semi-elasticity” estimated by the IMF in its most recent *External Balance Assessment* (EBA) exercise (IMF 2014a).

The coefficient on relative growth has the correct sign, considering that higher US growth should boost imports and higher foreign growth should increase US exports. The coefficient is large and thus probably captures cyclical swings as well as long-term trends. Thus, an increase in the US growth rate above the world growth rate by 1 percentage point boosts the nonoil trade deficit by 0.326 percent of GDP.<sup>30</sup> Considering the share of nonoil goods and services imports in GDP (an average of 12.1 percent over the period), by implication the combined long-run and cyclical elasticity for import demand is high at about 2.7.<sup>31</sup> For its part, the time trend variable indicates that on average the balance has eroded by about 0.1 percent of GDP annually. As suggested by the close fit in figure A.1 (with predicted values shown in the red squares), the degree of explanation is high (adjusted  $R^2$  of 0.91). The model coefficients are also highly significant.

With respect to the variable  $T$  indicating a negative time trend, there is a long empirical tradition of finding an adverse trend for the US trade balance at a constant real effective exchange rate. Cline (2005, 70–73) discusses the “Houthakker-Magee” tradition attributing the trend to a higher income elasticity for imports than for exports and a subsequent “Krugman-Gagnon” approach emphasizing outward-shifting supply capacity in exports of emerging-market economies. Bosworth and Collins (2010) find a significant negative time trend, even though they confirm more recent empirical estimates finding that the Houthakker-Magee asymmetry has disappeared. A summary interpretation of the trend, similar to the Krugman-Gagnon approach, would be to recognize that there must be a rich-

27. The index has March 1973 = 100 as its base.

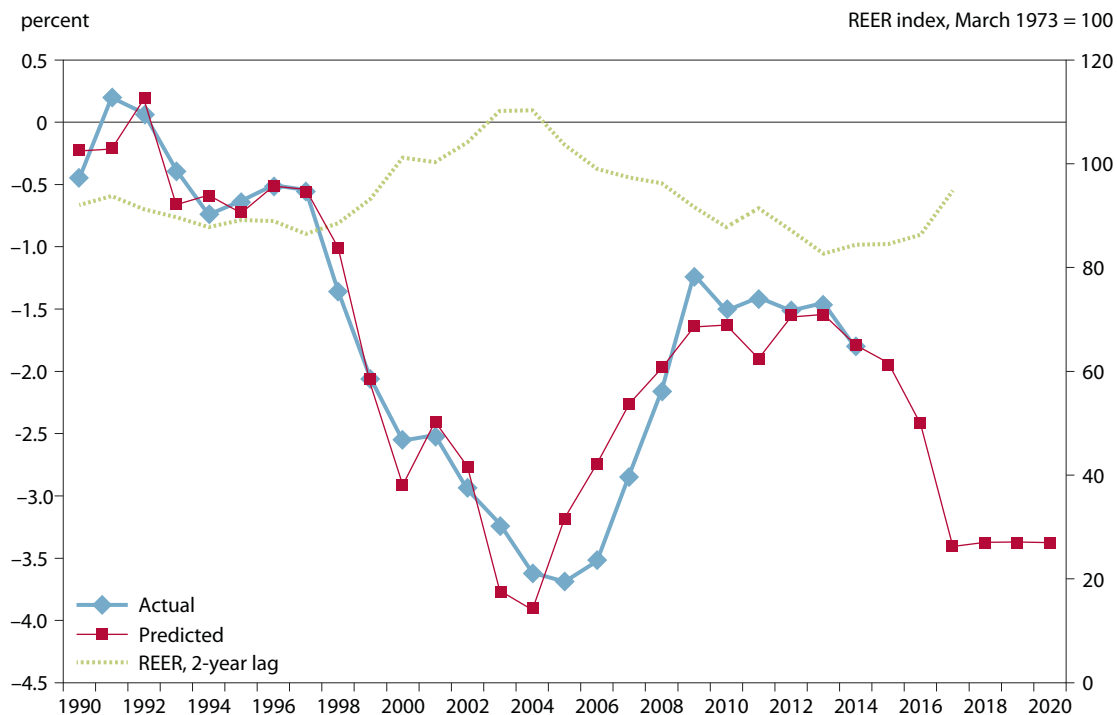
28. By inspection, although there is a downward time trend for the nonoil trade balance, there is no corresponding trend for the real exchange rate. Nonstationarity should thus not be of much concern.

