Peterson Institute for International Economics

Policy Brief

NUMBER PB09-10

JUNE 2009

# 2009 Estimates of Fundamental Equilibrium Exchange Rates

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*Note: The authors thank Thomas Emmons for research assistance.*



When we first published our estimates of fundamental equilibrium exchange rates (FEERs) in July 2008 (Cline and Williamson 2008), we stated that this was intended to be a regular series of publications. This policy brief updates those estimates in light of the momentous changes in the world economy during the past year. Many of those changes, notably changes in actual exchange rates, should not influence FEERs, except insofar as we allow a range of variation of the target current account balance.[1] But equally clearly, one does expect some of the changes, notably forecasts of the prices of oil and other commodities, to be important determinants of equilibrium exchange rates.

A major consequence of the global financial crisis has been a further rise in the already overvalued dollar, as investors have turned to the United States as a relatively safe haven. A larger overvaluation implies a larger external deficit, after the two-year or so lag from the exchange rate signal to trade flows. Similarly, the rise in perceived risk combined with the reduction in high domestic interest rates in some countries for countercyclical purposes has ended the "carry trade" and contributed to a strengthening of the yen in particular, reversing the currency's gap from its previous estimated FEER, from a significant trade-weighted overvaluation in 2008 to a small undervaluation today.[2] The extreme and unusually synchronized global recession has also caused major reductions in oil and commodity prices, a second potentially important cause of changes in FEERs. Finally, the most severe postwar global recession may have changed investors' perceptions of long-term relative growth prospects across countries, although it is too early to judge this definitively.

As in Cline and Williamson (2008), we once again take as our point of departure the current account projections provided by the International Monetary Fund (IMF) in its 2009 *World Economic Outlook* (WEO). The WEO incorporates changes in the outlook for key commodity prices. The most important of these is the oil price, which the Fund assumes will average $52 a barrel in 2009 and $62.50 in 2010, and remain constant in real terms thereafter. This is a major reduction from the IMF's

1. It is also possible that actual exchange rates have influenced estimates of FEERs illegitimately, for example if the projections on which the estimates are partially based tend to be extrapolations that take inadequate account of the impact of misaligned exchange rates.

2. The yen still needs to appreciate substantially in bilateral terms against the dollar to reach FEER levels, however. The Swiss franc may be another key currency buoyed by reversal of the carry trade, particularly in light of the collapse throughout Eastern Europe. The extent of the appreciation of the Swiss franc against the other European currencies has caused competitiveness concerns that have prompted Swiss authorities to intervene in the exchange market to weaken the currency, exactly the wrong action for adjustment toward FEERs.

assumption in 2008 of $95 per barrel, adopted when the oil price was skyrocketing. Because of this change the IMF forecasts show lower surpluses by the oil exporters, the main counterpart of which is a lower US current account deficit. This is forecast to persist largely unchanged throughout the forecasting period.

In contrast, Cline (2009) forecasts that the US current account deficit will expand again after 2009 on the basis of the stronger dollar earlier in 2009 compared with a year ago. We regard this expectation as more realistic, and accordingly we reject the IMF's complacent view that there is no longer a need for adjustment in the dollar exchange rate. However, if the US current account deficit is going to be larger, then arithmetical consistency demands that there be corresponding surpluses elsewhere. Cline's (2009) current account model projects a US deficit of 5.6 percent of GDP by 2012, based on the strong level of the dollar in the new base period (March 2009) and on the price of oil forecast by the Department of Energy (Energy Information Administration 2009).[3] The difference between the IMF's forecast and Cline's non-oil forecast has been distributed as increased surpluses in other countries in proportion to their total bilateral trade with the United States, and the trade balances have also been adjusted for the increased oil price. In a variant of these estimates not reported here, we assumed an oil price equal to that forecast by the IMF, thereby omitting the latter adjustment.

**A major consequence of the global financial crisis has been a further rise in the already overvalued dollar, as investors have turned to the United States as a relatively safe haven.**

In this policy brief we first discuss the concept of the FEER, which may be skipped by those who recall the similar discussion in Cline and Williamson (2008). We then review the main assumptions that have gone into calculating the FEERs presented in this policy brief. In the third section, we review the nature of the model employed, specifically Cline's (2008) symmetric matrix inversion method (SMIM), which is also very similar to the discussion in Cline and Williamson (2008) and can therefore be omitted by those with a good memory. In the final section, we lay out and discuss our new estimates of FEERs.

## THE CONCEPT OF THE FEER

A fundamental equilibrium exchange rate (FEER) is defined as an exchange rate that is expected to be indefinitely sustainable on the basis of existing policies. It should therefore be one that is expected to generate a current account surplus or deficit that matches the country's underlying capital flow over the cycle, assuming that the country is pursuing internal balance as well as it can and that it is not restricting trade for balance-of-payments reasons. In a growing world where the demand to hold reserves is therefore growing over time, one needs to deduct the secular growth of reserve holdings in determining either the amount of capital outflow available from a current account surplus, or the amount of foreign capital available to finance a current account deficit.

Few countries now restrict trade for balance-of-payments reasons. Similarly, the dominant view that the pressure of demand drives the *acceleration*, rather than the *level*, of inflation pretty much settles what is meant by internal balance. In contrast, the widespread advent of high capital mobility has made it far more difficult to pin down in any definitive way what is meant by a country's "underlying capital flow." An extreme view would be that *any* level of current account imbalance can be financed by an endogenous capital flow, making it impossible to define a FEER. We believe that this goes altogether too far and that one can still identify dangerously large capital inflows (i.e., borrowing) and economically unproductive capital outflows (i.e., lending, including reserve buildups). There is nevertheless a range of indeterminacy: Within some limits, capital flows and therefore current accounts may vary without inducing forces that tend to curtail the flows. In this policy brief we adopt the position that limits lie at the edges of this range of indeterminacy and that it is desirable to work toward a situation in which these limits are respected.

Naturally a FEER is defined in *real* (i.e., inflation-adjusted) terms. If a country suffers 10-percent higher inflation than its peers, then its currency will have to depreciate by 10 percent in order to restore the same real position as before. Only then will its producers have their competitive position restored and will its consumers face the same choices as before. Similarly the relevant exchange rate concept is an *effective* rate, i.e., one in which foreign currencies are taken into account and weighted by their importance in the foreign trade of the country in question to form a single estimate of the exchange rate. The practice of measuring a currency's value in terms of the currency of a

3. The 2012 price of West Texas Intermediate oil is set at $87.60 per barrel, instead of the $64 used by the IMF (Energy Information Administration 2009). Note that the corresponding projections used by Cline (2009) use this higher oil price assumption but assume that there is some decline in the dollar as the safe-haven effect of the global financial crisis abates.

single trading partner and calling this "*the* exchange rate" is quite wrong for any country with reasonably diversified trade. This is a bilateral rate, in contrast to the effective rate, which gives a measure of a country's overall competitive position. None of this is to deny that competitiveness is also influenced by many other factors, like productivity, which are implicitly being held constant in the analysis of exchange rates. While productivity may be enhanced by a "strong" currency policy, as advocates of such a policy assert (though with little empirical evidence to substantiate their case), we do not believe that productivity is stimulated so much that a country pursuing this policy can hope to emerge with a balance-of-payments position that is strengthened as a result of its policy.

