The real exchange rate fell steeply in 2008 but has risen somewhat in the recent term, as can be seen in Chart 1, and is now close to its thirty-year average. As Chart 2 indicates, the rise is due for the most part to the nominal appreciation of the króna, although higher inflation in Iceland than in trading partner countries has also contributed. Over this period, there has been a sustained surplus on external trade. Furthermore, GDP growth has been robust, terms of trade have improved, and the external debt position has improved substantially. As a result, it can be assumed that this rise in the real exchange rate reflects to some extent a rise in the equilibrium real exchange rate. This Box attempts to estimate the current level of the equilibrium real exchange rate and how much it has changed in recent years.

Definitions
There are various ways to estimate the equilibrium real exchange rate (see, for instance, Appendix 1 in *Monetary Bulletin* 2007/3). This Box focuses on the method based on the external sustainability of the economy, which means that the net international investment position (NIIP) as a share of GDP is stable over time. The equilibrium real exchange rate is then defined as the real exchange rate that ensures a large enough surplus on external trade to ensure that the NIIP remains unchanged over time.

If we let *CA* be the current account balance, *X* and *M* exports and imports (and *NX = X - M* net exports), *A* Icelanders' external assets, *D* their external debt and r^A and r^D their respective rates of return, the following accounting relationship applies (where the variables in parentheses are what is termed the balance on primary income):

$$CA = NX + (r^A A - r^D D)$$

It also applies to the NIIP – that is, the difference between Icelanders' external assets and their liabilities (*NA = A - D*) – that, if changes in the value of assets and liabilities (for instance, changes in share prices or write-offs due to bankruptcy) are ignored, the change in the NIIP will be equal to the current account balance:

$$NA = NA_{-1} + CA$$

where NA_{-1} denotes net assets in the prior year. If there is a current account deficit, it must be financed, which means that the NIIP deteriorates: liabilities increase and/or assets decline. By the same token, the NIIP improves over time if there is a current account surplus.

It is possible to show that these two accounting relationships give a simple relationship between the NIIP and the current account balance that ensures external sustainability. If *g* represents growth in nominal GDP, lower-case letters denote ratios to GDP, and equilibrium ratios are indicated with asterisks, then:
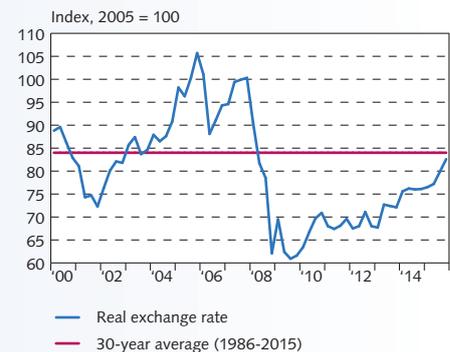
$$ca^* = \frac{g}{1 + g} na^*$$

If, for instance, it is assumed that the steady-state GDP growth rate is 2.7%, annual nominal growth in GDP is 5.27%, assuming that the price level rises in line with the Central Bank's inflation target. If the NIIP is -133% of GDP, as it was at year-end 2008, the current account deficit can equal 6.7% of GDP in steady state without further deterioration in the NIIP. As is discussed in Box 4, the NIIP has improved markedly following the settlement of the failed banks' estates, measuring only -14.4% of GDP at the end of 2015. If equilibrium GDP growth and the assumptions concerning returns on assets and liabilities are unchanged, the steady-state equilibrium current account deficit is much smaller, or 0.7%.
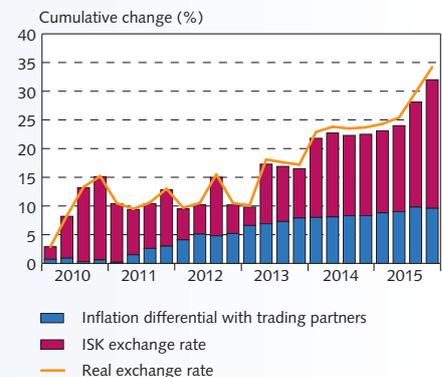
Box 3

Has the equilibrium real exchange rate risen?

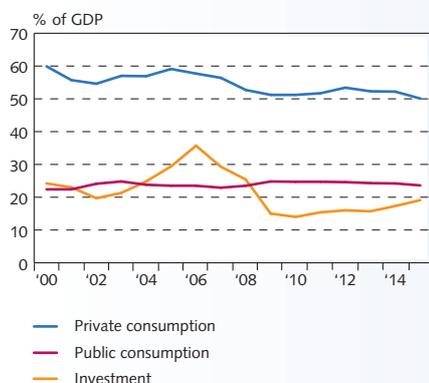Chart 1

Real exchange rate
Q1/2000 - Q4/2015

Index, 2005 = 100

— Real exchange rate
— 30-year average (1986-2015)

Source: Central Bank of Iceland.

Chart 2

Rise in real exchange rate from Q4/2009

Cumulative change (%)

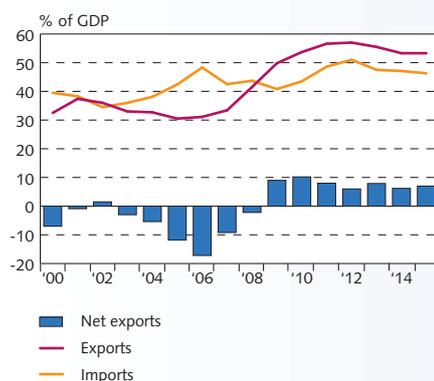■ Inflation differential with trading partners
■ ISK exchange rate
— Real exchange rate

Sources: Statistics Iceland, Central Bank of Iceland.

Chart 3

Ratio of key demand components to GDP
2000-2015

% of GDP

— Private consumption
— Public consumption
— Investment

Source: Statistics Iceland.