29. That is:  $0.119/93.9 = 0.00127$ .

30. Note, however, that the average growth difference for the full period is surprisingly small, at only  $-0.24$  percent annually. The fact that US growth has been so close to the average reflects the use of market exchange rate GDP rather than purchasing power parity, which would give greater weight to rapidly growing emerging-market economies.

31. That is:  $0.326/0.121$ .

**Figure A.1 US Nonoil trade balance (goods and services) as percent of GDP and lagged REER**



REER = real effective exchange rate  
 Sources: BEA (2015d, e), Federal Reserve (2015b), and author's calculations.

country counterpart to the developing-country “Balassa-Samuelson” effect. In this effect, the real market exchange rate of developing countries appreciates over time because of greater productivity gains in the tradables sector than in the nontradables sector of those economies.<sup>32</sup> Thus, if it requires some ongoing pace of REER appreciation for China to prevent its trade surpluses from rising (and by other emerging-market economies to prevent increases in their balances), by implication there is an ongoing pace of needed REER depreciation for the United States and other advanced economies as the counterpart.

Figure A.1 shows the projection of the nonoil goods and services trade balance through 2020 under the assumption that the REER remains fixed at its April 2015 level (the 2017 data point for the lagged REER) and that US and world growth in 2015–20 are as projected by the IMF (2015a). In the projection, the deficit widens from about 1.8 percent of GDP in 2014 to about 3.4 percent in 2017 and then plateaus at that level.

**Oil** Table A.1 shows projections of US oil trade prepared by the US Energy Information Agency (EIA 2015). The EIA projects that oil exports will rise from 3.15 million barrels per day (mmbpd) in 2012 and 4.33 mmbpd in 2014 to 5.83 mmbpd in 2020, whereas oil imports will fall from 10.57 mmbpd and 9.4 mmbpd to 8.54 mmbpd in these years respectively. The agency expects oil prices, which averaged about \$100 per barrel in 2012–13 and \$90 in 2014, to fall to about \$51 in 2015, but then to rise gradually to about \$80 per barrel in 2020 (nominal current dollars). In the midpoint of the projection period in 2017 the price is about \$73 nominal, which would correspond to about \$70 at 2015 constant prices. This price is only slightly higher than that implied by the IMF (2015a) estimate of \$65.65 per barrel in 2016.<sup>33</sup>

The table uses the projected EIA values as the basis for translating to corresponding estimates for balance of payments estimates, based on the ratios of the two sets of estimates for 2014. The result is a set of projections that show the oil trade balance improving from a deficit of 1.81 percent of GDP in 2012 and 1.08 percent in 2014 to a deficit of only 0.5 percent in 2015 and 0.41 percent by 2020.

32. This effect is the reason purchasing power parity exchange rates are much higher than market exchange rates for low-income countries.

33. Assuming 2 percent inflation, the Fund's corresponding price for 2017 (holding the real price constant) would be \$67.

