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# A review of the trade weighted exchange rate index

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Over the past year the Bank has completed a review of the official trade weighted index (TWI). This article documents that review, noting issues of importance when considering the most appropriate effective exchange rate for a central bank, and presenting a number of different weighting methodologies. Whilst different effective exchange rate indices are suited to different purposes, at this time we believe the current official five-currency TWI remains a good summary measure for monetary policy purposes. However, the Bank will also begin publishing an extended 14 currency TWI, which includes the currencies of a number of Asian economies with which New Zealand's bilateral trade has increased markedly in recent years. This 'extended' TWI will be published on the Bank's website as an analytical series and the properties of the series will be further monitored as trade flows develop.

## 1 Introduction

The exchange rate plays an important role in the tradables sector of the New Zealand economy. Movements in the exchange rate affect both the demand and supply of exports and imports, and the New Zealand dollar prices at which these products are transacted. The rise and fall of the exchange rate against our major trading partners is therefore fundamental to the analysis of the economy.

As a small open economy, New Zealand's international transactions tend to be denominated in a range of different currencies; as a result, New Zealand faces many exchange rates and a weighted average measure of individual bilateral exchange rates against the New Zealand dollar (NZD) is necessary to summarise the country's exchange rate position. These summary measures are often referred to as an effective exchange rate or a trade weighted exchange rate index (TWI). The Reserve Bank has calculated and published a trade weighted index for New Zealand for many years and the index is widely used by analysts. At present, this TWI is based on five currencies — the Australian dollar, US dollar, UK pound, Japanese yen, and the euro.

There are many different ways to construct trade weighted indices and practices differ from country to country. Decisions need to be made on the number of currencies to include and on the most appropriate weighting methodology. These decisions depend partly on the purposes for which the TWI

is being used, and partly on practical considerations such as the availability of data and computational requirements. To ensure that the index is appropriate, the Bank reviews the construction of its TWI periodically.<sup>2</sup>

The Bank last reviewed the TWI in 1997. This review focused on ways of better capturing the indirect link between the exchange rate and external sector competitiveness.<sup>3</sup> Following the review, the weighting methodology used to construct the official TWI was changed to incorporate the relative economic size of the countries included in the index, in addition to the country's weight in trade with New Zealand. The new index replaced the previous TWI that had been based on bi-lateral trade shares only. The review of the TWI also coincided with the introduction of the euro; accordingly, the euro replaced the deutschemark in the index.

This article documents a further review of the TWI undertaken over the past year. A review of the index was timely, given increasing trade flows between New Zealand and many Asian economies, the currencies of which are not captured by the five currency index. Following the latest review, the Bank has decided to begin constructing a 14 currency TWI, calculated analogously to the five currency index. This extended index will be published on the Bank's website alongside the existing five currency TWI. In both cases, the weighting methodology will be that adopted at the time of the last review.

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<sup>1</sup> The author would like to thank to Rachel Holden for her contribution to the article; Tahia Equab and Graham Howard for their work on data series; and other members of the Economics department for comments.

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<sup>2</sup> The index weights are updated annually as a matter of course.

<sup>3</sup> See White (1997).

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The structure of this article is as follows: Section 2 briefly reviews the relevance of a TWI for a central bank. Section 3 considers a number of different weighting methodologies that can be used to derive effective exchange rate indices and assesses the potential pros and cons of such measures. Section 4 presents different TWIs based on variations in the number of currencies and weighting methodologies. The section also explains why the Bank has decided to continue with the existing weighting methodology when introducing the 14 currency index. Section 5 then presents some estimates of the real exchange rate — TWIs that take into account relative inflation rates or production costs of the countries concerned relative to New Zealand. In principle, these indices are more appropriate for gauging longer-term trends in New Zealand’s international competitiveness. Section 6 of the article concludes.

## 2 What is the Reserve Bank’s main interest in a TWI?

There are a number of different ways to calculate a TWI, and many purposes for which such indices may be used. The Reserve Bank’s main interest in the TWI is as a yardstick for measuring:

- the *direct* influence of exchange rate movements on prices (exchange rate ‘pass-through’); and
- the *indirect* influence of the exchange rate on inflation through its influence on external sector competitiveness.

