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# CHANGE IN BASE YEAR OF CONSTANT PRICE ESTIMATES FROM 1979-80 TO 1984-85

NEW ISSUE

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## Introduction

1. Constant price estimates provide a convenient way of measuring 'real' growth in various economic statistics (i.e. the growth after adjustment of values to remove the effects of inflation). The ABS began publishing annual constant price estimates of expenditure on gross domestic product in 1963 and quarterly estimates in 1970. Since 1963, constant price estimates have been developed for other important economic statistics: gross product by industry, retail sales, agricultural output, building activity and approvals, private new capital expenditure, stocks, manufacturers' sales, overseas trade and expenditure on research and development.

2. Over time, several different base years have been used for constant price estimates. For expenditure on gross domestic product the earliest was 1953-54 which was followed by 1959-60, 1966-67, 1974-75 and, currently, 1979-80. Some other constant price estimates have also been compiled using several base years — though not always the same base years as those for expenditure on gross domestic product. The latest base year for all ABS constant price estimates, however, is 1979-80.

3. Constant price estimates are being rebased to average 1984-85 prices. During the course of this year, these estimates will replace those at average 1979-80 prices in relevant ABS publications, commencing with the release on 23 June 1988 of constant price estimates of expenditure on gross domestic product (and its major components).

4. The purpose of this information paper is to answer some of the questions posed when a new base year is introduced, such as why base years have to be changed, and why a particular year has been chosen to be the new base year. To answer such questions it is best to first consider why constant price estimates are produced.

## Why are constant price estimates needed?

5. Many economic statistics, such as gross domestic product, relate to a wide range of goods and services. In order to express the transactions in goods and services as a single aggregate, it is necessary to combine quantities of the component goods and services using a common unit of measurement. The only practicable way in which quantities of diverse goods and services can be aggregated is in terms of money values i.e. dollars. One of the difficulties involved in interpreting the impact of changes in money values from one period to another is that any observed movement is generally a combination of a change in price and a change in quantity. In many cases, interest lies in the changes in physical quantity underlying the dollar value of transactions. Hence, there is a need for estimates to be adjusted to remove the direct effects of price changes. Such estimates are said to be at constant prices (or in 'real' terms).

## What are constant price estimates and how are they calculated?

6. The current price value of a transaction may be thought of as being the product of a price and a quantity. The value of the transaction at constant prices may be derived by substituting, for each current price, the corresponding price in the chosen base year. Total estimates at constant prices for a period are then obtained by summing the constant price value of each component transaction during the period. Hence, total quarterly exports of goods at constant prices can be considered to be the sum of the constant price value of each good exported during the quarter.

7. Conceptually, the preferred way of deriving an estimate of expenditure, or output, at constant prices is to explicitly follow the steps in the definition in the previous paragraph (i.e. for each transaction multiply the quantity of each good or service by the base year price of that good or service to obtain the constant price value, and then sum the constant price values of all these transactions). This method is called *quantity revaluation*. In practice, it is possible to employ quantity revaluation for only a minority of estimates because quantity data are often unavailable, insufficiently homogeneous, or subject to quality changes

that are difficult to quantify. Exports and imports of merchandise f.o.b. and agricultural and mining output are the major components for which quantity revaluation is used to compile constant price estimates.

8. The more common method used to derive estimates at constant prices is to divide the current price estimates by a price index. This method is called *price deflation*.

9. The price indexes used in price deflation comprise a number of price indexes of component goods and services weighted together. If a price index were available for each type of good and service contributing to the current price estimate and if the weight given to it for each period were proportional to the underlying quantity in the current price estimate, then price deflation would give exactly the same result as quantity revaluation. Price indexes weighted in this way are known as *current-weighted* (or Paasche) *price indexes*.

10. In general, price information is collected only for a selection of goods and services. Furthermore, the information needed to calculate weights is generally available only intermittently, and so *fixed-weighted* (or Laspeyres) *price indexes* are generally used in price deflation. Fixed-weighted price indexes are inferior to current-weighted ones for the purpose of calculating constant price estimates, but this deficiency is lessened by revaluing current price values at the most detailed level practicable.

