



**Economics
International
Inc**

Estimates of Fundamental Equilibrium Exchange Rates, November 2023

William R. Cline¹
November 20, 2023

This study updates estimates of Fundamental Equilibrium Exchange Rates (FEERs) using October 2023 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, 2023a, b). I apply the real effective exchange rate (REER) series of the Bank of International Settlements (BIS, 2023a) to take account of changes in real exchange rates subsequent to the base period used in the WEO.

Dollar Returns Close to October 2022 Peak

After easing substantially from its October 2022 peak, the US dollar rebounded significantly from July 2023 to October. The broad real exchange rate for the dollar estimated by the Federal Reserve (2023) fell by 7.0 percent from October 2022 to July 2023, but then narrowed this decline to only 2.7 percent by October 2023 (Figure 1). The broad real rate for the dollar calculated by the BIS shows that at its peak a year ago, the real dollar stood 21.9 percent higher than its average over the 28 years from 1994 through 2021, and 4.1 percent higher than the prior peak in that period (February 2002).²

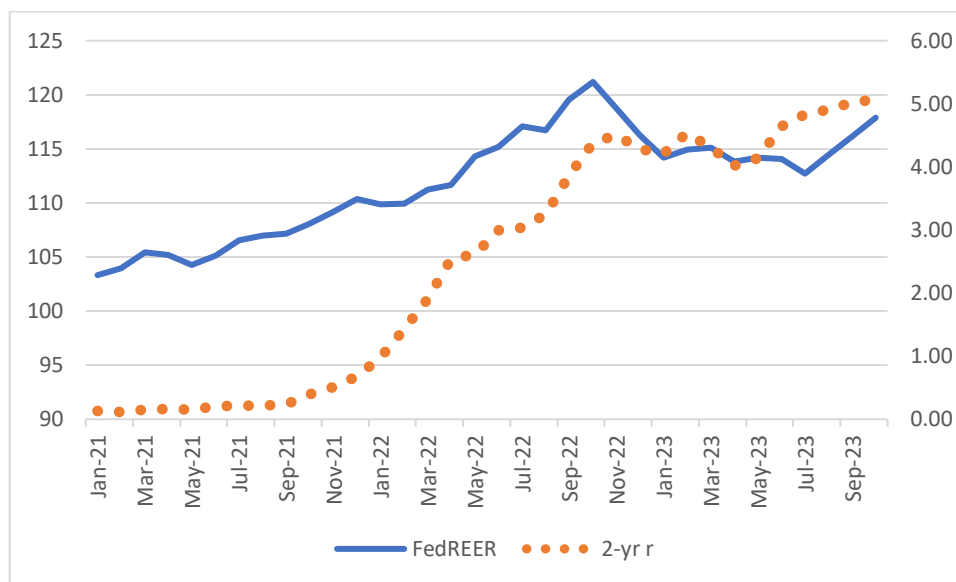
The driving force in the rise of the dollar through late 2022 and then again through late 2023 has been the rise in US interest rates as the Federal Reserve tightened monetary policy to address the surge in inflation associated with, first, pandemic supply constraints, and then the excess demand consequences of enormous fiscal expenditures on pandemic relief (Cline, 2023). As shown in Figure 1, the US 2-year Treasury rate rose by about 300 basis points during the course of 2022. The easing of the dollar in the first half of 2023 reflected the temporary plateauing of interest rates, and the partial recovery toward the peak has reflected a further rise in interest rates to 5 percent by October 2023 as financial markets absorbed the Federal Reserve's message of "higher for longer" rates to curb inflation further.

¹ President, Economics International Inc. (<https://econintl.com>)

² As reported by FRED (2023), series RBUSBIS.

Figure 1

Federal Reserve Broad Real Dollar Index^a (left) and
2-year US Treasury Rate (% , right)



a. January 2006 = 100

Source: Federal Reserve (2023); FRED (2023, series DGS2)

Nominal and Real Bilateral Rates against the Dollar for Four Major Currencies

As shown in table 1, the strongest recent periods for the four leading currencies against the dollar tended to be in early 2021 and early 2022. By October 2023, three of the four currencies had declined against the dollar from those high points by a nearly uniform 13 percent. The Japanese yen was the outlier, as its decline from its high point of 103.8 per dollar in January 2021 to its October 2023 low of 149.6 amounted to 31 percent.