In the 1997 review, the new weights were designed to better capture changes in the competitiveness of the external sector by attempting to allow for third-country competition — the competition exporters face from competing suppliers in their export markets (see box 1). To do so, the bilateral trade weights for the currencies included in the TWI were adjusted to reflect the relative size of the economy in question by placing a 50 percent weight on GDP. This was intended to capture the notion that larger economies are likely to be a bigger competitive force in the world markets in which New

Zealand competes.<sup>4</sup> With more emphasis on the link between the exchange rate and export sector competitiveness, the new index was thought to better capture the indirect influence of the exchange rate on inflation.

The new index was also considered to provide a useful yardstick for measuring the direct effect of exchange rate fluctuations on import and export prices and, to some extent, on consumer prices. Econometric studies conducted at the time of the last review concluded that the currencies of large economies tend to have a greater influence on consumer price inflation in New Zealand than indicated by the country’s share in bilateral trade. In effect, the simple bilateral trade weight was found to understate the importance of the US dollar on inflation, and give too much weight to the Australian dollar. At the time, there were some reservations expressed about the robustness of the econometric results, and it was concluded there was insufficient formal evidence for a move away from using simple bilateral trade weights.<sup>4</sup> Nonetheless, by including country GDP in TWI weights in order to take account of external sector competitiveness, we are, in effect, aligning country weights more closely to those suggested by these studies.

The focus on improving the TWI as a measure of the indirect influence of the exchange rate on activity and prices at the time of the last review was considered consistent with developments in monetary policy, away from a focus on the exchange rate’s direct price effects on inflation towards its indirect — and more medium-term — effects on inflation that occur through its impact on economic activity. Given the current Policy Targets Agreement, which requires the Bank to target inflation of 1–3 percent, on average over the medium term, this focus remains appropriate.

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<sup>4</sup> Caveats included the use of historical data to derive weights, given subsequent structural changes in the NZ economy (1985 float of NZ, for example) and the possible evolution of the degree to which firms re-price in response to fluctuations in the exchange rate. For more information, see Hargreaves and White (1999).

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## Box 1

### What is third-country competition?

Third-country competition refers to the competition that New Zealand faces when its exports to a foreign country compete with imports into that country from third countries (as well as domestically produced goods). When considering relative currency weights to be used in New Zealand's effective exchange rate index, it may be important to take into account the currencies of these third countries as well as the country with which we trade directly.

To comprehensively take into account the competition that exporters face we must account for the share of third countries in the market for all New Zealand's traded goods and adjust for the importance of that good to total New Zealand trade. Due to the differences in the way international prices are determined for commodities compared to manufactured goods, we must also account for these separately. This calculation thus requires not only data on New Zealand trade flows, but world trade flows in manufactured goods and world trade of the commodities relevant for New Zealand.

## 3 What are the issues to consider?

In reviewing whether the current five currency TWI remains appropriate, the Bank has considered a number of issues, including:

- The pros and cons of different methodologies for calculating the TWI;
- the appropriate number of currencies for inclusion in the index;
- the current calculation of GDP weights as proxies for country size in the index; and
- the desire of the Bank to provide a TWI that is transparent and easily replicable by external users.

The following is an outline of the issues considered. As noted earlier, the Bank has decided to retain the current official five currency TWI, and to also begin publishing a broader index that includes 14 currencies. The existing methodology has been retained.

### Calculation methods

#### *Multilateral exchange rate indices*

A number of countries now construct effective exchange rates that comprehensively take into account the relative importance of the currencies of trading partners to the home country's competitiveness. These indices are constructed in a similar way to the multilateral TWI used by the IMF.<sup>5</sup> The IMF weighting methodology allows for *import competition*,

*export competition and third-market competition* to be captured. The calculation involves a relatively complex methodology and a vast matrix of cross-country data; the basic steps involved in such an index are described in box 2. Hargreaves and White (1999) discuss the IMF methodology and its application to New Zealand in more detail. The authors found that multilateral TWI weights constructed (based on IMF methodology) for New Zealand tend to be relatively similar to weights that use GDP as a proxy, and the resulting exchange rate indices move closely over time.

Hargreaves and White also identify a number of problems when applying the IMF methodology to New Zealand. In particular, the IMF multilateral methodology does not account for the importance in the world market of countries that produce and consume large amounts of a commodity internally (the world price for the commodity is affected by the internal trade, but without internal production and consumption data the importance of this is not included in the calculation of TWI weights). In New Zealand, we are highly dependent on trade in commodities, and it is important that we take world production of commodities into account when thinking of an ideal exchange rate measure. In principle, it would be possible to construct a 'tailored' multilateral index for New Zealand that took into account the competitive structures of the various markets in which the country operates as well as the relative importance of internal production and consumption of different countries. However, such an index would potentially be extremely complex even relative to the more generic approach adopted by the IMF.

