Articles

Measures of New Zealand's effective exchange rate

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At the beginning of this year, the Bank made some changes to the method used to calculate the trade-weighted index (TWI) value of the New Zealand dollar. This article discusses different ways to summarise the combined effect of exchange rate changes on the New Zealand economy and price level. It suggests that there is no single measure of New Zealand's exchange rate correct for every purpose, but that the TWI currently being used by the Bank is well suited to capturing the medium-term effect of the exchange rate on the price level.

1 Introduction

New Zealand is a small open economy, so the exchange rate has a key influence on the level of demand for New Zealand produced goods, and New Zealand prices. But which exchange rates are most important? For example, what are the consequences for the New Zealand economy if, as over 1997, the New Zealand dollar depreciates by 16 percent against the US dollar but appreciates by 48 percent and 49 percent respectively against the Korean won and Thai baht?

In order to answer this sort of question, we need to form a weighted-average measure of the relevant exchange rates: an 'effective exchange rate' that summarises their combined influence. This is a particularly pertinent issue for New Zealand, because New Zealand's trade is unusually diversified. Our largest trading partner (Australia) accounts for only 22 percent of our merchandise trade,[2] and our five largest trading partners account for less than 60 percent. By comparison, over 75 percent of Canada's merchandise trade is with the United States.

There are many different measures of an effective exchange rate. Different measures emphasise different aspects of the effect of the exchange rate on the economy, and it is generally necessary to consider a range of measures to obtain an overall view.

Nonetheless, it is also useful to have a summary measure, and the Reserve Bank's TWI has served this role since its inception in 1979. At the beginning of 1999, the Bank significantly changed the way it constructs the TWI, and adopted a currency weighting regime which it was thought would better take account of the overall effect of the exchange rate on the economy and inflation. The TWI was changed from an index that attributes the relative importance of trading partners' currencies to their share of New Zealand's bilateral trade, to one that weights the currencies partly (50 percent) on the basis of the size (GDP) of the trading partner's economy, and partly (50 percent) on their share of New Zealand's bilateral trade.

One of the motivations for this article is to review the appropriateness of the changes to the TWI introduced at that time. We begin, in the next section, by summarising two key avenues - one direct, and one indirect - by which exchange rate movements have an influence on the price level, and the techniques used to capture the relative importance of the individual exchange rates in each of these channels of influence. In section 3 we elaborate on a methodology, based on a model of how countries compete with each other, for measuring how different currencies indirectly affect the New Zealand price level, and present the results of calculations that use this methodology with New Zealand data. Section 4 then shows how index numbers of the overall or "effective" value of the New Zealand dollar can be derived from these results. A series of such measures is outlined in section 5, and our conclusions are in section 6.

[1] Other Economics Department staff, particularly Dean Minot, Christine Tether, and Leo Bonato, contributed to the analysis described in this article. Ron Sandrey and Peter Guinness (MFAT), Toshitaka Sekine (IMF) and Eric Hansen (Celtic Pacific), provided helpful advice and/or assistance in obtaining data.

[2] Merchandise trade is trade (exports plus imports) in goods. Trade in services (such as tourism) is not included.

2 Direct and indirect effects of the exchange rate

Shifts in the exchange rate alter the price of things produced in New Zealand relative to the price of things produced overseas. For example, if the New Zealand dollar depreciates, the relative price of overseas-sourced goods rises. This exchange rate change is likely to first manifest itself in an increase in the New Zealand dollar (NZD) price of imported goods, such as oil and electronic equipment. Because a substantial portion of consumer goods sold in New Zealand are imported, this directly impacts on the New Zealand CPI.

However, this 'direct' channel is not the only way the exchange rate affects inflation. When we depreciate against a key trading partner, our exports to that country become more competitive, while their exporters to our country will not be able to compete as well against New Zealand producers. Both these effects result in an expansion of New Zealand output and, as production capacity constraints are approached, this indirectly puts upward pressure on New Zealand prices.[3]

The overall effect of an exchange rate depreciation on the New Zealand price level is the sum of these two influences.

The direct effect: previous studies and an update

When New Zealand adopted a quantitative inflation targeting approach to monetary policy in the late-1980s, with a target that required annual CPI inflation to be kept within 0 and 2 percent, it became more important to be able to measure and forecast the effect of exchange rate changes on the CPI. As summarised in White (1997), this prompted a number of studies, inside and outside of the Bank, of the "pass-through" from exchange rate movements to the CPI, which attempted to establish (amongst other things) which exchange rates mattered most for the New Zealand CPI. These studies generally involved the econometric estimation of equations with a structure as in the stylised equations (1) and (2) below.

In principle, the β terms in equation (1) account for the relative importance of each currency in determining New Zealand import prices. The λ_1 term in equation (2) then provides a measure of how important import prices are in explaining the level of the overall CPI. By multiplying the β of a given currency by λ_1, a measure of the direct effect of each currency on the New Zealand CPI can be obtained.

These studies, almost without exception, suggested that the currencies of large countries, and in particular the United States dollar, had an influence on the CPI that exceeded those countries' shares of New Zealand's bilateral trade. This implied that the TWI, which attributed weights to the constituent currencies on the basis of bilateral trade shares alone, was not an ideal indicator of how exchange rate changes mattered for inflation.

A number of caveats were attached to these results. An obvious problem was that there had been substantial structural change in the New Zealand economy (eg shifting tariff structures, changing trade patterns, the floating of the NZD in 1985, and so on). These structural changes made it unclear that weights estimated from historical data would be appropriate going forward.

