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Australian Bureau of Statistics

Information Paper

Consumer Price Index: Concepts, Sources and Methods

Australia

2009

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Australia

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AUSTRALIAN BUREAU OF STATISTICS

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ABBREVIATIONS

ABN	Australian Business Number
ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
APR	arithmetic mean of price relatives, also referred to as the Carli formula
APRA	Australian Prudential Regulation Authority
ATO	Australian Taxation Office
AWE	average weekly earnings
CCB	Child Care Benefit
CCR	Child Care Rebate (formerly known as Child Care Tax Rebate: CCTR)
CCTR	Child Care Tax Rebate
COICOP	Classification of Individual Consumption by Purpose
COLI	cost of living index
CPI	consumer price index
CRA	Commonwealth Rent Assistance
DEST	Australian Government Department of Education, Science and Training
DHA	Commonwealth Department of Health and Ageing
EEH	Survey of Employee Earnings and Hours
EPI	export price index
FAO	Family Assistance Office
GDP	gross domestic product
GM	geometric mean
GST	goods and services tax
HEC	Household Expenditure Classification
HECS	Higher Education Contribution Scheme
HES	Household Expenditure Survey
HESA	*Higher Education Support Act 2003*
HFCE	household final consumption expenditure
ILO	International Labour Organization
IPD	implicit price deflator
IPI	import price index
ITPI	International Trade Price Indexes
LPI	labour price index
PBS	Pharmaceutical Benefits Scheme
PPI	producer price index
RAM	random-access memory
RAP	relative of the arithmetic mean of prices, also referred to as the Dutot formula
SEE	Survey of Employment and Earnings
TAU	type of activity unit
TNTS	The New Tax System
WPI	wage price index

CHAPTER 1 INTRODUCTION

AIM OF THIS PUBLICATION

1.1 This publication provides a comprehensive description of price index theory and methodology, focusing on the Australian Consumer Price Index (CPI) and the concepts, sources and methods behind its compilation. It also provides some insight into the kinds of conceptual and practical difficulties that the Australian Bureau of Statistics (ABS) encounters in compiling the CPI, and how it deals with these challenges.

1.2 The ABS currently publishes a brief description of the CPI in *A Guide to the Consumer Price Index, 15th Series* (cat. no. 6440.0). The Guide is for those interested in a straightforward and brief account of the main features of the CPI. This Concepts, Sources and Methods publication, on the other hand, is for those users who need a deeper understanding of the CPI, and of the methods and techniques used to deal with the complex situations that arise in constructing price indexes across the spectrum of household consumer expenditure.

OTHER SOURCES OF INFORMATION ABOUT THE CONSUMER PRICE INDEX

1.3 The CPI is compiled quarterly by the ABS for quarters ending on 31 March, 30 June, 30 September, and 31 December each year. The quarterly index numbers are usually published between three and four weeks after the end of each quarter in the publication *Consumer Price Index, Australia* (cat. no. 6401.0).

1.4 The CPI is reviewed and re-weighted every five or six years. The last major review of the CPI resulted in the 13th series of the index which was introduced in the September quarter 1998. Several important changes were made to the index at that time. The most important of these was to change the CPI from a measure of living costs of employee households to a general measure of price inflation for households. As part of this major review, the ABS published three Information Papers:

- *Issues to be Considered During the 13th Series Australian Consumer Price Index Review* (cat. no. 6451.0);
- *Outcome of the 13th Series Australian Consumer Price Index Review* (cat. no. 6453 .0); and
- *Introduction of the 13th Series Australian Consumer Price Index* (cat. no. 6454.0).

1.5 These papers describe the review process, the issues considered, the review outcomes, the re-weighting process and outline the changes from the previous series.

1.6 The 14th series of the CPI was introduced in the September quarter 2000, after a minor review completed early in 2000. The changes introduced in the 14th series were considered necessary to address issues arising from the introduction of The New Tax System (TNTS) on 1 July 2000. As part of the review process the ABS published two Information Papers describing the changes:

- *Price Indexes and The New Tax System* (cat. no. 6425.0); and
- *Introduction of the 14th Series Australian Consumer Price Index* (cat. no. 6456.0).

1.7 The 15th series CPI introduced in September quarter 2005 was also a minor review. The item weights were revised in line with expenditure patterns identified in the 2003-04 Household Expenditure Survey (HES), and a new sub-group called Financial services was introduced into the index. Once again, ABS published an Information Paper describing the changes:

- *Introduction of the 15th Series Australian Consumer Price Index* (cat.no. 6462.0).

OTHER SOURCES OF INFORMATION ABOUT THE CONSUMER PRICE INDEX continued

1.8 The ABS intends to update this manual periodically. Therefore, the ABS would welcome comments from the users of statistics covered in this publication. You may direct your comments or questions to:

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CHAPTER 2 PURPOSE AND USES OF CONSUMER PRICE INDEXES

WHAT CONSUMER PRICE INDEXES MEASURE

2.1 As the name suggests, a consumer price index measures the change in the prices paid by households for goods and services to consume. All expenditures by businesses, and expenditures by households for investment purposes, are out of scope of a consumer price index. In this regard, expenditure on housing presents particular difficulties as it can be considered as part investment and part purchase of shelter–related services.

2.2 There is currently no single, universally accepted definition of a consumer price index. The often quoted description of a CPI is the following statement from the Resolution concerning consumer price indices released in 2003 by the Seventeenth International Conference of Labour Statisticians convened by the International Labour Organization (ILO) (the Resolution is reproduced in Appendix 4):

"*The CPI is a current social and economic indicator that is constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use or pay for consumption. The index aims to measure the change in consumer prices over time. This may be done by measuring the cost of purchasing a fixed basket of consumer goods and services of constant quality and similar characteristics, with the products in the basket being selected to be representative of households' expenditure during a year or other specified period.*"

PRINCIPAL PURPOSES OF A CONSUMER PRICE INDEX

2.3 A consumer price index may serve several purposes. However, three principal purposes are generally recognised, namely to measure:

- changes in the purchasing power of money incomes;
- changes in living standards; and
- price inflation experienced by households.

Purchasing power of money incomes

2.4 A CPI designed to measure the purchasing power of money incomes is concerned with answering questions such as how much income is required today to purchase the same basket of goods and services that was purchased in the base period. The appropriate domain of the basket in this case is all those outlays on consumer goods and services actually made by households in the base period.

2.5 For this purpose the correct measure of income to use is net income (i.e. after income tax), not gross income. Application of the index to gross income is only valid if income tax is proportional to income, and the treatment of property income is identical to that of wage and salary income. A progressive income tax regime, such as that applying in Australia, emphasises the need to use net income. In addition, as the significance of different sources of income and expenditure varies considerably between household types, changes in purchasing power are best assessed by type of household rather than in total.

Assessing changes in living standards

2.6 In assessing changes in living standards, the CPI is used in conjunction with data on expenditures by households to measure changes in their volume of consumption of all goods and services.

Assessing changes in living standards continued

2.7 For this purpose, the first thing to do is to define standard of living. A narrow definition of standard of living is the volume of goods and services consumed by households in the base period. For many consumer items, the acquisition of, the payment for, and the consumption of, an item all occur at about the same time. However, for some items the volume of the item consumed in a period may have little relationship to the payments made in the period. A good example of this is a consumer durable such as a private motor vehicle where the vehicle may have been purchased several years earlier. For other items, the price is substantially below the economic cost of providing the good or service, so that the expenditure is not a true reflection of the quantity of the item consumed. Typical examples of this are services provided by the public sector such as education and medical care. Estimates must be made of the economic value of these items actually consumed in the base period.

2.8 Estimates of the market value of the consumption of consumer durables can be made by reference to the market prices of similar items (thus private rents can be used as an indicator of the value of owner–occupied housing, and leasing charges for households' fleet of motor vehicles). For insurance services, estimates of the service component (essentially operating costs plus profit) are derived from the published accounts of insurance companies. For publicly supplied goods and services, the ABS compares their prices with those of private suppliers of similar services or makes estimates based on the cost of providing the service (e.g. teachers' salaries plus building and running costs for educational services).

2.9 Of course, a broader definition of living standards is possible. It might include environmental conditions such as the quality of air and water, or the area of national parks. Although these are important in their own right, the measurement of these factors, the value placed on them by households, and the means of including them in an index of living standards, are as yet insoluble problems (see Pollak (1998)). So for practical reasons, the narrow definition is used.

2.10 Against this background, the domain for an index designed to assess changes in living standards would include:

- residential rent payments;
- imputed rent of owner–occupied dwellings;
- consumer durables;
- the value of insurance and banking service charges;
- other private–sector goods and services; and
- government–provided goods and services valued at cost or at their estimated market prices.

2.11 This measure accords with the concept of Household final consumption expenditure in the Australian National Accounts.

Measuring household inflation

2.12 Another possible purpose of the CPI is to measure price inflation facing households as consumers. This measure is primarily for use in macro–economic management, and also has some possible uses in contracts where an index of prices for household consumption items is appropriate. Of course, as the CPI measures only households' price experience, it is not a measure of economy–wide inflation.

Measuring household inflation continued

2.13 As there is no generally agreed definition of inflation, the issue of how it should be measured is complicated. Nevertheless, it seems clear that an index of household inflation should attempt to measure the contemporary rate of change in prices of consumer goods and services.

2.14 An important aspect of a measure of inflation is that it should only include market–determined prices. Thus, an inflation measure would not include imputed rent of owner–occupied dwellings (which, however, would be included in a cost–of–use approach as discussed below). A measure of house prices would be more appropriate, if housing is not considered an investment. Financial assets would not be considered a good or service, thus prices of shares and the like would be out of scope. However, such a measure would need to capture changes in the service charges of intermediaries involved in financial and asset–transaction services, such as banks, insurance companies, and real–estate agents.

2.15 It could be argued that an inflation measure should also exclude goods and services provided to households at subsidised prices. The reason is that the inflation rate has implications for government policy, and as such it should be determined by market forces unhindered by the actions of governments themselves. The argument goes that subsidies are distortions of pure market forces, and subsidised prices do not reflect the true market price (or economic value) of the goods and services. However, the treatment of taxes, and subsidies which are regarded as negative taxes, should be symmetrical. Excluding subsidised goods would lead to some significant goods and services (e.g., education) being omitted that would otherwise be considered essential for complete coverage in a CPI. Consequently, the most common practice is to include subsidised goods and services.

2.16 The domain for a measure of household inflation would thus include:

- residential rent payments;
- net purchase of owner–occupied dwellings;
- net purchase of consumer durables;
- the value of intermediary services for transactions in real and financial assets (e.g. banking and stockbroking services); and
- other consumer goods and services provided at market prices.

2.17 As it presently stands, the Australian CPI is specifically designed to provide a general measure of price inflation for households residing in the capital cities.

CONCEPTUAL APPROACHES TO CONSTRUCTING A CONSUMER PRICE INDEX

2.18 Once the purpose of a CPI is decided, a method of construction can be worked out to satisfy that purpose. Consistent with the three purposes outlined above, there are three possible conceptual approaches for constructing a CPI. These approaches are consistent with the ILO Resolution which says that "...a reference population acquires, uses or pays for consumer goods and services".

These are the three methods.

(i) *The Acquisitions method:* in the base period, any goods and services acquired (i.e., actually received) by the reference population are included in the CPI regardless of the period in which payment or use occurs.

CONCEPTUAL APPROACHES TO CONSTRUCTING A CONSUMER PRICE INDEX *continued*

(ii) *The Cost–of–Use method:* in the base period, any goods and services used (i.e., consumed) by the reference population are included in the CPI regardless of when they are paid for or acquired. In particular, the cost of using the good or service is measured by its true economic cost.

(iii) *The Outlays method:* in the base period, any goods or services for which payments were made are included in the CPI without regard to the source of the funds.

2.19 The acquisitions and outlays approaches are similar. The acquisitions approach leads to a CPI basket that can be viewed as a subset of the basket resulting from an outlays approach. Both conceptual approaches include goods and services acquired during the base period, but the outlays approach also effectively includes any inescapable costs associated with the acquisition of a good or service, such as interest charges. The cost–of–use approach can result in a basket that differs from both the acquisitions and outlays approaches.

2.20 The choice of conceptual approach for construction of the index depends on the purpose. The approach that is most appropriate for each of the three possible CPI purposes is outlined below.

(i) *Purchasing power of money incomes*. In order to determine changes in the purchasing power of money, an outlays approach is most appropriate. The outlays approach provides a proxy for household income through measurement of consumer outlays.

(ii) *Assessing changes in living standards*. The cost–of–use approach provides the best indication of changes in living standards as it relates to goods and services actually consumed in the base period.

(iii) *Measuring household inflation.* The acquisitions method is the most appropriate for this purpose. A measure of household inflation should relate to the contemporary rate of change in the prices of goods and services. The acquisitions approach captures this by measuring changes in the prices of goods and services actually acquired in the base period.

COMPARISON OF THE CONCEPTUAL APPROACHES

2.21 In practice, for most goods and services purchased by the reference population, outlay, acquisition, and use all occur within a short period, and the price paid by the reference population is a true economic value, effectively making the distinction between the approaches academic. However, in some cases there can be significant lags between outlay, acquisition, and use; or the price paid may differ significantly from what is considered the true value.

2.22 There are three areas of households' expenditure in which these conceptual approaches provide significantly different results. These are:

(i) the purchase of housing;

(ii) the purchase of durable goods; and

(iii) financial services, including the use of credit.

COMPARISON OF THE CONCEPTUAL APPROACHES *continued*

2.23 To illustrate the differences among the three approaches, the way in which these three special cases are treated under each approach is outlined below.

