



Estimates of Fundamental Equilibrium Exchange Rates, November 2021

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This study updates estimates of Fundamental Equilibrium Exchange Rates (FEERs) using October 2021 as the base month. These new estimates take as their point of departure the most recent issue of the World Economic Outlook (WEO) of the International Monetary Fund (IMF, 2021a). I apply the real effective exchange rate series of the Bank of International Settlements (BIS, 2021a) to take account of changes in real exchange rates subsequent to the base period used in the WEO.

Trends in Exchange Rates

Over the past two years, changes in major exchange rates have tended to reflect the perceived performance of countries in terms of pandemic management, as well as changes in relative interest rates. Both influences have become more ambiguous in recent months, while a new influence – a risk of high inflation in the United States – has gained prominence.

By October 2021 there had been a sufficient number of reversals in perceived pandemic performance that the weight of that influence may have eased. US leadership in vaccine introduction in early 2021 had shifted to lagging behind vaccination coverage in many other countries, in the face of greater public resistance to vaccination (reflecting in considerable part US political division). The merits of zero-Covid strategies of large island- or otherwise-isolated countries were facing new doubts given the contagious Delta variant. By November a new wave of infections and lockdowns was hitting several European countries.

The upswing of the US 10-year government bond rate from about 60 basis points in mid-2020 to a peak of about 175 basis points in mid-March 2021 was followed by a downswing to 120 basis points by August, muddying response to interest rates despite a return of the rate to some 160 basis points in November (FRED, 2021).

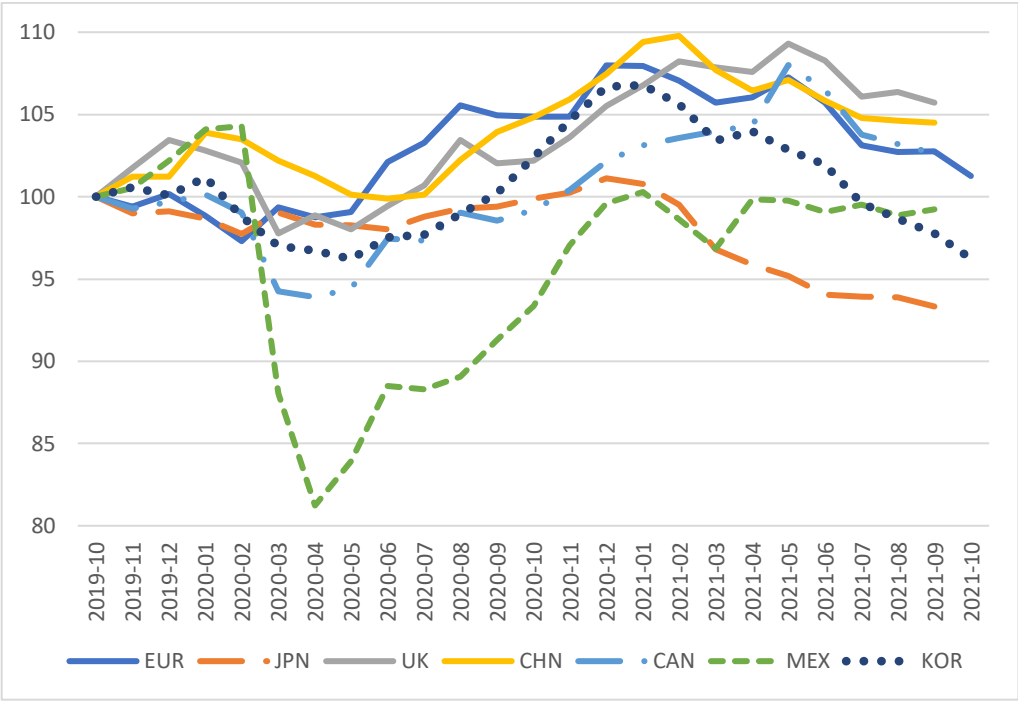
Figure 1 shows the path over the past two years of the bilateral real exchange rate against the US dollar for 7 key currencies: the euro, the Japanese yen, pound sterling, the Chinese yuan, the Canadian dollar, the Mexican peso, and the Korean won. The estimates

