Economic Commentaries

Since the financial crisis broke out in September 2008 the value of the Swedish krona has fluctuated substantially. Thus it is natural to ask what may be a reasonable long-term development for the krona exchange rate. The Riksbank's assessment in recent Monetary Policy Reports has been that the krona will strengthen in the longer term, and that the recent weakening is linked to the financial crisis. This Economic Commentary describes the background to the Riksbank's long-term exchange rate assessment. Why does the Riksbank believe that the krona will strengthen? The authors explain this by discussing important concepts such as nominal and real exchange rates, and by briefly summarising the most important theories for the long-term development of real exchange rates. They also describe the historical development of the krona exchange rate in a longer term perspective.

The long-term development of the krona

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The Riksbank has no target for the krona, but continuously follows its development. Prior to each monetary policy meeting a new exchange rate forecast is made since this will affect the inflation forecast. The Riksbank's assessment in recent Monetary Policy Reports has been that the krona should strengthen in the longer term, and that the recent weakening is linked to the financial crisis. This Commentary explains why the Riksbank's assessment is that the krona should strengthen. To do so, we need to begin by analysing what is meant by real and nominal exchange rates.

Nominal and real exchange rates

When talking about the krona's exchange rate in everyday terms, people are normally referring to the nominal exchange rate, for example, 8 kronor per dollar or 10 kronor per euro. When economists talk about the exchange rate – and the macroeconomic effects of fluctuations in the value of the krona – they are usually talking about the real exchange rate, that is, the Swedish krona's purchasing power. More precisely, a real exchange rate is the nominal exchange rate adjusted by the relative price level at home and abroad:

$$\text{real exchange rate} = \frac{\text{nominal exchange rate x foreign price level}}{\text{domestic price level}}$$

The real exchange rate thus shows the relationship between the price levels in different countries or currency areas, where price levels are measured in the same currency. If the price levels are the same when measured in the same currency, the real exchange rate is equal to 1. "The Economist" regularly reports the price of a Big Mac hamburger in various countries measured in US dollars and it is clear that the price differs substantially from country to country. One can see such calculations as real exchange rates "in miniature" as they measure the price level in different countries in the same currency, albeit for a single good. When economists calculate real exchange rates they instead tend to use price indices, for example the consumer price index (CPI), to measure the price levels in the different countries.

The real exchange rate is strengthened either when the nominal exchange rate strengthens or when the price level increases more rapidly at home than abroad.[2] Economists are often more interested in the real exchange rate than in the nominal one, as it is the real exchange rate that determines – and reflects – a country's competitiveness and its purchasing power. The stronger the real exchange is, the higher the purchasing power a Swedish krona will have abroad. However, at the same time Swedish competitiveness declines. And the weaker the real exchange rate is, the stronger competitiveness is, but Swedes who travel abroad will notice that their Swedish kronor are not worth very much. How does this work?

Let us assume that a Swedish-manufactured product costs SEK 500 in Sweden and that the krona's exchange rate against the US dollar is 8 kronor. In the United States a domestically-produced article of the equivalent quality costs USD 50, which corresponds to 50x8=SEK 400. The price of the product is thus higher in Sweden when calculated in kronor. If we use the expression of the real exchange rate above and let the price of the product represent the price level in Sweden and in the United States respectively, the real exchange rate will be 400/500=0.8. The real exchange rate is thus lower than 1, which means that SEK 500 can buy one unit of the product in Sweden but more than one unit of the corresponding product in the United States. In this way a strong real krona exchange rate reflects the Swedish krona's purchasing power being high abroad.

If we regard the above example through the eyes of the Swedish manufacturer, we see instead that competitiveness is weaker in Sweden than in the United States with a strong real krona exchange rate. If the Swedish product was exported to the United States and sold in dollars at the nominal exchange rate, the price would be 500/8=USD 62.50, which does not appear particularly competitive compared with the US-produced article's price of USD 50. The competitiveness of Swedish export companies thus weakens when the real exchange rate strengthens.