Secondly, equation (1) was generally only estimated over New Zealand's most important trading partners, and missed out the significant volume of our trade that is carried out with smaller trading partners.

Thirdly, in equation (1) it is explicitly assumed that exchange rate fluctuations are "passed through" to local currency prices in exactly the same way as changes to the foreign currency price. However, there are reasons for thinking this need not be the case. For example, there is evidence that firms do not automatically adjust prices in response to exchange rate

$$\text{NZ Import Price} = \alpha + \beta_{US}(\text{US Price} - \text{USD/NZD rate}) + \beta_{AU}(\text{AU Price} - \text{AUD/NZD rate}) \quad (1)$$

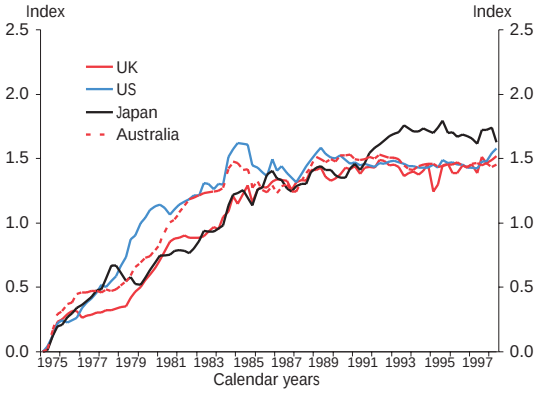
$$\text{NZ CPI} = \alpha + \lambda_1(\text{NZ Import Price}) + (\text{aggregate demand, wages, other domestic factors}) \quad (2)$$

[3] For a further discussion of these effects, see the box in the Reserve Bank of New Zealand's August 1998 *Monetary Policy Statement*.

fluctuations. Also, the effects of foreign exchange hedging on pricing behaviour are ignored.

Finally, over the period for which the equations were estimated, New Zealand's high inflation rate and the consequent steady depreciation of the NZD meant that New Zealand's bilateral exchange rates had been highly collinear (that is, they had moved quite closely together, as shown in figure 1). This meant that the relative importance of each currency was difficult to estimate with much certainty.

Figure 1
New Zealand's import prices (in NZD) by source country, 1975-1998



Source: Statistics New Zealand. Early (1975-1982) figures are Reserve Bank estimates based on the export price indices of overseas countries, converted into New Zealand dollars. Figures are in logs.

For these sorts of reasons, the authors generally expressed reservations about their results (summarised in table 1), and hesitated to suggest that the TWI should be calculated on the basis of their results rather than on the basis of bilateral trade shares.

We have attempted similar estimations using more recent data and, while we had difficulty getting stable and meaningful results, the best performing equations did support the previous results. However, although our most robust equation, which we include in table 1, suggested a relatively low weight on the Australian dollar, it could **not** reject the hypothesis that the weight on the Australian dollar should correspond with Australia's bilateral trade share with New Zealand. Thus, the results provide no more basis for supporting a move away from bilateral trade based weights for the TWI weights than the previous studies.

Most of the above-mentioned reasons for being wary of the econometric results still hold; some perhaps even more than previously. For instance, figure 2 makes it clear that in the 1990s there has been a change in the extent to which exchange rate changes have been passed through to the New Zealand dollar price of imported goods. Similar changes have been observed in many other countries, which suggests that there have indeed been changes in pricing behaviour in response to exchange rate changes that are not captured by these equations.

Figure 2
Import prices and the TWI

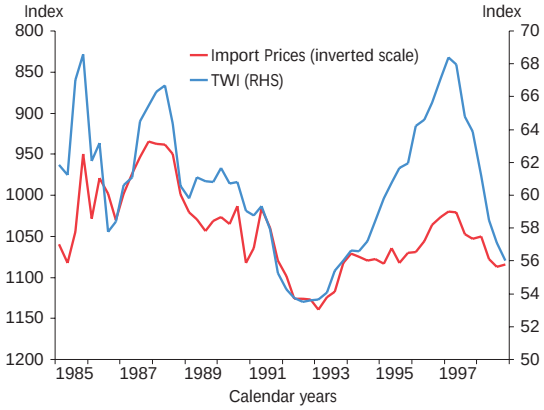


Table 1: Official TWI weights and those calculated in 5 studies

	AUD	USD	JPY	UK Stg	Dmk/Euro
Previous TWI weights (December 1998)	37	27	21	9	6
Current TWI weights (from January 1999)	18	31	20	8	23
Weights from 5 studies					
Schoefisch (1990)	13	31	29	12	15
Clements (1992)	20	30	35	10	5
Rae (1994)	19	37	23	10	11
Hansen (1994)	22	52	20	6	na
Our analysis (1999)	13	42	32	13	na
Average estimate[4]	17	36	27	10	10

[4] 'Average' results were adjusted to reflect the fact that our results and Hansen's results do not include the Euro, by assigning the Euro a weight in these studies equal to what it was on average in the other 3 studies.

Despite all these uncertainties, it is striking that all the studies have tended to conclude that a TWI based on bilateral trade weights understates the effect on New Zealand prices of one or more major currencies, and overstates the effect of the Australian dollar. The studies suggest a need for further enquiry, and were a factor that contributed to our decision to change our method of TWI calculation in January 1999.