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deflate monthly nominal dollar exchange rates (BIS, 2021b) by country consumer price indexes (FRED, 2021). The figure shows the sharp decline of the Mexican peso at the outset of the pandemic, followed by recovery to its original level by the beginning of 2021. The Japanese yen showed little initial decline, but over the course of two years has declined against the dollar in real terms by the most among these currencies, by a cumulative 6.7 percent from October 2019 to September 2021. The Korean won has similarly fallen in real bilateral terms against the dollar, by 3.8 percent from October 2019 to October 2021. In both cases the higher cumulative inflation in the United States contributed significantly to the real declines in the bilateral rates.

Figure 1

Real Bilateral Exchange Rate against the US Dollar
October 2019 = 100



Source: Calculated from FRED (2021)

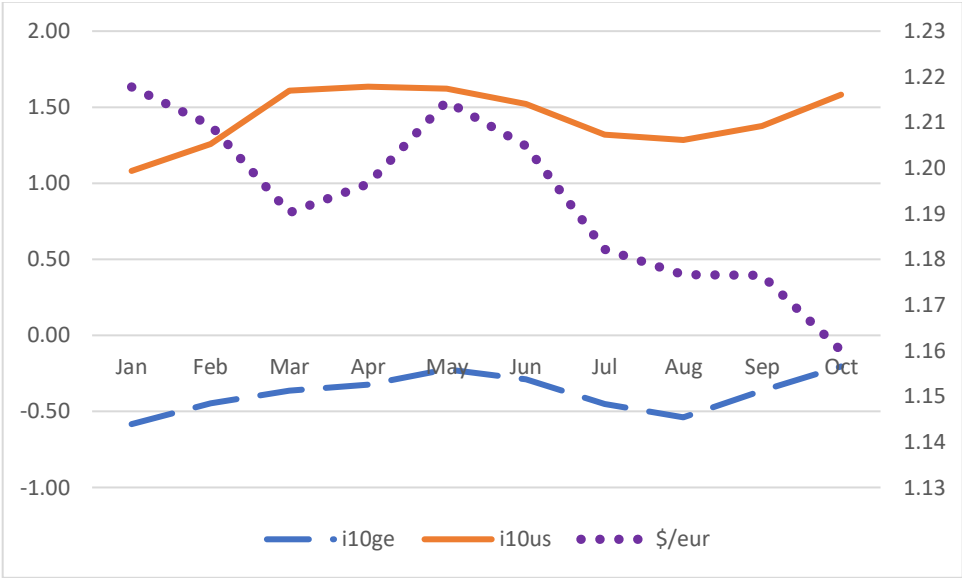
The euro rose in real terms against the dollar by about 8 percent from October 2019 to January 2021, but has then given up almost all of the gains during the course of 2021. In early 2021 the pound sterling and Chinese yuan reached peaks of about 10 percent above their initial real values against the dollar, but by September these gains had been trimmed to about 5 percent. Although not shown in the figure, by late November the euro had experienced a substantial further decline, reflecting concerns over new Covid restrictions.²

² The euro fell from an average of about \$1.21 in January 2021 to \$1.16 in October and \$1.13 by November 19 (FRED, 2021; BIS, 2021b).

The decline of the euro against the dollar during 2021 has reflected in part the rise of the US 10-year government bond rate against the 10-year rate for the euro. Figure 2 shows that this differential rose from 50 basis points in January to 125 basis points in March, and reached 140 basis points in May. After some narrowing during the third quarter, by October the differential still stood at 138 basis points. The surge in US inflation relative to euro area inflation that had become conspicuous by November underscored market expectations that US monetary policy would tighten ahead of that in the euro area.³

Figure 2

Strength of the Euro against the Dollar (right, \$/€) and US versus German 10-year Government Bond Rate (left, %)