**Table A.1 US oil trade**

	Price per barrel (dollars)		Oil trade (millions of barrels per day)		Implied trade (billions of dollars)		Balance of payments basis (billions of dollars)			Balance (percent of GDP)	
	Brent	WTI	Import average	Imports	Exports	Imports	Exports	Imports	Exports		Balance
2012	111.65	94.12	101.09	10.57	3.15	390.0	108.2	434.3	141.2	-293.1	-1.81
2013	108.64	97.91	98.12	9.8	3.56	351.0	127.2	387.6	154.4	-233.2	-1.39
2014	99.02	93.26	89.09	9.4	4.33	305.7	147.4	351.0	162.5	-188.4	-1.08
2015	57.58	54.58	51.26	8.8	4.52	164.6	90.1	189.0	99.3	-89.7	-0.50
2016	75.00	71.00	67.52	8.91	4.99	219.6	129.3	252.1	142.6	-109.5	-0.58
2017	81.99	75.32	73.15	8.69	5.49	232.0	150.9	266.4	166.4	-100.0	-0.50
2018	83.41	76.65	74.26	8.54	5.62	231.5	157.2	265.8	173.4	-92.4	-0.44
2019	86.58	79.68	77.03	8.44	5.72	237.3	166.3	272.5	183.4	-89.1	-0.41
2020	89.75	82.75	79.96	8.54	5.83	249.3	176.1	286.2	194.2	-92.0	-0.41

WTI = West Texas Intermediate

Sources: BEA (2015e), EIA (2015), and IMF (2015a).

**Capital Services** The rise in the dollar affects the flow of capital services in two ways. First, foreign equity assets translate to lower dollar equivalents, reducing earnings expressed in dollars. Second, the cumulative effect of a larger current account deficit is to build up larger stocks of foreign claims on US residents. Interest payments on those additional claims widen the deficit.

A key question is whether the United States will be able to continue its anomaly of earning a net surplus on its capital despite the fact that its external liabilities greatly exceed its external assets. Thus, in 2014, earnings on foreign assets amounted to \$813 billion and payments were only \$586 billion, even though the stock of foreign assets at the end of 2013 (at \$20.9 trillion) was considerably smaller than the stock of foreign liabilities (\$26.3 trillion) (BEA 2015a, b). The reason for this paradox is that US foreign assets are more heavily concentrated in direct investment than other assets, and US direct investment abroad has a much higher return than foreign direct investment in the United States and other financial assets, whether US- or foreign-held.<sup>34</sup>

The capital services block of the current account model developed in Cline (2005, chapter 3) can be applied to recent data to provide estimates of capital services going forward. Annual earnings are projected at the average 2006–14 rates for each class of equity assets. New direct investment flows are set at their average ratios to GDP in this period. Interest rates are based on weighted averages of short-term and long-term US bond rates, applying the interest rate projections of the Congressional Budget Office (CBO 2015).<sup>35</sup>

**Current Account** Table A.2 shows the results for the projected baseline for the US current account balance. Under the assumption that the REER stays at its April 2015 level, the US current account deficit widens to 4.3 percent of GDP by 2020. The table begins in 2006 when the US current account deficit was at its peak of nearly 6 percent of GDP. The deficit on nonoil goods and services narrowed by about 2 percentage points of GDP from 2006 to 2013, but now with the stronger dollar it is on track to reverse almost all of that improvement. Nonetheless, the deficit is not headed back to its previous peak because the deficit on oil trade is likely to be much smaller, at about 0.4 percent of GDP by 2020 instead of about 2 percent in 2006, thanks to the shale fracking revolution and the steep decline in oil prices. Through 2011, capital services had continued and widened their paradoxical surplus despite a net international liability position, but this surplus will fall from a 2011 peak of about 1.5 percent of GDP to only about 0.3 percent

34. In 2006–14, the average annual return on US direct investment abroad was 8.3 percent, versus 3.9 percent for foreign direct investment in the United States. Average returns on other financial assets were much more symmetrical at about 3 percent for portfolio equity assets and for bonds and loans (but only about 2 percent for foreign portfolio equity claims). Calculated from BEA (2015b, c).