The development of the real exchange rate – some theories

Purchasing power parity

What determines the long-term development of the real exchange rate? The best known (and simplest) theory goes under the name of *Purchasing Power Parity*, a concept launched by the Swedish economist Gustav Cassel almost one hundred years ago.[3] The basic principle for this theory is that a unit of currency should have the same purchasing power in different countries. The examples above with Sweden and the United States and The Economist's Big Mac surveys are thus contradictions of purchasing power parity. If one refers to a specific good, one talks about the law of one price. According to this law, a kilo of gold, for instance, should cost as much in Sweden as in the United States when the price is translated into kronor. The reason is that one would otherwise buy the article in the country where it is cheapest and sell it in a country with a higher price. In this way prices, expressed in a common currency, are equalized between countries.

When one examines purchasing power parity, one compares price levels in general, and these are normally measured in terms of price indices, such as the CPI.[4] All in all, purchasing power parity entails the following: the price level expressed in a common currency should be the same in different countries, which means that the real exchange rate is equal to 1. This is sometimes also called *absolute* purchasing power parity.

However, it is difficult to directly compare price indices in different countries. An alternative concept is then *relative* purchasing price parity, which means that differences in the rate of price increase – i.e. inflation – between countries are matched by equally large changes in the nominal exchange rate. Then the real exchange rate is held constant, but is not necessarily equal to 1. In this way the purchasing power in different countries is kept at the same level.

In practice, economists normally use the concept of purchasing power parity in a different sense, namely that the real exchange rate should not have any trend in a particular direction.[5] Various statistical tests can be used to lend support to or reject purchasing power parity. If the real exchange rate behaves as predicted by purchasing power parity, it will in the long term return to the mean value according to a particular pattern. A reasonable long-term forecast for the real exchange rate is in this case equal to its mean value.

[3] G. Cassel (1921): "The World's Money Problems", New York: E.P. Dutton and Co. and G. Cassel (1922): "Money and Foreign Exchange after 1914", New York: MacMillan.
[4] Please note that purchasing power parity may apply without the law of one price applying to individual articles; the various price differences may "offset" one another. If the law of one price applies to all articles, then of course purchasing power parity also applies.
[5] In a statistical sense the real exchange rate should be stationary if relative purchasing power parity prevails, which means, for instance, that the mean value and standard deviation will be constant over time.

Figure 1 shows how the Swedish real exchange rates has developed since 1970, along with the nominal exchange rate. The lines show summarising measures of the development of the Swedish krona, which are obtained by combining currencies and foreign price levels in accordance with the structure of Sweden's international trade, what is known as a TCW index. [6] In this figure the exchange rates are expressed in terms of indices with the value of 100 set at the time immediately prior to the fixed exchange rate being abandoned in November 1992.

As we have seen in the news, changes in the nominal exchange rate occur every day. However, firms cannot change prices as often. This is usually described as prices being sticky. Changes in the nominal exchange rate – e.g. the weakening of the krona 1992 after it began to float - therefore give rise to corresponding short-term changes in the real exchange rate, and thereby changes in competitiveness and relative purchasing power. But differences in inflation rates also give rise to changes in the real exchange rate. Such was the case, for instance, during the fixed exchange rate regime of the 1980s, when inflation was much higher in Sweden than in other countries. This led to a real strengthening of the krona of around 25 per cent between 1983 and 1992, despite a stable nominal exchange rate.

As shown in Figure 1, the Swedish real exchange rate has shown periods of both strengthening and weakening, but regarded as a whole over the period 1970-2009 it has weakened by more than 50 per cent. If purchasing power parity had been a good description of the development of the Swedish real exchange rate it would have shown a more "oscillating" pattern, that is, shown long cycles around a constant average. Instead, the real exchange rate shows a weakening trend, at least up to the mid-1990s. Expressed in a different way, the price level in Sweden has fallen relative to the rest of the world during this period. Competitiveness has thus strengthened, while purchasing power has weakened.

Purchasing power parity can possibly be said to be a good description of how the krona measured in terms of the TCW index has developed during the period with a floating exchange rate. If one only examines the period from 1993 – when the krona began to float – and onwards using statistical methods one cannot detect any clear trend in the real exchange rate.[7] Increased economic integration and trade also point to increased price convergence between countries within, for instance, the EU. The average for the real exchange rate since 1993 could then be a reasonable long-term forecast. This would then indicate a long-term strengthening of the real TCW index of around 15 per cent from this spring's levels.