## ASSUMPTIONS

We make two main types of assumptions in our estimation of FEERs, apart from those embodied in the model that we use (notably Cline's 2008 SMIM). One type involves projections about what would occur if there were no changes in real exchange rates. The other type of assumption relates to the policy objectives that should be pursued by macroeconomic policy.

The projections come directly from the IMF's latest WEO (April 2009). In principle it would seem better to use the longest projections published by the Fund, in this case for 2014, on the ground that these build in a return of output levels to their cyclically normal positions. However, the IMF (2009) projects that in the out-years the US current account deficit will cycle around its projected 2009 level of 3 percent of GDP, rather than that a renewed overvaluation of the dollar will lead to a progressive deterioration in the US current account, which we believe to be overwhelmingly probable and is forecast by Cline's (2009) model of the US current account balance. Since we judge Cline (2009) to be correct in forecasting a renewed deterioration of the US balance, we are faced with a dilemma: Either we use 2009 or 2010 payments projections from the Fund and implicitly assume that the impact of cyclical factors is roughly the same in all countries and that there are no important recent exchange rate changes with J-curve effects being modeled by the Fund, or we use more-distant estimates that embody what we regard as unrealistic assumptions about the long-term impact of misalignments.

We have chosen a modified version of the second approach. While the IMF's figures for 2009 may be well grounded in fact, they have the crippling disadvantage for our purposes that they make no allowance for differing recoveries from cyclical weakness or for the working-out of J-curve effects from recent exchange rate changes. Instead, we combined the IMF's figures for 2012 with estimates from Cline's (2009) model of the expected increased US deficit and made assumptions about how this deficit is likely to be distributed as higher surpluses in other countries.[4] Our assumption is that the IMF figures are distorted by a false assumption that misalignments do not have balance-of-payments consequences only as regards the United States, although we are concerned that the problem of IMF payments projections being little more than extrapolations of the present may be more general.[5]

The April 2009 WEO was prepared on the basis of exchange rate data from February 25 to March 25, 2009. Because of this we have estimated the bilateral dollar exchange rates consistent with achievement of all FEERs as changes in dollar exchange rates compared to the average rates of March 2009.[6]

We do not believe that it would be fruitful to attempt to estimate the equilibrium exchange rates of the currencies of the oil-exporting countries, represented in our set of major economies by Saudi Arabia, Norway, Russia, and Venezuela. These rates depend negatively upon the countries' saving strategies and positively on the oil price. Saving strategies vary enormously from one country to another: Norway saves virtually all of an increment in the oil price, while Ecuador spends virtually everything and would face difficulties in the event of a protracted oil price decline. The world has to find a way to accommodate countries like Norway, since such a saving strategy reflects the transformation of natural, exhaustible resource wealth into wealth in the form of foreign assets. If exchange rate targeting came to be viewed as a way to cajole countries like Norway into acting contrary to their enlightened long-run interest and to force them into excessive adjustment, they would naturally be reluctant to participate. Sophisticated estimates of equilibrium exchange rates that avoided this danger would require knowledge and appraisal of the saving strategies of each oil exporter identified in the study. That would, at the least, require a detailed knowledge of each country that we do not claim to possess.

The other critical variable in estimating FEERs for oil exporters is the oil price. Here we have adopted the Department of Energy's assumptions (Energy Information Administration 2009) precisely because of a reluctance to stick out our own

4. Specifically, we assumed that a larger US surplus would be distributed among its trading partners in proportion to the value of their two-way trade with the United States, as explained above. We used 2012 figures, rather than those for 2014, because one can assume that most short-run effects will have worked themselves out by 2012 and that this is reflected in IMF forecasts, while more-distant figures become more speculative. In practice, however, they do not seem to be much different.

5. For example, the average absolute projected change for our 34 economies in the current balance over the 3-year period of 2009–12 is 1.7 percent of GDP, whereas the actual change over the preceding 2-year period of 2007–09 was more than twice as large (3.8 percent of GDP).

6. Data are not conveniently available for intramonth averages.

necks in making a forecast when this is not our field of expertise. It is better to restrict our task to that of estimating the equilibrium exchange rates of other countries, in the hope that these estimates are reasonably independent of the oil price.[7]

None of this diminishes our doubts about the policy of many oil exporters to peg their currencies to the dollar or supports the endorsement of this policy by some economists such as our colleague Mohsin Khan (2009). As Brad Setser has argued (2007), most of these countries would benefit both themselves and the world economy if they either floated their exchange rates or pegged them to a basket that contained both the currencies from which they buy their imports and the oil price.[8] This would not necessarily increase the total amount of adjustment that occurs (which should not be our aim), but it would make adjustment both more rapid and more focused on changes in the income and spending of the private sector. Perhaps most important, it would enable adjustment to occur without the inevitable side product of macroeconomic instability that accompanies adjustment under a dollar peg.

**The extreme and unusually synchronized global recession has also caused major reductions in oil and commodity prices, a second potentially important cause of changes in FEERs.**

Our other critical assumptions relate to the objectives that macroeconomic policy should seek. Pride of place here goes to the current account target a country pursues, because at least for a non–oil exporting economy this is the most important determinant of its equilibrium exchange rate. We started from a presumption that imbalances should generally not exceed 3 percent of GDP in the intermediate run. This has become a standard figure, so the first justification for using it is to avoid basing our conclusions on assumptions that are at variance with the conventional wisdom. But one should also ask whether its adoption as conventional wisdom is sound. The answer is that there is at least a modicum of statistical support to justify the contention that most countries should not accept deficits exceeding 3 percent of GDP on a long-run basis.[9] If one does not wish the burden of adjustment to fall overwhelmingly on deficit countries, then one needs to have a roughly symmetrical rule applying to surplus countries.