<sup>5</sup> Bayoumi, Tamin et al (2005).

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## Box 2

### A basic summary of how a multilateral effective exchange rate is calculated: Calculating the weight on country A in New Zealand's exchange rate index.

The IMF produces separate formulas for the construction of weights in the commodity, manufacturing, and tourism sectors. The commodity weights are designed so that they incorporate the global importance of the foreign country (country A) in the trade of each commodity and the internal importance of each commodity to New Zealand. The manufacturing and tourism weights account for different goods (services) markets separately; the basic steps involved are described below:

#### **1. Weights for the three types of competition, for each country, for each product, are calculated.**

- (a) *The Import competition* weight assigned to country A is equal to the share of total imports into New Zealand that come from country A.
- (b) *The Bilateral export competition* weight assigned to country A is calculated using the share of New Zealand exports that go to country A and the proportion of

country A's domestic market that is supplied by domestic producers (the degrees of openness of country A for the good). If country A is a relatively closed economy, then country A will have a higher weight, as it is more important as a direct bilateral competitor.

- (c) Weights that take account of *third-market competition* are calculated by multiplying country A's share in total supply of goods to a third market by the relative importance of the market as a destination for New Zealand exports.

#### **2. Aggregation**

The *import competition*, *bilateral export competition* and *third-market competition* weights are then aggregated according to their relative importance to New Zealand. A huge amount of trade flow data is required to determine these weights and they tend not to vary too much over time.

### **More parsimonious methods: The 50:50 trade to GDP methodology**

The 50:50 trade-to-GDP weighted TWI that was adopted in 1999 was designed to be a simpler proxy for the more complicated multilateral index.

The intuition behind the use of GDP in the currency weight is that large countries are more likely to have a presence within other countries' domestic economies, and hence act as a competitor to our export markets. For example, it is more likely that we are going to compete in country A with a third country that is relatively large than one that is relatively small. Thus, by incorporating GDP into currency weights, we can, to some degree, capture the importance of third-country competition. Similarly, it is more likely that larger countries will have a bigger influence on the world price of a commodity than smaller countries. Thus GDP can also be used as a proxy for the importance of a country in the pricing of trade commodities.

This is a straightforward proxy for a complicated process. Although there are conceptually superior ways to account for the competition effects, by using GDP we are applying an easily calculated index that is simple and transparent. In the past, the 50:50 weighted TWI has been found to track closely to the multilateral TWI and the 50:50 weights have therefore been considered an approximation to the more complicated IMF multilateral trade weights.<sup>6</sup>

It may be possible to construct exchange rate indices that better capture the influence of trading partner economies on the world price of New Zealand's commodity exports than the more parsimonious IMF multilateral index. Such indices could include weights based on global trade in particular New Zealand commodities, or country production and consumption of particular commodity exports. However, there are a number of limitations associated with calculating such indices. In order to comprehensively account for trade

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<sup>6</sup> Hargreaves and White (1999).

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or production of New Zealand main commodity exports, a number of countries not currently included in the current five currency index (such as Brazil and Chile) would need to be included. With the increasing number of currencies in the index, the availability and accuracy of data can become a problem and may lead to a considerable time lag in construction of weights. In addition, the direct trade flows between a number of these countries and New Zealand will be small and the influence of countries where direct trade flows are large, but commodity production or trade is small, may be swamped.

Hargreaves and White find that, when calculated on a multilateral trade weighted basis, weights applicable to certain sectors are considerably different to aggregate weights. Given the Bank is more interested in the impact of the exchange rate on aggregate activity, it would not be ideal to have exchange rates measures biased towards competitiveness in certain industries. Thus, a great number of different commodity markets and a large number of countries must be included to get a summary measure and the resulting index will quickly become very complex. Nonetheless, it is important to understand how certain sectors are being influenced by exchange rate movements, and thus would be useful to continue to investigate producing indices that focus on specific sectors or commodities in addition to a more economy-wide measure of exchange rates.

Further, services trade flows are becoming increasingly important in overall trade. Data on services trade is limited and excluding this from a measure of the exchange rate is not ideal. It may, therefore, be the case that a more abstract methodology that does not focus particularly on specific export industries may meet our goals more appropriately at present.