Deviations from purchasing power parity: "Prices are higher in wealthier countries"

To understand the development of the Swedish trade-weighted real exchange rate since the 1970s purchasing power parity is not enough, and we must look to theories that explain lasting changes, or trends, in real exchange rates.

A common theme for theories regarding trends in real exchange rates is that the price level is higher – and thus the real exchange rate is stronger – in "wealthy" countries. Where the theories differ is in the definition of "wealth". Below we give an account of three different measures of countries' economic "wealth": developments in relative GDP, net foreign assets and the terms of trade.

The so-called Balassa-Samuelson effect is perhaps the most famous theory for deviations from purchasing power parity and is based on the price level measured in a common currency tending to be higher in countries with a high GDP ("wealthy" countries).[8] How does this effect arise?

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[6] A good approximation of the TCW weights is given by euro 65 per cent, US dollars and British pounds 12 per cent each, Norwegian kronor 6 per cent and Japanese yen 5 per cent. A rough approximation is euro 84 per cent and US dollars 16 per cent. For a detailed description of the TCW index, see J. Alsterlind (2006): "Effective exchange rates – theory and practice", Sveriges Riksbank Economic Review, 2006:1.

[7] In international studies using very long time series of real exchange rates one has often found confirmation of purchasing power parity. See, for example, M. P. Taylor (2002): "A Century of Purchasing Power Parity", Review of Economics and Statistics 84. For reviews of the academic research on purchasing power parity, see for example K. Froot and K. Rogoff (1995), "Perspectives on PPP and Long-run Real Exchange Rates", G. M. Grossman and K. Rogoff (ed.) *Handbook of International Economics* and A.M. Taylor and M.P. Taylor (2004): "The Purchasing Power Parity Debate", *Journal of Economic Perspectives* 8.

[8] This is also sometimes called the Harrod-Balassa-Samuelson effect. See B. Balassa (1964): "The purchasing power parity doctrine: a reappraisal", Journal of Political Economy 72 and P. A. Samuelson (1964): "Theoretical notes on trade problems", Review of Economics and Statistics 46.

A basic starting point is to divide the economy into a goods sector and a services sector and assume that purchasing power parity applies for goods but not for services.[9] Deviations from purchasing power parity are thus caused by changes in the price level for services. Countries with high economic growth tend to have strong productivity growth in the goods sector. In the Balassa-Samuelsson theory, labour is assumed to be perfectly mobile within the country but not internationally. Strong productivity growth in the goods sector leads to real wages and nominal wages rising in this sector. The perfect mobility of the labour force within the country means that nominal wages rise in the whole economy, also in the services sector. As productivity normally develops more slowly in the services sector, real wages cannot rise as quickly there.[10] Prices must therefore rise in the services sector to compensate for the increases in nominal wages. This means that prices in the whole economy rise, and the real exchange rate strengthens.[11]

An empirical conclusion of the Balassa-Samuelsson theory is thus that countries with high growth typically have stronger real exchange rates, while countries with weak growth have weaker real exchange rates. A well-known example of this phenomenon is Japan during the post-war period up to the beginning of the 1990s. Then the yen strengthened substantially against the US dollar in real terms, at the same time as growth in Japan was much higher than growth in the United States. This was largely connected to a strong development in productivity in Japan's export-oriented goods sector.[12]

Figure 2 shows GDP in Sweden and abroad, where the countries abroad are weighed together with the TCW weights. Sweden had a relatively low GDP growth from 1970 to the mid-1990s compared with other industrialised nations, and in this way became relatively "poor". This could explain the weak development in the real krona exchange rate. However, since the mid-1990s, the gap between the GDP level in Sweden and the level in other countries has narrowed, as growth has been higher in Sweden than in other countries. This could explain the fact that the weakening trend in the krona exchange rate appears to have ceased since the 1990s. It is also one of the main reasons why the Riksbank's assessment is that the krona should strengthen. We will return to this below.