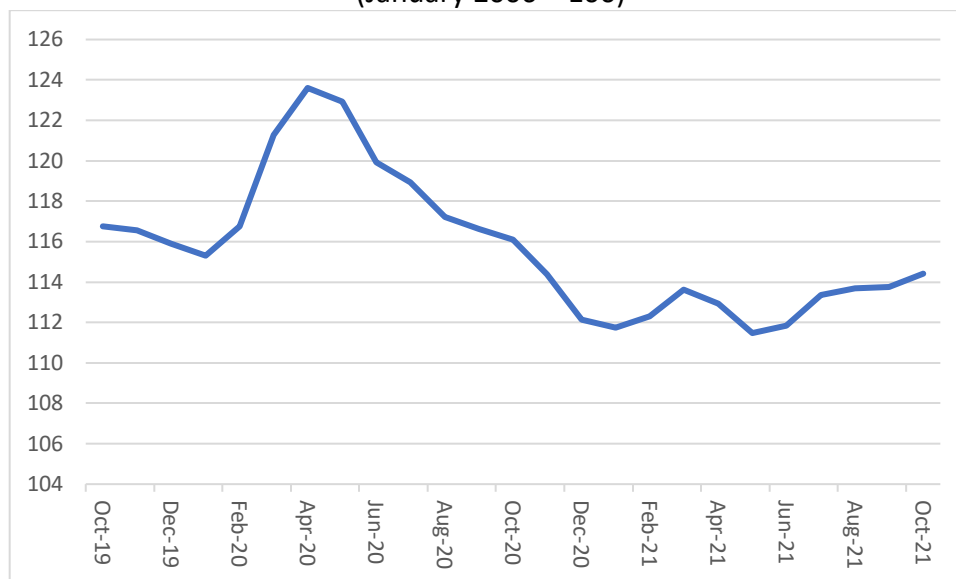


Source: FRED (2021).

Despite the dollar’s rise against the euro in 2021, the dollar is still not as strong against the currency as it was in 2019 as a whole (\$1.12/€; FRED, 2021). Nor is the trade-weighted real value of the exchange rate (REER) for the US dollar anywhere near as high as it reached in the second quarter of 2020 at the worst economic stage of the Covid-19 shock (figure 3). On a trade-weighted basis, the real dollar is still slightly below its level in October 2019.

³ See for example Elliot Smith, “Covid, the ECB, and Trade: Why the Euro Is Undergoing a ‘Fundamental Realignment’,” CNBC, November 23, 2021.

Figure 3
 US Federal Reserve Broad Real Effective Exchange Rate of the Dollar
 (January 2006 = 100)



Source: Federal Reserve (2021)

Recovery with Significant Inflationary Shift

The pandemic has imposed a price shock as well as a shock to output and employment. This outcome reflects the unique combination a forced reduction in supply from lockdowns with maintenance of, or substantial increase in, the public’s available resources thanks to pandemic relief payments. The US consumer price index rose by 6.2 percent in the 12 months ending October 2021, an annual rate last experienced in 1982 (FRED, 2021). There has been a sharp escalation in expert questioning of the mantra that the rise in prices has been transitory, along with corresponding calls to accelerate US “tapering” of quantitative easing and the timing of increases in the policy interest rate.⁴

Whereas the concerns about inflationary risks have been prominent in the United States, the acceleration in price increases has been much more generalized across major economies. Table 1 shows annual inflation rates during 2018-2020 and in the 12 months to September (or latest available month) in the economies covered in the FEERs series. The data are ordered from highest to lowest 2021 inflation. Although the United States is in the unusual

⁴ See Mohamed El-Erian, “The Fed’s Inflation Miscalculations Risk Hurting the Poor,” *Financial Times*, November 11, 2021; Lawrence H. Summers, “On Inflation, It’s Past Time for Team ‘Transitory’ to Stand Down,” *Washington Post*, November 16, 2021; Michael R. Strain, “Cooling the Overheated Economy,” *New York Times*, November 24, 2021. For a useful review of price pressures from the pandemic’s skewing of demand away from contact services such as air travel, restaurants, and retail marketing to housing and consumer durables, and the additional pressures from supply chain snags (notably the shortage in semiconductor chips that has curbed auto production), see James Tankersley, “The Inflation Miscalculation Complicating Biden’s Agenda,” *New York Times*, November 24, 2021.

position of being close to the top of the list (exceeded only by Russia, Brazil, Turkey, and Argentina), for 27 of the 33 economies shown inflation over the most recent 12 months has exceeded the annual rate in 2019 before the pandemic. Median inflation for the 33 economies was 2.2 percent in 2019, slightly lower at 1.7 percent in 2020, but much higher at 4.1 percent in the most recent 12 months.