Table 1

Change in Euro, Pound Sterling, Chinese Yuan, and Japanese Yen from
Recent Highs against US Dollar to October 2023

						% change from
	Recent high		Oct '22	Jan '23	Oct '23	recent high
dollar/Euro	May '21	1.21	0.985	1.078	1.057	-13.02
dollar/Pound Sterling	May '22	1.41	1.133	1.226	1.218	-13.55
China yuan/dollar	Mar '22	6.34	7.190	6.790	7.307	-13.17
yen/dollar	Jan '21	103.8	147.1	130.5	149.6	-30.62

Source: Calculated from FRED (2023). Series DEXUSED, DEXUSUK, DEXCHUS, DEXJPUS

Because pandemic (and Russia-Ukraine related) inflation has been higher in Europe than in the United States, the real declines in the euro and pound sterling bilateral rates against the dollar have been somewhat more modest than indicated in table 1. Adjusting for differential inflation, the bilateral declines against the dollar in real terms have been about 10 percent for the euro and 6 percent for the pound sterling. Conversely, with inflation far lower in China and Japan than in the United States, the real bilateral declines from the recent peaks in table 1 have been about 18 percent for China and 35 percent for Japan.³

The strong outlier in these trends is the Japanese yen. From its recent high point in January 2021 to October 2023 Japan's real effective exchange rate fell 25.6 percent (BIS, 2023a). Yet the IMF has not changed its estimate of Japan's medium-term current account surplus, which was placed at 3.2 percent of GDP for 2026 in the April 2021 WEO, and is still at 3.2 percent of GDP for 2028 in the October 2023 WEO.⁴ One suspects that as a result, the degree of undervaluation of the yen has been understated in the estimates discussed below.

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 estimates of current account balances in 2022 in the October 2023 WEO. The second column reports the Fund's projection of the current dollar value of GDP for each economy in 2028.

The third column of the table reports the Fund's 2028 current account projections, as a percent of GDP. The fourth column then adjusts the 2028 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

³ Note however the most recent months available for the ending consumer price index in these calculations are September for the euro and August for the other three economies, and the text estimates correspondingly apply the September or August exchange rates. Calculated from BIS (2023b, c).

⁴ See the WEO database in IMF (2023a) and its counterpart for April 2021.

⁵ The October 2023 WEO uses July 25- August 22 as its base period (IMF, 2023b, p. 93). The adjustments apply the weighted average of the real effective exchange rates (REERs) for July (one-fourth weight) and August (three-fourths). The REERs are from the Bank of International Settlements "broad" series (BIS, 2023a).

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.

Notable increases in REERs from the July-August WEO base to October included a rise by 3.6 percent for the United States, 11.2 percent for Turkey, and 8.5 percent for Argentina. Notable declines included a fall by 7.4 percent for Chile, 5.7 percent for Czech Republic, 5.0 percent for Israel, and 4.6 percent for Mexico. For most economies, the adjusted 2028 current account estimate (next to last column) is close to the unadjusted WEO projection (previous column).⁷

The FEERs methodology sets ± 3 percent of GDP as the permissible external imbalance.⁸ 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 2 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.

Table 3 reports the results of running the Symmetric Matrix Inversion Method (SMIM) model 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 2028 if it is outside this limit. As usual in this series, there are large targeted reductions in the surpluses of Singapore (by 9 percent of GDP) and Taiwan (by 8 percent of GDP). There are also targeted reductions of 2.3 percent of GDP for Switzerland, 2 percent for Hong Kong, 1.3 percent for Israel, 1.2 percent for Thailand, 1 percent for Sweden; and reductions in the range of -0.6 to -0.3 percent of GDP for Czech Republic, Japan, Malaysia, and Korea.