11. When constant price estimates are rebased, the weights used in the fixed-weighted price indexes are replaced (often for just the later part of the series) by weights that most closely pertain to the new base year. Thus, the movements of the new fixed-weighted price indexes usually differ from those of the old fixed-weighted price indexes. Consequently, the movements of the old and rebased constant price estimates differ. The extent of the differences is determined by a combination of the extent to which the new weights differ from the old ones and the extent to which the growth rates of the component price indexes differ from each other.

**Why do base periods have to be changed?**

12. Constant price estimates attempt to isolate the effects of changes in quantities by removing the effects of price movements from current price values. Conceptually, at least, quantities of different commodities are combined using the relative prices in the base period as weights. However, the constant price estimates based on a particular year are not unique measures of the value of 'real' expenditure or output. Estimates on different base years will show different rates of growth if the price relativities in the economy have changed between the base years and if the quantities of the components have changed at different rates. Even though the underlying quantity data are the same, the quantities are combined using different weighting patterns (i.e. different price relativities).

13. The price relativities at a particular time reflect the relative economic worth of goods and services at that time. They are not only influenced by past changes in the economy but they also influence future changes. They are signals that play an integral part in the evolution of the economy. It therefore follows that if one is concerned with the short-term movements of constant price estimates, then it is desirable that the price relativities used in calculating constant price estimates for the period concerned are as close as possible to those in the base year. This is the principal reason why the ABS rebases its constant price estimates at fairly frequent intervals. A lesser, but still important, reason arises from the need to accurately estimate quality and specification changes (usually by discounting their price effects in the price indexes used to deflate the current price values) and to give proper weight to new goods (such as video cassette recorders, compact disk players and microcomputers). A rebase also provides an ideal opportunity to introduce enhanced methods and more appropriate data sources.

**Why change the base year now?**

14. There are several criteria for selecting a base year. Unfortunately, they are not always compatible.

They are:

(a) the base year should be as recent as possible;

(b) 'normal' prices and price relationships should prevail in the chosen year; and

(c) if possible, the base year should comply with the international recommendations (by the United Nations Statistical Office) that base years be those ending in zero and five (e.g. 1975, 1980, 1985).

15. Ideally, a 'normal' year would be chosen as the base year, but, even if such years exist, they would be difficult to identify until several years had elapsed. Precedence is given to the other criteria, namely that the base year should be reasonably recent and coincide with international recommendations. The frequency with which the base year should be changed depends on how rapidly the price relativities of the economy are changing, but very frequent — such as annual — rebases are impracticable. A rebase every five years is generally considered to be a reasonable compromise. For these reasons 1984-85 has been chosen to be the new base year.

**What are the effects of rebasing constant price estimates?**

16. The most obvious effect is that the level of the rebased constant price estimates is quite different from that of the earlier base year estimates for most series. The reason is that inflation has led to prices being higher in the later base year for most goods and services.

17. As mentioned earlier, constant price estimates of a series calculated using different base years generally have different movements. Often the differences are not very great, but in some cases they can be substantial, particularly if a change in methodology has been adopted with the introduction of the rebased estimates. In some cases the differences in movement appear to be random, while in others they appear to be systematic and result in significantly different long-term growth rates. An example of the latter that has occurred at every rebase, including the present one, is a lowering of the growth rate of private final consumption expenditure. The reason is that there is a substitution effect in which some goods and services experiencing relatively low price increases also tend to

experience relatively high quantity increases. Consequently, those goods and services which have experienced a lower increase in prices (and a greater increase in quantities) are accorded less weight in the constant price estimates with a later base year than those with an earlier base year.

18. Derived series such as implicit price deflators, the terms of trade and gross domestic product adjusted for the terms of trade will be quite different on the new base year. The implicit price deflators will all have a value of 100.0 in 1984-85 instead of in 1979-80. Their movements will also be different, but to a lesser extent than their levels. Such differences will correspond (inversely) to the differences between the movements of the old and new base year constant price estimates used to derive them.

19. The terms of trade are a measure of export prices relative to import prices and are calculated by the ABS as the ratio of the implicit price deflator for exports of goods and services to the implict price deflator for imports of goods and services. Consequently, this series too will have a value of 100.0 in 1984-85 instead of in 1979-80. Changes to the movements will result from changes in the movements of the exports and imports implicit price deflators.