Another commonly recurring explanation on the theme of "prices are higher in wealthier countries" is based on a country's net foreign assets. This shows a country's total claims or liabilities towards other countries. The basic idea here is that countries with high net foreign assets have strong real exchange rates. And vice versa, countries with large net foreign debts have weaker real exchange rates. The most common explanation for this is a transfer effect, which means that foreign debt gives rise to interest payments and amortisation, and financing these requires a surplus on the current account.[13] The real exchange rate must therefore be weakened.[14] To simplify, one can say that changes in the real exchange rate are required to achieve a long-term balance in foreign trade. The relationship between real exchange rates and net foreign assets is supported in the data, at least when groups of countries are studied in what are known as panel studies.[15]

[9] Services are regarded as "non-tradable" goods.

[10] According to the Baumol-Bowen theory, productivity growth is higher in the goods sector than in the services sector, which in turn means that prices for services rise more quickly than goods prices. Baumol and Bowen (1966), "Performing Arts, the Economic Dilemma", use as an example productivity among artists, for instance, symphony orchestras, which is not noticeably higher today than 200 years ago. However, wages have risen, which means that the relative price has risen compared with the manufacturing industry, which has become less and less labour intensive.

[11] Similar ideas formed the base for the Swedish EFO model for wage formation, which was launched in the 1970s by economists at the Swedish Trade Union Confederation (LO), the Swedish Employers Confederation (SAF) and the Swedish Confederation for Professional Employees (TCO). The scope for wage increases in the economy as a whole is determined in the long run by productivity developments in the internationally competitive sector. See Gösta Edgren, Karl-Olof Faxen and Clas-Erik Odhner (1973): "Wage Formation and the Economy", Allen and Unwin.

[12] An in-depth analysis of the empirical research into the Balassa-Samuelson theory is provided by J.R. Lothian and M.P. Taylor (2008): "Real Exchange Rates Over the Past Two Centuries: How Important is the Harrod-Balassa-Samuelson Effect?" Economic Journal 118.

[13] The concept of "the transfer effect" derives from a discussion between Bertil Ohlin and J. M. Keynes in the 1920s on the economic effects of Germany's war damages. For an empirical survey of this effect, see P.R. Lane and G.M. Milesi-Ferretti (2000): "The Transfer Problem Revisited: Net Foreign Assets and the Real Exchange Rate", Review of Economics and Statistics 86.

[14] Another explanation for the relationship between the international investment position and the real exchange rate could be that a wealth effect of a strong international investment position means that people "feel wealthier" and thus work less. With an unchanged demand for labour wages will rise, and thus so will prices.

[15] See, for example, P.R. Lane and G.M. Milesi-Ferretti (2002): "External wealth, the trade balance, and the real exchange rate", European Economic Review 46.

What is the empirical relationship between net foreign assets and the real exchange rate in Sweden? Firstly, it is necessary to produce a measure of net foreign assets and this can be done in several ways. One is to summarize current accounts over time. The current account shows the balance in foreign trade (net exports) together with capital income and various fees to and from other countries. Figure 3 shows the real exchange rate together with the development of the current account since 1980. Up until the beginning of the 1990s Sweden had a deficit on its current account, and this was duly followed by a period with a real weakening of the krona, as predicted by the theory.

However, Figure 3 also shows that Sweden has now had a surplus on its current account for almost fifteen years and that net foreign assets have become increasingly strong when measured in this way. This points to a strengthening of the real exchange rate, but no significant strengthening has taken place. What can this be due to?

One possible explanation concerns the fact that it is difficult to measure net foreign assets, and that summarizing current accounts simply does not provide the right picture of Sweden's total claims and liabilities towards other countries.[16] Figure 4 shows both net foreign assets in the form of accumulated current accounts, and the market-valued international investment position.[17] Between 1975 and 2000 these two measures showed a qualitatively similar picture of Sweden's net foreign assets, although the method of market valuation shows a greater deterioration in net foreign assets up to the mid-1990s. However, for the past few years the two measures give entirely different pictures. This difference between the various measures of net foreign assets contributes to uncertainty regarding the forecasts for the real exchange rate based on this version of the "wealth theory". The current account surpluses imply quite clearly a strengthening in the real exchange rate, but this is not supported by the market-

$$\text{Terms of trade} = \frac{\textbf{Domestic prices on export from Sweden}}{\textbf{Foreign prices on import to Sweden x nominal exchange rate}}$$

valued calculation of the international investment position.[18]

Finally, the terms of trade, which is the relationship between export prices and import prices, can affect a country's degree of "wealth". The terms of trade are usually calculated as follows:

The terms of trade are thus similar to a real exchange rate, but with an inverted relationship between price levels and with price levels that refer to exported and imported goods. Weaker terms of trade mean that export prices fall in relation to import prices. If, for example, the oil price rises substantially, Sweden will have to pay more for its imports. If at the same time exports generate equally large income as before, and the terms of trade will fall. Sweden has then become "poorer" as a result of the oil price having risen. When the terms of trade fall the real exchange rate should weaken. Do we see this in the data?