However, we also see some logic in the IMF's third approach to estimating equilibrium exchange rates (Lee et al. 2008), which seeks to stabilize the ratio of net foreign assets (NFA) to GDP.[10] As we stated last year (Cline and Williamson 2008), we do not believe it generally makes sense to aim to stabilize NFA/GDP, but we are sympathetic to the aim accomplished by this rule of excluding Ponzi strategies, especially in highly indebted countries. We have therefore decided to employ a supplementary rule that states that a country should be allowed a surplus or deficit larger than 3 percent of GDP, but only if this is consistent with it not increasing its ratio of net foreign assets or liabilities to GDP. We apply this rule to surplus/creditor countries as well as to deficit/debtor countries to maintain some symmetry in adjustment obligations. This results in large creditor countries like Singapore and Switzerland, as well as large debtor countries like Australia and New Zealand, being allowed to run larger imbalances than 3 percent of GDP, but it limits the size of those imbalances in a less arbitrary way than the method adopted last year. It also allows other large creditor countries similar treatment: The three that "benefit" in practice are all in Greater China (mainland China, Hong Kong, and Taiwan).

Table 1 (page 11) presents the data used to calculate the current account targets. Column 1, included purely for perspective, shows the IMF's (2009) estimate of what the actual current

7. Our estimates of FEERs made with the IMF's oil price assumptions, which are not presented here, were quite close to those presented in this policy brief using the Department of Energy's assumptions. This provides some support for our hope that our FEERs estimates are reasonably independent of the oil price.

8. However, simulations suggest that the 50 percent weight on the oil price suggested by Setser (2007) would be far too high. A reasonable value in our view would fall in the range of 10 to 15 percent.

9. For emerging-market economies, Reinhart, Rogoff, and Savastano (2003) identify 40 percent as a critical threshold for external debt relative to GDP, beyond which countries have tended to be vulnerable to default. External debt stabilizes at a debt-to-GDP ratio that equals the ratio of the current account deficit as a percent of GDP to the nominal growth rate of GDP in foreign currency. With emerging-market growth rates typically in the range of 4 to 5 percent and world inflation at 2½ percent in dollars or euros, nominal GDP growth in foreign currency is typically on the order of 7 percent. Forty percent of this growth rate is about 3 percent, so the critical debt-to-GDP ratio translates into a current account deficit of about 3 percent of GDP. For industrial countries, Freund (2000) found that reversals of deficits tend to begin at a threshold of 5 percent of GDP and involve a slowdown in growth in the adjustment period. Mann (1999, 156) has identified 17 episodes in the 1980s and 1990s when a widening of the current account deficit of industrial countries was reversed; the average ratio of the current account deficit to GDP was 4.5 percent when the reversal began (although she emphasized that the turning points were not necessarily the threshold of unsustainability). For the important case of the United States, Cline (2005, 172–74) argued that 3 percent of GDP is a prudent long-term ceiling for the current account deficit despite the national advantage in the past of earning a higher return on foreign assets than it paid on liabilities, plus favorable valuation effects from exchange rate changes. Williamson (2004, 30) and Mussa (2005, 189) set the ceiling at 2 to 2.5 percent of GDP.

10. The IMF's (Lee et al. 2008) other two methods of estimating equilibrium exchange rates are discussed below.

account imbalance will be in 2009 as a percentage of GDP. Column 2 shows the Fund's forecast of 2012 GDP in dollars at market exchange rates. Column 3 shows the IMF's forecast of 2012 current account balance as a percentage of GDP. Column 4 adjusts that figure to take account of (a) the move toward surplus that would be the counterpart to the higher US non-oil deficit forecast by Cline (2009) and (b) the higher oil price assumed by Cline (2009). Column 5 shows the current account that would keep NFA/GDP unchanged.[11] Column 6 shows our consequential figure for the target current account as a percent of GDP. This column will be further explained below.

Given these two rules—current account surpluses or deficits should generally not exceed 3 percent of GDP in the intermediate run, but larger imbalances are permitted if the surplus or deficit is consistent with not increasing the country's absolute NFA/GDP ratio—it is possible to classify in the following way the 30 non–oil exporting countries whose FEERs we are seeking to establish:

- Fifteen economies have projected 2012 imbalances (after adjusting for the greater US deficit and increased oil price) no greater than 3 percent of GDP in absolute terms. We regard it as appropriate to leave these countries alone, and have accordingly assigned them a preliminary target equal to the current projection.
- Seven countries (Australia, New Zealand, India, South Africa, Poland, Chile, and the United Sates) have projected adjusted deficits for 2012 in excess of 3 percent of GDP. We then look at column 5 of table 1: If maintenance of a constant NFA/GDP is consistent with a deficit larger than 3 percent of GDP (as it is for Australia, New Zealand, and marginally Poland), the target is either that larger deficit or the actual projection, whichever is smaller in absolute value. Otherwise, we assume (in this preliminary calculation) that the country should reduce its deficit to 3 percent of GDP.
- Eight non–oil exporting economies (China, Hong Kong, Malaysia, Singapore, Taiwan, Sweden, Switzerland, and Canada) have projected adjusted surpluses in excess of 3 percent of GDP. We again compare the results with column 5 and allow a surplus up to that size. Otherwise, we assume (in the preliminary calculation) that the surplus should be reduced to 3 percent of GDP.

This provides preliminary targets for our 30 economies. As stated above, we did not attempt to formulate targets for the four countries whose exports are dominated by oil.

On this basis, however, the world would be targeting an aggregate $92 billion worsening in its current account. To prevent this inconsistency we have distributed that sum proportionately to GDP among our 30 countries (adding 0.2 percent of GDP to the target of each) to calculate the final current account targets as a percentage of GDP, which are shown in column 6 of table 1.

For most countries, this method is most similar to the first of the three methodologies employed by Lee et al. (2008) in their description of the methodologies used by the IMF's Consultative Group on Exchange Rate Issues (CGER) to assess equilibrium exchange rates. Their macroeconomic balance approach differs in two important ways from our approach. First, it uses an econometric rather than a judgmental approach to determine current account targets. Second, it uses estimated country-specific responses of the trade balance to the real exchange rate rather than the more-standard responses for each country that we postulate.

So far as the first difference is concerned, Lee et al. (2008) use an estimated equation with arguments of fiscal balance, demographics, net foreign assets, oil balance, economic growth, economic crises, and whether a country is a financial center to determine the current account targets for 54 advanced and emerging-market countries. It is inevitable that the staff of an international organization will seek to use a formula rather than judgment in such a sensitive exercise. Our judgments are of course influenced by what seems reasonable in light of factors similar to some of those used in the IMF's equation, but we nevertheless chose a judgmental approach. Estimation reflects what actually happened rather than what should have happened. However, the results of the IMF's equation offend normative sense. These results average to a current account target of +0.3 percent of GDP for advanced countries in Europe, –1.9 percent of GDP for all other advanced countries (dominated by the United States), +1.3 percent for emerging markets in Asia, –0.3 percent for Latin America, and –2.8 percent for Central and Eastern Europe (Lee et al. 2008, 7). But surely it is hardly normative for Asian emerging-market countries to run sizable surpluses rather than to receive net capital inflows to assist in their development, any more than it is normative for advanced economies outside of Europe to run deficits or the countries of Central and Eastern Europe to have had such large deficits as to generate crises.