A near-term implication of the high recent inflation in the United States could be erosion of competitiveness even if the nominal exchange rates remain unchanged. Thus, if inflation were to persist in the range of 4-6 percent, the much lower rates in Japan (-0.4 percent), China (0.6 percent), and Korea (2.6 percent), as well as the lower rate in the euro area (3.4 percent), would mean significant real appreciation of the dollar. This appreciation could be at least temporarily reinforced if a move to tighter monetary policy raised US interest rates and strengthened the nominal exchange rate of the dollar against these and other major competitors.

Table 1

Inflation and Growth in 33 Major Economies

	Inflation					Growth	
	2018	2019	2020	2021:	12mo to:	2020	2021
Argentina	34.2	52.8	40.5	51.7	Sep	-9.91	7.50
Turkey	16.3	15.2	12.3	19.6	Sep	1.79	8.95
Brazil	3.7	3.7	3.2	10.2	Sep	-4.06	5.23
Russia	2.9	4.5	3.4	6.5	Jul	-2.95	4.69
United States	2.4	1.8	1.2	6.2	Oct	-3.41	5.97
Mexico	4.9	3.6	3.4	6.0	Sep	-8.31	6.25
Poland	1.8	2.2	3.4	5.9	Sep	-2.72	5.12
Hungary	2.8	3.3	3.3	5.5	Sep	-4.96	7.60
Chile	2.4	2.3	3.0	5.3	Sep	-5.85	11.00
India	3.9	3.7	6.6	5.3	Aug	-7.25	9.50
South Africa	4.6	4.1	3.3	5.0	Sep	-6.43	5.00
Czech Republic	2.1	2.8	3.2	4.9	Sep	-5.79	3.79
New Zealand	1.6	1.6	1.7	4.9	Sep	-2.05	5.06
Philippines	5.2	2.5	2.6	4.8	Sep	-9.57	3.22
Canada	2.3	1.9	0.7	4.4	Sep	-5.31	5.69
Norway	2.8	2.2	1.3	4.1	Sep	-0.77	3.03
Australia	1.9	1.6	0.8	3.8	Jun	-2.35	3.54
Euro area	1.8	1.2	0.3	3.4	Sep	-6.34	5.04
United Kingdom	2.5	1.8	0.9	3.0	Sep	-9.85	6.76
Korea	1.5	0.4	0.5	2.6	Aug	-0.85	4.28
Sweden	2	1.8	0.5	2.5	Sep	-2.80	4.04
Singapore	0.4	0.6	-0.2	2.4	Aug	-5.39	6.03
Israel	0.8	0.8	-0.6	2.2	Aug	-2.15	7.06
Malaysia	1	0.7	-1.1	2.2	Sep	-5.65	3.50
Thailand	1.1	0.7	-0.8	1.7	Sep	-6.10	0.96
Hong Kong	2.4	2.9	0.3	1.6	Aug	-6.08	6.44
Indonesia	3.2	3.0	2.0	1.6	Sep	-2.07	3.20
Switzerland	0.9	0.4	-0.7	0.9	Sep	-2.51	3.71
China	1.9	3.0	2.6	0.6	Aug	2.34	8.02
Saudi Arabia	2.5	-2.1	3.4	0.6	Sep	-4.11	2.84
Japan	1	0.5	0	-0.4	Sep	-4.59	2.36
median	2.4	2.2	1.7	4.1		-4.59	5.06

Source: BIS (2021c)

Results of the Main Calculations

Table 2 reports the current account projections of the IMF for the 34 countries (with the euro treated as one economy) covered in the FEERs series dating back to 2008. The first column reports the IMF's projections of current account balances in 2021 in the October 2021 WEO. The second column reports the Fund's projection of the current dollar value of GDP for each economy in 2026.