35. For equity, earnings rates are as follows: foreign direct investment, 8.3 percent for assets, 3.9 percent for liabilities; portfolio, 3.1 percent for assets, 2.2 percent for liabilities. Capital stocks have valuation adjustments for inflation (at the GDP deflator rate) as well as the exchange rate change for external assets. Debt has earnings weights of 0.6 short-term and 0.4 long-term for US assets, and the reverse for US liabilities. The short-term Treasury rate rises from 0.2 percent in 2015 to 1.2 percent in 2016, 2.6 percent in 2017, and 3.5 percent thereafter; the long-term rate is 2.8 percent in 2015, 3.4 percent in 2016, 3.9 percent in 2017, and about 4.4 percent thereafter. Flows into new direct investment are set at constant percentages of US GDP, at 2.5 percent for assets abroad and 1.6 percent for foreign-held assets in the United States. Flows for portfolio equity are set to increase real stocks at the same rate as real GDP growth.

**Table A.2 US current account balance** (percent of GDP)

	Nonoil goods and services	Oil and gas	Capital services	Transfers <sup>a</sup>	Total
2006	-3.53	-1.97	0.39	-0.72	-5.82
2007	-2.83	-2.04	0.77	-0.86	-4.96
2008	-2.16	-2.66	1.07	-0.92	-4.67
2009	-1.22	-1.44	0.92	-0.90	-2.64
2010	-1.51	-1.79	1.24	-0.90	-2.97
2011	-1.41	-2.13	1.48	-0.90	-2.96
2012	-1.51	-1.81	1.31	-0.83	-2.85
2013	-1.45	-1.39	1.24	-0.79	-2.39
2014	-1.82	-1.08	1.30	-0.76	-2.36
2015	-1.93	-0.50	1.41	-0.84	-1.86
2016	-2.42	-0.58	1.01	-0.84	-2.83
2017	-3.41	-0.50	0.73	-0.84	-4.02
2018	-3.37	-0.44	0.44	-0.84	-4.22
2019	-3.37	-0.41	0.42	-0.84	-4.21
2020	-3.37	-0.41	0.33	-0.84	-4.30

a. Includes net employee income.

Sources: BEA (2015a), table A.1, and author's calculations.

of GDP by 2020 as the consequence of a further increase in net international liabilities, exchange rate valuation effects, and a rebound in interest rates to more normal levels.<sup>36</sup>

**Impact of Depreciation** Combining the model of equation A.1 for nonoil goods and services with the capital services block of the model updated from Cline (2005) as just discussed, it is possible to simulate the effect of a shock to the exchange rate. If the REER for the dollar were to decline by 10 percent in 2016 from its April 2015 level, returning it approximately to its 2013 level, the consequence would be to cut the 2020 current account deficit to 2.6 percent of GDP. The balance on nonoil goods and services would narrow from a deficit of 3.37 percent of GDP to a deficit of 2.25 percent, and the surplus on capital services would widen from 0.33 percent of GDP to 0.85 percent of GDP. The total effect amounts to an impact parameter of -0.165 percent of GDP change in the current account for a 1 percent rise in the REER.<sup>37</sup> Of this parameter, a share of a bit more than two-thirds (0.68) is attributable to changes in the (nonoil) goods and services balance, and a bit less than one-third (0.32) to changes in capital services. An implication is that exclusion of special attention to capital services will substantially understate the exchange rate impact.

**Comparison to WEO Estimate** The calculations in the main text use the 2020 estimate of a deficit of 4.3 percent as the benchmark for the FEER calculations for the United States. In contrast, the April 2015 WEO (IMF 2015a) places the 2020 current account balance for the United States at 2.6 percent of GDP. The previous WEO in October 2014 (IMF 2014b) had estimated the 2019 balance at a deficit of 2.8 percent of GDP. In view of the sharp depreciation of the dollar between the two sets of estimates, a natural question is why there was not a sizable increase in the projected medium-term deficit rather than a slight decrease.