11. This was calculated as follows. First, the medium-term rate of real GDP growth was assumed to be equal to the 2001–07 average. Second, global dollar inflation was assumed to be equal to 2 percent per year to arrive at the expected rate of growth of nominal dollar GDP. The ratio of the current account surplus (or deficit) to GDP, expressed as a percent, to the percent nominal GDP growth rate can then be as large as the ratio of net foreign assets to GDP without causing a long-run (absolute) spiraling upward of the NFA ratio. Essentially the current account as a percent of GDP relative to nominal GDP growth determines the marginal NFA ratio, and so long as it is no greater than the average ratio, that ratio will remain within current limits.

We would not deny that it is conceptually preferable to use estimated country-specific elasticities rather than our approach of using standard assumptions. But we believe that the uncertainties of estimating elasticities are such as to give minimal advantage to the IMF approach.

The second of the IMF's approaches amounts to estimating a behavioral equilibrium exchange rate (BEER), which, as we argued in Cline and Williamson (2008), we regard as appropriate only if it can be argued that on average the exchange rate was in equilibrium over the period in question.

The third approach employed by the IMF aims to stabilize NFAs as a proportion of GDP at an appropriate level. In practice, the IMF has interpreted that as stabilizing NFA/GDP at its 2006 level.[12] As the IMF study concedes (Lee et al. 2008, 15–16), this has little normative content since it may be optimal to raise or lower the level of NFA/GDP, but the method does have the virtue of ruling out Ponzi strategies. As stated above, we make use of this insight in calculating the targets for countries with large assets or debts (absolutely large NFA/GDP ratios).

**The US dollar reverted to a position of considerable overvaluation early in 2009.**

## NATURE OF THE MODEL EMPLOYED

Cline (2008) developed a symmetric matrix inversion method (SMIM) model to calculate FEERs for 34 economies. This method is symmetric in that it gives equal weight to each country in arriving at the realignment to FEERs, rather than (as in Cline 2007) requiring exact achievement of the adjustment target for the United States and then solving for partner exchange rate changes that would be both broadly consistent with this requirement and also roughly consistent with the other current account targets.

The model is based on two sets of relationships. The first is economic: The current account depends on the real effective exchange rate.[13] The second is essentially algebraic: Any set of effective exchange rates has a direct mapping to a corresponding set of bilateral exchange rates against the dollar, and there must be consistency not only between all of the desired changes in effective exchange rates but also between the resulting changes in all bilateral rates in a realignment to FEERs.

The economic relationship states that the change in the current account as a percent of GDP will be equal to the percentage change in the effective exchange rate, multiplied by a country-specific impact parameter. The impact parameter equals the export price elasticity multiplied by the share of exports in GDP. As noted above, export elasticities in Lee et al. (2008) are specially tailored to each economy, thus being able in principle to reflect such factors as idiosyncrasies of greater or lesser exchange rate responsiveness (including, for example, influences of product composition as well as exchange rate pass through) of the economy's principal trading partners. In our work, however, the export price elasticity is assumed to follow a standard formula set at unity for a relatively closed economy with exports amounting to 10 percent of GDP, and falling to 0.5 (because of increasing supply constraints) for a highly open economy, with exports equal to 100 percent of GDP or more.[14]

The overall effect is that the impact parameter varies from about a 0.15 percent of GDP change in the current account for each percentage point change in the effective exchange rate for a relatively closed economy to a maximum of a 0.5 percent of GDP change per percentage point change in the effective exchange rate for a highly open economy. In the case of China, for example, we estimate an impact parameter of a 0.3 percent of GDP reduction in the current account surplus for a 1 percentage point appreciation in the real effective exchange rate.[15] If the target external adjustment is a reduction in the current account surplus by 6 percent of GDP, the target effective exchange rate appreciation will need to be 6/(0.3) = 20 percent.

The first step in the analysis, identification of the target change in each country's real effective exchange rate (REER), is thus simple. For each country, the change equals the desired change in the current account as a percent of GDP divided by the elasticity-based impact parameter. The problem then becomes more complicated, however, when consistency is imposed on all of the resulting changes in REERs. Changing the REER for any given country necessarily changes those of its trading partners.

12. 2006 was the last year for which complete data were available when Lee et al. (2008) was published.

13. This relationship focuses on the relative price or "elasticity" effect in determination of trade. There is a parallel shadow "absorption" effect that must also be consistent, involving the national accounts identity whereby net imports equal investment minus saving (including public). Implicitly the focus on the effective exchange rate in external-sector adjustment assumes that parallel influences on domestic demand, such as a fiscal adjustment, take place to facilitate external adjustment and maintain the economy at full capacity.

14. For the United States, the estimates use an impact parameter derived from a much more complete model and include capital income effects from cumulative changes in net foreign liabilities.

15. To calculate the effective exchange rate, the importance of each of the 34 trading partners in the trade turnover (exports plus imports) of a country is calculated from a matrix of bilateral trade flows.

The second part of the analysis, then, involves a set of algebraic relationships among individual economies' effective exchange rates, and between bilateral and multilateral effective exchange rate changes. If a currency appreciates by, say, 10 percent against the dollar in isolation, its effective appreciation against all trading partners also equals the bilateral appreciation, or 10 percent. But if other trading partners also appreciate, the home country's appreciation in effective terms will be diminished by an amount that depends on the importance of the other appreciating countries as trading partners. This influence turns out to be particularly important when considering possible corrective changes in exchange rates in East Asia. Bilaterally against the dollar, some of the indicated changes can be quite large, but because several regional trading partners also show sizable bilateral appreciations against the dollar in order to reach adjustment targets, the corresponding effective exchange rate changes are considerably smaller, and thus likely not as daunting in policy terms.

The SMIM model solves for a set of bilateral exchange rate changes against the dollar ($z_i$, for country $i$) that is consistent with a target set of changes in effective exchange rates ($r_i$). It turns out that this solution is the answer to a matrix algebra problem, in which the bilateral exchange rate changes (in percent), the effective exchange rate changes (in percent), and a matrix of trade weights enter in the equation.[16] It also turns out that there is not one single solution to this problem. With 35 economies, the number considered in this study (counting the rest of the world as an economy), there are 35 possible alternative solutions. The reason is that there are 35 equations for target effective exchange rate changes (one for each country, in light of its target current account change and impact parameter) but only 34 unknown exchange rate changes against the dollar, because the dollar cannot change against itself (in the jargon of the exchange rate literature, it is the numeraire). Our approach to dealing with this problem of "overdetermination" is simply to average the alternative possible sets of exchange rate changes.[17]

## RESULTS

The results of these calculations are shown in table 2 (page 12). The first column shows the target change in the current account balance as a percentage of GDP and is simply the difference between column 6 and column 4 of table 1. The adjacent column shows how close the simulations of the model came to achieving the targets laid out. This simulation gives an equal weight to all the 34 countries in meeting the targets of column 1. Because of this, the United States may in principle somewhat overachieve or underachieve its needed adjustment.