The indirect effect

In the studies discussed above, the effect of the exchange rate on inflation is through altering the price of imported goods in the CPI. However, this direct effect is not the only way the exchange rate affects inflation. Indeed, it is the indirect effect of the exchange rate on prices, through influencing activity in the New Zealand economy, that features most prominently today in the Bank's policy thinking.[5] Hence, we would prefer to have a measure of the exchange rate that provides an indicator of its effect on aggregate demand, rather than its direct impact on prices. This is particularly true because the TWI is primarily used as the measure of the exchange rate relevant to forecasting inflation over the medium term (using the framework provided by FPS, the Bank's model of the New Zealand economy).[6]

Unfortunately, equations (1) and (2) do not capture the indirect channel from the exchange rate to inflation via aggregate demand and activity. While domestic demand is allowed to affect consumer prices through the domestic influences in equation (2), there is typically no channel from exchange rate changes to domestic demand. In principle, a third equation could be added to the system to estimate the relative importance of each currency in determining domestic demand. However, the econometric difficulties in estimating such an equation are likely to be even more pronounced than those faced when estimating the direct effect with equation (1).

There is a growing body of research dealing with how to approach problems like this that confound econometric estimation, through methods known as model calibration. Essentially, calibration involves the use of economic theory to uncover a relationship between an unknown model parameter and other observable phenomena.[7]

The International Monetary Fund (IMF) has developed a theoretical model of how exchange rates affect demand and economic activity which is based on how a country's different imports and exports compete with producers at home and abroad.[8] This permits use of observable (trade) data to calibrate the parameters that determine how different currencies influence a country's competitiveness, and thus the weights that should be attached to them in measuring the effective exchange rate for that country. The thinking behind the Fund's model is outlined in the next section, and a more technical specification is provided in the technical appendix.

3 Deriving a measure of the indirect effect

To derive a measure of the indirect effect of exchange rate changes on the New Zealand price level, we need a framework for assessing how exchange rate changes affect the competitiveness of New Zealand's producers.

New Zealand producers compete with overseas producers in a number of different ways. To see this, it is helpful to distinguish between trade in commodities and trade in manufactured goods. Commodity products of a given type tend to be very similar to each other: for example, a Japanese paper company is unlikely to care whether it uses wood pulp produced here or in Canada. Hence, economists think of commodity prices as being determined in a single 'world' market, with the price fluctuating according to shifts in world supply and demand.

To consider the implications of exchange rate changes for commodity trade, suppose New Zealand exports all its logs

[5] See Orr, Scott and White (1998) for a discussion of the role of the exchange rate in the Bank's policy thinking.

[6] See Drew and Frith (1998). In the short run, where direct effects are more important, inflation predictions are determined using a components based forecast. That is, rather than looking at summary variables like the TWI, the short-run factors relevant to major individual overseas-sourced items in the CPI (for example, evolving market conditions, the relevant exchange rates, and currencies of invoicing) are considered.

[7] King (1995) discusses the differences between calibration and estimation.

[8] Wickham (1987) outlines the model. Zanello and Desurelle (1997) is a more recent description of how the effective exchange rates are calculated in practice.

to Australia. If the Australian exchange rate depreciates suddenly, and Australian log buyers exit the market, what will happen to New Zealand's ability to sell logs overseas? Although there may be transitional difficulties in switching the product into other markets, it is likely that before long New Zealand will be able to sell its log output elsewhere on the world market, because world supply and demand conditions are little changed (given that Australia is not a major buyer of logs on the world market). On the other hand, suppose Australian conditions remain unchanged, but a major world log buyer (eg Japan) experiences a substantial depreciation of its currency and stops buying logs. World log prices will fall. Even though Australia's ability to pay for our logs is unchanged, NZ suppliers will be forced to lower their price in line with the world price, as Australian buyers could otherwise source logs elsewhere at lower prices. From this example, it is evident that it is the currencies of the large participants in the commodity markets we trade in that matter most for our commodity trade.

The situation is somewhat different for manufactured goods, because here there is likely to be a greater degree of product differentiation. For example, New Zealand exporters of refrigerators to Australia are likely to have tailored their product specifically for the Australian market. Now, suppose India exports refrigerators, but to China, and experiences an exchange rate depreciation that makes India much more competitive. Would this affect our trade with Australia? Not necessarily. If India is not a player in the Australian market, say because their refrigerators operate on the wrong voltage, India cannot quickly begin competing with New Zealand in that market.

On the other hand, if India was already a major exporter of refrigerators to Australia, then depreciation of the rupee would reduce the competitiveness of New Zealand refrigerators in the Australian market. In this case, the value of the rupee would be of relevance to New Zealand trade even though we have no bilateral trade with India in refrigerators. Thus, bilateral trade weights may not accurately measure competitiveness effects.

We want to find a way of taking into account these various ways in which the exchange rate is relevant for trade in manufactured (differentiated) goods, and (homogeneous) commodities. As outlined in the technical appendix, the IMF's model is designed to do just that, using disaggregated data on global trade flows. In this article, we apply the same methodology to New Zealand, but with more recent trade data than that used by the IMF.[9] We have used a sample of 24 countries that are either a significant bilateral trading partner for New Zealand, or a major player in one or more of our commodity markets. We call the resulting measures multilateral TWI weights.

The calculation requires a large amount of data: not just on New Zealand trade, but also on trade in manufactured goods between our major trading partners and other countries, and on the world commodity trade of those countries that are important buyers or sellers of commodities relevant to New Zealand. Because the method involves building an aggregate index from disaggregated trade data, we can also present the currency weights relevant to different sectors of the New Zealand economy. Ideally, we would also incorporate trade in services, but we were not able to obtain the data required.

Our key results are summarised in table 2 overleaf.