⁷ For the United States, the 3.6 percent rise in the REER, applied to the impact factor (γ) of -0.165 percent of GDP decline in the current account for each 1 percent rise in the REER, would increase the deficit by 0.59 percent of GDP. After shrinkage by one-half to allow for the potentially transitory nature of a three-month swing (see note 5), the change from the long-term WEO baseline is placed at -0.3 percent of GDP, boosting the 2028 deficit from 2.4 percent of GDP to 2.7 percent.

⁸ For a summary of the FEERs methodology, see Cline and Williamson (2012), Appendix A.

Table 2: Target Current Accounts (CA) for 2028

Country	IMF Estimate of 2022 CA (percent of GDP)	IMF 2028 GDP forecast (billions of US dollars)	IMF 2028 CA forecast (percent of GDP)	Adjusted 2028 CA (percent of GDP)	Target CA (percent of GDP)
Pacific					
Australia	1.1	2,054	-0.9	-0.8	-0.8
New Zealand	-9.0	297	-4.2	-4.1	-3.0
Asia					
China	2.2	23,609	0.7	0.6	0.6
Hong Kong	10.6	499	5.2	5.0	3.0
India	-2.0	5,944	-2.3	-2.3	-2.3
Indonesia	1.0	2,093	-1.5	-1.3	-1.3
Japan	2.1	5,158	3.2	3.5	3.0
Korea	1.8	2,129	3.1	3.3	3.0
Malaysia	3.1	603	3.0	3.4	3.0
Philippines	-4.5	699	-1.1	-1.3	-1.3
Singapore	19.3	626	11.8	12.0	3.0
Taiwan	13.3	960	10.9	11.0	3.0
Thailand	-3.0	683	3.3	4.2	3.0
Middle East/Africa					
Israel	3.4	661	3.5	4.3	3.0
Saudi Arabia	13.6	1,276	0.5	0.3	0.3
South Africa	-0.5	459	-2.1	-2.0	-2.0
Europe					
Czech Republic	-6.1	439	2.2	3.6	3.0
Euro area	-0.7	18,819	1.8	2.1	2.1
Hungary	-8.0	288	0.5	0.4	0.4
Norway	30.2	605	17.5	18.1	18.1
Poland	-3.0	1,068	-1.0	-0.7	-0.7
Russia	10.5	1,987	2.3	2.5	2.5
Sweden	4.8	751	4.0	4.0	3.0
Switzerland	10.2	1,191	8.0	5.3	3.0
Turkey	-5.3	1,576	-2.3	-3.7	-3.0
United Kingdom	-3.8	4,576	-3.5	-3.4	-3.0
Western Hemisphere					
Argentina	-0.7	728	1.0	0.4	0.4
Brazil	-2.8	2,774	-2.2	-2.0	-2.0
Canada	-0.3	2,699	-2.1	-1.3	-1.3
Chile	-9.0	427	-3.0	-1.7	-1.7
Colombia	-6.2	456	-3.9	-3.7	-3.0
Mexico	-1.2	2,357	-0.9	0.4	0.4
United States	-3.8	32,690	-2.4	-2.7	-2.7
Venezuela	3.6	...	...	...	...

Source: IMF (2023a) and author's calculations

Only four of the 34 economies show required improvements in current account balances to limit their deficits to no more than 3 percent of GDP: New Zealand (by 1.1 percent of GDP), Colombia (by 0.7 percent of GDP), Turkey (by 0.7 percent of GDP), and the United Kingdom (by 0.4 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 surplus reductions required for eleven economies (median reduction: by 1.2 percent of GDP) but deficit reductions required for just four (median: by 0.7 percent of GDP). As a consequence, the globally-consistent solution under-adjusts for excess surplus countries by a median of 0.4 percent of GDP for the excess surplus countries. For the four excess-deficit, the simulated solution over-adjusts by 0.2 to 0.3 percent of GDP. Similarly, for all 19 economies requiring no adjustment at all, the solution imposes a rise in the current account balance, typically by 0.2 to 0.3 percent of GDP.