Column 3 shows our estimates of the target changes in the multilateral exchange rates in March 2009, derived from the target changes in the current account in 2012 and the impact parameters. Column 4 shows the corresponding model estimates that approximate each country's target as closely as possible while ensuring consistency across countries. A positive number indicates that the currency of the area in question needed to appreciate and thus that the currency was undervalued. A negative number indicates that the currency needed to depreciate, which implies that it was overvalued. The largest undervaluations are estimated to be those of China (with a needed appreciation of 21.4 percent), Malaysia (18 percent), Taiwan (13.8 percent), Switzerland (12.7 percent), Sweden (12.6 percent), and Singapore (10.6 percent). The largest overvaluations are estimated to be those of the United States (with a needed depreciation of 17.4 percent), South Africa (13.2 percent), and Australia (11.9 percent). All other misalignments are estimated to be in single digits; all except one of these is less than 5 percent.

Column 5 shows the actual dollar exchange rates in March 2009. Column 6 presents the results of applying Cline's SMIM model to estimate the percentage changes needed in the dollar exchange rates. These are quite large appreciations except for some of those countries close to the United States (whose trade is therefore dominated by US trade) and may involve significant appreciation even for countries like South Africa that are estimated to need a large effective depreciation. This reflects the fact that Cline's model shows that the US dollar needs a substantial depreciation from its value in March 2009 in order to forestall the reemergence of a large US deficit. It had already accomplished over a tenth of the needed decline by mid-May.

The final column translates these changes into a form that will be familiar to connoisseurs of the particular economies involved, the FEER-equivalent dollar exchange rates. These are usually expressed as units of local currency per dollar, though

16. Namely: $Z = B^{-1}R$, where $Z$ is a vector of bilateral exchange rate changes against the dollar (percentages), $R$ is a vector of effective exchange rate changes (percentages), and $B = I - A$ where $B$ is the matrix obtained by subtracting the trade-weights matrix $A$ from the identity matrix $I$.

17. There is a single exception, for each currency. Of the 35 solutions, the average for the currency in question is that of the 34 equations in which the country has been included. The remaining equation omits the direct effective rate equation for the country and only obtains the country's bilateral exchange rate change indirectly as needed to generate the set of effective exchange rate changes sought for the other countries. The average of the 34 results with Own Country Included, or 34OCI, is used as the estimate of the bilateral exchange rate change for the country in question, because the one Own Country Excluded (OCE) result systematically turns out to be unrepresentative. The OCE estimate is always lower than the 34OCI average, in some cases absurdly so. With the 34OCI estimates in hand for each of 35 economies' exchange rate change against the dollar (except for the dollar itself, which is zero), the corresponding set of effective exchange rate changes is then calculated. Because of the overdetermination problem, this estimated consistent set shows divergences from the target set of effective exchange rate changes. These divergences are generally small, however.

where it has been traditional to express them the other way around (Australia, New Zealand, the euro area, and the United Kingdom) we follow suit.[18]

Comparing these estimates with the central simulation presented a year ago (Cline and Williamson 2008), we can see that the euro's FEER-equivalent dollar rate is estimated to be much the same ($1.53 now versus $1.47 last year). The yen's FEER-equivalent dollar rate is estimated to be substantially stronger (82 now versus 90 yen to the dollar last year), as is the estimate for the renminbi's FEER-equivalent dollar rate (4.88 now versus 5.45 last year). Against this are substantial declines in the estimated FEER-equivalent rates of the United Kingdom (then $1.91 versus $1.65 now), Canada (C$1.02 to C$1.18), Mexico (10.6 pesos to 14.0 pesos), and Korea (850 won to 1,197 won).

**The only large countries that display large imbalances and therefore pose systemic threats are the United States and China.**

Since this is the first occasion on which we have been able to test the frequently repeated complaint that it would be impossible to estimate FEERs because they are ill-defined, we compare our estimates from last year (Cline and Williamson 2008) with those made now. It is of course true that the similarity of estimated FEERs does not prove that the estimation is valid: It could be that similar ill-justified conventions have been used on both occasions. Nevertheless, this test seems to be a way of getting at an estimate of the minimum degree of uncertainty that has to be expected in estimating FEERs.

The differences between last year's and this year's estimates, measured as the percentage change from last year's figure, are presented in table 3 (page 13). There are 29 estimates—one for each of the non–oil exporter currencies except the numeraire—to be considered. The results show that after correcting for differential inflation, only 15 of the 29 estimates lie within 10 percent of last year's figure and no less than four lie more than 20 percent away.

An analysis of the cases where changes in FEER-equivalent dollar rates were greater than 10 percent from 2008 to 2009 reveals several possible causes of these changes. First, there are new rules for external targets in this round of FEERs estimations, so a large divergence may be expected in some cases (e.g., Singapore, New Zealand, and Australia). Second, the wide latitude allowed in the range for the current account target, from minus to plus 3 percent of GDP, has permitted a sharp depreciation to occur without triggering the diagnosis of a need for revaluation (e.g., the United Kingdom, Indonesia, and Korea). Third, some major changes in exchange rates have occurred with minimal changes between last year's IMF current account projection for 2009 (IMF 2008) and this year's IMF projection for 2012. In this category, we suspect that there are large pipeline effects not taken into account by the IMF (e.g., Canada, Chile, Brazil, and Mexico).[19] It may be that the IMF staff are reluctant to forecast large changes in current account balances on the basis of what they assume to be temporary exchange rates (like the overvalued Brazilian real in 2008 or the gross undervaluation of the Korean won in March 2009), but if so the inadvertent consequence is to diminish the value of using an analysis that is supposed to be based on the assumption that existing exchange rates hold into the indefinite future. Note that China may also be in the category of inadequate pipeline effects, but in the other direction, because its projected current account surplus has remained essentially unchanged despite a sizable real appreciation from the 2008 level, which was caused by pegging to the dollar at an unchanged level as the dollar appreciated (riding the dollar up).