Expenditure on housing

2.24 Under the acquisitions approach, the required measure is the change in prices for both the net purchase of housing, and the increase in the volume of housing because of renovations and extensions, plus other costs incurred in ensuring the continued supply of services provided by owner–occupied dwellings (e.g. maintenance costs and council rates). Changes in rents are measured for that part of the reference population that resides in rented dwellings. Costs such as maintenance of rental dwellings are paid by investors who are out of scope of a CPI.

2.25 Under the outlays approach, the required measure includes changes in the amount of interest paid on mortgages, and the costs incurred in ensuring the continued supply of services provided by the dwellings (e.g. maintenance costs and council rates). Also included are changes in rents which are measured for that part of the reference population that resides in rented dwellings.

2.26 Under the cost–of–use approach, the required measure is the change in the economic value of the services provided by dwellings. The price of these services is usually measured as the rental value of the dwellings. For owner–occupied dwellings, the rental values are imputed. Costs such as maintenance costs are not included as they are part of the cost of maintaining an investment, and so are outside the scope of a CPI.

Durable goods

2.27 For durable goods, the three approaches result in the following treatments.

(i) Acquisitions – the basket includes those durable goods acquired in the base period, and their price measure is the transaction (purchase) price.

(ii) Outlays – the basket includes those durable goods paid for in the base period, and their price measure is the transaction price.

(iii) Cost–of–use – the basket includes the services of durable goods consumed in the base period, regardless of the period in which they were purchased, and the price measure is the market value of the services provided by those goods (measured in business accounts as depreciation plus the return on investment).

Financial services and the use of credit

2.28 Under the acquisitions approach, interest paid is not a charge that is within scope of the CPI basket of goods and services. The service for which prices are required is that of providing banking services (including the provision of loans).

2.29 Under the outlays approach, the product being priced is the cost of servicing loans taken out to purchase products that are part of the CPI basket. Thus the change in the level of interest paid on this debt is the required price measure.

2.30 The cost–of–use approach requires that the cost of the financial services used is measured in a similar manner to the acquisitions approach.

Concluding remarks

2.31 Although these alternative approaches to the construction of a CPI are characterised by conceptual differences, they are more likely to result in short–term rather than long–term differences in outcomes. This is particularly so with the acquisitions and outlays approaches. In practice, each approach covers a broad range of consumer goods and services which tend to have similar long–term price behaviour in the absence of external shocks or institutional change. In addition, there are many items common to all three approaches.

THE AUSTRALIAN CONSUMER PRICE INDEX

1997 Review and the adoption of an acquisitions basis for the CPI

2.32 In 1997 a major review of the CPI was conducted, involving consultation with a wide range of organisations and individuals representing government, social, business and community interests. This review concluded that the ABS should adopt an acquisitions approach in compiling the CPI. Since the introduction of the 13th series CPI in the September quarter 1998, the CPI has been compiled on an acquisitions basis. For more detail on the 1997 Review, see:

- *Information Paper: Issues to be Considered During the 13th Series Australian Consumer Price Index Review*, Apr 1997 (cat. no. 6451.0);
- *Information Paper: Outcome of The 13th Series Australian Consumer Price Index Review*, 1997 (cat. no. 6453.0); and
- *Information Paper: Introduction of the 13th Series Australian Consumer Price Index*, 1998 (cat. no. 6454.0).

Uses of the CPI

2.33 A major use of the CPI is to assist governmental economists in conducting general economic policy, especially monetary policy. Since 1993, Australian monetary policy has been conducted with the aim of meeting a medium–term inflationary target. Since the introduction of the 13th series CPI in the September quarter 1998 that target has been the inflation rate as measured by the CPI.

2.34 The CPI, or one of its components, is also widely used in indexation arrangements in both the private and public sectors. These include indexing pension and superannuation payments, taxes and charges, some governmental bonds, and business contracts.

2.35 In Australia the use of the CPI in wage determination has diminished with the trend towards decentralised, enterprise–based wage and salary setting arrangements with outcomes focused on the commercial circumstances of each business.

CHAPTER 3 HISTORICAL BACKGROUND

INTRODUCTION

3.1 Before the introduction of the CPI in 1960, there were five series of retail–price indexes compiled by the (then) Commonwealth Bureau of Census and Statistics. Those indexes were as follows.

(i) The A Series Index, covering only food, groceries and housing rents (for all houses), which was first compiled in 1912 with index numbers going back to 1901, was discontinued in 1938. Its main use was for adjusting wages between 1913 and 1933.

(ii) The B Series Index, covering only food, groceries and housing rents (for four– and five–roomed houses), which was first compiled in 1925 and was discontinued in 1953. It was introduced to replace the A Series Index for general statistical purposes, but was never used for adjusting wages.

(iii) The C Series Index, covering food and groceries, housing rents (for four– and five–roomed houses), clothing, household drapery, household utensils, fuel, lighting, urban–transport fares, smoking and some miscellaneous items, which was introduced in 1921, and was discontinued in 1961. The food and rent component of the C Series Index was the same as that for the B Series Index. The C Series Index was used to adjust wages from 1934 until it was discontinued.

(iv) The D Series Index, which was derived by combining the A Series and C Series Indexes, and was compiled especially for wage adjustment purposes for a short period in 1933–34.

(v) The Interim Retail Price Index, covering food and groceries, housing rents (for four– and five–roomed houses), clothing, household drapery, household utensils, fuel, lighting, urban–transport fares, smoking, and some services and miscellaneous items was first compiled in 1954 and was discontinued in 1960. As the name implies, the Interim Index was intended to serve as a transitional index, but to some extent it replaced the C Series Index for general statistical purposes for a few years before 1960. It was never used for wage adjustment purposes.

C SERIES INDEX

3.2 By far the most important of these old price indexes was the C Series Index which was the principal retail price index in Australia for almost forty years. It was first compiled in 1921 with index numbers compiled back to 1914. C Series Index numbers were compiled for:

(i) the capital city in each of the six states;

(ii) four of the larger towns in each of the six states;

(iii) weighted average of five towns (including the capital city) in each of the six states;

(iv) weighted average of the six state capital cities;

(v) weighted average of thirty towns (including the capital cities); and

(vi) three additional towns – Whyalla, Port Augusta, and Canberra.

3.3 The C Series Index was reviewed in 1936 and a slightly revised regimen was introduced following that review. The regimen then remained unchanged until the C Series Index was discontinued.

C SERIES INDEX *continued*

3.4 The main reason for the long interval without any review or change in composition of the C Series Index after 1936 was the recurrent changes in consumption patterns which occurred during and after World War II. It was considered impossible at the time to devise a revised weighting pattern which would be any more representative of post–war consumption than the existing weighting pattern of the C Series Index. The Commonwealth Statistician of the time, in successive editions of the Labour Report during the 1950s and 1960s, explained the absence of any re–weighting of the C Series Index in the following words.

"*From the outbreak of war in 1939 to late in 1948, periodic policy changes in various wartime controls (including rationing) caused recurrent changes in consumption and in the pattern of expenditure. This rendered changes desirable but made it impracticable either to produce a new index, or to revise the old one, on any basis that would render the index more representative than it already was of the changing pattern of household expenditure in those years. When commodity rationing had virtually ceased in the latter part of 1948 action was taken by the Statistician to collect price data of about 100 additional items and to gather information as to current consumption and expenditure patterns. This was done to facilitate review of the component items and weighting system of the C Series Retail Price Index in the light of the new pattern of wage earner expenditure and consumption that appeared to be then emerging. But there supervened, in the next few years, conditions which caused wide price dispersion, coupled with a very rapid rise in prices and a new sequence of changes in consumption and in the pattern of wage earner expenditure. Under these conditions it was not possible to devise any new weighting pattern likely to be more continuously representative of conditions then current, than was the existing C Series Index on the 1936 revision.*"

3.5 In 1953, the decision was made to continue compiling the C Series Index on its pre–war basis, but also to compile an interim retail price index based as nearly as possible on the post–war pattern of consumer usage and expenditure. Nevertheless, the C Series Index continued to be regarded by the majority of users as the principal official index, and was the one used in most indexation and escalation arrangements throughout the 1950s.

INTERIM RETAIL PRICE INDEX

3.6 The Interim Retail Price Index was based on post–war consumption weights. Compared with the C Series Index, the Interim Index covered an expanded range of items, including additional foods (such as packaged breakfast foods, soft drinks, ice cream, and confectionery) and services (such as dry–cleaning and shoe repairs). Throughout the period of its compilation, no attempt was made to revise its weights to take account of major changes in expenditure patterns and lifestyles that were occurring during the 1950s. During that decade, house renting was substantially replaced by home ownership, the use of motor cars partially replaced the use of public transport, and a variety of electrical appliances, and subsequently television, became widely used by households. During the same period, widely disparate movements occurred in the prices of different items routinely purchased by households. It was considered that the combined effect of these factors made it impracticable to introduce a comprehensive new retail price index during the period to 1960.

CONSUMER PRICE INDEX

3.7 In 1960, a new approach was tried. Instead of the former emphasis on long–term fixed–weighted indexes, the aim was to compile a series of shorter term indexes that would be chain linked to form long–term series. The Consumer Price Index, commonly referred to as the CPI, was the first price index of this kind constructed in Australia.

3.8 The CPI was first compiled in 1960 with index numbers compiled back to mid–1948. Like the old indexes, the CPI was designed to measure quarterly changes in the retail prices of goods and services purchased by metropolitan wage–earning households.

3.9 The CPI has been reviewed and re–weighted fourteen times since then. At its inception in 1960, the CPI consisted of three original series linked together with changes in weights in 1952 and 1956. Weights were changed in 1960 and subsequently in 1963, 1968, 1973, 1974, 1976, 1982, 1987, 1992, 1998, 2000 and 2005. The method of linking the sequence of short–term price indexes to form one continuous series is described later in this publication.

LONG–TERM LINKED SERIES

3.10 To provide an approximate long–term measure of consumer price change for the period since the first Australian retail price index was compiled, the ABS has constructed a single series of index numbers by linking together selected retail and consumer price index series from amongst those described above (see Table 3.1). The index numbers are expressed with a reference base of 1945 equals 100.0 which was the end of a period of price stability during World War II. The successive series linked together to produce this long–term series of index numbers are:

- from 1901 to 1914, the A Series Retail Price Index;
- from 1914 to 1946–47, the C Series Retail Price Index;
- from 1946–47 to 1948–49, a combination of the C Series Index, excluding rent, and the housing group of the CPI; and
- from 1948–49 onwards, the CPI.

3.11 This long–term series of index numbers is updated each year. A graph of the series taken from the table below is presented in Figure 3.1.

LONG–TERM LINKED SERIES *continued*

3.1 RETAIL/CONSUMER PRICE INDEX NUMBERS(a)(b)

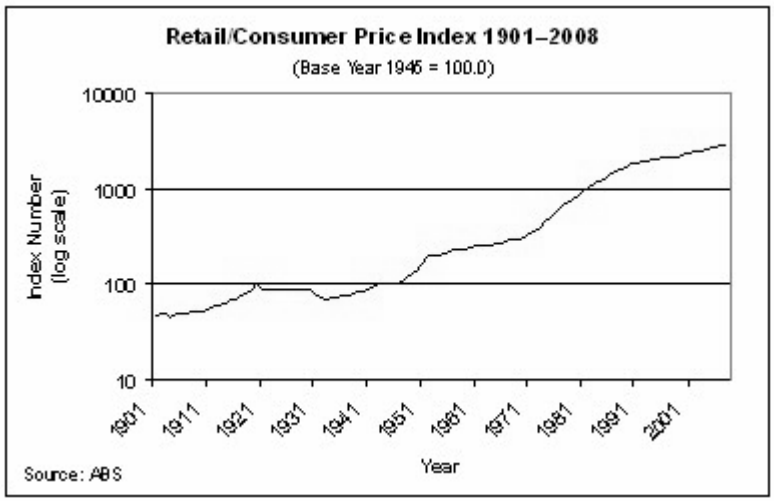
Year	*Index*	*Year*	*Index*	*Year*	*Index*	*Year*	*Index*
1901	47	1931	78	1961	252	1991	1,898
1902	50	1932	74	1962	251	1992	1,917
1903	49	1933	71	1963	252	1993	1,952
1904	46	1934	73	1964	258	1994	1,989
1905	48	1935	74	1965	268	1995	2,082
1906	48	1936	75	1966	276	1996	2,136
1907	48	1937	78	1967	286	1997	2,141
1908	51	1938	80	1968	293	1998	2,159
1909	51	1939	82	1969	302	1999	2,191
1910	52	1940	85	1970	313	2000	2,289
1911	53	1941	89	1971	332	2001	2,389
1912	59	1942	97	1972	352	2002	2,462
1913	59	1943	101	1973	385	2003	2,530
1914	61	1944	100	1974	443	2004	2,588
1915	70	1945	100	1975	510	2005	2,658
1916	71	1946	102	1976	579	2006	2,753
1917	75	1947	106	1977	650	2007	2,817
1918	80	1948	117	1978	702	2008	2,940
1919	91	1949	128	1979	766		
1920	103	1950	140	1980	844		
1921	90	1951	167	1981	926		
1922	87	1952	196	1982	1,028		
1923	89	1953	205	1983	1,132		
1924	88	1954	206	1984	1,177		
1925	88	1955	211	1985	1,257		
1926	90	1956	224	1986	1,370		
1927	89	1957	229	1987	1,487		
1928	89	1958	233	1988	1,594		
1929	91	1959	237	1989	1,714		
1930	87	1960	245	1990	1,839		

(a) Base: Calendar Year 1945 = 100.0

(b) The index numbers relate to the weighted average of six state capital cities from 1981. Index numbers are for calendar years.

