The Reserve Bank Inflation Calculator[1]

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In June 2003, the Reserve Bank released a web-based inflation calculator, enabling users to select two dates and a dollar amount, and calculate an amount adjusted for inflation between those two dates. The "New Zealand CPI Inflation Calculator" (the Calculator) handles dates from the March quarter of 1919 up to the present day. This article discusses the functionality of the Calculator and gives examples of its uses.

1 Introduction

1. *"I've got a pound note from 1935. What would it be worth [in terms of purchasing power] in 1990 dollars? What would it be worth in today's money?"*
2. *"If a product returned a profit of $2.50 per unit in 1970, what profit should it return in dollar value today to have kept pace with inflation over the past 33 years?"*
3. *"If it cost £3,000 in 1920 to build the Somewhere Community Hall, how much would it cost today, based on CPI inflation?*
4. *"What was the average annual inflation rate during the 1970s? The 1980s?"*

The Reserve Bank regularly receives questions such as these from members of the public wanting to compare the purchasing power of money between different dates. Inspired by the inflation calculator on the Bank of Canada's web site (http://www.bankofcanada.ca/en/inflation_calc.htm), the Reserve Bank's Inflation Calculator was developed to provide a resource that would enable members of the public to easily calculate inflation-adjusted figures, via an application delivered on the Bank's web site (http://www.rbnz.govt.nz). The Calculator was also designed to generate related statistical information based on the dates and amounts entered by the user, such as the total percentage change and the average annual percentage change in prices between the two input dates.

2 What is "CPI inflation"?

The Calculator uses the Consumers' Price Index (CPI) to generate its outputs, and to understand what the Calculator does, it is helpful to outline what the CPI is, and what it measures. The CPI, published by Statistics New Zealand, is New Zealand's primary indicator of consumer inflation, and records the change in the price of a weighted "basket" (or regimen) of goods and services purchased by an "average" New Zealand household. Statistics New Zealand weights and indexes the various items in the basket and forms the "all-groups" index. The percentage change, usually expressed in annual terms, of this index is typically referred to as "CPI inflation". The contents of the basket are defined by Statistics New Zealand, who periodically review and re-weight them, using data obtained from their annual Household Economic Survey. This is necessary because the basket of goods and services purchased by the average household will change over time.

The changing pattern of consumption is significant over lengthy periods, reflecting changes in technology, lifestyles, demographics, and increasing standards of living. For example, a household in the 1950s could not buy computers or television sets, and not all households owned a motor vehicle. By the turn of the twenty-first century, that had changed dramatically; most households had at least one television and motor vehicle, and many had a computer. The CPI regimen review process is designed to detect changes in consumption patterns so as to ensure that the CPI continues to reflect the spending patterns of average New Zealand households.

Although the CPI takes into account changing consumption patterns, it is generally acknowledged that no CPI (or other price index for that matter) can perfectly adjust for changes in the *quality* and *nature* of goods and services. Quality

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adjustments are made to selected household appliances by Statistics New Zealand, but the price implications of these changes are unlikely to be perfectly captured by the CPI, because these adjustments are generally subjective. In periods when rapidly changing technology results in substantial improvements in the quality and nature of particular products or services, the true inflation rate may be slightly overstated to the extent that these improvements are not fully reflected in the final index.

Furthermore, the inflation rate experienced by an individual or household will vary depending on the nature of their consumption pattern. This will be influenced by the age of the consumer, their state of health, their lifestyle, their standard of living and where they live, and consequently may not match the *average* inflation rate as measured by the CPI. Nonetheless, the CPI provides a reliable basis for measuring the inflation rate for households on average, across the entire population.

As largely a *consumption*-based index, the CPI aims to measure price movements in respect of items that households consume, such as food, clothing, consumer durables and other items that form a standard part of the household consumption pattern. The CPI does not measure inflation in other parts of the economy – such as capital expenditure-related items like mortgage interest rates,[2] house purchases,[3] share purchases, assets, or other expenditure items that might more readily be identified as *investments*. The CPI also does not measure inflation for the non-household sector, such as an inflation rate applicable to the purchase of inputs by manufacturers or farmers. These inflation rates are measured by different indices compiled by Statistics New Zealand.

Accordingly, although various other price indices are published by Statistics New Zealand to provide a gauge of inflation in the non-household sectors of the economy, the CPI is the most commonly used and recognised measure of inflation in New Zealand.