It turns out that there is a systematic and very strong tendency for changes in the FEERs estimated in 2008 versus 2009 to move in parallel to actual changes in the REERs over the period of February 2008 to March 2009; the correlation is 0.91. In other words, an important reason that some countries are found to have much weaker FEERs is that their actual REERs depreciated significantly during the year. This could be due to three reasons. The first, a benign reason, is built into our methodology as noted above: To the extent that the depreciation causes a stronger predicted current account within the range –3 to +3 percent of GDP, we simply accept the improvement and do not ask for a reversal. A second, more-malign reason is also possible, and that is a tendency for the IMF to project forward essentially unchanged current accounts rather than to build in the effects of misaligned exchange rates in producing ever-larger current account imbalances. For example, the latest WEO (IMF 2009) projections show the Korean current account surplus approaching 3 percent of GDP this year and then remaining around that level out to the year 2014.[20] If in fact the won stayed at the highly undervalued level of March 2009 out to 2014 as assumed by the IMF, we would project a far-larger surplus than this. But this

18. Canada is ambiguous: Our 1.18 is Canadian dollars per US dollar, equivalent to 85 US cents per Canadian dollar.

19. The cases of Canada and Mexico are of particular importance because their large shares in US trade result in large allocations to them of additional surpluses corresponding to the increment in the US deficit above that projected by the IMF.

20. The IMF throws in a small, essentially random variation for Korea and some other, but not all, countries.

projection is not in the baseline that we use, and without the quite-unrealistic project of building our own global macroeconomic model or a reform in the practices of the IMF we are liable to show FEERs following REERs to an unrealistic extent.

The third, and another benign, reason might help explain the major changes between the FEERs estimated last year and the current estimates: Changes in the world economy may have actually changed prospective FEERs. To the extent that the prospects of commodity prices, for example, have actually changed, as reflected in the IMF's assumptions, one may hope that estimated FEERs will have changed accordingly.[21] But this clearly means that one should not expect the FEER-equivalent rates to remain unchanged from one year to the next. Unfortunately there is no obvious way of disentangling the impact of these three possible reasons for FEERs to have altered.

The analysis is of particular interest in the case of China, which continues to have a large projected imbalance. Unlike the other large country with a large imbalance, the United States, China appears to show inconsistent results from one year to the next. Last year we showed the United States needing to depreciate another 7 percent to reach its FEER (Cline and Williamson 2008). In fact it appreciated around 10 percent from February 2008 to March 2009, and this time we show it needing to depreciate around 17 percent, which is broadly consistent. We argued last year that China needed to appreciate around 19 percent on an effective basis, a figure that has risen to 21 percent in this year's calculations despite an intervening real appreciation of 14 percent[22] and despite the fact that differential inflation has enlarged this gap by almost 1 percent. One possible explanation for this finding is the collapse of raw material prices, of which China is a heavy importer. Another factor that might help explain this inconsistency is an apparent tendency to underestimate the pipeline effects in IMF projections. If last year's figure was broadly correct, then the main need to effect Chinese adjustment is to peg the effective exchange rate so as to avoid depreciating again with the dollar if and when the latter adjusts. If we are nearer the mark this year, then there is still a need for additional movement against all currencies, so it will be important to resume regular crawling revaluations as well.

## CONCLUSION

Although the degree of uncertainty is greater than would be desired, it does seem possible to reach some basic conclusions that depend on the basic structure of Cline's model rather than the details. In particular:

- The US dollar reverted to a position of considerable overvaluation early in 2009. There can be no reasonable expectation that the world will emerge from its financial crisis without a resurrection of the global imbalances unless this overvaluation is corrected. Every single other currency that we examined needs to appreciate against the dollar.
- Although the overvaluation relative to Europe had reemerged during the crisis, the bulk of the imbalance is vis-à-vis Asian countries, most conspicuously China. It is they who need the large appreciations, and the strong stimuli to domestic demand that has to go with them, if the world is to achieve macroeconomic balance.
- For most countries the increase in their bilateral dollar exchange rates far exceeds the increase in their effective exchange rates. Indeed, currencies such as the euro, rupee, yen, and rand would combine a sizable bilateral appreciation against the dollar with an effective depreciation in the sort of realignment envisaged here.
- The only large countries that display large imbalances and therefore pose systemic threats are the United States and China. For China, it is possible there are unrealized pipeline effects, which would mean that the further exchange rate action needed is substantially less than calculated here. We are skeptical, however, that these effects would be sufficient to reduce the projected surplus so sharply as to largely eliminate the need for further appreciation in order to reach the target current account levels.[23] What is clear, however, is that after the highly appropriate effective appreciation, it is important that China changes its peg from the dollar to a basket to stabilize the effective rate. Alternatively, it should resume the upward crawl of the peg against the dollar. Unfortunately the most recent evidence points in the other direction, as the policy over the past several months of keeping the renminbi unchanged against the dollar has remained intact despite the dollar's reversal toward a declining trend subsequent to its peak in early March.[24] China has again begun to ride the dollar down.

21. China seems a likely beneficiary of such an effect.

22. This figure is similar to the JPMorgan estimate and only slightly larger than the one from the Bank for International Settlements, though Citi actually shows a depreciation of China's real effective rate.

23. If the IMF has included no pipeline effects whatsoever of the 14 percent effective appreciation of the renminbi from February 2008 to March 2009, potentially the surplus by 2012 would be 4.2 percent of GDP smaller than in the Fund's projections (applying China's impact coefficient of 0.3). However, with lower prospective commodity prices than seemed likely last year, the lower cost of China's commodity imports could account for a significant offset to the surplus reduction otherwise to be expected from the real appreciation.

24. The Federal Reserve's broad index of the nominal dollar against major currencies peaked on the same day as the recent trough of the US stock market, on March 9. The subsequent reversal in both the currency and the financial markets provides timing evidence supporting the notion of the safe-haven effect as a major source of the rise of the dollar from early 2008 to early 2009.

## REFERENCES


Ahearne, Alan, William R. Cline, Kyung Tae Lee, Yung Chul Park, Jean Pisani-Ferry, and John Williamson. 2007. *Global Imbalances: Time for Action*. Peterson Institute for International Economics Policy Brief 07-4. Washington: Peterson Institute for International Economics.

Cline, William R. 2005. *The United States as a Debtor Nation*. Washington: Institute for International Economics.

Cline, William R. 2007. Estimating Reference Exchange Rates. Paper prepared for the workshop on Policies to Reduce Global Imbalances, sponsored by Bruegel, the Korea Institute for International Economic Policy, and the Peterson Institute for International Economics, Washington, February 8–9.

Cline, William R. 2008. *Estimating Consistent Fundamental Equilibrium Exchange Rates*. Peterson Institute for International Economics Working Paper 08-6. Washington: Peterson Institute for International Economics.

Cline, William R. 2009. Long-Term Fiscal Imbalances, US External Liabilities, and Future Living Standards. In *The Long-Term International Economic Position of the United States*, ed., C. Fred Bergsten. Washington: Peterson Institute for International Economics.

Cline, William R., and John Williamson. 2008. *New Estimates of Fundamental Equilibrium Exchange Rates*. Peterson Institute for International Economics Policy Brief 08-7. Washington: Peterson Institute for International Economics.

Energy Information Administration. 2009. Forecasts and Analyses. Washington: Department of Energy. Available at www.eia.doe.gov (accessed on May 28, 2009).