The first column shows the weights applying to the entire New Zealand economy. It is clear that, as foreshadowed above, the major economies of the world tend to receive weights higher than their bilateral trade shares with New Zealand. Most notably, the weights attached to the euro and the yen (18 percent and 21 percent respectively), are considerably higher than Euroland's and Japan's bilateral trade shares with New Zealand (11 percent and 14 percent respectively). Conversely, some important bilateral trading partners, notably Korea, are given a low weight by the 'competitiveness' methodology. This is because we primarily export commodities to Korea and, as outlined above, bilateral trade in commodities is not relevant in determining the competitiveness weights. Instead, it is the currencies of the key buyers and sellers in the world market for that commodity that matter.

[9] IMF periodically updates its weights, but the need to use a consistent dataset across all member countries means the data used is dated. The Fund's weights are currently based on 1988-91 data, whereas we are able to use 1994-96 data.

Table 2
'Multilateral' TWI weights

	Total	Export	Import	Manuf.	Meat	Dairy	Fish	Wool	Wood
Australia	10.2	10.0	10.5	13.1	11.5	12.3	1.2	39.8	2.6
Japan	20.5	18.7	22.7	23.4	38.4	7.9	34.7	9.2	16.5
EU (excl. UK)	18.0	21.1	14.2	12.2	8.1	50.5	16.0	25.4	9.2
USA	15.5	10.2	22.2	26.2	16.9	2.0	8.1	3.6	0.9
UK	5.4	4.5	6.5	5.7	0.6	1.5	1.5	2.7	9.0
Subtotals	69.7	64.6	76.1	80.6	75.6	74.3	61.6	80.6	38.2
Argentina	1.1	1.8	0.2	0.1	2.9	2.0	2.1	2.2	1.1
Brazil	2.3	3.1	1.2	0.2	3.9	5.8	0.2	0.0	2.8
Canada	4.0	6.2	1.3	1.6	1.9	0.1	2.7	0.0	31.0
Chile	0.6	1.0	0.1	0.1	0.5	0.0	1.7	0.0	2.2
China	4.7	4.4	5.0	2.6	3.7	0.0	3.0	5.6	6.5
Taiwan	1.5	0.5	2.7	3.8	0.0	0.0	0.0	0.0	0.0
HK	2.4	2.5	2.3	1.4	3.1	1.5	2.4	0.0	2.7
Indonesia	0.7	0.8	0.6	0.4	0.0	0.0	3.5	0.0	0.7
Korea	2.4	2.8	1.9	1.8	2.5	0.0	0.9	4.3	5.3
Malaysia	1.8	1.7	1.9	2.2	0.7	3.6	0.3	1.4	0.0
Singapore	1.9	1.8	2.0	3.4	1.0	2.3	0.7	0.0	0.0
South Africa	0.5	0.7	0.1	0.3	0.6	0.0	0.5	2.8	0.0
Switzerland	1.3	1.3	1.1	1.0	1.6	2.5	0.6	0.0	0.8
Thailand	2.0	2.5	1.3	0.7	1.9	3.1	5.3	0.0	3.1
Russia	1.7	2.1	1.1	0.0	0.0	3.0	7.0	0.0	5.0
Iran	0.7	0.7	0.9	0.0	0.0	1.8	0.0	0.0	0.0
Norway	0.5	0.9	0.0	0.0	0.0	0.0	5.3	0.0	0.5
India	0.2	0.4	0.1	0.0	0.0	0.0	2.4	3.0	0.0
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

As the remaining columns of table 2 show, the weights applicable to certain commodities are quite different from the aggregate weights. In other words, the importance of different currencies to the New Zealand economy varies significantly across particular industries. For example, according to our figures, the competitiveness of the wood products industry is most affected by fluctuations in the currencies of Canada (a major exporter) and Japan (a major importer). Japan is also a large buyer in the world meat and fish markets, and Europe's exports of dairy products and imports of wool make it an important player in the markets for these commodities. Although Australia is the major external market for New Zealand manufactures, once third country competition and imports of manufactures are taken into account, it is Japan and the US that feature with the largest weights in our manufacturing effective exchange rate.

The US weights for most commodities are low, reflecting the fact that its net trade in those commodities is small, though its production may be high.[10] For example, the US weight in the world dairy market (2.0 percent) clearly doesn't reflect its importance as a dairy producer. This illustrates a problem with our methodology, which means that the weights calculated are indicative rather than precise. As discussed in the technical appendix, if some countries produce and consume large amounts of a commodity internally, their importance in the world market will be understated by our method. The US, which has large internal trade in a number of commodities, is a case in point. On the other hand, most Japanese commodity trade will be external, so we are likely to have significantly overestimated the yen's weight at the expense of the US dollar.

Table 3: Previous, Current, and Multilateral TWI weights

	AUD	USD	UKP	JPY	DMK	Euro
Previous TWI (Dec 98)	37	27	9	21	6	
Current TWI (from Jan 99)	18	31	8	20		23
Multilateral TWI	15	22	8	29		26

10 The reason for using net rather than gross trade is explained in the Technical Appendix.

Table 3 (opposite below) shows the overall multilateral weights for an index that contains only the 5 currencies currently included in the official TWI, and compares them with the previous and current TWI weights.

The multilateral weights clearly suggest the importance of the NZD/AUD cross rate was overstated in the previous TWI. The current TWI weights are reasonably close to the multilateral weights, with the main difference being the high weight assigned by our calculations to the yen, at the expense of the US dollar. As discussed above, this yen weight is likely to be somewhat overstated: in other words, if we had the ability to account for internal commodity trade, it is likely that the multilateral weights would align even more closely to the weights in the current TWI.