In the Fund's standard external balance assessment calculations, the "semi-elasticity" for the United States for the impact of 1 percent REER appreciation is a decline in the current account by 0.13 percent of GDP (IMF 2014a).<sup>38</sup> From the base month of the October WEO to that of the April WEO, the REER of the dollar rose by 10 percent. So application of the Fund's semi-elasticity parameter should have caused the medium-term current account balance to decline by 1.3 percent of GDP rather than rise by 0.2 percent. The gap of 1.5 percent is far too large to be explained by offsetting influences of lower oil prices and lower projected US growth.

With regard to lower US growth, as discussed above, the estimates of the present study take account of foreign growth as well as domestic US growth. Over the 5-year period there is only a minimal change in this growth differential between the two WEOs, accountable for at most a reduction in the medium-term deficit of about 0.13 percent of GDP.<sup>39</sup>

With respect to oil, the October WEO placed the 2015 price at \$99.36 per barrel, remaining unchanged in real terms thereafter and thus implying a nominal price of \$109.30 by 2020 (adjusting by the GDP deflator inflation). The April WEO placed the 2016

36. Note that the net international liability position rises from -32 percent of GDP at the end of 2013 to -52 percent in 2020 in the baseline, although this number is not particularly meaningful, given a still positive balance on capital earnings.

37. That is:  $(-4.30 - [-2.65])/10 = -0.165$ .

38. Note that the EBA semi-elasticity does not include the influence of changes in capital income. The notes to the EBA report indicate that the semi-elasticity typically applies "a common elasticity assumption of 0.71 for exports and 0.92 for imports, adjusted by the size of exports and imports in GDP with a further adjustment for commodity trade ..." (IMF 2014a, p. 3).

39. In the October WEO, which assumes continuation of growth in 2020 at the 2019 rate, cumulative world growth from 2014 to 2020 (at market exchange rates) was 22.0 percent; cumulative US growth, 18.2 percent, for a cumulative US difference of -3.8 percent. The corresponding estimates in the April WEO were 20.5 percent and 16.3 percent, for a cumulative US difference of -4.2 percent. Applying the relatively high parameter of equation A.1, -0.326, the resulting difference in the US current account by 2020 would be  $(3.8-4.2) \times -0.326 = +0.13$  percent of GDP.

price at \$65.65, implying a 2020 nominal price of \$71.20. If an average price of \$109 for 2020 is applied to table A.1, the oil deficit in 2020 would rise from -0.41 percent of GDP (table A.2) to -0.56 percent. So the favorable impact of lower oil prices between the two WEOs might appropriately be placed at 0.15 percent of GDP. The combined positive effect of growth and oil price developments would then amount to 0.28 percent of GDP, much too small to offset the adverse 1.3 percent of GDP impact of the stronger dollar using the EBA semi-elasticity.

Overall, there are considerable grounds for concluding that the most recent WEO projections for the US current account significantly understate the medium-term deficit.



## APPENDIX B

## ALTERNATIVE ESTIMATES FOR OTHER COUNTRIES

Cline (2014a) provides evidence supporting the notion that the IMF WEO projections of medium-term current account balances manifest considerable inertia, showing less change between successive issues of the WEO than might be expected from the corresponding changes in exchange rates (and often even showing changes in a direction opposite from that expected). In a period of unusually large exchange rate changes such as that of the past several months, it would not be surprising for this problem to be more acute than usual. This issue of FEERs estimates therefore prepares a full set of alternative medium-term current account estimates and uses the average of these estimates with the IMF (2015a) projections as the basis for the analysis of misalignments. The four oil-exporting economies in the FEERs group are exceptions. The WEO estimates for them are accepted unchanged, as impacts from exchange rate changes from the usual trade elasticities are less likely to apply, and IMF country desks are likely to have considered fiscal and other adjustments to the large changes in oil prices.