The third column shows the change in the REER implied by the target change in the current account. Thus, for Taiwan, the target reduction in the current account surplus by 8 percent of GDP requires an appreciation of the REER by 18.4 percent in view of Taiwan's "gamma" coefficient (-0.43 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 1.5 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 2023 (BIS, 2023b). The sixth column shows the percent change in the bilateral rate against the US dollar 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 \$1.05 per euro, 143 yen per dollar, 7.18 Chinese yuan per dollar, and 1.19 dollars per pound sterling. Australia and New Zealand have FEER-consistent US dollar rates of 65 US cents and 57 US cents, respectively.⁹

⁹ There is no estimate for Venezuela, where hyperinflation and import controls turn an estimate meaningless.

Table 3: Results of the Simulation: FEERs Estimates

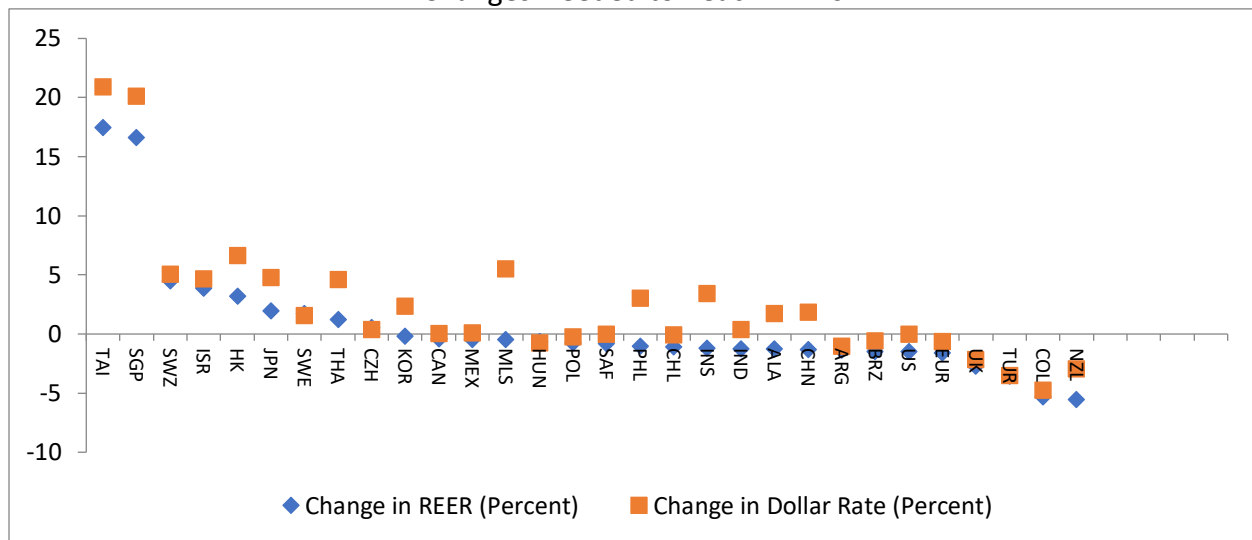
Country	Changes in Current Account as Percentage of GDP		Change in REER (percent)		Dollar Exchange Rate		FEER-consistent dollar rate
	Target Change	Change in Simulation	Target Change	Change in Simulation	Oct 2023	Percentage Change	
Pacific							
Australia*	0.0	0.2	0.0	-1.2	0.63	1.8	0.65
New Zealand*	1.1	1.4	-4.4	-5.5	0.59	-3.0	0.57
Asia							
China	0.0	0.3	0.0	-1.3	7.31	1.8	7.18
Hong Kong	-2.0	-1.6	4.0	3.2	7.82	6.6	7.34
India	0.0	0.3	0.0	-1.2	83.2	0.4	82.9
Indonesia	0.0	0.2	0.0	-1.2	15760	3.5	15233
Japan	-0.5	-0.3	3.1	2.0	150	4.8	143
Korea	-0.3	0.1	0.9	-0.2	1351	2.4	1320
Malaysia	-0.4	0.2	0.8	-0.4	4.75	5.5	4.50
Philippines	0.0	0.2	0.0	-1.0	56.8	3.0	55.1
Singapore	-9.0	-8.3	18.0	16.7	1.37	20.2	1.14
Taiwan	-8.0	-7.6	18.4	17.5	32.3	20.9	26.7
Thailand	-1.2	-0.6	2.5	1.2	36.5	4.6	34.9
Middle East/Africa							
Israel	-1.3	-1.1	4.7	3.9	3.98	4.7	3.80
Saudi Arabia	0.0	0.3	0.0	-0.9	3.75	1.0	3.71
South Africa	0.0	0.2	0.0	-0.8	19.07	0.0	19.06
Europe							
Czech Republic	-0.6	-0.3	1.3	0.6	23.3	0.4	23.2
Euro area*	0.0	0.4	0.0	-1.6	1.06	-0.6	1.05
Hungary	0.0	0.3	0.0	-0.6	365	-0.7	367
Norway	0.0	0.3	0.0	-0.9	11.01	-0.9	11.11
Poland	0.0	0.3	0.0	-0.8	4.27	-0.2	4.28
Russia	0.0	0.2	0.0	-0.8	97.1	-0.2	97.4
Sweden	-1.0	-0.6	2.8	1.7	11.03	1.6	10.85
Switzerland	-2.3	-2.0	5.2	4.5	0.90	5.1	0.86
Turkey	0.7	0.9	-2.7	-3.6	27.88	-3.5	28.89
United Kingdom*	0.4	0.7	-1.7	-2.7	1.22	-2.1	1.19
Western Hemisphere							
Argentina	0.0	0.2	0.0	-1.4	350.0	-1.0	353.58
Brazil	0.0	0.2	0.0	-1.4	5.07	-0.6	5.09
Canada	0.0	0.1	0.0	-0.4	1.37	0.0	1.37
Chile	0.0	0.3	0.0	-1.1	926	0.0	927
Colombia	0.7	0.9	-4.3	-5.3	4222	-4.7	4432
Mexico	0.0	0.1	0.0	-0.4	18.1	0.1	18.1
United States	0.0	0.2	0.0	-1.5	1.00	0.0	1.00
Venezuela	#N/A	0.2	0.0	-0.8	...	...	...