LONG–TERM LINKED SERIES *continued*

Figure 3.1: Graph of long–term Retail/Consumer Price Index



CHAPTER 4 PRICE INDEX THEORY

OVERVIEW

4.1 Price indexes in one form or another have been constructed for several centuries, and are commonly used in everyday life. However, the complexities of price indexes are not always fully appreciated or understood. This chapter provides an overview of the theory and practices that underpin the construction of price indexes.[1]

4.2 The chapter commences by describing how a price index is a single–number representation of information about many prices. It then discusses the relationship between indexes of prices, quantities and expenditures.

4.3 Two levels of construction of price indexes are described. At the lowest level is the construction of an index for a narrowly defined commodity from price observations. The other is the aggregation of these basic or elementary aggregate indexes across a range of commodities. Various mathematical formulae for constructing these indexes are discussed. The problem for prices statisticians is to select the most appropriate methodology. The advantages and disadvantages of the various formulae are discussed, along with criteria to guide decisions on the most appropriate formula.

4.4 The chapter concludes with a discussion of index number bias which can arise from the use of an inappropriate formula or poor index construction practices. Approaches to minimising bias are discussed.

THE CONCEPT OF A PRICE INDEX

Comparing prices

4.5 There are many situations where there is a need to compare two (or more) sets of price observations. For example, a household might want to compare prices today with some earlier period; a manufacturer would be interested in comparing prices between markets to determine where to sell its output, or to compare price movements between two times with movements in its production costs; and economists and market analysts need to be able to compare prices between countries and over time to assess and forecast a country's economic performance.

4.6 In some situations, the price comparisons might only involve a single commodity. Here it is simply a matter of directly comparing the two price observations. For example, a household might want to assess how the price of shampoo today compares with the price at some previous time.

4.7 In other circumstances, the required comparison is of prices across a range of commodities. For example, a comparison of clothing prices might be required. There is a wide range of clothing types and thus prices to be considered (e.g. toddlers' jump suits, women's fashion skirts, boys' shorts, men's suits). Although comparisons can readily be made for individual or identical clothing items, this is unlikely to enable a satisfactory result for all clothing in aggregate. A method is required for combining the prices across this diverse range of items allowing for the fact that they have many different units or quantities of measurement. This is where price indexes play an extremely useful role.

The basic concept

4.8 A price index is a measure of changes in a set of prices over time. Price indexes allow the comparison of two sets of prices for a common item or group of items. In order to compare the sets of prices, it is necessary to designate one set the reference set and the other the comparison set.[2] The reference price set is used as the base (or first)

1 For a detailed discussion of price index theory and internationally recommended practices, see *Consumer Price Index Manual, Theory and Practice, 2004* (International Labour Office).

2 This is the terminology used by Pollak (1971).

The basic concept continued

period for constructing the index, and by convention is always given an index value of 100. For example, suppose for a single item the average of prices in set 1 was $15 and for set 2 was $30. Then, designating set 1 as the reference set gives an index of 200.0 (30/15x100) for the comparison set 2. Designating set 2 as the reference set gives an index of 50.0 (15/30×100) for the comparison set 1.

4.9 The most common comparison is between sets of prices at two times (temporal indexes). The times can be adjacent (this month and previous month) or many periods apart (this year and ten years earlier). Another application is to compare prices between regions or countries for the same time (spatial indexes). This latter application is a useful one in which to introduce the concept of a price index.

4.10 Suppose the objective is to determine levels of household expenditure that are equivalent between two cities, say Darwin and Hobart. To do this, an index is required which allows the price levels in the two cities to be compared. This can be done by specifying a basket (i.e. quantities) of goods and services, and pricing this basket in both cities. The ratio of the total price of the basket in each city gives a measure of price relativities.

4.11 The composition of the basket would depend on the comparison required. For example, suppose the household was considering relocating from Darwin to Hobart and desired to be no worse off in terms of the overall basket of goods and services it could purchase. The reference basket should then comprise the quantities of each item currently purchased by the household in Darwin. Alternatively, if the household were in Hobart and considered relocating to Darwin, then it would specify the reference basket as the quantities of goods and services being purchased in Hobart.

4.12 The composition of the basket reflects the consumption preferences of the subject, in this case the household. It will reflect the household's preferences under the prices and income prevailing in its current situation. Ideally, what would be required is some indication of how the household's tastes or preferences might change between locations. Clearly the household could choose a different mix of items in Hobart than in Darwin, reflecting differences in relative prices between the cities, climate and other factors. The objective, though, is the same: to measure the relativity between expenditures in the two cities for which the household is equally satisfied (or indifferent).

4.13 Similarly, price indexes can measure movements in prices between two times. Typically the method is to nominate one set of prices as the reference prices and to revalue the quantities (or basket) of items purchased in the base period by prices in the second (or comparison) period. The ratio of the revalued comparison period basket to the value of the reference period basket provides a measure of the price change between the two periods. This simple revaluation, however, does not take account of any changes or substitutions that may be made in quantities consumed in response to changes in relative prices between the two periods. Nor does it allow for any change in tastes between the two periods. These changes to the preferences of consumers are significant in the choice of index methodology.

The basic concept continued

4.14 Handling quantity changes that occur in response to changes in relative prices is fundamental to price index construction. Changes in the relative importance of items in the basket of goods and services can have a significant effect on index movements.

REFINING THE CONCEPT

4.15 Expenditure on an individual item is the product of price and quantity, that is:

$$e_t = p_t q_t \qquad (4.1)$$

where e is expenditure, p is price, q is quantity and the subscript t refers to the time periods at which the observations are made.

4.16 Consider the expenditures on the same commodity at two different times. Changes in these expenditures can reflect changes in the price, changes in the quantity, or a combination of both price and quantity changes. For example, suppose the price of Granny Smith apples at a particular market is $2.00 per kg in one period, and it rises to $2.50 per kg at a later one. The change in the price of apples between these two periods is obtained from the ratio of the price in the second period to the price in the first period; that is, $2.50/$2.00 = 1.25 or an increase of 25 per cent in the price. If a consumer bought exactly the same quantity of apples in the two periods, the price of the purchase would rise by 25 per cent. However, if the amount purchased in the first period was 10 kg, and the amount purchased in the second period was 12 kg, the quantity would also have risen by a factor of 12/10 = 1.20 or 20 per cent. In these circumstances, the total expenditure on apples increases from $20 in the first period (10 kg at $2.00 per kg), to $30 in the second period (12 at $2.50 per kg), an increase in expenditure of $10 or 50 per cent. The ratio of the current expenditure to the previous expenditure is the product of the change in price and the change in quantity (1.25 x 1.20 = 1.50).

4.17 The ratio between the price in the current period and the price in the reference period is called a price relative. A price relative shows the change in price for one item only (e.g. the pricing of Granny Smith apples at one particular fruit market).

In terms of the formula in equation 4.1:

e_1 (expenditure in period 1) = p_1 ($2.00) x q_1 (10 kg) = $20, and

e_2 (expenditure in period 2) = p_2 ($2.50) x q_2 (12 kg) = $30

where: p_1 is the price per kg in period 1; q_1 is the quantity in period 1;

p_2 is the price per kg in period 2 and q_2 is the quantity in period 2.

The ratio between the prices in the two periods, p_2 and p_1 ($2.50/$2.00 = 1.25) is the price relative.[3]

4.18 It is only necessary to have observations on two of the three components of equation 4.1 to analyse contributions to change in the expenditure. Using the apple example, suppose observations were only available on expenditure and price. The expenditure observations could be divided by the price to estimate the quantity (or the movements in expenditure and price could be used).

3 In this example, the price relative shows the change in price between two times. If, instead of two different periods we looked at the price between two different markets in the same period, the price relative would show the difference between the prices in the two markets in the same period.

REFINING THE CONCEPT *continued*

4.19 Now consider the case of price and quantity (and expenditure) observations on many commodities. The quantity measurements can have many dimensions, such as kilograms, tonnes, or even units (e.g. number of motor cars), and the quantities and prices of items are likely to show different movements between periods. Answers are required to questions such as these: what is the change over time in the quantity of commodities, and what is the contribution of price changes to changes in the expenditure on the bundle of commodities over time? Answering these questions is the task of index numbers: to summarise the information on sets of prices and quantities into single measures to assist in understanding and analysing changes.

4.20 In essence, an index number is an average of either prices or quantities compared with the corresponding average in a base period. The problem is how to calculate the average.

4.21 More formally, the price index problem is how to derive numbers IP (an index of price) and IQ (an index of quantity) such that the product of the two is the change in the total value of the items between the base period (*0*) and any other period (*t*), that is

$$I_t^P I_t^Q = V_t / V_0 \qquad (4.2)$$

where V_t is the value of all items in period t and V0 is their value in period 0 (base period). Based on equation (4.1), V_t can be represented as :

$$V_t = \Sigma v_{it} = \Sigma p_{it} q_{it} \qquad (4.3)$$

that is, the sum of the product of prices and quantities of each item denoted by subscript i. The summation range (i=1..N) is not shown in order to make the formula more readable.

MAJOR INDEX FORMULAE

4.22 In presenting index number formulae, a simple starting point is to compare two sets of prices (sometimes called bilateral indexes). Consider price movements between two periods, where the first period is denoted as period 0 and the second period as period *t* (period 0 occurs before period *t*). To calculate the price index, the quantities need to be fixed at same period in time. The initial question is what period should be used to determine the basket (or quantities). There are several possibilities.

(i) *The quantities of the first (or earlier) period.* This approach answers the question how much would it cost in the second period, relative to the first period, to purchase the same basket of goods and services that was purchased in the first period. Estimating the cost of the basket in the second period's prices simply requires multiplying the quantities of items purchased in the first period by the prices that prevailed in the second period. A price index is obtained from the ratio of the revalued basket to the total price of the basket in the first period. This approach was proposed by Laspeyres in 1871, and is referred to as a Laspeyres price index I_{Lt}. It may be represented, with a base of 100.0, as:

$$I_{Lt} = \frac{\Sigma p_{it} q_{i0}}{\Sigma p_{i0} q_{i0}} \times 100 \qquad (4.4)$$

MAJOR INDEX FORMULAE *continued*

(ii) *The quantities of the second (or more recent) period.* This approach answers the question how much would it have cost in the first period, relative to the second period, to purchase the same basket that was purchased in the second period. Estimating the cost of purchasing the second period's basket in the first period simply requires multiplying the quantities of items purchased in the second period by the prices prevailing in the first period. A price index is obtained from the ratio of the total price of the basket in the second period to the total price of the basket valued at the first period's prices. This approach was proposed by Paasche in 1874, and is referred to as a Paasche price index I_{Pt}. It may be represented, with a base of 100.0, as:

$$I_{Pt} = \frac{\Sigma p_{it} q_{it}}{\Sigma p_{i0} q_{it}} \times 100 \qquad (4.5)$$

(iii) *A combination (or average) of quantities in both periods.* This approach tries to overcome some of the inherent difficulties of using a basket fixed at either time. In the absence of any firm indication that either period is the better to use as the base or reference, then a combination of the two is a sensible compromise. In practice this approach is most frequent in:

a) the Fisher Ideal price index,[4] which is the geometric mean of the Laspeyres and Paasche indexes:

$$I_{Ft} = (I_{Lt} I_{Pt})^{\frac{1}{2}} \qquad (4.6)$$

and

b) the Törnqvist price index, which is a weighted geometric mean of the price relatives where the weights are the average shares of total values in the two periods, that is:

$$I_{Tt} = \prod_i \left(\frac{p_{it}}{p_{i0}}\right)^{s_i} \qquad (4.7)$$

where $s_i = \frac{1}{2}(e_{i0}/\Sigma e_{i0} + e_{i1}/\Sigma e_{i1})$ is the average of the expenditure shares for the i^{th} item in the two periods.

The Fisher Ideal and Törnqvist indexes are often described as symmetrically weighted indexes because they treat the weights from the two periods equally.

4.23 The Laspeyres and Paasche formulae are expressed above in terms of quantities and prices. However, in practice, quantities might not be observable or meaningful (e.g. consider the quantity dimension of legal services, public transport, and education). Thus in practice, the Laspeyres formula is typically estimated using expenditure shares to weight price relatives – this is numerically equivalent to the formula (4.4) above.

4.24 To derive the price relatives form of the Laspeyres index, multiply the numerator of equation 4.4 by $\frac{p_{i0}}{p_{i0}}$ and rearrange to obtain:

$$I_t = \Sigma \frac{p_{it}}{p_{i0}} \left(\frac{p_{i0} q_{io}}{\Sigma p_{i0}}\right) \times 100$$

where the term in parentheses represents the expenditure share of item ***i*** in the reference (or, more commonly labelled, base) period. Let:

$$w_{i0} = \frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} = \frac{e_{i0}}{\Sigma e_{i0}}$$

then the Laspeyres formula may be expressed as:

4 The use of the geometric mean of the Laspeyres and Paasche indexes was first proposed by Pigou in 1920, and given the title "ideal" by Fisher (1922).

MAJOR INDEX FORMULAE *continued*

$$I_{it} = \Sigma w_{i0}\left(\frac{p_{it}}{p_{i0}}\right) \times 100 \qquad (4.10)$$

where $\frac{P_{it}}{P_{io}}$ is the price relative for the *i*th item.

4.25 In a similar manner, the Paasche index may be constructed using expenditure weights. In equation 4.5, multiply the denominator by $\frac{p_{it}}{p_{it}}$ and rearrange terms to obtain:

$$I_{Pt} = \frac{\Sigma p_{it}q_{it}}{\Sigma p_{it}q_{it}\frac{p_{i0}}{p_{it}}} = \frac{1}{\Sigma \frac{p_{i0}}{p_{it}}}\left(\frac{\Sigma p_{it}q_{it}}{p_{it}q_{it}}\right) \times 100 \qquad (4.11)$$

which may be expressed as:

$$I_{Pt} = \frac{1}{\Sigma w_{it}\frac{p_{i0}}{p_{it}}} \times 100 \qquad (4.12)$$

which is the inverse of a 'backward' Laspeyres index (i.e. a Laspeyres index going from period *t* to period *0* using period *t* expenditure weights).[5]

4.26 The important point to note here is that if price relatives are used, then value (or expenditure) weights must also be used. On the other hand, if prices are used directly rather than in their relative form, then the weights must be quantities.