Whilst an index that comprehensively takes into account external competition is important, a guiding principle for the Bank is to construct a TWI that is transparent and replicable by external users. Given some of the limitations inherent in the more complex constructs, the Bank decided to retain the existing 50:50 methodology for calculating its TWI.

## The use of US dollar exchange rates to convert country GDP

There is, however, a question as to whether the current calculation of the 50:50 weights could be improved. Under the current methodology, nominal GDP weights are converted into US dollars at the exchange rate applying for the year in question. The use of market exchange rates means that US dollar movements may cause fluctuations in GDP weights that do not reflect changes in the importance of the currency to New Zealand trade. It has been suggested that GDP weights that have been converted to a common currency using country purchasing power parity (PPP) may be more appropriate.<sup>7</sup> GDP calculated using PPPs tends to be more stable over time than GDP measured using the US dollar exchange rate.

However, it is not clear that the use of PPP-based GDP weights is conceptually appropriate. The intuition behind using the GDP-based weights is to account for the effects of third-country competition by giving more weight to large currencies that are more likely to have a significant impact on the price New Zealand receives for its goods abroad (as discussed above). Increasing the weight of a currency because residents have more purchasing power in domestic markets may be at odds with this intuition.

In addition, there are many problems associated with the quality of the PPP measures, including; poor quality data, inconsistency across member currencies with regard to organisation and collection of data, and problems with aggregation methods. Official benchmark year PPPs are also only calculated every three years; for non-benchmark years, PPP conversion rates are estimated.<sup>8</sup>

Nevertheless, in the following section, we calculate a PPP-based variant of the TWI and examine how different this index is to the current TWI. We find that the two indices are actually very similar, which suggests that, over time, the

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<sup>7</sup> PPPs are the rates of currency conversion that eliminate the differences in price levels between countries see the International Comparison Programme (ICP) at [www.worldbank.org](http://www.worldbank.org). PPP data used in calculations is based on data sourced from the WDI online.

<sup>8</sup> Furthermore, the ICP does not publish data for Taiwan; the PPP-based GDP for Taiwan can be obtained from the Penn World Tables and is an estimate.

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volatility in GDP weights may not actually be a large problem for the TWI. Given the conceptual and data problems, an exchange rate conversion of GDP may be preferable.<sup>9</sup>

### The number of currencies to include in the index

Another issue to consider when calculating a TWI is how many currencies to include in the index. The TWI that the Bank has been publishing to date is made up of five currencies — the US dollar, Australian dollar, British pound, euro and Japanese yen. The countries or regions to which these currencies relate account for approximately 60 percent of New Zealand's international trade. It can be argued that a broader range of currencies would be appropriate to provide a comprehensive measure of New Zealand's effective exchange rate.

Importantly, the published five-currency TWI does not cover any Asian currencies other than the Japanese yen. In the past, the relatively narrow focus of the NZ TWI has been justified on the basis that many Asian currencies have been pegged to the US dollar and hence there has been little justification for expanding the overall number of currencies. But with the recent removal of the currency peg in China, and increasing trade-flows between New Zealand and Asia more generally, capturing exchange rate movements against the currencies of these countries is likely to become increasingly important in the future. The Bank has therefore decided that it should begin to calculate an expanded currency version of the current TWI.

How many countries is enough? There is no magical answer to this question — in the following section we calculate a 14 currency index including all countries that account for more than 1 percent of trade (countries included make up a little more than 80 percent of total trade).

To ensure consistency with the current index, in which the number of currencies is fixed, the number of currencies in the extended index that we construct has been set constant

at 14. In future there may be scope for updating the number of countries included based on trade share. However, in practice the trade share of countries included are unlikely to vary significantly year to year, and given the weight on the lowest weighted currency is small, any minor changes to the inclusion of these countries are unlikely to have a significant bearing on the index.

## 4 Potential TWI measures

To illustrate the significance of some of the issues discussed in the previous section, this section presents a range of different TWI measures for comparison.

It is important to note that the five currency exchange rate series presented in this section is an analytical series calculated in an analogous way to the current official TWI. Post 1999, the weights, and resulting five currency exchange rate series, differ only marginally from the official TWI (see figure 1).<sup>10</sup> However prior to 1999, the analytical series differs more markedly from the official TWI, because of the use of the current 50:50 GDP-to-trade methodology, rather than the simple bilateral trade weights that were used in the official TWI at this time.<sup>11</sup> The use of the analytical five currency TWI facilitates comparison with the extended 14 currency index that has been constructed using historical GDP and the 50:50 GDP-to-trade methodology. Both indices use the deutschemark in place of the euro before 1999.