20. Adjusting gross domestic product (GDP) at constant prices for the terms of trade effect provides a better measure of the change in the real purchasing power of the income generated by domestic production than does the unadjusted estimate. The adjustment to GDP for the terms of trade effect will be zero in 1984-85, and so the relationship between GDP and GDP adjusted for the terms of trade effect — both at average 1984-85 prices — will be different from that currently observed using estimates at average 1979-80 prices. However, there will still be a significant divergence in the growth rates in 1985 between GDP and GDP adjusted for the terms of trade.

**Will the ABS continue to provide long, continuous constant price estimates of expenditure on gross domestic product?**

21. Constant price estimates of expenditure on gross domestic product at average 1979-80 prices are fully compiled back to 1969-70. For some applications, such as econometric modelling, there is a demand for longer continuous time series at constant prices. In an attempt to meet this demand the ABS began, in 1987, to publish estimates at average 1979-80 prices for the years 1948-49 through to 1968-69 and for the quarters from September quarter 1959 through to June quarter 1969. These estimates have been derived by successively 'splicing' estimates relating to earlier base years. Results of the splicing and details of the methods used are described in Appendix C of *Australian National Accounts: National Income and Expenditure, 1985-86* (5204.0).

22. With the introduction of constant price estimates at average 1984-85 prices, estimates relating to earlier base years will be similarly spliced to provide long, continuous time series at average 1984-85 prices.

**New Price Index for Computer Equipment**

23. A number of methodological changes will be introduced with the rebased estimates. In most cases, they will have only a small impact on the estimates. However, one change will have a major effect on the growth rates of certain estimates, and it warrants a special note.

24. Ideally, price indexes should relate to goods and services of fixed specification, but manufactured goods, in particular, frequently undergo changes in specification or 'quality'. Generally, when a significant change occurs in a good in a price survey an attempt is made to prevent the change in price attributable to the change in specification from being reflected in the price index. Three common approaches are:

(i) Estimate the value of the specification change based on the cost to the manufacturer of making the change and discount it from the price.

(ii) If the good without the specification change is still available when the good with the specification change is introduced, the value of the specification change can be imputed by comparing their prices. This value can then be discounted from the price of the good with the change.

(iii) Omit the good from the price survey for the period (month or quarter) during which the specification change occurred. (A variant of this approach is also often used when new goods are included in a price survey).

25. None of these three approaches is satisfactory when a good is undergoing rapid and continual technological change as has occurred, and continues to occur, with computers and their peripherals. It is fairly common for a new model of computer equipment to offer not only greater performance than its predecessor but at a lower price as well. As a consequence of employing one or other of the above approaches, the price indexes used in the past to deflate expenditure on computer equipment have not truly reflected the decline in the price-performance ratio of computer equipment. This in turn has meant that constant price estimates of expenditure on computer equipment, derived using these price indexes, have understated the growth in the acquisition of computing power.

26. In recognition of this problem, a new price index for computers and their peripherals has been developed by the US Bureau of Economic Analysis (BEA) in co-operation with IBM. Econometric models have been used to estimate implicit prices for the principal characteristics of large and medium size computer processors, disk drives, tape drives, terminals (visual display units), printers and personal computers. For example, the principal characteristics identified for computer processors are speed and the volume of main memory. Implicit prices of the principal characteristics are used to impute base year prices of current models that were not available in the base year. This has enabled Paasche price indexes to be formed in which prices both for models that existed in the base year and those that did not are included. The BEA computer equipment price index is formed by taking a weighted average of these price indexes — the weights being determined from US manufacturers' sales data. A full

account of the development and application of the price indexes is presented in three articles appearing in the January and March 1986 issues of the US Department of Commerce's publication, *Survey of Current Business*.

27. There is no Australian computer equipment price index equivalent to that of the BEA's, and the cost of developing and maintaining one would be considerable. Therefore, the ABS has decided to use the BEA index in the estimation of constant price expenditure on computer equipment. In doing so, it has been implicitly assumed that the BEA index is an adequate proxy for Australian computer equipment price movements. This assumption can be justified on the following grounds:

(i) The US is the major source of imports of computer equipment into Australia. In 1986-87, 43 per cent of computer equipment, by value, came from the US.