4.27 An example of creating index numbers using the above formulae is presented in Table 4.1. For the purposes of this exercise, a limited range of the types of commodities households might purchase is used. The quantities that these items would typically be measured in may vary. There are likely to be differences in price behaviour of the commodities over time. Further, the quantities of these items households purchase may vary over time in response to changes in prices (of both the item and other items) and household incomes.

4.28 Differences that might arise in price changes (and, by implication expenditure patterns) are illustrated by the following:

- prices of high labour content items, such as clothing, will tend to show steady trends over time relative to other items;
- prices of high technology goods, such as computers, tend to decline over time, either absolutely or relative to other items, reflecting productivity and technological advances;
- prices of some items, such as fresh fruit, are affected by climatic and seasonal influences and so move erratically; and
- prices of some items might at times be influenced by changes in taxation rates (e.g. beer).

4.29 Price changes influence, to varying degrees, the quantities of items households purchase. For some items, such as basic food stuffs, the quantities purchased may show little change in response to price changes. For other items, the quantities households purchase may change by a smaller or greater proportionate amount than the price change.[6]

5 For further discussion of forward and backward Laspeyres and Paasche price and quantity indexes, refer to Chapter 2 of Allen (1975).

6 Economists measure the change in the quantity of an item in response to a change in price (or income) by elasticities, which are measured as the ratio of the percentage change in the quantity to the percentage change in price (or income). An item is price inelastic if the percentage change in the quantity is less than the percentage change in price. It has unit elasticity if the percentage changes are the same, and is price elastic if the percentage change in the quantity is greater than the percentage change in price. If an item is price inelastic, the

MAJOR INDEX FORMULAE *continued*

4.30 The examples in Table 4.1 reflect some of these possibilities.

4.31 In Table 4.2 the different index formulae produce different index numbers, and thus different estimates of the price movements. Typically the Laspeyres formula will produce a higher index number than the Paasche formula in periods after the base period, with the Fisher Ideal and the Törnqvist of similar magnitude falling between the index numbers produced by the other two formulae. In other words the Laspeyres index will generally produce a higher (lower) measure of price increase (decrease) than the other formulae and the Paasche index a lower (higher) measure of price increase (decrease) in periods after the base period.[7]

Generating index series over more than two periods

4.32 Most users of price indexes require a continuous series of index numbers at specific time intervals. There are two options for applying the above formulae when compiling a price index series.

(i) Select one period as the base and separately calculate the movement between that period and the required period. This is called a fixed base or direct index.

(ii) Calculate the period–to–period movements and chain these (i.e. calculate the movement from the first period to the second, the second to the third with the movement from the first period to the third obtained as the product of these two movements).

4.33 The calculation of direct and chained indexes over three periods (*0*, *1*, and *2*) using observations on three items, is shown below. The procedures can be extended to cover many periods.

change in expenditure will be in the same direction as the change in price (i.e. if price increases, then expenditure also increases). If the item has unit elasticity, then expenditure is unchanged. If the item is price elastic, the change in expenditure will be in the opposite direction to the price change (i.e. if price increases, then expenditure decreases).

7 The relationship between the Laspeyres and Paasche indexes holds while there is a normal relationship (negative correlation) between prices and quantities; that is, quantity declines if price increases between the two periods, and vice versa.

Generating index series over more than two periods continued

4.1 COMPILING PRICE INDEXES OVER TWO PERIODS

Item		Price ($)	Quantity	Expenditure $	Expenditure shares	Price relatives
			Period 0			
Bread	loaves	2.50	2 000	5 000	0.4310	1.0000
Fresh fruit	kg	3.00	500	1 500	0.1293	1.0000
Beer	litres	4.50	200	900	0.0776	1.0000
Computers	units	1 500.00	2	3 000	0.2586	1.0000
Clothing	units	30.00	40	1 200	0.1035	1.0000
Total				**11 600**	**1.0000**	
			Period t			
Bread	loaves	2.75	2 000	5 500	0.4532	1.1000
Fresh fruit	kg	4.00	450	1 800	0.1483	1.3333
Beer	litres	6.50	130	845	0.0696	1.4444
Computers	units	1 000.00	3	3 000	0.2472	0.6667
Clothing	units	33.00	30	990	0.0817	1.1000
Total				**12 135**	**1.0000**	

Index numbers

		Period 0	Period t
Index formula			
Laspeyres	no.	100.0	104.5
Paasche	no.	100.0	98.4
Fisher	no.	100.0	101.4
Törnqvist	no.	100.0	101.6

In order to have expenditure weights summing exactly to unity, the weight for clothing has been derived as a residual. The following illustrate the index number calculations:

Laspeyres

$(0.4310 \times 1.1000) + (0.1293 \times 1.3333) + (0.0776 \times 1.4444) + (0.2586 \times 0.6667) + (0.1035 \times 1.1000) \times 100 = 104.5$

Paasche

$1/((0.4532 \times 1.1000) + (0.1483 \times 1.3333) + (0.0696 \times 1.4444) + (0.2472 \times 0.6667) + (0.0817 / 1.1000)) \times 100 = 98.4$

Fisher

$(104.500 \times 98.400)^{1/2}$

Törnqvist best calculated by first taking the logs of the index formula

$(1/2) \times (0.4310+0.4532) \times \ln(1.1000)$

$+ (1/2) \times (0.1293 + 0.1483) \times \ln(1.3333)$

$+ (1/2) \times (0.0776 + 0.0696) \times \ln(1.4444)$

$+ (1/2) \times (0.2586 + 0.2472) \times \ln(0.6667)$

$+ (1/2) \times (0.1035 + 0.0817) \times \ln(1.1000)$

Generating index series over more than two periods continued

= 0.015422

and then taking the exponent multiplied by 100 = 101.6.

4.2 CONSTRUCTING PRICE INDEX SERIES

Item	*Period 0*	*Period 1*	*Period 2*
	Price ($)		
1	10	12	15
2	12	13	14
3	15	17	18
	Quantity		
1	20	17	12
2	15	15	16
3	10	12	8

INDEX NUMBER

Index formula			
Laspeyres			
Period 0 to 1	100.0	114.2	
Period 1 to 2		100.0	112.9
chain	100.0	114.2	128.9
direct	100.0	114.2	130.2
Paasche			
Period 0 to 1	100.0	113.8	
Period 1 to 2		100.0	112.3
chain	100.0	113.8	127.8
direct	100.0	113.8	126.9
Fisher			
Period 0 to 1	100.0	114.0	
Period 1 to 2		100.0	112.6
chain	100.0	114.0	128.3
direct	100.0	114.0	128.5

4.34 An index formula is said to be 'transitive' if the index number derived directly is identical to the number derived by chaining. In general, no weighted index formula will be transitive because period–to–period calculation of the index involves changing the weights for each calculation. The index formulae in Table 4.2 will only result in transitivity if there is no change in the quantity of each item in each period or all prices show the same movement. In both these cases, all the formulae will produce the same result.

4.35 The direct Laspeyres formula has the advantage that the index can be extended to include another period's price observations when available, as the weights are fixed at some earlier base period. On the other hand, the direct Paasche formula requires both current period price observations and current period weights before the index can be extended.

Unweighted, or equally weighted indexes

4.36 In some situations, it is not possible or meaningful to derive weights in either quantity or expenditure terms for each price observation. This is typically so for a narrowly defined commodity grouping in which there might be many sellers (or producers). Information might not be available on the total volume of sales of the item or for the individual sellers or producers from whom the sample of price observations is taken. In these cases, it seems appropriate not to weight, or more correctly to assign an equal weight, to each price observation. It is a common practice in the CPI in many countries that the price indexes at the lowest level (where prices enter the index) are calculated using an equally weighted formula, such as an arithmetic mean or a geometric mean.

4.37 Suppose there are price observations for n items in period *0* and period t. Then three approaches[8] for constructing an equally weighted index are as follows.

(i) Calculate the arithmetic mean of prices in both periods and obtain the relative of the second period's average to the first period's average (i.e. divide the second period's average by the first period's average). This is the relative of the arithmetic mean of prices (RAP) approach, also referred to as the Dutot formula:

$$I_D = \frac{\frac{1}{N}\Sigma p_{it}}{\frac{1}{N}\Sigma p_{io}} \qquad (4.13)$$

(ii) For each item, calculate its price relative (i.e. divide the price in the second period by the price in the base period) and then take the arithmetic average of these relatives. This is the arithmetic mean of price relatives (APR) approach, also referred to as the Carli formula:

$$I_C = \frac{1}{N}\Sigma \frac{p_{it}}{p_{io}} \qquad (4.14)$$

(iii) For each item, calculate its price relative, and then take the geometric mean[9] of the relatives. This is the geometric mean (GM) approach, also referred to as the Jevons formula:

$$I_G = \Pi\left(\frac{p_{it}}{p_{io}}\right)^{\frac{1}{N}} \qquad (4.15)$$

4.38 Although these formulae apply equal weights, the basis of the weights differs. The geometric mean applies weights such that the expenditure shares of each observation are the same in each period. In other words, it is assumed that as an item becomes more (less) expensive relative to other items in the sample the quantity declines (increases) with the percentage change in the quantity offsetting the percentage change in the price. The RAP formula assumes equal quantities in both periods. That is, the RAP assumes there is no change in the quantity of an item purchased regardless of either its price movement or that of other items in the sample. The APR assumes equal expenditures in the first period with quantities being inversely proportional to first period prices.

4.39 The following are calculations of the equal weight indexes using the data in Table 4.2. Setting period *0* as the base with a value of 100.0, the following index numbers are obtained in period t:

RAP formula: $$113.5 = \frac{\frac{1}{3}(12+13+17)}{\frac{1}{3}(10+12+15)} \times 100$$

8 The implicit weights applied by the three formulae are equal base–period quantities (RAP), equal base–period expenditures (quantities inversely proportional to base–period prices) (APR) and equal expenditure shares in both periods (GM).

9 The geometric mean of n numbers is the nth root of the product of the numbers. For example, the geometric mean of 4 and 9 is 6 (= $\sqrt{4 \times 9}$), but the arithmetic mean is 6.5 (= (4+9)/2).

Unweighted, or equally weighted indexes continued

APR formula: $113.9 = \frac{1}{3}(\frac{12}{10} + \frac{13}{12} + \frac{17}{15}) \times 100$

GM formula: $113.8 = \sqrt[3]{\frac{12}{10} \times \frac{13}{12} \times \frac{17}{15}} \times 100$

4.40 Theory suggests that the APR formula will produce the largest estimate of price change, the GM the least and the RAP a little larger but close to the GM.[10] Real life examples generally support this proposition,[11] although with a small sample as in the example above, substantially different rankings for the RAP formula are possible depending on the prices.

4.41 The behaviour of these formulae under chaining and direct estimation is shown in Table 4.3 using the price data from Table 4.2. The RAP and GM formulae are transitive, but not the APR.

4.3 LINKING PROPERTIES OF EQUAL WEIGHT INDEX(a)

Formula	*Period 0*	*Period 1*	*Period 2*
RELATIVE OF AVERAGE PRICES (RAP)			
period 0 to 1	100.0	113.5	
period 1 to 2		100.0	111.9
chain	100.0	113.5	127.0
direct	100.0	113.5	127.0
AVERAGE OF PRICE RELATIVES (APR)			
period 0 to 1	100.0	113.9	
period 1 to 2		100.0	112.9
chain	100.0	113.9	128.6
direct	100.0	113.9	128.9
GEOMETRIC MEAN (GM)			
period 0 to 1	100.0	113.8	
period 1 to 2		100.0	112.5
chain	100.0	113.8	(b)128.0
direct	100.0	113.8	(b)128.1

(a) Uses the same price data as in Table 4.2.
(b) Difference in calculated index is due to rounding.

10 For a mathematical proof of this see Diewert (1995). The unweighted indexes will all produce the same result if all prices move in the same proportion (have the same relative). In addition, the RAP and APR will produce the same index number if all base–period prices are equal. Diewert also refers to other studies that compare real world results for elementary aggregate formulae.

11 For example, Woolford (1994) calculated these indexes for twenty three fresh fruit and vegetable elementary aggregates of the Australian CPI over the period June 1993 to June 1994. He found that the GM produced the lowest increase in sixteen of the twenty three elementary aggregates, and the APR produced the highest increase for nineteen of the elementary aggregates. The RAP formula produced the middle estimate for thirteen of the elementary aggregates. Combining the elementary aggregates to produce the fresh fruit and vegetables index, the index compiled using the APR estimates was 4.7 per cent higher than the index based on GM estimates, and the RAP was 1.7 per cent higher than the index based on GM.

Unit values as prices

4.42 A common problem confronted by index compilers is how to measure the price of items in the index whose price may change several times during an index compilation period. For example, in Australia petrol prices change almost daily at many outlets, but the CPI is quarterly. Taking more frequent price readings and calculating an average is one approach to deriving an average quarterly price. A more desirable approach, data permitting, would be to calculate unit values and use these as price measures.[12] Unit values are obtained by dividing a value by a quantity (e.g. the total value of petrol sold in a particular period divided by the number of litres sold will give a unit value per litre for the price of petrol over the period). Unit values can be used to measure price changes only when the values are for similar (homogeneous) products.