The third column of the table reports the Fund's 2026 current account projections, as a percent of GDP. The fourth column then adjusts the 2026 outlook to take account of the change in exchange rates from the July-August base period used in the October WEO to the October base used in this report.⁵ The adjustment applies the percent change in the real effective exchange rate (REER) to the current account impact parameter ("gamma", the percent of GDP change in the current account for a 1 percent rise in the country's REER).⁶

The FEERs methodology sets ± 3 percent of GDP as the permissible external imbalance.⁷ A deficit of 3 percent of GDP could eventually bring the economy to a precariously high level of net external debt. The ceiling of 3 percent on the surplus is meant to provide symmetry for the purpose of global adding-up. The final column of table 4 accordingly shows the target current account as either ± 3 percent of GDP (the limit) or the actual projected current account if it is within this limiting range. The four oil-exporting economies are exceptions, with no limits imposed because they are primarily transforming resource wealth into financial wealth rather than increasing total wealth.

⁵ The October WEO uses July 23-August 20, 2021, as its base period (IMF, 2021b, p. 83). The adjustments here approximate this period using the average for August. Changes in the real effective exchange rate (REER) from August to October use the Bank of International Settlements "broad" series (BIS, 2021a).

⁶ This parameter is essentially an overall export price elasticity set at unity, applied to the size of exports of goods and services relative to GDP. The relationship is less than linear and is subject to a ceiling of 0.5, such that for a small open economy with exports at 100 percent of GDP a 1 percent rise in the REER would reduce the current account by 0.5 percent of GDP. Note that for the adjustment from the WEO base month, the calculation further applies only one-half of the normal impact calculation, reflecting past experience with slowly-changing IMF projections of the long-term current account. There is also a special adjustment reducing Switzerland's estimated surplus by 3 percent of GDP to account for the fact that current account data do not separate out the portion attributable to foreign multinational companies.

⁷ For a summary of the FEERs methodology, see Cline and Williamson (2012), Appendix A.

Table 2: Target Current Accounts (CA) for 2026

Country	IMF Projection of 2021 CA (percent of GDP)	IMF 2026 GDP forecast (billions of US dollars)	IMF 2026 CA forecast (percent of GDP)	Adjusted 2026 CA (percent of GDP)	Target CA (percent of GDP)
Pacific					
Australia	3.6	2,052	-0.5	-0.6	-0.6
New Zealand	-3.3	320	-3.1	-3.3	-3.0
Asia					
China	1.6	24,996	0.5	0.4	0.4
Hong Kong	6.0	475	4.0	4.1	3.0
India	-1.0	4,394	-2.5	-2.5	-2.5
Indonesia	-0.3	1,673	-2.2	-2.3	-2.3
Japan	3.5	6,344	3.2	3.5	3.0
Korea	4.5	2,316	4.3	4.7	3.0
Malaysia	3.8	576	3.4	3.2	3.0
Philippines	0.4	544	-1.8	-1.7	-1.7
Singapore	15.9	483	14.9	15.0	3.0
Taiwan	15.6	1,049	10.8	10.9	3.0
Thailand	-0.5	735	3.0	2.7	2.7
Middle East/Africa					
Israel	4.5	612	3.2	3.2	3.0
Saudi Arabia	3.9	1,006	-1.4	-1.4	-1.4
South Africa	2.9	533	-2.4	-2.3	-2.3
Europe					
Czech Republic	1.6	387	0.8	0.9	0.9
Euro area	2.6	18,558	2.7	2.8	2.8
Hungary	0.6	263	0.7	1.4	1.4
Norway	7.2	509	3.2	2.3	2.3
Poland	2.3	955	0.0	0.0	0.0
Russia	5.7	1,944	2.9	2.3	2.3
Sweden	4.8	837	3.0	2.9	2.9
Switzerland	7.2	1,039	7.5	4.7	3.0
Turkey	-2.4	1,334	-1.9	-1.3	-1.3
United Kingdom	-3.4	4,162	-2.9	-2.8	-2.8
Western Hemisphere					
Argentina	1.0	536	0.9	0.4	0.4
Brazil	-0.5	2,388	-3.3	-3.1	-3.0
Canada	0.5	2,631	-1.8	-1.9	-1.9
Chile	-2.5	438	-2.0	-1.7	-1.7
Colombia	-4.4	394	-3.9	-4.1	-3.0
Mexico	0.0	1,666	-1.0	-0.7	-0.7
United States	-3.5	29,103	-2.4	-2.4	-2.4
Venezuela ^a	0.3	44	-2.3	0.0	-2.2