The alternative estimates take as their point of departure the medium-term (2019) current account balances estimated in the October 2014 WEO (IMF 2014b). Those estimates were applied without change (except for base-period updating) in the previous issue of FEERs estimates in this series. For each country, the alternative estimates of this appendix are calculated as follows. First, the new medium-term current account balances (percent of GDP) that would have been expected are estimated as:

$$B.1) Z_1^{exp} = Z_0 + \gamma[dR^*\%] + \phi_x[\%dY_f] - \phi_m[\%dY_h] + dOil$$

Here,  $Z_0$  is the medium-term estimate of the October 2014 WEO. The coefficient  $\gamma$  is the SMIM model impact parameter for the change in current account (percent of GDP) for a 1 percent change in the REER. The variable  $dR^*\%$  is the percent change in the REER from the previous base period (“August” 2014) to the new base period (“February” 2015).<sup>40</sup> The coefficients  $\phi_x$  and  $\phi_m$  are the shares of exports and imports of goods and services in GDP, respectively. The variables  $\%dY_f$  and  $\%dY_h$  are the 5-year cumulative percentage changes in foreign and domestic real GDP, respectively, between the two sets of WEO projections. Foreign growth is a weighted average applying the SMIM model parameters for the importance of each partner in the trade of the country in question. Application of the trade shares to changes in foreign and domestic GDP assumes that income elasticities of demand are unity. Finally,  $dOil$  is an estimate of the impact of the decline in the price of oil from \$100 to \$60 per barrel.<sup>41</sup>

Table B.1 reports the results of the calculations from equation B.1. It turns out that meaningful differences from the April WEO estimates are relatively frequent. Thus, the alternative estimates differ from the WEO estimates by 1 percent of GDP or more for 20 of the 30 nonoil economies. In the case of the United States, this alternative estimate is close to that obtained in the more detailed model in appendix A. In the case of China, the medium-term surplus is considerably smaller than estimated in the WEO (at 1.42 percent of GDP instead of 3.0 percent), reflecting the impact of the strong appreciation of the REER (by 10.36 percent from August to February). In the case of the euro area, the medium-term surplus is significantly higher than the WEO estimate (3.62 percent of GDP instead of 2.45 percent), again reflecting a sizable exchange rate change (about 5 percent depreciation of the REER). The strong depreciation in Brazil (by 10.67 percent) similarly yields a considerably smaller medium-term deficit than indicated by the WEO (1.68 percent of GDP versus 3.23 percent).

Table B.2 then arrives at the adjusted current account estimate used in the FEER calculations in the main text. The first step is to average the last two columns of Table B.1 to obtain an estimate of the medium-term balance implied by the February exchange rate, weighting the alternative estimates of equation B.1 and the WEO estimates equally. The next step is to update for the change in the REER from February to April. As in recent issues in this series, this updating applies one-half of the change implied by application of the parameter  $\gamma$  to the change in the REER. In the case of the United States, the adjusted estimate directly applies the projection obtained by application of the model in appendix A. The final column (“constrained”) then applies a further adjustment to ensure adding-up consistency.<sup>42</sup>

40. Respectively: July 26–August 27, 2014, and February 6–March 6, 2015.

41. This estimate is simply twice the size of the estimate reported in Cline (2014b, appendix B) for a decline to \$80 per barrel (\$87 instead of \$108 in 2019).

42. First, a relatively small summation discrepancy of \$33 billion is distributed across the economies in proportion to their share in total exports plus imports for the 34 economies. Second, a larger induced discrepancy from forcing an alternative estimate for the United States (a change of –\$375 billion in the US current account) is distributed across countries according to the parameters for importance of each partner in US trade. This allocation has a particularly large effect for Canada and Mexico.