Figure 5 shows Sweden's terms of trade together with the same trade-weighted real krona exchange rate as in Figure 1. As predicted by the theory, during the 1970s the terms of trade fell substantially at the same time as the real exchange rate weakened. And vice versa, the terms of trade rose during the remainder of the 1980s at the same time as the real exchange rate strengthened. However, the terms of trade have weakened substantially over the past 10 years – a result of the world market price of oil rising substantially between 2003 and 2008 and of the prices of telecom goods exported from Sweden falling – at the same time as the real exchange rate has both weakened and then strengthened. Thus, there does not appear to be any simple relation between the development of the real krona exchange rate and the terms of trade

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[16] See G. Blomberg and M. Falk "How do large current-account surpluses co-exist with a weak international investment position?" Sveriges Riksbank Economic Review 2006:1.

[17] A market-valued international investment position means that assets and liabilities will be taken up at market value, which gives a valuation effect on the international investment position in the event of, for instance, stock market crashes and exchange rate fluctuations. The value of all assets abroad owned by Swedes and the value of all assets in Sweden owned by foreigners can develop in different ways.

[18] The same problem, although reversed, is found in the United States. The US current account balance has shown a significant deficit for a long period of time, but this is not entirely reflected in the United States' market-valued international investment position. See further the description of this in G.M. Milesi-Ferretti (2008): "Fundamentals at Odds? The U.S. Current Account Deficit and the Dollar", IMF Working Paper 08/260.

in Sweden. The deterioration in the terms of trade since the mid-1990s does mean, however, that Sweden's "wealth" in relation to other countries has not strengthened in the way indicated by the relative GDP growth, which could explain the absence of a strengthening trend in the krona exchange rate since the mid-1990s.

Summary and conclusions regarding the long-term development of the krona

What can one then say is a reasonable long-term level for the krona exchange rate given the above reasoning? Two different basic theories exist regarding the determination of the real exchange rate in the long term. First, purchasing power parity means that the real exchange rate does not have any trend, and in the long term it will return to its mean value. Second, there are various theories explaining trends in real exchange rates and deviations from purchasing power parity. These theories can be summarised as "wealthier countries have stronger real exchange rates".

It is possible that purchasing power parity is a good description of developments during the period with a floating exchange rate over the past 15 years, as a clear trend in the real krona exchange rate is lacking, and this means that the average value is a reasonable long-term forecast. At the levels seen during the spring, the real krona exchange rate is approximately 15 per cent above its mean value since 1993, and thus it should strengthen. However, it is difficult to statistically determine the plausibility of this assumption even with data over such a long period as 15 years.

If one looks at the period since 1970 there appears to be a weakening trend in the real exchange rate, which must be explained by the other type of theories. The hypothesis then is that "wealthier countries have stronger real exchange rates". Up to the middle of the 1990s the average growth rate in Sweden was lower than in other countries, which explains a large part of the substantial weakening in the real exchange rate since the beginning of the 1970s. But from the mid-1990s Sweden's growth has been higher than that in other industrialized countries, which should imply a strengthening of the real exchange rate. This has not taken place, however, which may be due to a deterioration in the terms of trade, which points towards a weaker real exchange rate. At the same time the current account has shown large surpluses for over a decade, suggesting the real exchange should strengthen. However, net foreign assets at market value does not provide the same picture of Sweden's "wealth"; the international investment position is around minus 4 per cent of GDP, but has not shown any clear trend over the past decade.