The analytical five currency series shown in figure 1 shows a higher peak than the official TWI index in the mid-1990s, a reflection of the much larger weight placed on the US dollar, which exhibited a greater cycle over this time. A lower weight was also placed on the Australian dollar. Given its consistent construction over history, the analytical series may be a more telling indicator when comparing highs and lows in the exchange rate.

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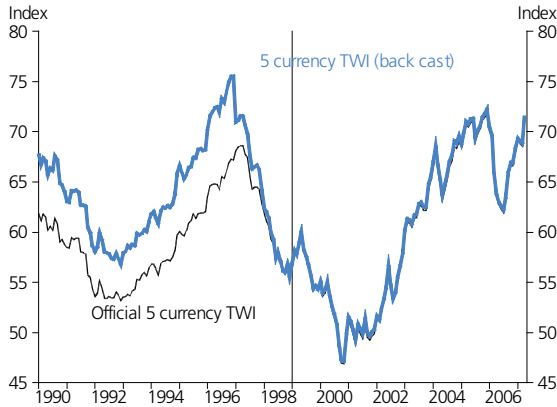
<sup>9</sup> In addition, if the volatility of the GDP weights became a major problem, there may be other ways of handling it (eg, by using moving averages of GDP to smooth year-to-year volatility).

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<sup>10</sup> The difference stems from the use of historical GDP (rather than real-time GDP) to calculate weights. These slight changes were made to the methodology to allow us to calculate a historical time series for the 14 currency index.

<sup>11</sup> In order to calculate TWI weights in 1999 and 2000, we have used synthetic euro exchange rates and GDP.

**Figure 1**  
The current official 5 currency TWI and the analytical 5- currency TWI, back cast using 50:50 GDP-to-trade methodology



Weights set in December 2006 (based on data from the year to 2005) are given in table 1 below. It is important to note that these weights have varied over time, with changes being particularly marked for developing economies and those countries with which trade flows have increased notably over the past decade – for example, the weight of China has increased to 8.1 percent from 2.2 percent in 1990.

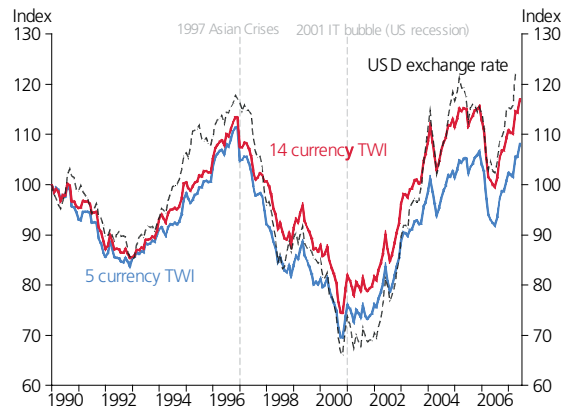
Despite the variation in currency weights, we find that the resulting exchange rate indices move very closely over time.

In the following, we present each index, and identify any divergence between the different measures.

**An expanded (14 currency) calculated using the same 50:50 methodology used in the current TWI**

Figure 2 shows an expanded index that includes the five currencies in the current TWI with the addition of the currencies of China, Malaysia, Indonesia, Thailand, Taiwan, Korea, Singapore, Hong Kong and Canada. These are

**Figure 2**  
The extended 14 currency TWI and 5 currency TWI (analytical series) (Index January 1990=100)



**Table 1**  
(a) Weights for the 14 and 5 currency TWI (analytical series)

Economy	5-currency			14-currency		
	GDP weight	Trade weight	Final weight	GDP weight	Trade weight	Final weight
Australia	2.4	35.1	18.8	2.0	25.0	13.5
USA	41.7	20.8	31.2	35.3	14.8	25.0
Japan	15.2	18.1	16.7	12.9	12.9	12.9
Euro	33.2	19.5	26.3	28.1	13.9	21
UK	7.5	6.5	7.0	6.3	4.6	5.5
Korea				2.2	3.7	3.0
China				6.5	9.8	8.1
Malaysia				0.4	2.5	1.4
Hong Kong				0.5	1.2	0.9
Indonesia				0.8	1.8	1.3
Thailand				0.5	2.3	1.4
Singapore				0.3	2.9	1.6
Canada				3.2	1.8	2.5
Taiwan				1.0	2.9	1.9