a. 2022 except 1st column

Table 3 reports the results of running the Symmetric Matrix Inversion Model (SMIM) to obtain the globally-consistent set of exchange rate changes that most closely approximate the target changes of REERs needed to bring the current account imbalances to their target levels (Cline, 2008). The first column shows the target change in the current account as a percent of GDP. This change is the difference between the ± 3 percent limit and the baseline projection for 2026 if it is outside this limit. As usual in this series, there are large required reductions in the surpluses of Singapore (by 12 percent of GDP) and Taiwan (by 7.9 percent of GDP). There are also required reductions of 1.7 percent of GDP for both Switzerland and Korea; by 1.1 percent for Hong Kong; by 0.5 percent for Japan; and by 0.2 percent of GDP for Malaysia and Israel.

Only three of the 34 economies show required improvements in current account balances to limit their deficits to no more than 3 percent of GDP: Colombia (by 1.1 percent of GDP), New Zealand (by 0.3 percent of GDP), and Brazil (by 0.1 percent of GDP). There are no required corrections for the United States, the euro area, or China.

The second column of table 3 reports the actual changes in the current accounts achieved in the globally-consistent simulation. There is a strong asymmetry between sizable surplus reductions required for several economies but only modest deficit reductions required for just Colombia and Hong Kong and a minimal reduction required for Brazil. As a consequence, the globally-consistent solution under-adjusts for excess surplus countries by 0.7 percent of GDP for Singapore; by 0.4 percent of GDP for Hong Kong and Taiwan; and by 0.2 to 0.3 percent of GDP for Japan, Malaysia, and Switzerland. The simulation correspondingly generates an improvement of typically 0.2 to 0.4 percent of GDP for economies not needing any improvement.

The third column shows the change in the REER implied by the target change in the current account. Thus, for Singapore, the target reduction in the current account surplus by 12 percent of GDP requires an appreciation of the REER by 24 percent in view of the “gamma” coefficient (constrained to the maximum allowed in the model, 0.5 percent of GDP change for 1 percent REER change). The fourth column shows the change in the REER accomplished on a globally-consistent basis in the SMIM simulation. There is a 1.6 percent REER depreciation needed for the United States for this global adding-up, even though for its own equilibrium the US does not need any depreciation.

The fifth column in table 3 reports the average exchange rate for each country against the US dollar in October 2021 (BIS, 2021b). The sixth column shows the percent change in the dollar rate obtained in the globally-consistent simulation. The final column applies this percent change to the actual rate in October to arrive at the FEER-consistent dollar exchange rate for each country. This rate is 1.15 dollars per euro, 108 yen per dollar, 6.30 Chinese yuan per dollar, and 1.36 dollars per pound sterling. Australia and New Zealand have FEER-consistent US dollar rates of 76 US cents and 71 US cents, respectively.⁸

⁸ There is no estimate for Venezuela, where hyperinflation and import controls turn an estimate meaningless.