Freund, Caroline L. 2000. *Current Account Adjustment in Industrialized Countries*. International Finance Discussion Papers no. 692 (December). Washington: Federal Reserve Board.

IMF (International Monetary Fund). 2008. *World Economic Outlook* (April). Washington.

IMF (International Monetary Fund). 2009. *World Economic Outlook* (April). Washington.

Khan, Mohsin S. 2009. *The GCC Monetary Union: Choice of Exchange Rate Regime*. Peterson Institute for International Economics Working Paper 09-1. Washington: Peterson Institute for International Economics.

Lee, Jaewoo, Gian Maria Milesi-Ferreti, Jonathan David Ostry, Alessandro Prati, and Luca Antonio Ricci. 2008. *Exchange Rate Assessments: CGER Methodologies*. IMF Occasional Papers no. 261 (April). Washington: International Monetary Fund.

Mann, Catherine L. 1999. *Is the US Trade Deficit Sustainable?* Washington: Institute for International Economics.

Mussa, Michael. 2005. Sustaining Global Growth While Reducing External Imbalances. In *The United States and the World Economy: Foreign Economic Policy for the Next Decade*, ed. C. Fred Bergsten. Washington: Institute for International Economics.

Reinhart, Carmen M., Kenneth S. Rogoff, and Miguel A. Savastano. 2003. *Debt Intolerance*. Brookings Papers on Economic Activity 1 (Spring): 1–74. Washington: Brookings Institution.

Setser, Brad. 2007. *The Case for Exchange Rate Flexibility in Oil-Exporting Economies*. Policy Briefs in International Economics 07-8. Washington: Peterson Institute for International Economics.

Williamson. John. 2004. Current Account Objectives: Who Should Adjust? In *Dollar Adjustment: How Far? Against What?* eds. C. Fred Bergsten and John Williamson. Special Report 17. Washington: Institute for International Economics.

**Table 1 Target current accounts (CA) for 2012**

| Country | IMF projection of 2009 CA (percent of GDP) | IMF 2012 GDP forecast (billions of US dollars) | IMF 2012 CA forecast (percent of GDP) | Adjusted CA (percent of GDP) | CA to keep NFA/GDP constant (percent of GDP) | Target CA (percent of GDP) |
|---|---|---|---|---|---|---|
| Pacific | | | | | | |
| Australia | –5.8 | 780 | –5.1 | –5.2 | –3.3 | –3.1 |
| New Zealand | –7.8 | 95 | –4.7 | –5.3 | –5.4 | –5.1 |
| Asia | | | | | | |
| China | 10.3 | 6,635 | 10.6 | 10.5 | 4.0 | 4.2 |
| Hong Kong | 7.2 | 236 | 6.1 | 7.1 | 16.4 | 7.3 |
| India | –2.5 | 1,441 | –2.8 | –3.6 | –0.9 | –2.8 |
| Indonesia | –0.4 | 581 | –1.0 | –1.3 | –1.8 | –1.1 |
| Japan | 1.5 | 4,897 | 1.8 | 1.4 | 1.7 | 1.6 |
| Korea | 2.9 | 826 | 3.1 | 1.9 | –1.7 | 2.1 |
| Malaysia | 12.9 | 255 | 10.2 | 12.0 | 1.1 | 3.2 |
| Philippines | 2.3 | 184 | 0.7 | 0.1 | –1.0 | 0.2 |
| Singapore | 13.1 | 211 | 12.5 | 12.6 | 7.3 | 7.5 |
| Taiwan | 9.7 | 382 | 11.9 | 13.3 | 7.3 | 7.5 |
| Thailand | 0.6 | 320 | –0.2 | –1.2 | –1.5 | –1.0 |
| Middle East/Africa | | | | | | |
| Israel | 1.1 | 227 | 0.4 | 0.3 | –0.3 | 0.5 |
| Saudi Arabia | –1.8 | 513 | 12.2 | 25.4 | — | 25.4 |
| South Africa | –5.8 | 278 | –6.6 | –7.6 | –2.0 | –2.8 |
| Europe | | | | | | |
| Czech Republic | –2.7 | 189 | –2.2 | –2.9 | –2.3 | –2.8 |
| Euro area | –1.1 | 12,329 | –0.7 | –1.2 | –0.6 | –1.0 |
| Hungary | –3.9 | 158 | –2.4 | –2.8 | –5.5 | –2.6 |
| Norway | 11.0 | 386 | 12.2 | 17.3 | — | 17.3 |
| Poland | –4.5 | 450 | –3.3 | –4.1 | –3.1 | –2.9 |
| Russia | 0.5 | 1,730 | 0.8 | 4.0 | — | 4.0 |
| Sweden | 6.9 | 410 | 7.8 | 7.6 | 0.1 | 3.2 |
| Switzerland | 7.6 | 446 | 9.8 | 9.9 | 5.3 | 5.4 |
| Turkey | –1.2 | 579 | –2.3 | –3.0 | –3.4 | –2.8 |
| United Kingdom | –2.0 | 2,245 | –1.0 | –0.7 | –1.1 | –0.5 |
| Western Hemisphere | | | | | | |
| Argentina | 1.0 | 341 | 1.9 | 2.4 | 0.8 | 2.6 |
| Brazil | –1.8 | 1,474 | –1.5 | –1.4 | –2.0 | –1.2 |
| Canada | –0.9 | 1,364 | 0.1 | 3.9 | –0.4 | 3.2 |
| Chile | –4.8 | 169 | –3.8 | –4.8 | –0.2 | –2.8 |
| Colombia | –3.9 | 235 | –2.5 | –1.1 | –1.4 | –1.0 |
| Mexico | –2.5 | 984 | –1.7 | 2.0 | –1.7 | 2.2 |
| United States | –2.8 | 15,390 | –3.4 | –5.6 | –1.0 | –2.8 |
| Venezuela | –0.4 | 322 | 6.6 | 11.6 | — | 7.7 |

*Sources:* IMF (2009) and authors' calculations.