Figure 1
The Consumers Price Index from 1919
(annual percentage change)

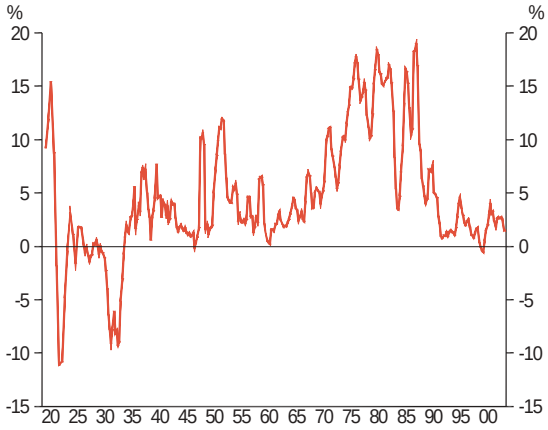


Figure 1 plots CPI inflation since 1919 – the start date used by the Calculator. Several key historical events are evident from the chart: a period of sharp deflation in 1921, when the wartime 'commandeer' of New Zealand's export produce ended and New Zealand entered a brief recession; a period of sustained deflation over 1931-34 – the period of the Great Depression; a brief rise in inflation in the mid-to late 1940s (reflecting the removal of some price controls over that period) and in the early 1950s (reflecting the price rises triggered in part by the Korean war); a period of relatively low and stable inflation from the mid-1950s to the early 1970s; high and relatively volatile inflation from the early 1970s to the late 1980s, including the 'oil shocks' of the 1970s; and the period of low and broadly stable inflation since the early 1990s, reflecting the period of inflation targeting. The dip in the inflation rate in 1982-83 represents the wage and price freeze imposed in that period. The apparent deflation in 1999 is a statistical illusion, caused by a change in the method of calculation by Statistics New Zealand.[4]

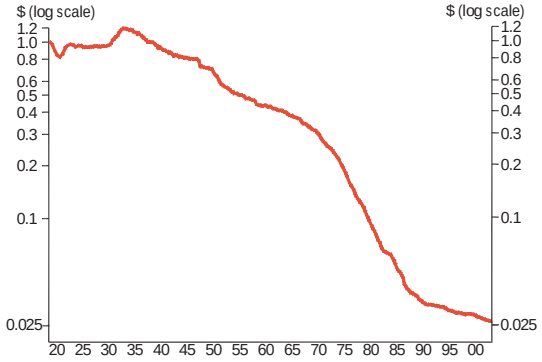
The result of this accumulated inflation for consumers, in terms of lost purchasing power, can be seen in figure 2,

[2] Between December 1974 and June 1999, interest rate expenses, including those for mortgage interest rates, were included in the CPI regimen and were therefore captured in Statistics New Zealand's main or "headline" CPI measure.

[3] Although house prices as such are not captured by the current CPI regimen, the CPI does include costs relating to the purchase and construction of new houses and the various costs associated with housing purchases such as real estate agent fees. Furthermore, house prices were included in the CPI regimen until the 1993 regimen revision, and section prices were included up until the 1999 revision.

[4] When Statistics New Zealand removed interest rates from the regimen in June 1999, they did not backcast the official index to take account of this. Therefore, the negative inflation seen through 1999 is technically a result of the regimen change and not the result of negative inflation.

Figure 2
The decline in purchasing power of $1 (= £0.50) from March 1919 – September 2003



opposite. The purchasing power of one dollar (£0.50 = ten shillings) in 1919 has fallen to a little over 2.5 cents, in terms of what it would be able to buy at 2003 prices. This implies that one dollar today only buys around 2.5 percent of what 10 shillings (one dollar) would have bought in 1919.

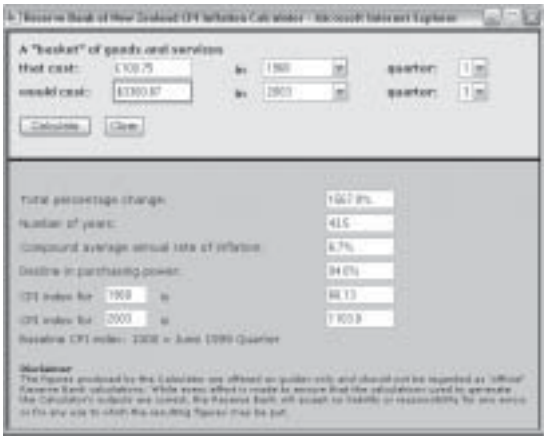
3 How does the Inflation Calculator work?

In using the Calculator, a number of features are worth noting:

- Although the *rate* of inflation is normally thought of in terms of quarterly or annual changes in the CPI, inflation over any period of time can be calculated by assessing the change in the CPI that has occurred between two points in time and expressing this as a percentage change.
- The Calculator allows the user to determine the effect of inflation on a given sum of money for any two points in time between 1919 and the latest available CPI figure. The difference between the user's input value and the Calculator's output value represents the effect of inflation or deflation over that time, as measured by the CPI.
- The start date of 1919 was used because this is the earliest that regular six-monthly CPI figures are available. Data for the missing quarterly observations between 1919 and 1925 have been interpolated. Partial Statistics New Zealand CPI data exist from 1914 and some unofficial annual estimates exist prior to 1914; but these were not included because of our preference to use only official and consistently available data.[4]
- New Zealand adopted decimalised currency in July 1967 Prior to this, New Zealand currency was made up of pounds, shillings and pence. If an input value is entered, and/or an output value is requested, for a date before the third quarter of 1967, the Calculator assumes the denomination is pounds. For example, if a value of "100" is entered with a date of 1965, the Calculator assumes the input amount is £100, but it will convert the output amount to dollars if the second date input by the user falls after July 1967.
- At decimalisation, NZ£1 was deemed to be equal to NZ$2. One pound was equivalent to 20 shillings, and a shilling was 12 pence. Because the Calculator only works with decimals, an amount such as £5.11.6 needs to be entered as 5.575 (£5 + 11.5/20 shillings). Although the Calculator produces answers down to the last cent, the figures should only be regarded as approximations of current value equivalents, given that the measurements of inflation are inevitably only approximate in nature.