Table 3: Results of the simulation: FEERs estimates

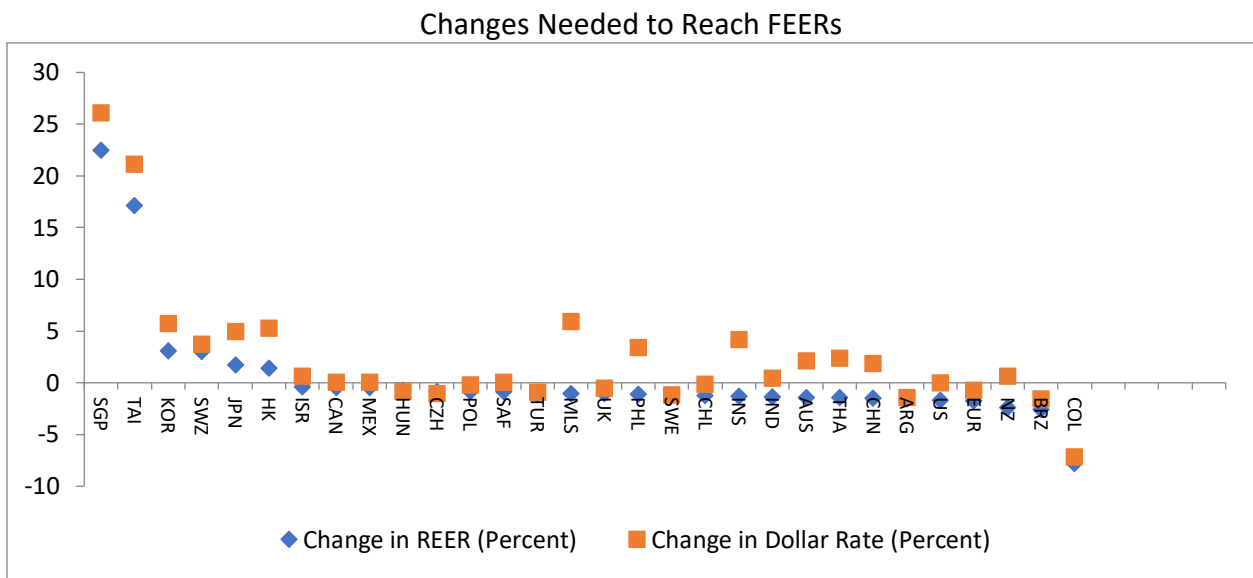
Country	Changes in Current Account as Percentage of GDP		Change in REER (percent)		Dollar Exchange Rate		FEER-consistent dollar rate
	Target Change	Change in Simulation	Target Change	Change in Simulation	Oct 2021	Percentage Change	
Pacific							
Australia*	0.0	0.3	0.0	-1.4	0.74	2.1	0.76
New Zealand*	0.3	0.6	-1.1	-2.3	0.71	0.7	0.71
Asia							
China	0.0	0.3	0.0	-1.5	6.42	1.9	6.30
Hong Kong	-1.1	-0.7	2.3	1.4	7.78	5.3	7.39
India	0.0	0.3	0.0	-1.4	75.0	0.5	74.6
Indonesia	0.0	0.3	0.0	-1.3	14179	4.2	13606
Japan	-0.5	-0.3	3.1	1.8	113	5.0	108
Korea	-1.7	-1.2	4.2	3.1	1182	5.8	1118
Malaysia	-0.2	0.5	0.3	-1.0	4.16	6.0	3.93
Philippines	0.0	0.3	0.0	-1.1	50.7	3.4	49.0
Singapore	-12.0	-11.3	24.0	22.5	1.35	26.1	1.07
Taiwan	-7.9	-7.5	18.2	17.2	27.9	21.2	23.0
Thailand	0.0	0.7	0.0	-1.4	33.5	2.4	32.7
Middle East/Africa							
Israel	-0.2	0.1	0.6	-0.4	3.21	0.6	3.19
Saudi Arabia	0.0	0.4	0.0	-1.0	3.75	1.4	3.70
South Africa	0.0	0.2	0.0	-0.8	14.85	0.0	14.84
Europe							
Czech Republic	0.0	0.4	0.0	-0.8	22.0	-1.0	22.2
Euro area*	0.0	0.4	0.0	-1.7	1.16	-0.7	1.15
Hungary	0.0	0.3	0.0	-0.7	311	-0.8	314
Norway	0.0	0.3	0.0	-1.0	8.46	-1.0	8.55
Poland	0.0	0.3	0.0	-0.8	3.96	-0.2	3.96
Russia	0.0	0.3	0.0	-0.9	71.3	-0.1	71.4
Sweden	0.0	0.4	0.0	-1.1	8.67	-1.2	8.77
Switzerland	-1.7	-1.4	3.8	3.1	0.92	3.7	0.89
Turkey	0.0	0.2	0.0	-1.0	9.21	-0.9	9.29
United Kingdom*	0.0	0.3	0.0	-1.0	1.37	-0.5	1.36
Western Hemisphere							
Argentina	0.0	0.2	0.0	-1.5	99.25	-1.4	100.63
Brazil	0.1	0.3	-0.9	-2.5	5.53	-1.6	5.62
Canada	0.0	0.1	0.0	-0.4	1.24	0.1	1.24
Chile	0.0	0.3	0.0	-1.2	814	-0.1	815
Colombia	1.1	1.3	-6.8	-7.8	3773	-7.2	4065
Mexico	0.0	0.1	0.0	-0.5	20.5	0.1	20.4
United States	0.0	0.3	0.0	-1.6	1.00	0.0	1.00
Venezuela	0.0	0.2	0.0	-0.9	...	-0.1	...