4.43 For example, suppose outlet X sells chocolate bars in weights of 50g, 80g and 100g. Further, suppose the outlet keeps records of the value of sales of these chocolate bars in aggregate and the number of each size of chocolate bar sold. It is then possible to calculate the total quantity of chocolate sold in grams. Dividing the value of expenditure on chocolate by the total quantity in grams produces a unit value that could be used as the price measure for chocolate.

4.44 The advent of scanner data from retail outlets is making the construction of unit values more feasible. To be successfully applied, the information is required across all outlets. Scanners provide information about both values and quantities at the point of sale, and so enable the collection of a large number of unit values at fine levels. In effect, these data would remove any need for the unweighted index formulae discussed above (at least for those items where unit values are available).

RESOLVING EXPENDITURE AGGREGATES

4.45 It is appropriate at this point to re–examine the decomposition of an expenditure aggregate into price and quantity components introduced in equation 4.1. It is important to know the form of the quantity index when a particular form of the price index is used (and vice versa) to ensure the accurate decomposition of the value change.

4.46 A value is the product of a price and a quantity (in its simplest form, the price of a single item multiplied by 1 is the value of the item). It follows that changes in the value of expenditure on an item from period to period are the result of changes in the prices or quantities or both. If any two of the value, price or quantity are known, the third can be derived (i.e. $E = P \times Q$, where E = expenditure, P = price and Q = quantity), e.g. $Q=E/P$. The calculation is straightforward when a single item is involved. However, in the case of an expenditure total that is the sum of several items, breaking up that expenditure into its price and quantity components becomes more complicated.

4.47 Price indexes provide a means of removing the effects of price changes from changes in expenditure so that the underlying changes in quantity can be identified. In the *Australian National Accounts*, price indexes are widely used in the process of estimating changes in volumes of expenditure, production etc. The process of using price indexes in this way is known as *price deflation*, with the index termed a *deflator*. The form of price index (current or fixed weighted) will determine the resulting index of quantity change.

4.48 The change in an expenditure aggregate between period *0* and *t* may be expressed as:

12 See Diewert (1995) for further discussion of unit values.

RESOLVING EXPENDITURE AGGREGATES *continued*

$$\frac{E_t}{E_0} = \frac{\Sigma p_{it} q_{it}}{\Sigma p_{i0} q_{i0}} \qquad (4.16)$$

4.49 Multiplying the right–hand side of equation (4.16) by $\frac{\Sigma p_{it} q_{io}}{\Sigma p_{it} q_{io}}$ allows the equation to be expressed as:

$$\frac{E_t}{E_0} = \frac{\Sigma p_{it} q_{i0}}{\Sigma p_{i0} q_{i0}} \times \frac{\Sigma p_{it} q_{it}}{\Sigma p_{it} q_{i0}} \qquad (4.17)$$

where the first term on the right–hand side of the equals sign is a Laspeyres price index and the second is a Paasche volume index.[13] This is referred to as the Laspeyres decomposition. In other words, if an index of value change is deflated by a base–period–weighted price index, then the index of quantity change is a current–period–weighted quantity index.

4.50 An alternative decomposition of the change in the expenditure aggregate is obtained by multiplying the right–hand side of (4.16) by $\frac{\Sigma p_{i0} q_{it}}{\Sigma p_{i0} q_{it}}$ which produces:

$$\frac{E_t}{E_0} = \frac{\Sigma p_{it} q_{it}}{\Sigma p_{i0} q_{it}} \times \frac{\Sigma p_{i0} q_{it}}{\Sigma p_{i0} q_{i0}} \qquad (4.18)$$

where the first term on the right–hand side of the equals sign is a Paasche price index and the second is a Laspeyres volume index. This is referred to as the Paasche decomposition. In other words, if an index of value change is deflated by a current–period–weighted price index, then the index of quantity change is a base–period–weighted quantity index.

4.51 A similar decomposition can also be undertaken for the Fisher Ideal index. By taking the geometric average of the alternative Laspeyres and Paasche decompositions of value change (right–hand sides of equations (4.17) and (4.18)) it can be shown that value change is the product of Fisher Ideal price and quantity indexes.

SOME PRACTICAL ISSUES IN PRICE INDEX CONSTRUCTION

Handling changes in price samples

4.52 All the index formulae discussed above require observations on the same items in each period. In some situations it may be necessary to change the items or outlets included in the price sample or, if weights are used, to re–weight the price observations. Examples of changes in a price sample include:

- a respondent goes out of business;
- the sample needs to be updated to reflect changes in the market shares of respondents;
- to introduce a new respondent; or
- to include a new item.

4.53 It is important that changes in price samples are introduced without distorting the level of the index for the price sample. This usually involves a process commonly referred to as *splicing*. Splicing is similar to chaining except that it is carried out at the level of the price sample. An example of handling a sample change is shown in the table below, for equally weighted indexes assuming a new respondent is introduced in period *t*. A price is also observed for the new respondent in the previous period *t–1*. The inclusion of the new respondent causes the geometric mean to fall from $5.94 to $5.83.

13 In a volume index, prices are held constant between the two periods, and the actual quantities from each period are used in the calculation. The change in the index is then measuring the weighted change in the volume of purchases, expenditure etc.

Handling changes in price samples continued

The ABS does not want this price change to be reflected in the index, but we do want to capture the effect of respondent 4's price movement between period *t–1* and *t*.

4.4 TABLE 4.4 A CHANGE IN SAMPLE - INTRODUCING A NEW RESPONDENT

	PRICE			PRICE RELATIVE		
Respondent						
OBSERVATIONS IN PERIOD t-1						
	Base	Period t-2	Period t-1	Base	Period t-2	Period t-1
1	4.00	5.50	6.00	1.000	1.38	1.50
2	4.50	4.50	5.00	1.000	1.00	1.11
3	5.00	5.50	7.00	1.000	1.10	1.40
Geometric mean (GM)	4.48	5.14	5.94	1.000	1.15	1.33
OBSERVATIONS IN PERIOD t						
	Base	Period t-1	Period t	Base	Period t-1	Period t
1	4.00	6.00	6.50	1.000	1.500	1.63
2	4.50	5.00	5.50	1.000	1.11	1.22
3	5.00	7.00	7.00	1.000	1.40	1.40
4	—	5.50	6.00	1.000	1.33	1.45
GM (all items)		5.83	6.22	1.000	1.33	1.42
GM (matched sample)		5.94	6.30			

— nil or rounded to zero (including null cells)

4.54 In the case of the APR and GM formulae, the process involves:

- setting the previous period price relative for period *t* for the new respondent (4) equal to the average of the price relatives of the three respondents included in period *t–1* (1.326); and
- applying the movement in respondent 4's price between period *t–1* and t to derive a price relative for period *t* (6.00/5.50 x 1.326=1.447).

4.55 For these two formulae, the average of the price relatives is effectively the index number, so the GM index for period *t–1* is 132.6 and for period t is 141.6.

4.56 In the case of the RAP formula, the method is similar, but prices are used instead of price relatives. The RAP formula uses the arithmetic mean of prices (not the arithmetic mean of the price relatives). The index for RAP can be calculated from the period–to–period price movements:

- between the base period and period *t–1*, the movement in the average price was 1.333 (6.00/4.50) without the new respondent;
- between period *t–1* and *t*, the movement in the average price was 1.063 (6.25/5.88) including the new respondent in both periods; and
- thus the index for period *t* is 141.7 (1.333 x 1.063 x 100).

Temporarily missing price observations

4.57 In any period, an event may occur that makes it impossible to obtain a price measure for an item. For example, an item could be temporarily out of stock or the quality is not up to standard (as may occur with fresh fruit and vegetables because of climatic conditions).

4.58 There are a few options available to deal with temporarily missing observations. These include:

Temporarily missing price observations continued

(i) repeat the previous period's price of the item;

(ii) impute a movement for the item based on the price movement for all other items in the sample; or

(iii) use the price movement from another price sample.

4.59 Approach (ii) is equivalent to excluding the item, for which a price is unavailable in one period, from both periods involved in the index calculation. It strictly maintains the matched sample concept.

4.60 An example of imputing using the first two approaches for the equally weighted formula is provided below. The example assumes that there is no price observation from respondent B in period *2*.

4.5 IMPUTATION OF MISSING PRICE OBSERVATIONS

Respondent	*Period 0*	*Period 1*	*Period 2*	*Period 3*
Price ($)				
A	10.00	11.00	12.00	13.00
B	12.00	13.00	-	12.00
C	15.00	15.50	14.50	17.00
D	14.00	13.50	15.00	18.00
Price relatives				
A	1.000	1.100	1.200	1.300
B	1.000	1.083	-	1.000
C	1.000	1.033	0.967	1.133
D	1.000	0.964	1.071	1.286
Impute using previous period's price				
Price for respondent B	12.00	13.00	13.00	12.00
Imputed relative for B		13.00/12.00=	1.083	
Indexes				
RAP	**100.0**	**103.9**	**106.9**	**117.6**
APR	**100.0**	**104.5**	**108.0**	**118.0**
GM	**100.0**	**104.4**	**107.7**	**117.3**
Impute using average price movement for other items in sample				
RAP				
Arithmetic mean price of A, C and D		13.33	13.83	
Imputed price for B		13.00x(13.83/13.33)=	13.49	
Index	**100.0**	**103.9**	**107.8**	**117.6**
APR				
Arithmetic mean of relatives of A, C and D		1.032	1.079	
Imputed relative for B		1.083x(1.079/1.032)=	1.132	
Index	**100.0**	**104.5**	**109.3**	**118.0**
GM				
Geometric mean of relatives of A, C and D		1.031	1.075	
Imputed relative for B		1.083x(1.075/1.031)=	1.129	
Index	**100.0**	**104.4**	**108.8**	**117.3**

HANDLING CHANGES IN GOODS AND SERVICES

Quality change

4.61 A price index by definition measures what can be described as pure price change; that is, it is not distorted by changes in quality. The concept of a good or service within a price index is important in determining whether an item is new or a modification (change in quality) of a previous item. Under the usual index compilation practices, if the change in price of the item fully or partly reflects a change in quality, then for index purposes an adjustment is necessary to account for that quality change. If it is a new item, then that item must be introduced into the index by linking (or splicing).

4.62 There are two main approaches to treating goods and services for the purposes of compiling a price index. The conventional or goods approach is to treat each good and service as a separate item; for example, a distinction might be made between red and green apples. The alternative approach could be termed a characteristics approach that takes commodities and tries to identify the component characteristics or attributes which are valued by the consumer. For example, the characteristics of an apple which households value might be its nutritional content plus the ability to consume without having to perform any food preparation. The outcome is that consumers satisfy their hunger.[14]

4.63 The characteristics approach provides a conceptual basis for describing quality change. In the context of price indexes, quality can be thought of as embracing all those attributes or characteristics of an item on which the consumer places some value.[15] Take apples as an example. Consumers will value them for nutritional content as well as taste and absence of blemishes and bruising. The price index will be biased unless an apple of the same quality is priced each period. For some items quality change over time is not a major issue (e.g. the quality change in apples might only reflect differences in growing conditions between seasons), but for other items quality changes are very important (e.g. the increase in power and speed of personal computers, and changes in safety and ride quality of motor vehicles).

4.64 The characteristics approach has not been used so far as the sole basis for constructing a consumer price index. However, it is the foundation of the so–called hedonic technique for estimating pure prices for commodities.[16] The hedonic technique is now being used by some countries in their CPIs for some types of consumer goods.[17] Essentially the hedonic approach involves estimating a relationship between a commodity's price and the characteristics that it contains (e.g. for personal computers, a relationship might be estimated between the price of the computer and its processing power (chip type and speed), amount of RAM, hard disk size, etc. over a range of

14 The characteristics approach to goods is the basis of the so–called household production theory. The development of this theory is generally attributed to Lancaster (1966), Muth (1966) and Becker (1965). Bresnahan and Gordon (1998) also provide a good example using household lighting, tracing the development from whale–oil lamps through to the electric light–bulb, pointing out how the additional inputs required on the part of households (such as trimming wicks etc.) were an important part of the production of light.

15 Pollak (1983) identifies two characteristics approaches, that of Lancaster (1966) and Houthakker (1952). The Lancaster approach assumes that characteristics are additive across items (e.g. protein from meat can be added to protein from bread) whereas the Houthakker approach assumes characteristics are commodity specific.

16 There are many examples in literature of the application of the hedonic technique; for example, Ohta and Griliches (1975). For an overview of household production theory and the hedonic technique, see Muellbauer (1974). Pollak (1983) provides an exposition on the treatment of quality in a cost–of–living index.

17 For example, the hedonic technique is now used for estimating pure price change for personal computers and television sets in the United States CPI, and personal computers in Australia.

Quality change continued

computers). This effectively imputes a price for each characteristic that can be used to adjust prices as specifications change.[18]

4.65 Strict adherence to a goods approach would see frequent linking in response to any change in the specifications of individual items priced. Frequent linking is undesirable as each link is effectively a break in the series and can introduce bias. In the absence of the hedonic approach, quality adjustments must rely heavily on subjective methods. In a consumer price index these adjustments should be based, as far as possible, on the value of the quality change to the consumer (user value). In this respect, use of manufacturing cost (resource cost) data to value quality change can be misleading in many situations.[19]

4.66 Although intuitively appealing, the hedonic technique is difficult to apply in practice. It requires a lot of information and the careful selection of attributes that would be appropriate in a household utility function (e.g. if performance is one characteristic of a motor vehicle that consumers desire, would engine power or acceleration speed or some other parameter be the best measure of it). In addition, there are issues such as the functional form to be used and weighting.[20] Nevertheless, the hedonic technique does provide a tool that may assist in identifying the characteristics of commodities that influence their price, and it does provide a basis for adjusting for quality change.

