

Appendix 3

Estimating Iceland's equilibrium real exchange rate

In a recent working paper, Robert Tchaidez, an economist at the International Monetary Fund (IMF) attempts to estimate the equilibrium real exchange rate of the Icelandic króna.¹ In carrying out his assessment, he uses three methods developed by the Fund: the macroeconomic balance approach, the equilibrium real exchange rate approach, and the external sustainability approach. The first two of these are based on regression analysis, wherein an attempt is made to find statistically significant relationships between the equilibrium real exchange rate and the current account norm and other economic factors (fundamentals), respectively using cross-country analysis, excluding Iceland. The last of the three methods is based on a calculation of the trade balance that sustains a given debt position and rate of return on assets and liabilities.

Macroeconomic balance

This method involves the use of statistical methods to explain developments in a country's current account. The following equation is considered most suitable:

$$CA^*/GDP = 0.19 \times PB/GDP - 0.14 \times F_{65} - 1.22 \times DPOP + 0.23 \times B_{oil}/GDP + 0.02 \times RI + 0.02 \times NFA/GDP$$

where CA^* indicates the equilibrium current account, GDP is gross domestic product, PB is the fiscal balance, F_{65} is ratio of population over 65 to the population aged 30-64, $DPOP$ is population growth, B_{oil} is the oil trade balance, RI is relative income corrected for differences in price levels, and NFA is net foreign assets.

The equation is used to forecast the current account norm based on IMF's forecast for the year 2012.² The outcome is that a current account corresponding to 1-2.2% of GDP is consistent with equilibrium. The IMF projects Iceland's current account deficit at 5.6% of GDP in 2012. In order to reduce the deficit to the equilibrium value, the real exchange rate should be 17-23% lower than the average real exchange rate for 2006.

1. See R. Tchaidez (2007), "Estimating Iceland's real equilibrium exchange rate", IMF Working Papers, forthcoming. Extensive discussions of exchange rate indices and the real exchange rate can be found in the following articles: "What do exchange rate indices measure?", *Monetary Bulletin* 2005/3, pp. 63-66; "The real exchange rate of the króna in a historical and international context", *Monetary Bulletin* 2005/1, pp. 68-71; and in Arnór Sighvatsson, "Real exchange rate of the krona: Does it exist?" (in Icelandic), *Fjármálatíðindi*, 2000, vol. 47, pp. 5-22.

2. These forecasts are published in *World Economic Outlook*. The data in the Working Paper are from the May 2007 issue.

Equilibrium real exchange rate

This method uses statistical methods to explain developments in a country's real exchange rate as a function of fundamental economic variables. The following equation is considered most suitable:

$$\ln(REER^*) = \text{constant} + 0,04 \times NFA / [(X + M)/2] \\ + 0.15[\ln(Pr_T) - \ln(Pr_{NT})] + 0.46 \times \ln(ToT) + 2.64 \times G/GDP$$

where \ln stands for the natural logarithm, $REER^*$ is the equilibrium real exchange rate, NFA is net foreign assets, X is exports, M is imports, Pr_T is relative productivity in tradables, Pr_{NT} is relative productivity in non-tradables, ToT is terms of trade, and G is government consumption.

Using this equation to forecast the equilibrium real exchange rate in Iceland, based on IMF projections for the year 2012, reveals that the equilibrium level is 95-98, while the exchange rate index stood at 106.7 for the year 2006. To achieve equilibrium, the real exchange rate would therefore have to decline by 8-11% from its average 2006 level.

External sustainability

An economy whose foreign debt grows faster than its domestic production and income cannot sustain itself. However, it is possible to maintain a given liability ratio indefinitely if certain conditions are met. If net foreign assets at the end of year t are assigned the value NFA_t , the nominal rate of return on that variable is called i^N , and TB_t is the difference between exports and imports (the trade balance), then the following applies:

$$NFA_t = TB_t + (1 + i^N)NFA_{t-1}$$

If GDP grows at the rate of n and NFA increases at the same rate, so that the ratio NFA/GDP remains constant, then: $NFA_{t-1} = NFA_t / (1 + n)$; and it is possible to rewrite the formula above as follows:

$$TB_t = -(i^N - n)NFA_t / (1 + n)$$

In Tchaidze's paper, assets and liabilities are split into direct investments and portfolio equity investment (assets are called E_A and liabilities E_L), and bonds, loans, and reserves (assets are called D_A and liabilities D_L). In this case, the following applies:

$$TB_t = [-(i^{EA} - n)E_{At} - (i^{DA} - n)D_{At} + (i^{EL} - n)E_{Lt} + (i^{DL} - n)D_{Lt}] / (1 + n)$$

where i^{EA} , i^{DA} , i^{EL} , and i^{DL} represent the nominal rates of return for the respective assets and liabilities. The premises for output growth and returns are based on IMF projections for the year 2012. Inserting these numbers into the equation, together with Iceland's foreign assets and liabilities, gives an equilibrium value for the trade balance as a percentage of GDP. According to Tchaidze, Iceland's net assets were -93% of GDP at the end of 2004 and -144% at year-end 2006

(excluding foreign exchange reserves). Based on the former figure, the equilibrium value of TB/GDP , the trade balance norm, is -0.8%, while the latter figure gives a trade balance norm of -2.1%. The reason why the equilibrium value falls as net foreign assets decline, which appears to run counter to logic, is that Tchaidze assumes not only that the rate of return on equities is higher than on bonds, but also that the return on Iceland's investments abroad is higher than that of foreign investments in Iceland. It is assumed that $i^{EA} - n = 2.8\%$, $i^{EL} - n = 1.5\%$, and $i^{DA} - n = i^{DL} - n = 0.6\%$, where n is the annual growth in GDP.

The IMF forecasts that the trade balance will be -4.3% of GDP in 2012. To reduce the trade deficit to -0.8% of GDP, the real exchange rate would have to be 18% lower than the 2006 average; and to reduce the deficit to -2.1% of GDP, the real exchange rate would have to be 11% below the 2006 average.

In his paper, Tchaidze points out various limitations and caveats that readers should bear in mind while examining the conclusions in the paper: data may be inexact, the forecasts upon which calculations are based are imprecise, and methodology may be subject to debate. However, the fact that all three of these calculation methods give similar results must be food for thought. The real exchange rate of the Icelandic króna may be too high, and it would need to drop by 8-23% in order to ensure internal and external economic equilibrium.

According to Central Bank calculations, the real exchange rate in August 2007 was 2½% above the 2006 average, which implies that a downward adjustment of 10-25% would be required to achieve the equilibrium estimated in Tchaidze's paper. In order to achieve this reduction in the real exchange rate, the exchange rate index would have to rise from its August 2007 average of 119.9 to somewhere between 134 (assuming a 10% real depreciation) and 160 (assuming a 25% real depreciation). These calculations do not, however, take into consideration the effects of changes in the exchange rate on price levels. If a decline in the nominal exchange rate increases price levels, the nominal exchange rate must depreciate further in order to achieve the same decline in the real exchange rate. If it is assumed that a depreciation will push prices upward with a weight of around 0.4, as econometric estimates indicate, an exchange rate index of 143-187 would be required to achieve equilibrium in accordance with the results in Tchaidze's paper. It is appropriate to reiterate that the conclusions drawn in the paper are quite uncertain. They are intended to shed light on the equilibrium real exchange rate, but the real exchange rate may adjust to its long-term equilibrium level over an extended period, and during the adjustment process it could dip below its long-term equilibrium value.