4 Calculating effective exchange rate indices from currency weights

In this section, we explain how our effective exchange rate indices are calculated, and consider a range of different index measures.

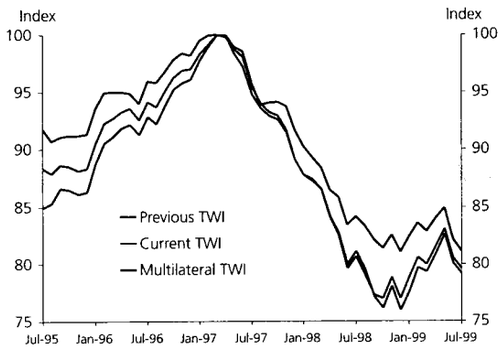
An effective exchange rate measure like the TWI is simply a weighted average – typically a geometric average – measure of the exchange rates for the relevant currencies, expressed as an index number relative to a normalised base period value. The formula in the case of the TWI is as follows:

$$EER_t = \left(\frac{E^{US}_{NZ\,t}}{E^{US}_{NZ\,o}}\right)^{W^{NZ}_{US}} \left(\frac{E^{AU}_{NZ\,t}}{E^{AU}_{NZ\,o}}\right)^{W^{NZ}_{AU}} \left(\frac{E^{JP}_{NZ\,t}}{E^{JP}_{NZ\,o}}\right)^{W^{NZ}_{JP}} \cdots \quad (4)^{11}$$

Where EER_t is New Zealand's effective exchange rate at time t, and (for example) E^{US}_{NZ} is the value of the NZ dollar in terms of US dollars, and W^{NZ}_{US} the weight of the US dollar in New Zealand's effective exchange rate.

Once the weights have been decided, calculating exchange rate indices merely requires exchange rate data. Figure 3 shows effective exchange rate indices derived from the previous, current, and "multilateral" TWI weights reported in table 3. The period chosen is roughly centred on the peak of the most recent cycle in the NZD, which occurred in early 1997, with the effective exchange rate indices based to equal 100 at that peak.

Figure 3
The previous, current and multilateral TWIs



The appreciation from the start of the sample period to the peak is quite different across the measures. The previous TWI shows a 9 percent appreciation, a TWI based on the multilateral weighting methodology shows an 18 percent appreciation, and the current official TWI (which uses 50:50 bilateral trade and GDP weights) shows a 13 percent appreciation. Similarly, the old TWI shows a smaller depreciation from the peak of the cycle than the other measures. The difference largely arises because the old TWI has a much higher weight on the Australian dollar, and our exchange rate cycle against the AUD has been much more muted.

5 Deriving measures of competitiveness

Strictly speaking, where we refer above to an "effective exchange rate," we should refer to a "nominal effective exchange rate". A nominal exchange rate differs from a "real effective exchange rate" in that the latter is based on exchange rates that have been adjusted for the difference in relative price levels between the two countries. Specifically, the exchange rate terms in the formula above are replaced with real exchange rate terms measured as:

$$RE^{US}_{NZ} = E^{US}_{NZ}[CPI_{NZ} / CPI_{US}] \quad (5)$$

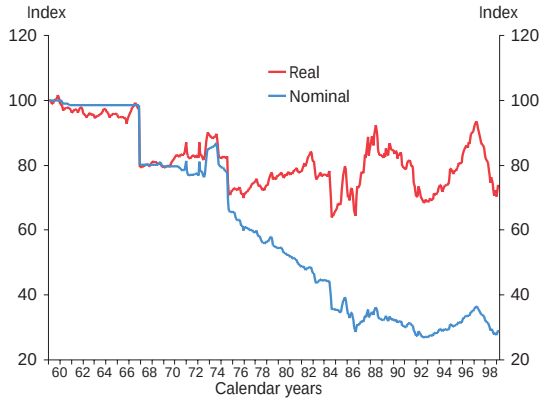
where RE^{US}_{NZ} is New Zealand's real exchange rate against the United States, and CPI_{NZ} is the level of the New Zealand CPI.

[11] The TWI actually uses weights that change across time, which necessitates the use of a scale factor to control for bias introduced over time by drifting weights (see White (1997) for a formula incorporating this). In this article, we calculate indices with constant weights over the entire period, eliminating this issue.

The advantage of a real effective exchange rate is that it takes account of how nominal exchange rates can shift over time merely because of the difference in the inflation rates between countries. If one country's currency is depreciating, but at the same pace as its price level is rising relative to those of its trading partners, then the exchange rate depreciation does not result in improved competitiveness in real terms. Rather, the lower currency is offset by higher costs. For this reason, when evaluating the effect of exchange rate movements on the economy, it is appropriate to focus on the real exchange rate. Of course, over shorter horizons, and in times of low inflation, movements in the nominal effective exchange rate will generally provide a reasonable guide to what is happening to the real rate.

In recent years, because New Zealand's inflation rate has been close to those of our trading partners, the real and nominal effective exchange values of the NZD have moved closely together. However, this was not the case in the 1970s and 1980s. During that period, as figure 4 shows, the nominal value of the New Zealand dollar steadily depreciated, but rising domestic costs and prices consistently offset the fall in the exchange rate.[12] Hence, in real effective exchange rate terms, there was no trend toward greater competitiveness, although there were substantial fluctuations around a flat trend. The noticeable steps down in our nominal and real exchange rate in 1967, 1975 and 1984 represent the devaluations that occurred in each of those years. The devaluations in 1975 and 1984 were only temporary in real terms, as in these cases the nominal devaluation was subsequently offset by higher inflation in New Zealand.

