TWI – Method of Calculation

The methodology used to construct the trade-weighted index of the Australian dollar (TWI) has changed several times over its history. These changes reflect both changes to the formula used to calculate the TWI and changes in the coverage of the weights (Table 1). The TWI originated in September 1974, after it was decided at this time that the Australian dollar's value would be pegged to a basket of currencies.[1] The series was backcast to May 1970, which was chosen as the base period for the TWI.

Table 1: Changes to the TWI Methodology

Time period	Calculation method	Base period	Country coverage	Trade coverage of weights
1970-1988	Weighted arithmetic mean	May 1970 = 100	Almost 100 per cent of merchandise trade, with smaller trading partners' trade weights allocated to major trading partners' currency weights	Merchandise only
1988-2011	Weighted geometric mean	May 1970 = 100	At least 90 per cent of merchandise trade, with smaller trading partners' currencies excluded	Merchandise only
2011-present	Weighted geometric mean	May 1970 = 100	At least 90 per cent of total trade, with smaller trading partners' currencies excluded	Merchandise and services

Current methodology (from December 2011)

The current calculation method for the TWI is based on a weighted geometric average of a basket of currencies chosen to account for at least 90 per cent of Australia's two-way merchandise and services trade. The base period for the TWI is May 1970 = 100. Weights are updated annually, with the TWI spliced together at every period in which the weights change.[2]

The TWI is calculated according to the following formula:

$$TWI_t = \left[\frac{A\$_t}{A\$_{\tau-1}}\right]^{\alpha_1} \times \left[\frac{E_t^2}{E_{\tau-1}^2} \times \frac{A\$_t}{A\$_{\tau-1}}\right]^{\alpha_2} \times \ldots \times \left[\frac{E_t^J}{E_{\tau-1}^J} \times \frac{A\$_t}{A\$_{\tau-1}}\right]^{\alpha_J} \times TWI_{\tau-1}$$

$$= \left[\frac{E_t^2}{E_{\tau-1}^2}\right]^{\alpha_2} \times \ldots \times \left[\frac{E_t^J}{E_{\tau-1}^J}\right]^{\alpha_J} \times \frac{A\$_t}{A\$_{\tau-1}} \times TWI_{\tau-1}$$

Where:

- $A\$$ = units of US dollars per Australian dollar
- E^i = units of foreign currency i per US dollar ($i = 2, \ldots, J$)
- α_1 = weight of the US dollar
- α_i = weight of foreign currency i ($i = 2, \ldots, J$)
- τ = period of last weight update
- t = current period
- J = number of currencies included in the TWI

[1] Between 1971 and 1974, the Australian dollar was pegged to the US dollar. In 1976, the Australian dollar's 'hard' peg to the TWI was replaced with a 'crawling' peg. See Debelle G and M Plumb (2006) 'The Evolution of Exchange Rate Policy and Capital Controls in Australia', Asian Economic Papers 5(2), pp 7–29, for a detailed discussion of the history of exchange rate policy in Australia.

[2] See Ellis L (2001) 'Measuring the Real Exchange Rate: Pitfalls and Practicalities', Reserve Bank of Australia, Research Discussion Paper 2001-04 for a formal description on splicing indices.

Weights for the TWI

For the J currencies included in the TWI, the weight for an individual currency of country i is based on country i's share of Australia's merchandise and services trade:

$$s_i = \frac{X_i^T + M_i^T}{\sum_{i=1}^{N}(X_i^T + M_i^T)}, \qquad \sum_{i=1}^{J} s_i < 1$$

Where:

X_i^T = total exports (both merchandise and services) from Australia to country i
M_i^T = country i's total imports to Australia
N = number of countries with which Australia trades

The weights for the J currencies included in the TWI are then calculated by re-scaling the trade shares (by s^T) so that they sum to 100:

$$\alpha_i = \frac{X_i^T + M_i^T}{\sum_{i=1}^{N}(X_i^T + M_i^T)} . s^T = s_i \, . s^T \qquad where \;\; s^T = \frac{1}{\sum_{i=1}^{J} s_i}$$

Where:

s^T = the inverse of the share of trade accounted for by the currencies included in the TWI basket, which make up at least 90 per cent of Australia's total merchandise and services two-way trade.