4.67 Recent research by Aizcorbe et al. (2000) has indicated that for high technology goods such as computers, the use of matched models and a superlative index formula, for example the Fisher Ideal index, captures the rapid quality change in these goods. This raises questions as to whether there is much to be gained by using the more complicated hedonic approach.

4.68 It is not clear that prices should be adjusted for all changes in quality. An issue here is the appropriate treatment of mandated environmental measures (such as pollution–control hardware on automobiles) which increase the cost of items.[21] Mandated measures that (say) increase consumer safety can have a user value imputed to them, but the situation is not as simple for environmental measures. Indeed, Pollak (1998) argues that it is impractical to include environmental variables and produce meaningful price indexes.

18 It is a moot point whether the increased speed and power of computers is reflected in corresponding increases in consumer utility, which raises questions as to whether the hedonic approach adequately captures quality change from a consumer perspective. However, studies have shown remarkable similarities in price indexes based on a hedonics approach and those for computers based on a comprehensive matched models approach.

19 This point, and the use of characteristics in compiling consumer and producer price indexes, are explained in Triplett (1983).

20 Current thinking as presented in Koskimaki and Vartia (2001) for example is that hedonic equations should have log price as the dependent variable and should be estimated for each period. The use of weighted regressions is also supported by researchers such as Diewert.

21 In the United States, the treatment of mandated anti–pollution devices has changed over the years. As from January 1999, modifications to goods and services solely to meet air–quality standards have not been regarded as quality improvements, a practice that had previously applied since 1971. See Fixler (1998) for more information. In Australia, such modifications have always been regarded as price increases, not quality improvements.

New goods

4.69 Prices statisticians are often confronted with the problem of determining when a new item on the market is a *new good* for index construction purposes. A completely new good is not easily included in an existing price collection because there is no product category to which it can be readily classified. In these cases, it may eventually require its own separate recognition within the index rather than being a part of an existing product group.

4.70 The use of a hedonics or characteristics approach may assist in defining new goods. For example, the hedonics approach might suggest that DVDs are not actually new goods, but rather a better bundling of sound and images and other characteristics that people value (such as a more durable medium).

4.71 The difficulty of new goods is that they often show substantial falls in price once they gain market acceptance (sometimes after improvements in quality), and the supply of the good expands. There are two problems here. The first is that the traditional fixed–weighted index does not allow for the introduction of new goods until weights are updated. The second is that if the new good is not included until some time after establishing a significant market share, then the initial phase of falling prices is missed.

4.72 It has been suggested (Hicks (1940), and Fisher and Shell (1972)) that, in a cost–of–living framework, new goods should be valued at their *demand reservation* price. This price is the intercept of the demand curve with the price axis, essentially the price at which no units of the good would be sold. However, procedures to estimate reliably the demand reservation price have yet to be established.

BIAS IN PRICE INDEXES

4.73 Some of the issues about bias have already been covered in this manual. However, it is useful to bring these matters together to consider further some of the practical issues involving price indexes, especially considering a major inquiry into the issue was held in the United States in 1996.[22]

4.74 A price index may be described as biased if it produces estimates which depart from a notionally true or correct measure. In the case of consumer price indexes, the true measure is usually taken to be the cost–of–living index, as it allows for the substitutions in consumption that consumers make in response to changes in relative prices. As it is impractical to construct a true cost–of–living index, official agencies are forced into second–best solutions.

4.75 The following types of bias, typically upwards, have been described by Diewert (1996).

(i) Elementary index bias, which results from the use of inappropriate formulae for compiling index numbers at the elementary aggregate level;

(ii) Substitution bias, which arises from using formulae at levels above the elementary aggregates which do not allow for substitution in response to changes in relative prices;

22 This is often referred to as the Boskin Report, see Boskin (1996). Boskin estimated that the United States CPI was biased upwards by about 1.1 percentage points a year. There were many submissions and views expressed about bias in the US CPI. For a semi–official perspective on the issue see Moulton (1996). The ABS has not released any estimates of the magnitude of bias in the Australian CPI. However, the ABS believes that bias in the Australian CPI is significantly lower than in the US, in part reflecting differences in pricing and compilation practices.

BIAS IN PRICE INDEXES *continued*

(iii) Outlet substitution bias, which occurs when consumers shift their purchases from higher cost outlets to lower cost outlets for the same commodity;

(iv) Quality adjustment bias, which arises from inadequate adjustment for quality changes; and

(v) New–goods bias, which arises largely from the failure to include new goods when first introduced into the market.

4.76 Although it is almost impossible to eliminate these sources of bias, some measures can be taken to minimise them.

(i) Use appropriate formulae in compiling elementary aggregate indexes, in particular use of the GM formula where appropriate or the RAP formula.

(ii) Use a superlative index formula rather than the Laspeyres, if current–period weighting data can be obtained on time. More frequent updating of weights in the Laspeyres formula is also suggested, although changing weights alone does not have a significant effect in the short to medium term unless the change in the weighting pattern is significant.[23] Other options might be to use formulae that allow substitution or assumptions about substitution between commodity groupings to be entered.

(iii) Closely monitor and update price samples to reflect changes in the outlets from which households purchase. For example, there is clearly a need to plan for the inclusion in consumer price indexes of purchases from outlets operating exclusively over the Internet.

(iv) Make greater use of the hedonic technique to adjust for quality change and to determine comparable items.

(v) Include new goods into the CPI as soon as possible. For a fixed–weighted index such as Laspeyres, there would also be a need to update the fixed weights to allow for the inclusion of the new goods if they are substituting for all goods in general, or to adjust the weights within a commodity grouping if the new good is substituting for specific items. For example, one could argue that CDs were a new good, but as they were substituting for records and tapes they could be introduced into the commodity grouping for records and tapes, and weights between these items adjusted accordingly.

CONCLUSION

4.77 Price index theory guides prices statisticians as to the best practices and formulae to use in compiling price indexes in order to produce reliable price measures. However, the highly desirable must be balanced against the practical. It would be highly desirable to use a superlative index formula such as the Fisher Ideal for all price indexes, but this is often not possible because of data problems and issues with timeliness.

4.78 There is much more to a price index than which formula to use. Also important is the determination of what items are to be included in the index, that is the index domain. This subject is covered in the next chapter.

23 As noted earlier, the issue of frequency of re–weighting or chaining is not straightforward. In a situation of price bouncing, chaining can introduce substantial bias into indexes (see for example Szulc (1983)). In general, chaining more frequently than annually, even if feasible in practice, is not recommended because it could introduce bias.

ITEM COVERAGE

5.1 The set of goods and services included in a CPI is called its item coverage, or more commonly, the CPI basket. In concept, all consumer goods and services are within scope of the index. However, the coverage will vary depending on the principal purpose of the index. In addition, if an index is compiled for a subgroup of households, it is possible that their expenditures on some commodities are nil, but conceptually the item is in scope.

5.2 As households acquire many different goods and services, it is not practical or necessary to price all the goods and services that they buy. Many related items have similar price movements, and households acquire more of some items than others. The items selected for pricing in the CPI are the more significant ones, and are likely to have price movements that are representative of a wider range of goods and services.

5.3 When determining what items to price, these factors are taken into consideration. The items:

- must be representative of purchases made by the CPI population group (see below);
- must be identifiable and specific commodities or services (e.g. 420g can of baked beans, or adult general admission to a Rugby league football game); and
- are not excluded because of moral or social judgements.

5.4 The exclusions and inclusions are discussed more fully below.

Business, savings, and investment–related purchases

5.5 As a general principle, a consumer price index only includes goods and services that are purchased by households for consumption. A consumption good or service is one from which households directly derive utility or satisfaction. Any business–related purchases by households are excluded from the basket, as are those items that have a significant savings or investment component, such as land and capital goods. All types of income are generally excluded as well, except those which directly offset a specific purchase, such as subsidies or trade–ins.

Taxes, levies, concessions, and subsidies

5.6 The prices of consumer goods and services, and the ability of households to purchase those items, are affected by a wide range of taxes, regulatory processes, and assistance measures. The treatment of these under the acquisitions and outlays approaches are similar, but there are differences under a cost–of–use approach.

5.7 As a general principle, the acquisitions and outlays approaches only include taxes and subsidies whenever they are tied to the level of consumption of a specific good or service. Thus any taxes based solely on income will generally be out of scope, whereas the prices of goods and services will be inclusive of indirect taxes and commodity–specific subsidies. In some cases, taxes and governmental charges may not be directly related to the level of consumption of a good or service. However, they may still be included if they are an inescapable cost of other decisions made by households about consumption. For example, local government rates and charges are an inescapable cost of home ownership, and so are included in a CPI.

5.8 A cost–of–use approach is concerned with the true value of goods and services consumed. For example, it will value subsidised items at their full market value. It will also exclude income taxes.

Secondhand goods

5.9 In concept, both the purchases and sales of secondhand goods should be included in a CPI. The purchases of secondhand goods by households are regarded as positive expenditure, and sales by households as negative expenditure. The exact treatment of secondhand goods will also depend on the nature and extent of transactions with other sectors of the economy. In practice, all transactions involving secondhand goods are assumed to occur within the household sector, with acquisitions and purchases cancelling out to give an effective weight of zero. There is also the difficulty of obtaining ongoing prices to constant quality for secondhand goods. Prices for secondhand goods are not collected for the CPI.

Illegal or undesirable goods and services

5.10 In principle, all purchases of goods and services for household consumption are in scope of a CPI. They include goods or services that are either illegal or may be considered socially or morally undesirable, such as alcohol and tobacco, gambling, prostitution, and so–called recreational drugs. However, decisions regarding the composition of the CPI basket are not based on moral grounds, but rather on practical considerations. In the Australian CPI, gambling is excluded as it is difficult to establish the service or utility that households derive from gambling, and thus to determine an appropriate price measure. Recreational drugs and prostitution are both excluded as it is very difficult and indeed dangerous to obtain estimates of prices and expenditures.

GEOGRAPHICAL COVERAGE

5.11 All price indexes have a geographical dimension such as city, rural area, state, region or country. A further aspect to the geographical coverage that is important for CPI price collection is whether the objective is to measure price changes for:

- sales within a particular geographical area; or
- purchases by the residents of a geographical area.

5.12 If the aim of the index is to measure the prices of items sold in an area then the basket will comprise all consumer goods and services sold in that region to households for final consumption. These sales can be made to households that are residents of that region, or to visitors to the region including overseas visitors.

5.13 On the other hand, if the index is to measure prices of items purchased by residents of a region, then it will comprise all consumer goods and services purchased by those households regardless of where they are purchased. So, in addition to purchases made in that region, it will include any purchases those households make whilst visiting other domestic regions and foreign countries, as well as items they order over the Internet or by post from suppliers outside the region.

5.14 The geographical dimension becomes more important the smaller the region to which the index relates.

5.15 The Australian CPI is compiled separately for each capital city. For general statistical purposes, the equivalent of a national index is the series published as the weighted average of eight capital cities. Each capital city index is compiled from data about acquisitions of goods and services by the resident population of that city, and includes their purchases from local outlets, purchases made in other capital cities and regions of Australia, and overseas purchases.

GEOGRAPHICAL COVERAGE *continued*

5.16 By and large, the ABS expects that most of the acquisitions made by capital city households will be from suppliers that are located in the same city. The most obvious exception is holiday accommodation services. Where mail order, phone, and Internet purchases are known to be significant (as with airfares and holiday accommodation), prices are collected from these sources.

DEMOGRAPHIC COVERAGE

5.17 The expenditures or weights applied to the index basket reflect the expenditures of a reference population. Typically the basic unit of this reference population is the household.[24] The household is an appropriate unit because all members of the household jointly consume or use many items, such as food, motor vehicles, and housing, and it is not practicable to determine an expenditure for each member of a household.

5.18 A CPI can be constructed for all households or for a subset of households (e.g. age pensioners, wage and salary earners, self–funded retirees). Even if the purpose of a CPI requires the broadest possible reference population, some types of households whose consumer expenditures are minimal or atypical may be excluded; for example, those living in institutions such as hospitals, barracks, prisons, and on board ships.

5.19 The reference population for the Australian CPI is private households in the eight capital cities. The eight capital cities are the six state capitals and the territory capitals of Canberra and Darwin. This is referred to as the CPI population group and it represents about two thirds of Australian private households. Ideally, the CPI population group should encompass all Australian households, but this is not feasible because of the substantial additional cost of collecting prices outside the capital cities. However, the ABS did construct a set of spatial price indexes for approximately two hundred Australian cities and towns over the period from 1960 to 1990. (A spatial price index is one that enables price levels to be compared between geographical regions at the same time.) Although these indexes were limited to food prices, the results indicated that in the absence of major structural change (such as the opening or closing of a branch railway line) the relative prices between regions remained fairly constant over time. In other words, although the price levels for the localities included in the study were often quite different from those prevailing in the capital cities, all areas exhibited similar price movements over time.

5.20 In Australia, few people are not part of a private household; that is, do not reside in a private dwelling. These people live in public dwellings such as hotels, boarding houses, prisons, and university residences. Expenditure by people who reside in public dwellings is excluded from the Australian CPI.