Figure 4
New Zealand's real and nominal effective exchange rate[13]
Index: Jan 1960=100.



Which relative price level measure?

Most commonly, real effective exchange rates (REERs) are calculated using relative Consumer Price Index (CPI) measures. However, the price index used should ideally measure the costs of domestic inputs into the production process, so that the real exchange rate measures the relative costs faced by producers here and overseas. The CPI may not be the most appropriate measure of this concept.

Since unit labour costs (ULC) in the manufacturing sector measure an important production cost for a key part of the tradeable sector, they are sometimes used as an alternative. However, it is not always clear that they are an appropriate cost measure. For countries such as New Zealand, where trade in primary commodities comprises a substantial proportion of total trade, labour costs may be less significant relative to the costs of other factor inputs.

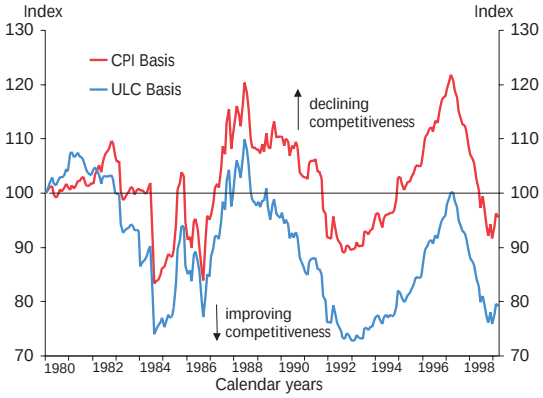
As shown in figure 5, a real exchange rate calculated using unit labour cost data suggests that New Zealand's competitiveness has improved (by around 20 percent) over the last 20 years.[14] This is quite different from the CPI measure. As discussed above, the CPI based measure suggests the real exchange rate has moved around a fairly flat long run trend. Part of the divergence between the two measures is likely to

[12] We calculated these indices using exchange rate and consumer price index data from the IMF's *International Financial Statistics*.

[13] In this chart and from this point forward, we use the multilateral weights. It should also be noted that we have calculated all of these indices with the weights fixed at the values appropriate for the relatively recent period. However, these weights may be inappropriate in history because of changing trade patterns. For example, the UK's share of New Zealand's bilateral trade with the TWI countries was 27 percent in 1978, but had fallen to 10 percent by 1998. Because of this issue, from this point forward we only consider the results for 1980 onwards. However, the point made above about the trend nominal depreciation of the NZD in the 1970s is still valid, since during that period New Zealand's high rate of inflation relative to its trading partners will have dominated the effects of changing trade patterns.

[14] We used OECD data on unit labour costs. Unit labour cost data tends to exhibit a cyclical pattern, owing to the tendency for output per worker to rise during good economic times. This cyclical pattern would need to be removed if the ULC measure was used to calculate precise changes in the NZ effective exchange rate over short (eg 1 year) periods, but the unadjusted measure remains valid as an indicator of broad trends.

Figure 5
Real exchange rates calculated with different deflators
Index: Jan 1980=100.



be the result of the introduction of GST during the 1980s, as GST raised the level of consumer prices but did not increase the level of unit labour costs. The remaining difference between the two measures reflects the fact that real unit labour costs in New Zealand have not been rising as fast as in our trading partners. The difference between the two measures emphasises the importance of examining a range of different price indices when assessing long run trends in REERs.

Large or small currency baskets?

Thus far, we have only considered measures of our competitiveness vis-à-vis our 5 major trading partners. One of the issues considered when the TWI was revised was whether a larger selection of trading partner currencies should be included. The omission of non-Japan Asian currencies in particular was focused on.

Figure 6
Real exchange rates with wider currency baskets
Index: Jan 1980=100.

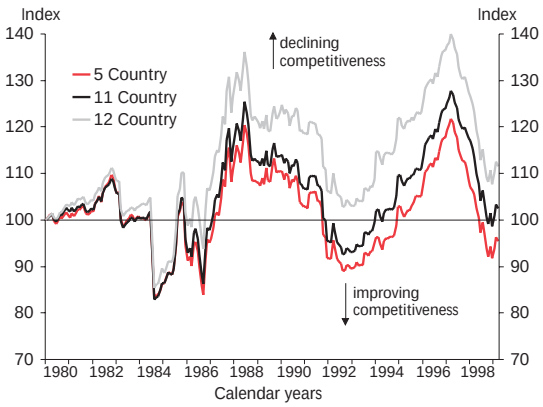


Figure 6 includes a CPI based measure of the real effective value of the NZD on an 11 currency basis.[14] This measure is very similar to the 5-country measure. However, it need not always be the case that the measure will be relatively unaffected by adding or subtracting currencies from the basket. For example, adding China to obtain a 12 country measure (the grey line) results in a significant divergence from the 5 and 11 currency measures. This may reflect that China has experienced a very substantial improvement in competitiveness over the period, and hence contributes to a material loss of competitiveness for New Zealand in overall terms. Equally, however, it may reflect that the exchange rate and price level data for China is not representative of the concepts we are attempting to capture. This is quite possible in the case of China, given that during the period it has moved from a dual to a unified exchange rate regime, and from administered toward market-based prices. These points highlight that although most measures of the real effective exchange rate follow a broadly similar path, specific factors can make a difference. This again underscores the need to assess competitiveness on the basis of a range of measures, and to understand the factors that give rise to the divergences amongst them.