October 1988 – November 2011

A significant change in methodology was implemented in October 1988: first, the calculation method was changed from a weighted arithmetic average to a weighted geometric average of a basket of currencies; and second, the coverage of the weights was also changed. The change to a weighted geometric average brought the RBA's calculation of the TWI into line with standard international practice at the time and removed the slight upward bias in the TWI, which arose from the use of a weighted arithmetic average. Under the previous method, the changes in the currencies that the Australian dollar was falling against had a reduced effect on the TWI over time, while changes in the currencies that the Australian dollar was rising against had an increased effect.

Also prior to October 1988, currency weights under the previous method were based on country groupings, since many of these countries maintained some form of formal link with major currencies throughout much of the 1970s and early 1980s. The weights, therefore, represented close to 100 per cent of Australia's merchandise trade. However, as currencies became more flexible and harder to group, the weighting system was changed to reflect trade with individual countries that made up at least 90 per cent of Australia's merchandise trade.[3]

Between October 1988 and November 2011, the methodology was very similar to that used currently. The only difference was that the weights were based on merchandise trade only, instead of both merchandise and services trade.

[3] The weight allocated to the euro is based on trade with all euro area countries.

That is, the formulae are as described above, except the trade weights relied on merchandise trade only:

$$\alpha_i = \frac{X_i^M + M_i^M}{\sum_{i=1}^{N}(X_i^M + M_i^M)} . s^M = s_i \, . s^M \qquad where \;\; s^M = \frac{1}{\sum_{i=1}^{J} s_i}$$

Where:

X_i^M = merchandise exports from Australia to country i
M_i^M = country i's merchandise imports to Australia

May 1970 – September 1988

Up until September 1988, the TWI was calculated as an arithmetically weighted average of a basket of currencies chosen to represent Australia's trading patterns.

That is, at each time *t*, the TWI was calculated using the following formula:

$$TWI_t = \left[\alpha_1 \left[\frac{A\$_t}{A\$_{\tau-1}}\right] + \alpha_2 \left[\frac{E_t^2}{E_{\tau-1}^2} \times \frac{A\$_t}{A\$_{\tau-1}}\right] + \cdots + \alpha_J \left[\frac{E_t^J}{E_{\tau-1}^J} \times \frac{A\$_t}{A\$_{\tau-1}}\right]\right] \times TWI_{\tau-1}$$

$$= \left[\alpha_1 + \alpha_2 \left[\frac{E_t^2}{E_{\tau-1}^2}\right] + \cdots + \alpha_J \left[\frac{E_t^J}{E_{\tau-1}^J}\right]\right] \times \frac{A\$_t}{A\$_{\tau-1}} \times TWI_{\tau-1}$$

Where:

$A\$$ = units of US dollars per Australian dollar
E^i = units of foreign currency i per US dollar ($i = 2, \ldots, J$)
α_1 = weight of the US dollar
α_i = weight of foreign currency i ($i = 2, \ldots, J$)
τ = period of last weight update
t = current period
J = number of currencies included in the TWI

Weights for the TWI

In this period, the weights for the TWI were derived to reflect the share of each country in Australia's total merchandise trade (exports plus imports). Initially, the currencies of Australia's 22 largest trading partners were included in the TWI, with the trade of the remaining countries with relatively small trade shares allocated to one of these major currency groups on the basis of 'similar exchange rate experience'. As mentioned above, during this period the TWI weights reflected close to 100 per cent of Australia's total merchandise trade. Prior to 1984, weights were updated sporadically, usually between 2-3 times in a year (although in 1975, there were no updates to the weights). From 1984 onwards, weights have been updated annually.