There is thus no individual measure of "wealth" that can in itself explain the development of the real krona exchange rate. When the Riksbank makes forecasts for the development of the real exchange rate, it therefore uses statistical models where the real exchange rate is estimated together with all of the measures of "wealth" just discussed, that is, relative GDP, the terms of trade and net foreign assets. Such estimates imply that the real trade-weighted krona exchange rate will strengthen in the long term by 10-15 per cent, i.e. essentially the same conclusion arrived at if one assumes that purchasing power parity is a reasonable description of the real exchange rate behaviour in the past 15 years.

What does this mean for the nominal exchange rate forecast? Since the real exchange rate is the relative price level in different countries expressed in the same currency, a strengthening of the real exchange rate can be achieved via a stronger nominal exchange rate or by Sweden having higher inflation than other countries. The Riksbank's forecast for the nominal exchange rate in the long term thus depends on how Swedish inflation is expected to develop in relation to inflation in other countries. Sweden's inflation is also affected by changes in the nominal exchange rate.[19] The assessment in the most recent forecast in the April Monetary Policy Update was that inflation in Sweden and abroad would be fairly similar over the coming three years. Thus the forecasts for the real and nominal strengthening of the krona exchange rate are roughly the same during this period, around 10-15 per cent in the coming years. Figure 6 shows the forecasts from the April Monetary Policy Update.

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[19] One current example of this is given in the article "The recent weakening of the krona" in Monetary Policy Report 2009:1.

Figures

Figure 1. Real and nominal exchange rates, TCW index, 1970 - 2009
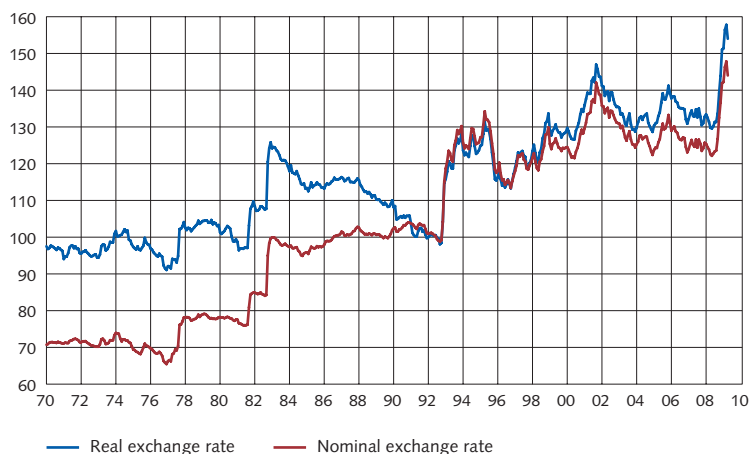**Index, 18 November 1992=100.**

Real exchange rate — Nominal exchange rate

Figure 2. GDP in Sweden and TCW-weighted rest of world 1970-2008.
Logarithmed data, index, 1 January 1970=1
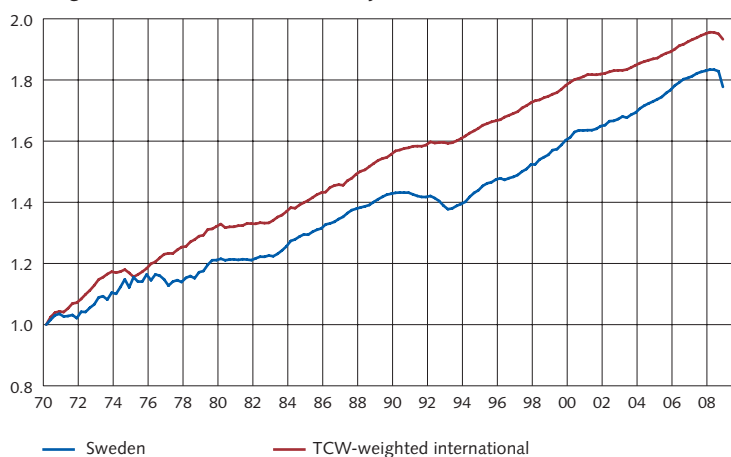