A sample of the Calculator's output for the input values of £100.75, 1960 and 2003 is reproduced below.

Figure 3
Calculator screen example



[4] In 1911, James W McIlraith published price indices for general prices (as opposed to consumer prices) for the years 1861 to 1908, subsequently revised and updated to 1912. Although the construction of this series is more akin to that of a GDP deflator, it would be possible to splice this series onto the official CPI series and interpolate a quarterly track. For more information on McIlraith's work, and other early data on prices, see Phil Briggs *Looking at Numbers – a view of New Zealand's economic history*, NZIER, Wellington 2003, pp. 45-49.

4 Some additional points to note in using the Calculator

- The Calculator will normally output a positive inflation figure if a current/more recent value is requested of a historical value, whereas a "negative" inflation figure will normally result if a historical value is requested of a current value, since inflation in New Zealand has generally been positive, rather than negative.
- The "total percentage change" represents the total growth in the price of an average consumer's bundle of goods and services over the period selected.
- The "compound average annual rate of inflation" is the average growth rate per year that would produce the total percentage increase over the given period.
- The "decline in purchasing power" is the percentage decline in the purchasing power of the dollar/pound between the dates selected, based on CPI inflation. For example, if $1 bought $1 worth of goods and services in Year A, but only 50 cents in Year B, then the purchasing power has declined by 50 per cent over that period, meaning that inflation was 100 per cent over that period. If it only purchases 5 cents worth of goods and services, then the decline is around 95 per cent, meaning that inflation over that period was approximately 1900 per cent. Where a rise in purchasing power has occurred, it will be expressed as a "negative decline" in purchasing power. This could happen if people enter a current value and want to find out its equivalent value some time in the past.
- When using the Calculator, do not use commas: ie input 10,000 as 10000.
- The Calculator is best viewed with Internet Explorer.

5 Historical examples

The prices and nature of particular goods and services relative to the average basket can move significantly through time, and we need to be cautious when using the CPI to estimate the current equivalent price of a particular consumption item or service, compared with its historical price. Nevertheless, prices of a particular product may be compared to the general purchasing power of the currency at a particular time.

For example, the £39 required to buy a refrigerator in 1935 is equivalent to around $3,455 in terms of the purchasing power of today's money (if today's money were used to buy the 1935 fridge).[6] Framed this way, the converted price is a direct comparison to purchasing power of the dollar and is therefore valid. We may also validly say that around $1,500 in today's money, the typical price of a modern fridge, is equivalent to the purchasing power of £17 in 1935. Although the two fridge models themselves will be quite different in terms of their technology, design and materials, the $3,455/$1,500 price differential gives a rough indication of the relative price of refrigeration for the household between 1935 and now.

Similarly, and ignoring the many quality and performance differences, the £185 required to purchase a new small car in 1932,[7] equates to $15,290 in today's money, which is not greatly different from the price of some new small cars in 2003. To cite an example for a larger car, in November 1935, one car manufacturer was able to boast of their new four-door sedan that "New Zealand assembly brings its price as low as £399".[8] This amount is worth around $35,000 in terms of the purchasing power of the dollar today.

6 Conclusion

The New Zealand CPI Inflation Calculator is a useful tool to gain an estimate of general price changes and associated changes in purchasing power. It is particularly well suited to providing estimates of the purchasing power of a sum of money between two points in time, or the total inflation that has occurred between specific points in time, as measured by the CPI. It can be used to compare the change in price of a specific item or service with general price movements. However, comparing the price of a particular

6 *Dominion*, 14 November 1935

7 *New Zealand Herald*, 2 February 1932

8 *Dominion*, 13 November 1935

item between two points in time requires care, with qualitative and judgmental factors often coming into play. The Calculator has particular value in highlighting the broad way that inflation erupted during the middle-late decades of the century, and in providing a graphic illustration of the way buying power has generally declined over time.

Finally, to satisfy those who are curious to know the answers to the questions posed at the beginning of this article, the answers provided by the Calculator are:

1. $69.74; $87.54
2. $29.45
3. $204,512
4. 1970s: around 12 per cent per year on average.

   1980s: around 11 per cent per year on average.