**Table B.1 Expected changes in medium-term current accounts between WEO base periods**

	October 2014 WEO medium-term estimate ( $Z_0$ )	Percent change in REER between base periods <sup>a</sup> ( $dR\%$ )	Impact parameter $\gamma$	Share of goods and services					5-year cumulative percentage changes in real GDP				Estimated impact of oil price decline ( $dOil$ )	Medium-term CA estimates				
				Exports		Imports		B x C	D	E	F	G		H	I	J	K	L
				( $\phi_x$ )	( $\phi_m$ )	( $\%dY_f$ )	( $\%dY_h$ )											
Argentina	0.62	15.49	-0.19	15.86	14.67	-1.61	9.39	-1.63	0.13	-3.83	-1.45							
Australia	-3.65	-5.86	-0.19	20.41	21.02	-0.80	0.05	-0.17	0.55	-2.16	-3.38							
Brazil	-3.54	-10.67	-0.12	11.76	13.63	-0.22	-2.59	0.33	0.21	-1.68	-3.23							
Canada	-2.01	-8.87	-0.27	31.54	32.44	-1.01	-1.33	0.11	-1.97	-1.50	-1.78							
Chile	-1.71	3.10	-0.29	33.59	32.03	-0.95	-0.86	-0.05	1.37	-1.29	-2.36							
China	2.96	10.36	-0.24	24.95	22.47	-0.61	-2.37	0.38	0.56	1.42	3.00							
Colombia	-3.42	-16.20	-0.17	16.61	19.54	-1.27	-2.88	0.35	-2.03	-2.30	-3.58							
Czech Republic	-0.41	0.80	-0.48	83.60	76.62	0.02	0.27	-0.19	1.06	0.08	-0.69							
Euro area	1.84	-5.08	-0.24	26.23	23.40	-1.01	0.42	-0.36	0.91	3.62	2.45							
Hong Kong	3.68	10.59	-0.50	216.02	215.90	-1.36	-1.07	-0.63	1.35	-0.89	3.14							
Hungary	-1.73	1.76	-0.50	88.79	81.21	-0.09	1.00	-0.90	1.30	-2.21	1.20							
India	-2.56	0.05	-0.22	24.95	29.87	-0.85	6.04	-2.01	1.22	-3.36	-2.46							
Indonesia	-2.51	3.75	-0.22	22.47	23.15	-0.31	0.04	-0.08	0.90	-2.52	-2.59							
Israel	1.85	-2.68	-0.31	32.93	31.50	-0.42	0.41	-0.27	0.91	3.31	3.76							
Japan	1.41	-7.77	-0.15	18.68	21.45	-0.98	-0.68	-0.04	1.24	3.76	2.32							
Korea	4.26	1.24	-0.43	51.39	45.42	-1.05	-1.53	0.16	1.67	5.57	3.65							
Malaysia	4.11	-5.18	-0.49	82.71	73.86	-0.32	-1.16	0.59	-0.13	7.13	1.44							
Mexico	-2.20	-6.33	-0.29	32.69	33.94	-1.03	0.02	-0.34	-0.78	-1.51	-2.30							
New Zealand	-5.92	-0.87	-0.26	28.81	27.74	-0.83	-0.73	-0.04	0.52	-5.22	-4.59							
Philippines	0.55	7.78	-0.24	26.68	30.72	-0.66	0.43	-0.31	0.81	-0.79	3.00							
Poland	-2.95	0.72	-0.37	46.14	43.95	-0.16	0.47	-0.28	0.98	-2.51	-3.48							
Singapore	14.53	-1.52	-0.50	187.54	163.11	-0.54	0.63	-2.04	1.86	15.11	14.51							
South Africa	-4.63	1.33	-0.25	31.23	33.10	-0.56	0.18	-0.23	1.52	-3.68	-4.18							
Sweden	5.49	-3.64	-0.38	43.86	38.13	-0.42	0.40	-0.34	0.61	7.14	5.59							
Switzerland <sup>b</sup>	4.93	9.78	-0.45	62.18	51.31	-0.28	-0.99	0.34	0.38	1.29	5.32							
Taiwan	9.56	-0.19	-0.44	59.74	52.79	-1.19	-0.20	-0.60	1.95	10.98	9.87							
Thailand	0.79	6.30	-0.48	73.44	70.82	-0.70	0.58	-0.92	1.66	-1.49	0.68							
Turkey	-5.75	5.44	-0.24	27.26	32.00	-0.72	0.40	-0.32	0.95	-6.42	-5.02							
United Kingdom	-1.43	4.93	-0.27	28.88	30.89	-0.04	-1.60	0.48	0.27	-2.02	-3.29							
United States	-2.78	10.12	-0.17	13.46	16.36	-0.80	-1.04	0.06	0.34	-4.05	-2.63							