* dollars/currency

... not available

Figure 2 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 Taiwan and Singapore) tend to be in Asia, and the countries with high trade shares with these economies 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 2
Changes Needed to Reach FEERs



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 the globally consistent simulations showing large real appreciations needed for Taiwan (by 17.5 percent) and Singapore (by 16.7 percent). Smaller globally-consistent real appreciations are needed for Switzerland (by 4.5 percent), Israel (3.9 percent), Hong Kong (3.2 percent), Sweden (1.7 percent), Japan (by 2.0 percent), and Thailand (1.2 percent). The needed

REER depreciations in the globally consistent solution stand at 5.5 percent for New Zealand, 5.3 percent for Colombia, 3.6 percent for Turkey, and 2.7 percent for the United Kingdom. In addition, global consistency imposes REER depreciations in the range of 0.4 to 1.6 percent (median: by 1.2 percent) for many economies even though their deficits do not exceed the allowed ceiling of 3 percent of GDP. This consistency effect is about the same for the euro (-1.6 percent REER change) and the United States (-1.5 percent).

References

BIS (Bank for International Settlements). 2023a. *Effective Exchange Rate Indices*. Basel (November). Available at: <https://www.bis.org/statistics/eer.htm>.

BIS. 2023b. *US Dollar Exchange Rates*. Basel (November). Available at: <https://www.bis.org/statistics/xrusd.htm>

BIS. 2023c. *Consumer Prices: K1, Consumer prices, indices*. Basel (November). Available at: <https://www.bis.org/statistics/cp.htm>

Cline, William R. 2023. *Fighting the Pandemic Inflation Surge of 2021-2022*. Working Paper 23-1. Washington: Economics International Inc. Available at: <https://econintl.com/working-papers/>

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., 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>

FRED (Federal Reserve Bank of St Louis). 2023. *Economic Data*. St. Louis: Federal Reserve Bank of St. Louis (November). See: <https://fred.stlouisfed.org>

IMF (International Monetary Fund). 2023a. *World Economic Outlook Database, October 2023*. Washington (October).

IMF. 2023b. *World Economic Outlook: Navigating Global Divergences*. Washington (October)