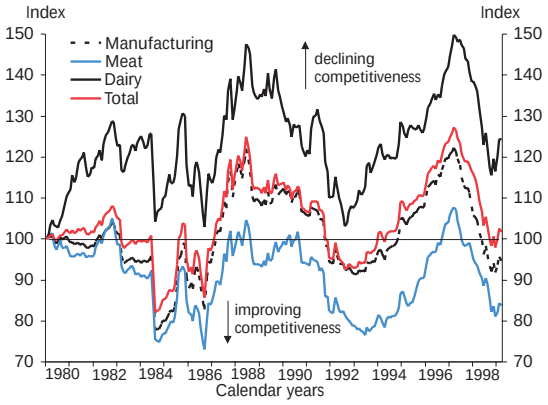
Economy wide versus sectoral real effective exchange rates

Looking at economy-wide measures of New Zealand's exchange rate generally makes sense for the Reserve Bank, since the Bank cannot independently influence specific bilateral exchange rates (and indeed can only temporarily influence the overall level of the real exchange rate). Nor, given that there is just one New Zealand dollar, can the Bank operate different monetary policies for different sectors of the economy.

However, much of the public interest in external competitiveness does lie at the sectoral, or industry, level. The Bank also has an interest in how exchange rates are affecting different sectors of the economy, as it needs to understand the factors lying behind sectoral developments when shaping

[14] The existing 5, plus Canada, Singapore, Malaysia, Thailand, Taiwan and Korea. Data difficulties prevented inclusion of other countries like Russia, Brazil and Argentina.

Figure 7
Real exchange rates for particular sectors
Index: Jan 1980=100.



an overall view of the economy. It will be evident from table 2 that the relative importance of different currencies varies quite a lot across different sectors of the economy, and this is reflected in their real effective exchange rates.

Figure 7 compares the CPI-based effective exchange rate facing the meat, dairy and manufacturing sectors with that facing the economy as a whole. It suggests that in the first half of the 1980s, the real effective exchange rate facing the dairy sector rose appreciably, while that facing the meat sector steadily depreciated, at least until about 1992. This reflects the meat sector's large exposure to the Yen, which the NZD depreciated against over the period, and the dairy industry's exposure to the European currencies, against which the NZD has appreciated (in real terms) over the period. Manufacturing's external competitiveness throughout the period has remained close to the average for the tradeable goods sector, though as noted above, in unit labour cost terms, the external competitiveness of New Zealand's manufacturing sector has probably improved.

However, it is important to note that sectoral measures of the real exchange rate do not tell us whether a particular sector has become "better off" over a period. The real effective exchange rate only measures the exchange rate's effect on competitiveness. Other factors are at least as crucial to the prosperity and growth of any particular sector of the economy: for example, how overseas consumers' preferences for that sector's product are evolving. Indeed, it would appear that the explanations for the meat industry having fared less well in recent years than the dairy industry lie more in these "other" factors than in exchange rate changes (given that the exchange rate facing the meat sector appears to have been relatively favourable).

6 Conclusions

It is evident from the analysis above that different weighting schemes don't give greatly different pictures of the cycle in New Zealand's effective exchange rate over the 1980-1999 period. However, different overall measures of the exchange rate can look quite different over shorter periods, and may suggest different long-run trends. To illustrate this, it is only necessary to look back at figures 3 and 5.

Elsewhere, the Bank has explained why it is the indirect effect of exchange rate movements on inflation (through influencing aggregate demand for New Zealand produced goods and services) that is most relevant to monetary policy. As has been outlined in this article, in order to capture the relative importance of trading partners' currencies for New Zealand's external competitiveness, it is necessary to recognise that external trade takes place in a global, multilateral trading system. For this reason, the currency weighting methodology developed by the IMF is to be preferred on conceptual grounds over the bilateral trade weighting methodology that was used to construct the TWI until January 1999.

In this article we have reported the currency weights that are arrived at by applying the multilateral weighting methodology to recent New Zealand trade data, and have found that the weights correspond reasonably closely with those that are generated by the new combined GDP and bilateral trade weighting method used to construct the TWI since the beginning of 1999. The notable exception is the relative weights assigned to the USD and the yen, which our analysis might be taken as suggesting are respectively over-weighted and under-weighted in the current official TWI. However, for reasons relating to our inability to take full account in our multilateral analysis of the importance of internal trade, we believe that on this point it is the current official TWI that is more likely to be correct.

The other main point that we have sought to make in this article is that although there can be only one "official" TWI,

there are in fact many different ways to summarise the effect of different exchange rates on the New Zealand economy. While the official TWI is likely to remain a focal point for analysis and discussion of the exchange rate, we will continue to work with a range of indices, utilising sectoral coverage, broader country coverage, and real measures based on different deflators. Furthermore, as data becomes available, we will seek to refine our results further, particularly if we find a suitable source of services (especially tourism) trade statistics.

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Technical appendix: calculating multilateral effective exchange rate weights

In this appendix, we outline in detail the methodology and data used to calculate the "multilateral" effective exchange rate weights.

The equations[16]

The overall weights in the effective exchange rate index are a weighted average of the weights that we calculate for manufactured exports, manufactured imports, and commodity trade (exports and imports). For example, the weight for the Australian dollar is calculated as:

$$WT^{AU} = \sum_X s_X C_X^{AU} + s_{MI} MI^{AU} + s_{ME} ME^{AU} \quad (6)$$

where:

WT^{AU} = Australia's overall weight in the NZ effective exchange rate index

s_X = the share of New Zealand's total trade (exports+imports) that is composed of commodity X.