Chart 4

Ratio of imports and exports to GDP
2000-2015

% of GDP

■ Net exports
— Exports
— Imports

Source: Statistics Iceland.

Finally, it can be seen that the steady-state value of net exports, *NX*, is determined by the NIIP and the rates of return on external assets and liabilities. If, for simplification purposes, it is assumed that the rates of return on assets and liabilities are equal, then:

$$nx^* = ca^* - r \cdot na^* = \left(\frac{g}{1+g} - r \right) na^*$$

If the foreign interest rates are equal to nominal GDP growth, then external sustainability will be ensured if exports are equal to imports. If foreign interest rates are higher than nominal GDP growth and the NIIP is negative, exports must exceed imports in order to achieve external sustainability. The converse is true if external assets exceed liabilities. Under current conditions in Iceland, where the NIIP is close to zero, external sustainability requires that external trade be approximately in balance, even if nominal GDP growth differs from nominal returns on foreign assets and liabilities.

The trade deficit has turned into a surplus …
Chart 3 shows developments in key economic variables relative to GDP. As can be seen, private consumption and investment declined sharply relative to GDP in the wake of the financial crisis. The investment ratio has gradually risen again, while the ratio of private consumption has remained low. The ratio of public consumption rose during the aftermath of the crisis but has declined slightly since then. As Chart 4 illustrates, the ratio of exports to GDP rose steeply in the wake of the crisis. This is due to the effects of exports from the Reyðarál aluminium smelter, which began in 2007; the decline in the real exchange rate, which raised the ratio of export prices to GDP; and in recent years, the surge in services exports, which is due mostly to the tourism boom. As the chart shows, the ratio of imports has also risen, but less sharply, and the trade deficit has turned into a surplus. The surplus has measured more than 5% of GDP each year since 2009, even though the real exchange rate has risen somewhat in the past few years. As a result, it can be assumed that if the ratio of exports and imports was somewhere close to its equilibrium level in 2015, the equilibrium real exchange rate is somewhat higher than the real exchange rate has been in recent years.

… and the equilibrium real exchange rate has probably risen
In order to calculate the equilibrium real exchange rate, it is necessary to consider two types of effects: the effects of increased demand on imports when variables such as private consumption and investment move towards their equilibrium values, and the effects of a higher real exchange rate on exports and imports. If it is assumed that the equilibrium investment-to-GDP ratio is about 21%, that the equilibrium ratio of public consumption to GDP is 23%, and that exports must be equal to imports in order to ensure external sustainability, it follows that the equilibrium ratio of private consumption to GDP is about 56%.[1] Based on these assumptions and the end-2015 current account balance and external position, and assuming that the rates of returns on external assets and liabilities are similar and are close to the steady-state growth rate of nominal GDP, it can be assumed that the equilibrium real exchange rate is about 89 points,

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1. The equilibrium investment ratio is determined by the capital-output ratio, GDP growth, and the rate of depreciation. The investment ratio has been just under 21% of GDP, on average, over the past thirty years, but was 19.1% in 2015. The ratio of public consumption to GDP has averaged 23% of GDP over the past thirty years but was 23.6% in 2015. Further discussion of the connection between steady-state expenditure ratios and the equilibrium properties of the economy can be found in Daníelsson (2009). Also discussed are various assumptions underlying the estimate of the equilibrium real exchange rate.

which is some 13% higher than it was in 2015 and 6% above the thirty-year average.[2]

This represents a somewhat higher equilibrium real exchange rate than previously estimated. For instance, Daníelsson (2009) found that, for the first seven years of this century, the equilibrium real exchange rate was about 72 points, or about a fifth below the current estimate, which is based on conditions in 2015. According to this, the conditions of the economy have improved enough that it can now sustain a higher spending level and a higher equilibrium real exchange rate than it could previously. The main reason for this is that the external balance of the economy has improved with the improvement in terms of trade and stronger exports, particularly in recent years, with the surge in services exports. These findings indicate that the recent rise in the real exchange rate is attributable in large part to the adjustment of the real exchange rate to a higher equilibrium level and that it therefore reflects a normal adjustment of the economy to a higher expenditure level than in recent years.

Estimates of the equilibrium real exchange rate are always somewhat uncertain

The results of such calculations depend on a number of assumptions. Both the actual and equilibrium real exchange rates are likely to continue rising if services exports continue to grow as fast as they have in recent years, because of strong foreign exchange inflows. Neither can the possibility be excluded that Icelanders' propensity to save has risen permanently in the wake of the crisis and that the equilibrium ratio of private consumption to GDP is now lower than before. Under such conditions, the economy could move towards a situation where the NIIP is positive (as it was at the end of World War II), with the associated impact on the equilibrium real exchange rate. Furthermore, global interest rates are uncertain. They have been extremely low for some time, although risk premia have been relatively high so that borrowers with low credit ratings are often faced with unfavourable borrowing terms. If global interest rates continue to be low and domestic GDP growth remains robust, this will also affect the estimate of the equilibrium real exchange rate.

Finally, it should be borne in mind that although it is possible to calculate the equilibrium real exchange rate for individual years and even individual quarters, it is most appropriate to calculate the equilibrium real exchange rate based on conditions over a period of several years. By the same token, it should be noted that the external position need not be consistent with its equilibrium value every year, although it must be in balance over a longer period of time to ensure that it is sustainable. The economy can remain on an unsustainable path for quite some time, and a small economy with low debt levels and a reasonable credit rating can tolerate a real exchange rate well above equilibrium and can accumulate debt before the forces that ultimately halt unsustainable developments make themselves felt.

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2. The Central Bank's QMM is used here, but a state-space model of the real exchange rate gives similar results. Further information on the QMM can be found in Daníelsson *et al.* (2015).