(b) Weights for the PPP-based 14 and 5 currency TWI (analytical series)

Economy	5-currency		14-currency	
	GDP weight (PPP)	Final weight (PPP)	GDP weight (PPP)	Final weight (PPP)
Australia	2.3	18.7	1.6	13.3
USA	44.1	32.5	30.5	22.6
Japan	14.1	16.1	9.8	11.3
Euro	22.5	26.0	22.5	18.2
UK	6.9	6.7	4.8	4.7
Korea			2.6	3.2
China			19.6	14.7
Malaysia			0.7	1.6
Hong Kong			0.6	0.9
Indonesia			2.1	2.0
Thailand			1.4	1.8
Singapore			0.3	1.6
Canada			2.6	2.2
Taiwan			1.1	2.0

the currencies of New Zealand's top 14 trading areas and together they make up approximately 80 percent of our trade; each of these countries individually has a trade share greater than 1 percent.

As shown by figure 2, the 14 currency index has tended to be slightly stronger over recent history than the five currency index. Aside from episodes around the Asian crisis and 2001 dot-com bubble, much of the relative movement in the extended TWI reflect movements in the US dollar. The influence of the US dollar on the extended index tends to be greater than in the five currency index, given the inclusion of a number of Asian currencies, such as the Chinese yuan, that have been largely fixed against the US dollar over recent history.

The influence of movements in the US dollar on the extended 14 currency index can clearly be seen in the years before the 1997 Asian crises. Over this time, the 14 currency index appreciated more sharply relative to the five currency index, in line with an appreciation of the NZD vis-à-vis the US dollar. However, following the peak of the Asian crises, the 14 currency index held up relative to both the five currency index and the US dollar cross rate – a reflection of the depreciation of the Asian currencies over this time, with the currencies of Indonesia, Thailand, Malaysia and Korea

depreciating most sharply against the NZD (together these economies had just over 7 percent weight in the index). Again, in the years following the 2001 dot com bubble, the NZD appreciated to a greater extent relative to the Asian currencies than the US dollar. However, more recently, the 14 currency index appears to have been supported by the marked appreciation of the NZD relative to the US dollar.

Of course, the influence of the US dollar on the extended index may decrease over time as the Asian currencies move further away from a US dollar peg. Indices may also diverge in future if changes in the relative GDPs across the countries were to lead to significant changes in the weights.

### Indices calculated using PPP-based GDP weights

Figure 3 (a) compares the newly-calculated 14 currency index with an alternative 14 currency index in which PPP-based GDP has been used to form the country weights (as discussed in section 3). Figure 3 (b) is a recalculation of the five currency TWI using PPP-based GDP.

The effect of PPP-GDP weighting is a relatively higher GDP weight on currencies where purchasing power in the domestic sector is high (relatively poor countries tend to have a higher PPP-based GDP than GDP converted to US dollars at current exchange rates). In the case of the 14 currency index, the final weight increases most significantly for China (see table 1 (b)). The weight on the US and Japan in the indices also decreases when PPP GDP is used. This is a result of the relatively lower purchasing power residents have in the domestic sector.

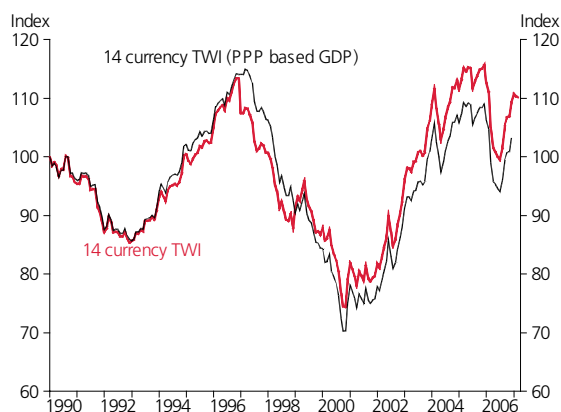
Given the marked difference in weights when PPP-based GDP is used in the 14-currency index, the similarities in the resulting exchange rate indexes may be somewhat surprising (figure 3 (a)). The PPP based GDP series has tended to move with the US dollar to a slightly greater extent in recent years, despite the reduced weight on the US dollar when PPP-based GDP is used. This effect is likely to reflect the higher weight placed on relatively poor currencies that have tended to be tied to the US dollar over this time. Certainly, there is potential for a more significant divergence in these indices in future, in particular, if we see the Chinese yuan move more freely against the US dollar.