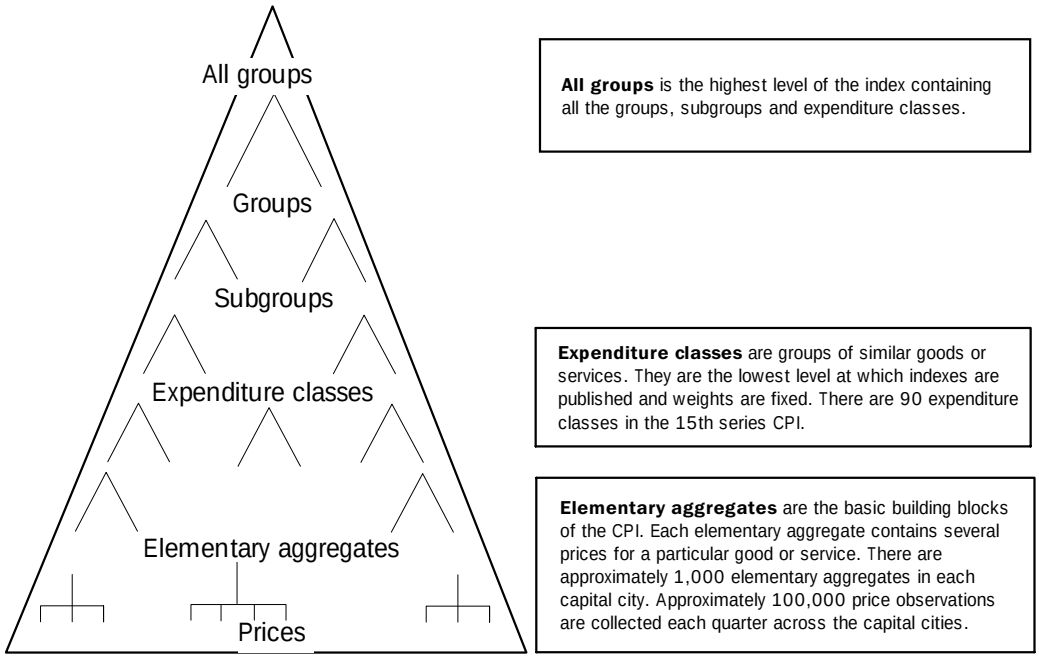
ITEM CLASSIFICATION

5.21 A diagrammatic overview of the structure of the Australian CPI is provided in the figure below. The structure can best be thought of from the top down. At the top is the total expenditure or pool of items purchased by the reference population. This is the All groups index, and it is commonly referred to as the headline rate of inflation. Below this, the index branches into finer and finer commodity groupings until, at the lowest level, there are samples of prices for the individual items (elementary aggregates). Indexes are

[24] A household is a group of people who usually reside and eat together. It may comprise one person or many.

only published down to expenditure class as this is the level at which the structure and weights are fixed for the life of a CPI series.

Figure 5.1: CPI STRUCTURE



5.22 This same structure is used for each of the eight capital cities. A full list of groups, subgroups and expenditure classes is provided in Appendix 2.

5.23 The division of the groups and subgroups into product classes is intended to reflect increasing levels of substitutability of the items consumed by households in response to changes in relative prices. For example, at the group level there are unlikely to be any substitution effects between Food and Transportation in response to changes in their relative prices. However, within the Fats and oils expenditure class it would be expected that households are more likely to substitute between margarine and butter in response to changes in their relative prices.

5.24 The commodity classification used in the Australian CPI is a demand–based classification that broadly aligns with the international standard Classification of Individual Consumption by Purpose (COICOP). This classification is based on the concept of household utility. A significant advantage of using a COICOP–based classification is to align the CPI more closely with the dissection of household final consumption expenditure in the Australian National Accounts.

5.25 The 15th series CPI basket is divided into eleven major groups, each representing a broad set of commodities:

- Food;
- Alcohol and tobacco;

ITEM CLASSIFICATION *continued*

- Clothing and footwear;
- Housing;
- Household contents and services;
- Health;
- Transportation;
- Communication;
- Recreation;
- Education; and
- Financial and insurance services.

5.26 These groups are divided in turn into thirty–three subgroups, and the subgroups into ninety expenditure classes. Presentation of the CPI in the form of groups and subgroups provides the user with quite a degree of versatility in interpreting the results. Index numbers for individual groups and subgroups can be analysed separately as can their individual effects on the whole index.

HOUSEHOLD EXPENDITURE CLASSIFICATION

5.27 In Chapter 6, which discusses weights and their sources, it can be seen that the ABS's Household Expenditure Survey (HES) is the most important source of CPI weights. The expenditures recorded in the HES were coded by ABS according to the Household Expenditure Classification (HEC). To derive expenditures for the CPI expenditure classes, a concordance was established with the HEC codes at their most detailed ten–digit level. Establishing the concordance involved examining detailed listings of commodities coded to each HEC code. The concordance is available as an Excel spreadsheet in *Consumer Price Index: Concordance with Household Expenditure Classification, Australia* (cat. no. 6446.0.55.001) on the ABS website.

5.28 The majority of HEC codes could be exclusively allotted to a CPI expenditure class. For example, all of HEC code 0302019902 Smallgoods expenditure is allotted to the CPI expenditure class Other fresh and processed meat. However, there are some HEC codes where a one–to–one correspondence could not be established. There are just over six hundred HECs at the ten–digit level, but only ninety CPI expenditure classes. The reasons why unique concordances could not be established are as follows.

- The HEC code may not be sufficiently detailed. For example, HEC 0302019901 Mince could be prepared from a variety of meats. So it was decided to spread household expenditure on mince across the various meat expenditure classes in the CPI.
- Information provided by households does not allow a commodity to be clearly identified. These expenditures are reported in codes such as 0302000000 Meat (excluding fish and seafood) nfd (where nfd is an abbreviation for not further defined). Again these expenditures were spread across appropriate CPI expenditure classes.
- Households cannot or do not separately identify some expenditures. For example, some state governments operate compulsory third–party vehicle insurance schemes, and the amount of insurance paid is included with the vehicle registration charge, often resulting in households reporting the combined amount only. In this case, a split was derived from average registration and insurance charges collected for the CPI.

HOUSEHOLD EXPENDITURE CLASSIFICATION *continued*

5.29 Where HEC codes were split across CPI expenditure classes, the splits were determined using any industrial or other data available or, as a last resort, subjectively. Mostly the expenditures concerned were small.

CHAPTER 6 WEIGHTS AND THEIR SOURCES

INTRODUCTION

6.1 This chapter describes the procedures that are typically followed in updating the CPI weights.

6.2 Weighting practices vary at different levels of the CPI. At the published levels, weights are reviewed every five or six years. These reviews follow the release of data from the Household Expenditure Survey (HES). At the unpublished levels, the weights can be varied at any time, and often are. At the elementary aggregate or price–sample level, there is no explicit use of weights.

FIXED WEIGHTS

6.3 At the level of the index at which the weights are fixed, the ideal is to have a snapshot of all household expenditure. It is important that the data are consistent across the population group, that is expenditures can be added up without concerns about coverage and double counting, and that all the information is for the same period. For example, if expenditures are for different periods for different items, then these could be affected by changes in economic conditions, tax rates, and population growth. Any of these influences could easily distort the weights. In addition, although an information source might provide an estimate of total sales of an item, it would be necessary to know the proportion of those sales to households as consumers. For example, sales of whitegoods and browngoods[25] will include sales that are not in scope of the CPI, for example sales to businesses, and to households as owners of rental properties.

6.4 The HES is the only source of data that comes close to the ideal. The HES is a sample of approximately seven thousand households. Data are collected using a diary of personal expenditures in which residents aged 15 years and older record their expenditure over a two–week period. An interview questionnaire also collects information about each household's characteristics, expenditures common to all members of the household, and irregular or infrequent expenditures. The HES used in the 15th series CPI is for the reference year 2003–04.

6.5 Although the HES provides a comprehensive coverage of household expenditures, there are some weaknesses in the HES data for CPI purposes.

6.6 The HES is a survey, and so is subject to sampling error. It is possible for the selection of one or several households with exceptionally high expenditure on an item to significantly affect the expenditure estimate for that item in a region, especially in the smaller capital cities.

6.7 Some expenditures recorded in the HES are not fully contemporaneous. Estimates for some items which are more expensive or purchased infrequently are obtained or supplemented by recall, rather than relying on expenditures actually recorded in the diary during the two weeks that the household is included in the survey. Periods over which households are asked to recall expenditure vary depending on the item.

6.8 The HES records all data exactly as reported by the households with no adjustments for known cases of under–reporting, especially in expenditure on alcohol and tobacco.

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d¶ So–called browngoods are household electrical items such as TVs, DVD players, sound systems, kettles, and toasters.

FIXED WEIGHTS *continued*

6.9 There are some expenditures required by the CPI which cannot be obtained from households, such as interest margins on deposit and loan facilities.

6.10 Thus, various adjustments need to be made to the information reported in the HES before it can be used in the CPI, and for some items the HES data are supplemented or replaced by other data which are thought to be more accurate.

Adjustments for under reporting

6.11 There are data sources other than the HES that provide estimates of households expenditure on some commodities, but often only nationally. These alternative sources are used for validating the HES data. For most products included in the CPI, these alternative data are similar to the HES estimates. However, historically there have been significant differences between HES and the other data sources for households' expenditure on alcohol and tobacco. For both products, households are the major consumers, and the imposition of excise and other taxes on these products means that the alternative estimates are more accurate than the HES estimates which appear to understate household's expenditures.

6.12 For alcohol and tobacco, under–reporting factors were derived nationally using estimates of household final consumption expenditure from the Australian National Accounts. These factors were applied to the HES expenditure estimates for each capital city. The 2003–04 HES has expenditure on tobacco at a little under half, and expenditure on alcohol at a little over half, of the national accounts estimates. The same adjustment factor was applied across all expenditure classes for alcoholic drinks in each capital city.

6.13 The intention of the CPI classification is that all expenditure on alcohol should be in the subgroup Alcoholic drinks. As noted earlier, households do not always separately identify expenditures as fully as we would like. With restaurant meals, expenditure on alcohol is not always reported separately, and is sometimes reported simply as drinks. A sample of household records from the HES was examined, and an estimate was made of the proportion of reported expenditure on restaurant meals that was probably expenditure on alcohol. Expenditures on meals were then adjusted by applying the factor across all capital cities.

Recall adjustment

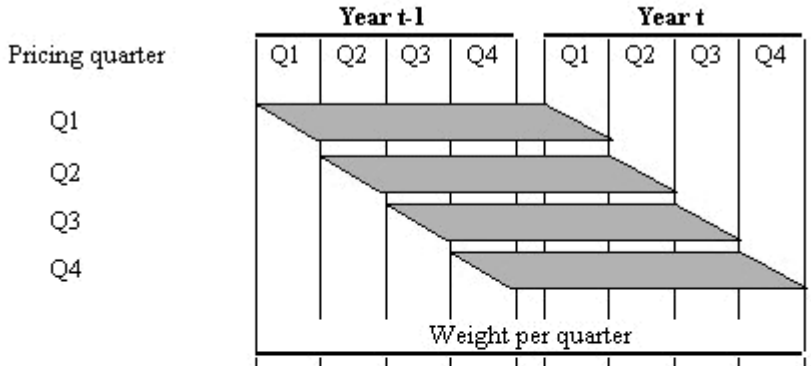
6.14 Some expenditures are collected in the HES as recalled items rather than as diary entries. The extent of the recall period varies. For some items, it is purchases in the last three months (most whitegoods and furniture, and repairs to houses); for general rates, electricity, and health services it is the last payment; for most vehicle–related expenditures, education, overseas travel, and alterations and additions to houses, the recall period is twelve months; and for house purchases it is the last three years. To the extent that prices for these items change between the time that the household last purchased them and their inclusion in the HES, expenditures will not accurately reflect the underlying quantities acquired during 2003–04. Accordingly, recall factors may be calculated to adjust the reported data for price changes.

6.15 No adjustments are made for any items where the recall period is the last three months since the adjustments would be small. Most items where the recall period is the last payment are typically those with a short billing cycle, often quarterly, or where there are options to pay periodically (e.g. local government rates). This leaves only a few items such as motor vehicle purchase, general insurance, overseas holiday travel, and

Recall adjustment continued

education where expenditures could have been incurred up to twelve months before inclusion in the HES. Adjustments are made for these items.

6.16 The adjustment procedure for a recall period of twelve months is as follows. In the first quarter (Q1) of the HES reference year, the period potentially covered will be from the start of the corresponding quarter of the previous year (for those households selected in the first week of the HES reference year) through to the end of the first quarter of the reference year. Similarly, the pricing period for the households first included in the last week of Q1 in the reference year will commence in the last week of Q1 of the previous year. If expenditures are distributed uniformly over the period, then effectively expenditures in the reference quarter and the corresponding quarter of the previous year will only be half that for the intervening quarters. Thus, assigning weights of, say, one for the intervening quarters and 0.5 for the start and end quarters, we can derive a weighting pattern as shown below.



	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Q1	0.5	1	1	1	0.5				
Q2		0.5	1	1	1	0.5			
Q3			0.5	1	1	1	0.5		
Q4				0.5	1	1	1	0.5	
Total	0.5	1.5	2.5	3.5	3.5	2.5	1.5	0.5	16
Weight	0.03	0.09	0.16	0.22	0.22	0.16	0.09	0.03	1.00

6.17 Thus the adjustment factor for items with a twelve–month recall for the 2003–04 HES is:

$$\frac{(I_{S03}+I_{D03}+I_{M04}+I_{J04})x0.25}{(0.03xI_{S02}+0.09xI_{D02}+0.16xI_{M03}+0.22xI_{J03}+0.22xI_{S03}+0.16xI_{D03}+0.09xI_{M04}+0.03xI_{J04})}$$

where I_{S03} is the CPI index number for the expenditure class for the September quarter 2003 etc.

Using the following hypothetical index numbers:

$I_{S02}=99; I_{D02}=100; I_{M03}=101; I_{J03}=102; I_{S03}=103; I_{D03}=104; I_{M04}=105; I_{J04}=106;$

Recall adjustment continued

The result of the above formula is:

$$\frac{(103+104+105+106)x0.25}{(0.03x99+0.09x100+0.16x101+0.22x102+0.22x103+0.16x104+0.09x105+0.03x106)}$$

$=1.02$

(which is the adjustment factor to be applied to the recalled price).