C_X^{AU} = the weight assigned to Australia in calculating New Zealand's competitiveness in commodity industry (see below).

s_{MI}, s_{ME} = the share of New Zealand's trade composed of manufacturing imports and exports respectively,

MI^{AU}, ME^{AU} = Australia's weight in calculating New Zealand's competitiveness in New Zealand's manufactured import and export markets respectively (see below).

The C_X^{AU}, MI^{AU} and ME^{AU} terms require further explanation, as follows:

C_X^{AU}: For commodities, our weights are designed to capture who the major buyers and sellers of the product on the world market are. For example, the weight ascribed to any particular country in calculating New Zealand's dairy competitiveness is that country's total trade in dairy products, divided by total world (excluding New Zealand) trade in dairy products. In the case of Australia,

$$C_X^{AU} = \frac{T_X^{AU}}{1 - T_X^{NZ}} \quad (7)$$

where T_X^{AU} and T_X^{NZ} are Australia and New Zealand's shares of world trade in commodity X.

MI^{AU}: For competition in New Zealand from manufactured imports, the weight assigned to a country is simply the proportion of New Zealand's manufactured imports coming from that country. In the case of imports of manufactures from Australia,

$$MI^{AU} = M_{AU}^{NZ} \quad (8)$$

where M_{AU}^{NZ} is the proportion of New Zealand's manufactured imports coming from Australia.

ME^{AU}: New Zealand manufactured exports compete with Australian manufacturers both in Australia, and in third markets that both New Zealand and Australia export to. The measure of competition in Australia is a function of how much we export to Australia (X_{NZ}^{AU}), and how large a share of their home market Australian manufacturers have (Australia's internal trade share, denoted IT_{AU}). This is the first part of equation (9) below. The second part accounts for competition in other markets. In other markets, our competition with Australian manufacturers is a function of how much we export to that market (X_{NZ}^{J} for country J), how big a share of that country's manufactured imports (excluding those from New Zealand) come from Australia

16 Zanello and Desurelle (1997) contains a more detailed but essentially equivalent exposition of the methodology set out here.

$M^{J}_{AU}/(1-M^{J}_{NZ})$, and how important imports are in that country's manufactured goods market $(1-IT_J)$.

$$ME^{AU} = X^{AU}_{NZ}(IT_{AU}) + \sum_{J \neq NZ,AU} X^{J}_{NZ} \frac{M^{J}_{AU}}{1-M^{J}_{NZ}}(1-IT_J) \qquad (9)$$

Data sources

Data on the major buyers and sellers of the commodities New Zealand exports and imports was taken from the United Nation's *Commodity Trade Statistics* Publication. For a set of commodity types relevant to New Zealand, we obtained data on exports and imports of key products within that group: for example, 'Fish and Seafood' was represented by "Fish, fresh, chilled, frozen", and "Shellfish, fresh, frozen". The commodity types we considered were Meat, Dairy, Fish, Wood, Fruit and Vegetables, Aluminium, Leather/Hides, Iron/Steel, Casein, and 'Alcohols and Esthers', 'Chemicals', Clothing, and Plastics. We used data from the 1994-1996 period. The countries included in our sample are shown in table 3 below.

For commodities, we departed from the IMF methodology in a significant way. A number of New Zealand's key agricultural commodities are traded very heavily in markets that (for transportation or trade barrier related reasons) are not fully accessible to NZ. For example, large quantities of milk cross the Dutch, French and Belgian borders, often only for processing before resale in other European markets. If all the intra-European 'trade' was recorded in our calculations, an inappropriately high weight (around 90 percent) would be ascribed to the EU in respect of dairy production.

Conceptually, the ideal way to deal with this problem would be to use data on production and final consumption of commodities rather than trade data. This would increase the weights for countries that produce a large quantity of a commodity, but consume it domestically (for example, North America, in the case of dairy products). But without the ability to do this, we dealt with the problem by calculating commodity market shares (the *T* terms in equation 7) on the basis of each country or area's net trade in a commodity (the absolute value of exports less imports, rather than the value of exports plus imports).

To obtain data on exports and imports of manufactured goods, we used the United Nations *TRAINS* database. We defined manufactured goods as harmonised series chapters 84-96, and again used a 1994-1996 period. This takes in most high value-added goods such as electronic goods, vehicles, optical and musical instruments and machinery. The IMF definition of manufactures, which includes items such as leather, paper and aluminium, is much broader than the one we employ. This was a deliberate decision on our part, reflecting a view that today, commodity manufactures such as leather and paper are best regarded as homogenous commodities, rather than highly differentiated products. Internal trade shares in manufactures, which are calculated using the national accounts data of each individual country, were provided by the IMF. For simplicity, we limited our accounting for third country competition to our significant manufactured export markets (those purchasing at least 2.5 percent of our manufactured exports).

This gave us enough information to calculate the competitiveness weights appropriate to each New Zealand import and export. We then calculated aggregate trade weights using equation 6. Data from the *NZ Trade Atlas* provided the *s* terms, the shares each item has in New Zealand's total trade. We used shares based on New Zealand's trade in the 1996-1998 period. The Trade Atlas data showed that the commodity and manufactured groups chosen covered roughly 80 percent of total exports and 75 percent of total imports excluding oil. (For technical reasons discussed in Zanello and Desurelle (1997), petrochemical trade is eliminated from this sort of calculation.)

Our data does not include trade in services. Given their increasing importance in New Zealand trade, we hope to update these results in the future incorporating weights for New Zealand's trade in tourism, and possibly other services.