* dollars/currency

... not available

Figure 4 shows the percent changes in exchange rates needed to bring current accounts into alignment with the FEERs targets. The economies are ordered from the largest REER appreciations to the largest REER depreciations. Following the pattern usually found, for the Asian economies there tends to be a greater (positive) difference between the amount of change needed in the bilateral rate against the dollar than in the multilateral REER. The countries with the highest needed appreciations (especially Singapore and Taiwan) tend to be in Asia, and the countries with high trade shares with these economics also tend to be in Asia. These regional trading partners tend to need to appreciate against the dollar to avoid experiencing a depreciation in the multilateral effective exchange rate as key partners appreciate against the dollar.

Figure 4



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

FEER: Fundamental Equilibrium Exchange Rate

REER: Real Effective Exchange Rate

Conclusion

The principal misalignments of exchange rates identified in this study are highly concentrated, with large real appreciations needed for Singapore (by 22.5 percent) and Taiwan (by 17.2 percent). Other misalignments are smaller and confined to just a few economies. Globally-consistent REER appreciations are estimated at 3.1 percent for Korea and Switzerland, and at 1.4 percent for Hong Kong. The needed REER depreciations in the globally consistent solution stand at 7.8 percent for Colombia, 2.5 percent for Brazil, and 2.3 percent for New

Zealand. In addition, global consistency imposes REER depreciations in the range of 1 to 1.7 percent for many economies even though their surpluses do not exceed the allowed ceiling of 3 percent of GDP.

References

BIS (Bank for International Settlements). 2021a. . *Effective Exchange Rate Indices*. Basel (November). Available at: <https://www.bis.org/statistics/eer.htm>.

BIS. 2021b. *US Dollar Exchange Rates*. Basel (November). Available at: <https://www.bis.org/statistics/xrusd.htm>

BIS. 2021c. *Consumer Prices*. Basel (November). Available at: <https://www.bis.org/statistics/cp.htm>

Cline, William R. 2008. *Estimating Consistent Fundamental Equilibrium Exchange Rates*. Working Paper 08-6. Washington: Peterson Institute for International Economics (July). Available at: <https://www.piie.com/publications/working-papers/estimating-consistent-fundamental-equilibrium-exchange-rates>

Cline, William R. 2021. *US Debt Sustainability Under Low Interest Rates and After the Covid-19 Shock*. Working Paper 21-01. Washington: Economics International Inc. (March). Available at: <https://econintl.com/working-papers>

Cline, William R., and John Williamson. 2012. *Estimates of Fundamental Equilibrium Exchange Rates, May 2012*. Policy Brief 12-14. Washington: Peterson Institute for International Economics (July). Available at: <https://www.piie.com/publications/policy-briefs/estimates-fundamental-equilibrium-exchange-rates-may-2012>

Federal Reserve (US Federal Reserve). 2021. *Foreign Exchange Rates – H.10*. Washington (November)

FRED (Federal Reserve Bank of St Louis). 2021. *Economic Data*. St. Louis: Federal Reserve Bank of St. Louis (November). See: <https://fred.stlouisfed.org>

IMF (International Monetary Fund). 2021a. *World Economic Outlook Database, October 2021*. Washington (October). Available at: <https://www.imf.org/en/Publications/WEO/weo-database/2021/October>

IMF. 2020b. International Monetary Fund, *World Economic Outlook, October 2021: Recovery During a Pandemic*. Washington (October). Available at: <https://www.imf.org/en/Publications/WEO/Issues/2021/10/12/world-economic-outlook-october-2021>