For the five currency index, the use of PPP-based GDP has little impact on the final TWI weights; thus, as we may expect, the exchange rate indices calculated using these differing methodologies move very closely over time (figure 3 (b)). The slight divergence between the indices represents the reduced weight on the US in the PPP index.

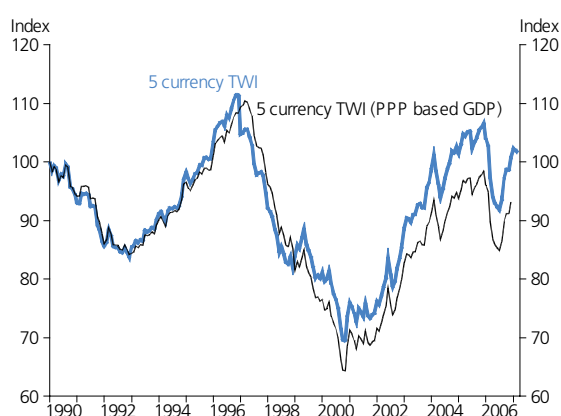
Figure 3

### Comparison of the TWIs with indices based on PPP-based GDP

(a) The 14 currency TWI and 14 currency TWI (based on PPP GDP rates) (Index January 1990=100)



(b) The 5 currency TWI (analytical series) and 5 currency TWI (based on PPP GDP rates) (Index January 1990=100)



## 5 A real TWI construct

The indices constructed above are 'nominal' exchange rate measures. Although such measures are often used as indicators of external competitiveness, a conceptually superior assessment of competitiveness should be done in terms of a real exchange rate index (where individual currencies in the TWI are scaled by the ratio of domestic production costs between New Zealand and the country or region in question). If New Zealand's production costs are rising more rapidly than in its trading partners, for example, this would be reflected in a real exchange rate appreciation (loss of competitiveness) for any given nominal exchange rate.

When inflation is low and stable among the countries included in the TWI, there should be little difference between movements in the nominal and in the real measures, and, over the short term at least, nominal exchange rate movements can be a useful proxy for real exchange rate movements. However, over the longer haul, and especially in the context of an expanded TWI, which includes countries with divergent inflation rates, it becomes imperative to look at the real exchange rate measures.

In this section, we calculate real counterparts to both the five and 14 currency indices. We use individual country Consumers Price Index (CPI) inflation in order to construct real exchange rates. Using consumer prices is not ideal, as theoretically the price deflator used to construct the real index should provide some indication of the relative costs faced by producers across the different countries. Box 3 explains why we use the CPI rather than more theoretically robust price measures.

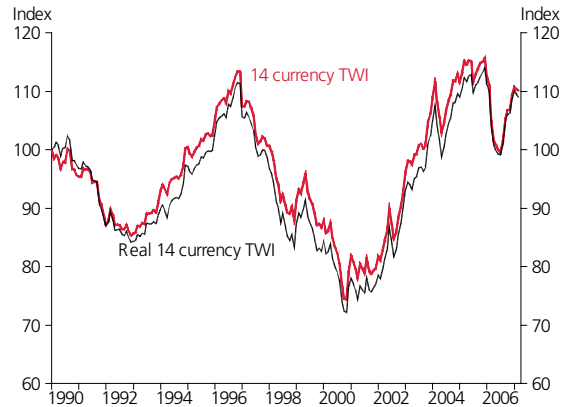
Figure 4 (b) illustrates the nominal and real indices for the five currency exchange rate; in real terms, the NZD has appreciated to a slightly greater extent over the past decade, because inflation has been a little higher in New Zealand relative to the weighted average of the five trading partners captured in the five currency exchange rate. This may not be a surprise, given the deflationary pressures in Japan over this time. The divergence between the real and nominal 14 currency indices (figure 4 (a)) is even smaller than for the five currency index, possibly reflecting the higher weight on Asian economies with inflation rates that tend to move the average trading partner inflation experience closer to New Zealand's inflation experience. We might expect the real and nominal 14 currency indices to diverge more over time, given rates of inflation can be more variable in emerging markets.