Sweden — TCW-weighted international

Figure 3. Real exchange rate (TCW index) and current account
in Sweden. **Current account: Per cent of GDP**
Real exchange rate: index, 18 November 1992=100
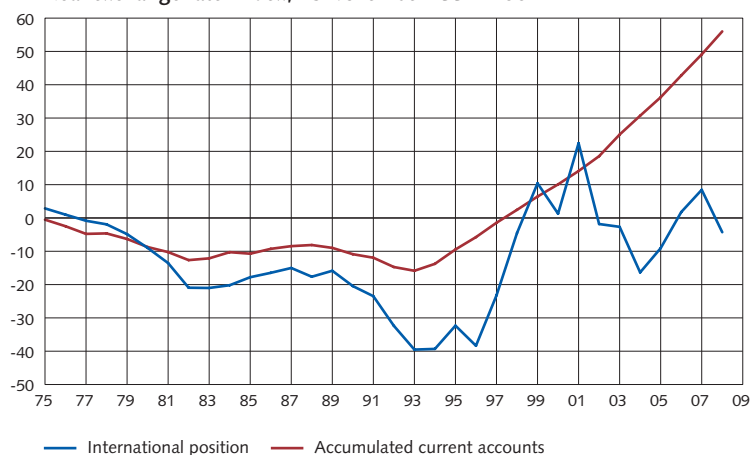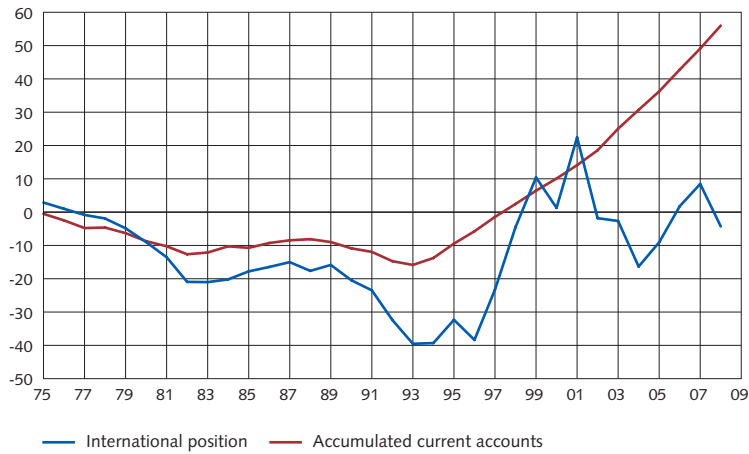

International position — Accumulated current accounts

**Figure 4. Sweden's net international investment position at market values
and accumulated current accounts respectively.**

Per cent of GDP

Legend: —— International position   —— Accumulated current accounts

**Figure 5. Terms of trade (right scale) and real trade-weighted exchange rate
(TCW index) for Sweden. Exchange rate: index, 18 November 1992=100
Terms of trade: index, 1 January 1975=100**

Legend: —— Terms of trade (right scale)   —— Real exchange rate (left scale)
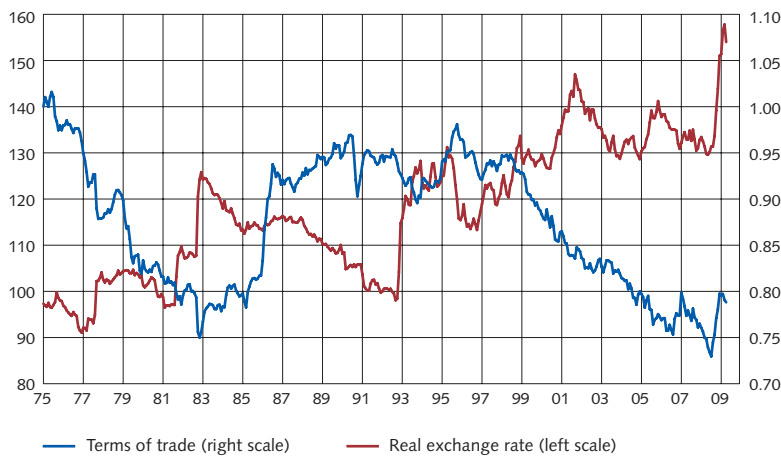
**Figure 6. Nominal and real exchange rate forecasts: TCW index.
Index, 18 November 1992=100**

Legend: —— Real exchange rate   —— Nominal exchange rate
······· Real forecast, MPU april   ······· Nominal forecast, MPU april