**Table 2 Results of the simulation**

| Country | Changes in current account as percent of GDP | | Change in REERs (percent) | | Dollar exchange rate | | FEER–equivalent dollar rate |
|---|---|---|---|---|---|---|---|
| | Target change | Change in simulation | Target change | Change in simulation | Actual, March 2009 | Percent change | |
| Pacific | | | | | | | |
| Australia[a] | 2.1 | 2.1 | –12.2 | –11.9 | 0.67 | 9.1 | 0.73 |
| New Zealand[a] | 0.2 | 0.1 | –0.7 | –0.4 | 0.53 | 16 | 0.62 |
| Asia | | | | | | | |
| China | –6.3 | –6.4 | 21.2 | 21.4 | 6.84 | 40.2 | 4.88 |
| Hong Kong | 0.2 | 0.1 | –0.3 | –0.2 | 7.75 | 28 | 6.06 |
| India | 0.7 | 0.7 | –5.2 | –4.9 | 51.1 | 14.2 | 44.8 |
| Indonesia | 0.2 | 0.1 | –0.6 | –0.4 | 11,922 | 22.8 | 9,707 |
| Japan | 0.2 | 0.1 | –1.5 | –1.2 | 98 | 19.2 | 82 |
| Korea | 0.2 | 0.1 | –0.5 | –0.3 | 1,450 | 21.1 | 1,197 |
| Malaysia | –8.9 | –9 | 17.7 | 18 | 3.67 | 39.6 | 2.63 |
| Philippines | 0.2 | 0.1 | –0.4 | –0.2 | 48.5 | 21.3 | 40 |
| Singapore | –5.1 | –5.3 | 10.3 | 10.6 | 1.53 | 33.5 | 1.15 |
| Taiwan | –5.8 | –5.9 | 13.6 | 13.8 | 34.3 | 36.4 | 25.2 |
| Thailand | 0.2 | 0.1 | –0.4 | –0.1 | 35.7 | 21.3 | 29.5 |
| Middle East/Africa | | | | | | | |
| Israel | 0.2 | 0.1 | –0.5 | –0.3 | 4.17 | 13.1 | 3.69 |
| Saudi Arabia | — | –0.1 | — | 0.2 | 3.76 | 18.6 | 3.17 |
| South Africa | 4.8 | 4.7 | –13.4 | –13.2 | 9.95 | 5 | 9.48 |
| Europe | | | | | | | |
| Czech Republic | 0.2 | 0.1 | –0.4 | –0.2 | 21 | 17.4 | 17.90 |
| Euro area[a] | 0.2 | 0.1 | –1.2 | –0.9 | 1.31 | 17.1 | 1.53 |
| Hungary | 0.2 | 0.1 | –0.4 | –0.2 | 234 | 17.9 | 198 |
| Norway | — | –0.1 | — | 0.1 | 6.79 | 18.1 | 5.74 |
| Poland | 1.2 | 1.1 | –3.6 | –3.4 | 3.56 | 14.7 | 3.1 |
| Russia | — | –0.1 | — | 0.2 | 34.8 | 19.1 | 29.3 |
| Sweden | –4.4 | –4.5 | 12.4 | 12.6 | 8.57 | 29.4 | 6.62 |
| Switzerland | –4.5 | –4.5 | 12.6 | 12.7 | 1.16 | 28.9 | 0.9 |
| Turkey | 0.2 | 0.1 | –0.6 | –0.5 | 1.71 | 17.4 | 1.46 |
| United Kingdom[a] | 0.2 | 0.1 | –0.7 | –0.6 | 1.42 | 16.2 | 1.65 |
| Western Hemisphere | | | | | | | |
| Argentina | 0.2 | 0.1 | –0.7 | –0.4 | 3.66 | 15.3 | 3.17 |
| Brazil | 0.2 | 0.1 | –1.1 | –0.7 | 2.32 | 14.7 | 2.02 |
| Canada | –0.7 | –0.8 | 2.3 | 2.4 | 1.26 | 7.6 | 1.18 |
| Chile | 2 | 1.9 | –6.4 | –6.1 | 603 | 9.8 | 549 |
| Colombia | 0.2 | 0.1 | –0.9 | –0.6 | 2,498 | 10.8 | 2,255 |
| Mexico | 0.2 | 0.1 | –0.7 | –0.6 | 14.6 | 4.4 | 14 |
| United States | 2.8 | 2.7 | –17.7 | –17.4 | 1 | — | 1 |
| Venezuela | — | –0.1 | — | 0.2 | 2.14 | 10.8 | 1.94 |

a.These countries have their currencies expressed as dollar per currency. All other currencies are expressed as currency per dollar.

*Source:* Authors' calculations.

**Table 3 Changes in the estimates of the FEER–equivalent dollar rate**

| | FEER–equivalent dollar exchange rate | | | |
|---|---|---|---|---|
| Country | Estimated 2008 | Estimated 2008, inflation adjusted | Estimated 2009 | Appreciation of FEER–equivalent dollar rate |
| 0–5 percent change | | | | |
| Taiwan | 25.1 | 24.9 | 25.2 | –0.9 |
| Hong Kong | 6.05 | 6.12 | 6.06 | 1 |
| Switzerland | 0.88 | 0.88 | 0.9 | –2.3 |
| Argentina | 3.06 | 3.25 | 3.17 | 2.5 |
| Czech Republic | 17 | 17.4 | 17.9 | –2.8 |
| Turkey | 1.32 | 1.42 | 1.46 | –3.1 |
| Euro area[a] | 1.47 | 1.47 | 1.53 | 3.8 |
| Malaysia | 2.47 | 2.51 | 2.63 | –4.5 |
| Thailand | 27.7 | 28.1 | 29.5 | –4.5 |
| 5–10 percent change | | | | |
| Hungary | 181 | 187 | 198 | –5.5 |
| South Africa | 8.21 | 8.82 | 9.48 | –7 |
| Colombia | 1,977 | 2,072 | 2,255 | –8.1 |
| Japan | 90 | 89 | 82 | 8.4 |
| Israel | 3.3 | 3.35 | 3.69 | –9 |
| Philippines | 34.4 | 36.1 | 40 | –9.8 |
| 10–15 percent change | | | | |
| India | 37.1 | 39.3 | 44.8 | –12.2 |
| Singapore | 1 | 1 | 1.15 | –12.7 |
| United Kingdom[a] | 1.91 | 1.89 | 1.65 | –12.8 |
| Sweden | 5.74 | 5.75 | 6.62 | –13.3 |
| Canada | 1.02 | 1.02 | 1.18 | –13.4 |
| China | 5.45 | 5.53 | 4.88 | 13.5 |
| 15–20 percent change | | | | |
| Poland | 2.59 | 2.63 | 3.1 | –15.1 |
| Brazil | 1.65 | 1.71 | 2.02 | –15.2 |
| Chile | 441 | 460 | 549 | –16.2 |
| Indonesia | 7,490 | 7,977 | 9,707 | –17.8 |
| 20–25 percent change | | | | |
| Mexico | 10.6 | 11 | 14 | –21.8 |
| 25+ percent change | | | | |
| New Zealand[a] | 0.85 | 0.84 | 0.62 | –26.3 |
| Australia[a] | 1.02 | 1 | 0.73 | –27.6 |
| Korea | 850 | 865 | 1,197 | –27.7 |

a. These countries have their currencies expressed as dollar per currency. All other currencies are expressed as currency per dollar.

*Sources:* Cline and Williamson (2008) and authors' calculations.