**Figure 4**

**Real TWI constructs**

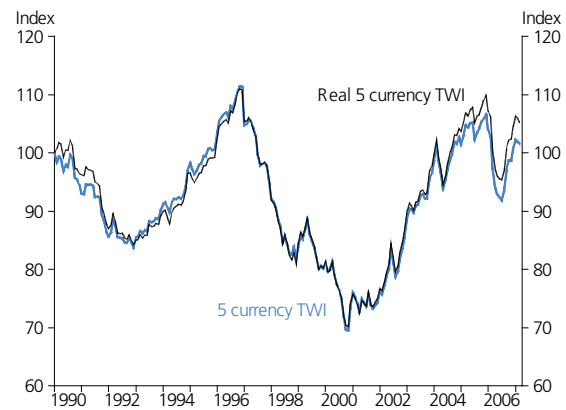
**(a) 14 currency TWI, real and nominal series**

**(Index January 1999=100)**



**(b) 5 currency TWI, real and nominal series**

**(analytical series) (Index January 1999=100)**



### Box 3

#### Constructing real exchange rate measures

When constructing real exchange rate measures, you need some measure of relative prices. The relative price measure used will depend on both theoretical and practical considerations. Theoretically, it would be ideal to use price indices that measure either the price of goods produced and exported by each country or a measure of costs faced by producers. Producer Price Indices (PPIs) or Export Price Indices (EPIs) are examples of indices that measure prices of traded goods, while Unit Labour Cost (ULC) indices measure part of the production costs faced by producers.

However, in practice, it may not be appropriate to use these price measures. In addition to theoretical considerations, the price measure should be:

- timely;
- similarly constructed across countries;

- available for a wide range of countries over a long time span;
- representative of price conditions in each of the countries; and
- reasonably free from measurement error.

Unfortunately the PPI, EPI and ULC all fail at least one of these conditions. For example, none of these price measures is constructed similarly across a wide range of countries and, in many cases, they are not available over a long time-span.

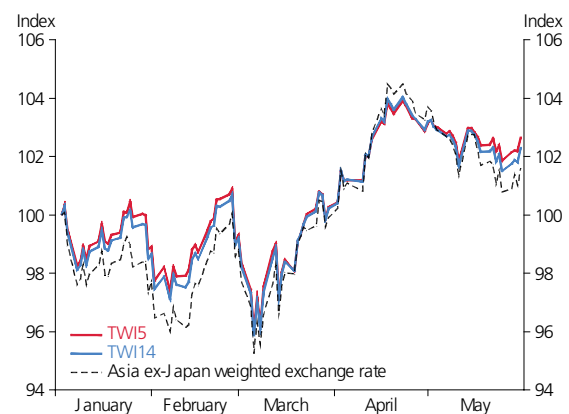
The CPI is not an ideal measure of relative prices in a theoretical sense, but in practical terms performs very well. Of all the price measures available, it is the one that best meets all the practical considerations. Most importantly, it is easily available for all the countries in the 14 currency index. Because all the other price measures perform poorly against the practical considerations, we use the CPI in our real exchange rate calculations. In the future, it may be possible to use a more theoretically appropriate price measure as countries produce more robust and comparable price statistics.

## 6 Concluding comments

In this article we have reviewed the current methodology used to produce the official TWI. We noted that a summary exchange rate measure designed to capture external sector competitiveness is the most appropriate for monetary policy purposes. After reviewing the methodological options, we found the current methodology remains a suitable proxy for the effect of third country competition. However, the importance of an index that captures a broader range of currencies than the five currency TWI has also led the Bank to begin calculating and publishing an expanded 14 currency TWI along with the present index. CPI-based real measures of the TWI corresponding to these two indices will also be regularly published on the Bank's website.<sup>12</sup>

The article showed that the 14 currency and five currency TWIs have not been substantially different in history, but this could change in the future given a world of increased exchange rate flexibility, especially in Asia. Figure 5 shows

Figure 5  
Relative movement in TWI14 and TWI5 in recent months  
(Index February 2007=100)



the divergence in the 14 and five currency TWIs over the course of the past five months. Whilst the series move very closely together, the 14 currency index has tended to exhibit a slightly larger cycle as the NZD has moved to a greater extent against Asian currencies (largely tied to the US dollar) over this time.

<sup>12</sup> Full technical details on the construction of the indices will also be provided.

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Whether the 14 currency index will provide a materially better 'fix' on New Zealand's international competitiveness and on the exchange rate–output linkage *in practice* will be an empirical matter. This should become clear when the various indices are tested over time (eg in export equations and in other modelling situations).

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