WEO = World Economic Outlook

a. July 26–August 27, 2014, to February 6–March 6, 2015.

b. Column A adjusted for statistical revision.

Sources: IMF (2015a) and author's calculations.

**Table B.2 Update of medium-term current account (CA) to April base**

	Average of expected and WEO medium- term current accounts (percent GDP)	Percent change in REER <sup>b</sup>	B x gamma	Adjusted current account estimate (percent GDP)	Final Adjusted CA constrained (percent GDP)
	A	B	C	D	E
Argentina	-2.64	2.14	-0.41	-2.85	-2.65
Australia	-2.77	0.10	-0.02	-2.78	-2.58
Brazil	-2.45	-3.95	0.49	-2.21	-1.92
Canada	-1.64	1.94	-0.52	-1.90	0.98
Chile	-1.83	3.05	-0.90	-2.27	-1.55
China	2.21	0.15	-0.04	2.19	2.48
Colombia	-2.94	0.34	-0.06	-2.97	-2.22
Czech Republic	-0.30	-1.92	0.92	0.16	0.20
Euro area	3.04	-3.57	0.87	3.47	3.77
Hong Kong	1.13	0.74	-0.37	0.94	1.55
Hungary	-0.51	-0.24	0.12	-0.45	-0.35
India	-2.91	-0.31	0.07	-2.88	-2.75
Indonesia	-2.56	-0.47	0.10	-2.50	-2.34
Israel	3.54	0.74	-0.23	3.42	4.54
Japan	3.04	-0.14	0.02	3.05	3.41
Korea	4.61	1.14	-0.49	4.36	4.79
Malaysia	4.28	0.16	-0.08	4.25	4.89
Mexico	-1.91	-1.37	0.39	-1.71	1.02
New Zealand	-4.90	1.46	-0.38	-5.09	-4.85
Norway	a	a	a	a	5.24 <sup>c</sup>
Philippines	1.10	-0.72	0.17	1.19	1.49
Poland	-2.99	0.86	-0.32	-3.15	-3.12
Russia	a	a	a	a	1.47 <sup>c</sup>
Saudi Arabia	a	a	a	a	5.91 <sup>c</sup>
Singapore	14.81	1.15	-0.57	14.53	15.54
South Africa	-3.93	-0.29	0.07	-3.89	-3.55
Sweden	6.36	-1.61	0.61	6.67	6.85
Switzerland <sup>e</sup>	3.30	0.55	-0.24	3.18	3.74
Taiwan	10.42	1.70	-0.76	10.04	10.82
Thailand	-0.40	-0.01	0.00	-0.40	0.19
Turkey	-5.72	-4.16	0.99	-5.22	-5.08
United Kingdom	-2.66	-0.75	0.20	-2.55	-2.31
United States	-3.34	0.41	-0.07	-3.37	-4.30 <sup>d</sup>
Venezuela	a	a	a	a	2.30 <sup>c</sup>

REER = real effective exchange rate; WEO = World Economic Outlook

a. Special calculation, oil exporter.

b. "February" 2015 (February 6–March 6) to April 2015.

c. Same as IMF (2015a).

d. Special estimate; see appendix A.

e. With statistical revision; see text.

Sources: IMF (2015a) and author's calculations.