(ii) Both the US and Australian computer equipment markets are very competitive. Information supplied by computer vendors supports the view that price changes in the US are followed by corresponding price movements in Australia.

(iii) The US's share of the Australian computer equipment market has been declining in recent years, suggesting that the BEA price index is unlikely to have overstated the extent of price falls in the Australian market.

(iv) The BEA index is so superior to the alternatives that the deficiencies in using it are almost certainly less than those of using other indexes.

28. In adopting the BEA index, the ABS has followed the same course as Statistics Canada which, in mid 1987, introduced it into the Canadian National Income and Expenditure Accounts.

29. The new computer equipment price index — after adjustment for exchange rate movements and, where appropriate, for time lags — will be used in deriving estimates at average 1984-85 prices for the relevant components of imports, exports, private final consumption expenditure on household durables, gross fixed capital expenditure (private and public), increase in private non-farm stocks, manufacturing gross product and related statistics. The new index will be used from September quarter 1974 in all cases, except private final consumption expenditure and stocks where it will be used from September quarter 1984.

30. The new computer price index has a strongly negative growth rate, unlike the conventionally compiled price indexes used previously. Thus, those constant price estimates that have a computing equipment component derived using the new price index display stronger growth than they would have if the computing equipment component had been derived using the price indexes used previously. The impact of the introduction of the new price index is greatest on those aggregates for which computing equipment forms a substantial component, such as imports and gross fixed capital expenditure on equipment. At average 1984-85 prices, imports of goods and services derived using the new index fell by 3.0 per cent between 1985-86 and 1986-87. Using the price indexes previously used for computing equipment the fall would have been 4.5 per cent. Similarly, over the same period, private gross fixed capital expenditure on equipment grew by 0.2 per cent using the new index as opposed to a fall of 3.4 per cent without it. (The longer-term impact on various national accounts series is shown in the graphs on the next page.)

31. The net effect of the introduction of the new price index on the growth of estimates of gross domestic product at constant prices is negligible, because the increased final expenditures are almost entirely offset by the higher imports — the level of domestic production of computing equipment is relatively small, although growing rapidly. Due to a paucity of data relating specifically to the Australian manufacture of computer equipment, the new index has been applied only to that part of Australian manufactured computer equipment that is exported.

32. The growth rates of the implicit price deflators (IPDs) for exports and imports are reduced by the application of the new price index. The effect is greatest on the imports IPD, because computer equipment accounts for a larger proportion of imports than it does for exports. Consequently, the growth rate of the terms of trade index is changed considerably.

33. The graphs on the next page show the changes attributable to the introduction of the new computer price index on the terms of trade and those major components of gross domestic product principally affected. Each graph compares, on a 1984-85 base, estimates calculated using the new computer price index with what they would have been if the price indexes previously used to deflate expenditure on computer equipment had been incorporated into the 1984-85 based estimates.

# IMPACT OF THE INTRODUCTION OF THE NEW COMPUTER PRICE INDEX

The graphs below display the impact of the new computer price index on those national accounts series principally affected by its introduction. All of the graphs are of seasonally adjusted estimates at average 1984-85 prices.

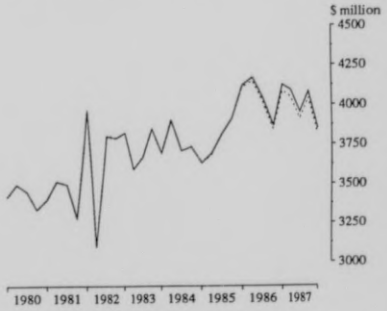
— Estimates derived using the new computer price index
.... Estimates derived using alternative price indexes (as were used previously to derive estimates at average 1979-80 prices)

**GDP AND GDP ADJUSTED FOR TERMS OF TRADE EFFECT**


**TERMS OF TRADE (1984-85=100)**


**PRIVATE GROSS FIXED CAPITAL EXPENDITURE ON EQUIPMENT**


**PUBLIC GROSS FIXED CAPITAL EXPENDITURE**

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