6.18 With a generally low rate of price change over 2002–03 and 2003–04, the adjustments made for recall were small. However, quite significant adjustments have been made in the past (e.g. for the 1984–85 HES).

6.19 In the 15th series CPI, a quantity adjustment was also applied to overseas holiday travel as the recall period included 2002–03 when the number of Australians travelling overseas fell temporarily. The adjustment factors were calculated using the same technique used in the price adjustment, with the number of short–term overseas departures replacing the price index in the formula above.

Salary sacrifice

6.20 Salary sacrifice is an arrangement between an employee and their employer whereby part of the employee's pre–tax cash salary is traded for non–cash benefits. Conceptually, these payments are part of both gross wages and salaries and household expenditure. Expenditures funded through salary sacrifice arrangements are generally not captured in the HES. Amounts that were reported to be salary sacrificed on the income side were used to adjust the average weekly household expenditures. In the 15th series, the items that have been adjusted for salary sacrifice are telecommunications, child care, computers, and motor vehicles. Salary sacrifice amounts reported against motor vehicles were allocated to purchases of vehicles, registration, insurance, repair and servicing, and automotive fuel.

Aberrant expenditures

6.21 Expenditure estimates for the CPI weights can be validated in time and spatial dimensions. Validation over time requires expenditure to be on a common pricing base (e.g. revaluing 1998–99 HES expenditures to 2003–04 prices, and comparing with the 2003–04 HES results will show changes in volume terms). Any large differences can then be investigated to see if they are valid. For example, there was a large rise in expenditures on telecommunications (both in nominal and constant prices) between the 1998–99 HES and 2003–04 HES, but this is broadly consistent with the growth in telephony services.

6.22 A few outlier adjustments were made in the smaller cities where sample sizes are smaller and, in general, the standard errors larger. In the 15th series CPI review, outliers were adjusted using the winsorisation technique of replacing the outlier expenditure with the expenditure of the next highest respondent. Where outliers could not be identified, differences were investigated to see if they were valid. A few volume changes could not be validated, resulting in adjustments using either alternative volume data or judgement.

Expenditures not sourced from HES

6.23 For the 15th series CPI, it was not possible to obtain suitable data from the HES for four items: purchases of new houses, financial services, general insurance services, and tertiary education.

Expenditures not sourced from HES continued

NEW HOUSE PURCHASES

6.24 The weight given to house purchase should reflect net acquisitions by households, and expansion of the housing volume by alterations and additions. Sales of houses that take place between households are excluded, so that the weights relate only to net additions to the housing stock arising from household purchases from other sectors (e.g. from businesses such as builders and developers).

6.25 An additional factor that arises with houses is that as well as providing shelter to their owners, they include an investment element because they typically appreciate over time. For the purposes of the CPI, the cost of housing should reflect only the shelter component. A common approach is to regard the cost of the land as the investment component, and the cost of the structure as the shelter (or consumption) component.

6.26 The net expenditure on house acquisition was estimated by applying the average value of private dwelling completions by capital city for 2003–04 published in *Building Activity Australia* (cat. no. 8752.0) to the net change in the number of owner–occupier households. The average value estimates for completions only include the cost of construction, and therefore enable the land component in house prices to be excluded from the weighting base. The net change in the number of owner–occupier households was derived by calculating the average annual net change in owner–occupier dwellings between the 1996 Census and the 2001 Census. This revised method of calculating the net change in the number of owner–occupier households was considered to be more accurate than the use of projected growth rates which was used in the 14th series CPI. Subsidies paid to first home buyers as part of the Commonwealth Government's First Home Owners' Scheme were treated as negative expenditure and subtracted from the expenditures recorded for house acquisition.

6.27 The alterations and additions component of house purchase includes any changes in the physical attributes of owner–occupied houses such as extensions, renovations, addition of insulation, and similar improvements to the structure. For this component, HES data are considered adequate.

FINANCIAL SERVICES

6.28 HES data are not useful for financial services because household expenditure on interest margins is a statistical construct; and it is too onerous to ask households to calculate their annual expenditures on the many fees and charges that they pay to financial intermediaries. Weights – as well as measures of price change – can only be calculated from information supplied by the financial intermediaries themselves. The weight of the Deposit and loan facilities expenditure class has two broad elements: implicit expenditure on interest margins, and fees and charges.

6.29 Interest margins has by far the biggest weight. To calculate household implicit expenditure on interest margins the ABS needs to know three things: the yields on individual consumer products, a suitable reference rate of interest, and the average balances of those products.

6.30 The sources of the data for these complex calculations are the financial intermediaries' monthly average balance sheet and related interest statements. They prepare these at different levels of consolidation. The ABS prefers to work at the lowest level that is available. This is often the product level. However, sometimes these

Expenditures not sourced from HES continued

FINANCIAL SERVICES *continued*

statements are available for sub–products. The financial intermediaries prepare these statements at these low levels mainly for the purpose of yield management.

6.31 The financial intermediaries work out the monthly average balances by taking the balances at the close of business each day, adding them up for the month, and then dividing by the number of days. Interest is the flow during each of the months. For ease of recognition, the ABS converts the monthly interest flows into annual yields by dividing by the number of days in the month, multiplying by 365 and finally by 100.

6.32 The ABS has found that the data in these statements are sometimes not as smooth as we might expect. Therefore three–monthly moving–averages of both the balance and interest series are used to smooth any accounting anomalies in the data reported to us.

6.33 The reference rate of interest is specific to each bank. We use as the reference rate the mid–point of the average interest rate received on all loans (including business loans) and the average interest rate paid on all deposits (including deposits by businesses). This approach minimises the problem of negative margins encountered by other statistical agencies that have used bill or cash rates as their reference rates of interest.

6.34 The difference between the reference rate and the product yield is the margin rate on the product. Applying the margin rate to the average product balances provides the measure of households' implicit expenditure on interest margins (weight).

6.35 We calculate the weight for fees and charges using fee revenue data from the financial intermediaries. The ABS receives these data by product, and since we know which products are consumer ones, we add up the fees attributable to those products to get the estimate of weight.

6.36 Data about commissions on sales of residential properties and from conveyancing work come from *Real Estate Services Australia, 2002–03* (cat. no. 8663.0). This information is used to derive expenditure on real estate agency services. Income data from *Legal Practices, Australia 2001–02* (cat. no. 8667.0) are used to derive expenditure on legal and conveyancing services purchased by households. The national expenditures derived from these surveys were revalued to 2003–04 dollars, and the aggregate expenditures reported in the 2003–04 HES were used to allocate the expenditures to capital city. Household final consumption expenditure from the Australian National Accounts was used to derive an estimate of the expenditures on stockbroking services. Expenditures on taxes on transfers were compiled using data supplied by the state and territory revenue offices.

INSURANCE SERVICES

6.37 The weight for general insurance reflects the service provided by insurers (gross premiums less claims) rather than the gross premiums paid by policyholders. Expenditures which are funded by insurance claims are included. However, as it is only possible for the HES to collect gross premiums, these are adjusted by the proportion that represents the insurance service using information obtained from the Australian Prudential Regulation Authority (APRA) and insurance companies. For some items such

Expenditures not sourced from HES continued

INSURANCE SERVICES *continued*

as motor vehicle write–offs and vehicle smash repairs, the HES estimates exclude expenditure funded from insurance claims. Expenditures funded by claims were added back to these items by calculating the claims relative to premiums using APRA and insurance company data.

6.38 As it is impractical to measure price change in the insurance service charge, price change in gross gross premiums paid by households is used as a proxy measure.

6.39 The weight for medical insurance, on the other hand, is determined by the gross premiums paid by households. Expenditures on individual types of medical services are not priced; rather the gross premiums paid are considered a suitable measure of payments for all medical services covered (including the insurance service component) and no redistribution of expenditure to individual medical services is carried out.

TERTIARY EDUCATION

6.40 Another area where the HES expenditures are not appropriate for use in the CPI weights is expenditure on university education. The 2003–04 HES recorded Higher Education Contribution Scheme (HECS) payments made up–front plus any HECS repayments made through the taxation system during the reference period. This approach is not consistent with an acquisitions–based CPI where expenditures should reflect the cost to households of the educational service enjoyed during the reference period. The CPI scope includes the payments made during the period (up–front payments) plus fees for educational services acquired during the period but deferred to be paid at a later date.

6.41 As in previous series, in the 15th series an alternative measure of expenditures on HECS was calculated using other sources, including data from the Department of Education, Science and Training (DEST), on the total up–front and deferred expenditures, and the number of university students liable for HECS.

Revaluing expenditures to the link period

6.42 The expenditure weights derived from HES are based on expenditures in 2003–04. This new expenditure pattern was not introduced into the CPI until the June quarter 2005 (the link period). As the quantities underlying these expenditures had to be preserved, the expenditures were revalued to June quarter 2005 prices. The ABS does this by multiplying the 2003–04 expenditures by the ratio of its price index for the June quarter 2005 to the average of its quarterly indexes for 2003–04.

Adjustments for quantity shifts

6.43 Ideally, the CPI weights should be as up to date as possible and be broadly representative of the expenditure pattern that might be expected over the life of the index series. Thus, when the June quarter 2005 link was being introduced, it was necessary to consider whether any developments and policy changes since 2003–04 might have significantly affected the expenditure pattern and whether any revalued expenditures needed to be adjusted.

6.44 There were no major policy changes identified during this period that would have significantly changed volumes between 2003–04 and June 2005.

Adjustments for quantity shifts continued

6.45 Other items where expenditures were likely to have changed between 2003–04 and June 2005 were also investigated. These included the purchase of computers and internet usage. Some adjustments were made, although the effect on the weights at the expenditure class level was minimal.

6.46 In principle, adjustments are appropriate for any significant change in expenditures between the time that the HES data are collected and inclusion of the weights into the CPI. However, this raises a methodological issue. The adjustments to expenditures are generally made without compensating adjustments to other expenditures in the CPI basket. In other words it is implicitly assumed that increased expenditure on internet services, for example, comes from savings and not from reductions in expenditure on other items.

LOWER LEVEL WEIGHTS

6.47 The weights and structure of the CPI below the level of expenditure class are continually reviewed and may be varied at any time. These changes are made through a process termed sample review. Essentially, a sample review involves selecting a component of the CPI and examining it closely. The review is generally performed for an expenditure class and determines what changes should be made to the items priced, the outlets they are sourced from, and the weights to be applied to the commodities and outlets within that expenditure class. For example, it might be determined from recent data that it is appropriate to introduce a price sample under the Fats and oils expenditure class for products composed of both butter and margarine, or to change the relative importance of large retail outlets and convenience stores in the price samples for soft drinks.

6.48 Information from any reliable source is used to assess the importance of one commodity relative to another. Sources include data collections of the ABS and other organisations, and publications by industrial organisations. Information from the HES is also considered but, for the main part, is not sufficiently detailed or reliable at the lower levels of the CPI structure. For example, the HES data for types of appliances purchased would not be as reliable as industrial sales data because of the small samples in the HES.

6.49 At the price sample or elementary aggregate level, there are no explicit weights. Rather, the price samples are constructed so they are self–weighting. For example, if there were a price sample for medium chocolate bars, and the major grocery outlets had 80 per cent of these sales and vending machines 20 per cent, then the price sample would be selected so that for every price from a vending machine there are four prices from the major grocery outlets.

INTRODUCTION

7.1 To achieve the conceptual objective of measuring pure price changes over time, regular monitoring of the prices of goods and services acquired by the CPI population group is necessary. However, it is not possible in practice to price every single type or variety of good and service purchased by the CPI population group at each collection cycle. The ABS overcomes this practical problem by using purposive sampling procedures, where representative sets of goods and services are selected for regular pricing. Similarly, it is not practicable to observe the prices of the selected goods and services in all retail outlets selling these items to the CPI population group. Again, the ABS uses purposive sampling to select a representative sample of outlets at which to price the selected items in each collection cycle.

SELECTING THE GOODS AND SERVICES

7.2 The goods and services included in the CPI pricing samples are selected carefully to represent the range of types and varieties of goods and services bought by the CPI population group. Selection is made only after obtaining detailed information about the buying habits of the CPI population group, such as which varieties and brands of products are the largest selling types or which packaging sizes are most commonly purchased. This process involves extensive consultations with, for instance, retailers, manufacturers, importers, government authorities, and professional and trade associations. In selecting the items to be priced, the following factors are taken into consideration.

- The importance of the expenditure class relative to the total CPI. In general, the more important the expenditure class, the larger the number of items priced.
- The degree of homogeneity in the range of goods or services covered by the expenditure class. The more homogeneous the range, the fewer the number of price indicators required.
- The extent to which the various products covered by an expenditure class are subject to different influences and cost pressures which are likely to result in disparate movements in prices.
- The likelihood of the particular type of good or service continuing to be available on the market for a reasonable period of time. In general, it is preferable to price the same specific items for a reasonable length of time rather than having to change price indicators regularly when particular goods or services appear and then disappear after only a short time on the market.
- The extent to which the item can be defined and described clearly and unambiguously to ensure that the selected goods or services can be priced to constant quality over time. For example, in pricing confectionery it is likely that packaged, brand name chocolates would be easier to price to constant quality over time than loose chocolates with no identifying brand name.

7.3 After the items to be priced have been selected, detailed specifications are prepared to ensure that all staff involved in price collection and compiling the CPI have exactly the same understanding of which particular items are to be priced. For most goods, it is a straightforward matter of describing their characteristics. These may include brand name, material of composition, model number, style, size, and type of packaging.

SELECTING THE GOODS AND SERVICES *continued*

7.4 It is generally more difficult to specify service items adequately because both quantity and quality are harder to describe. In addition, more detailed descriptions are usually required in the specifications for services in comparison to those for goods. For example, the specification for a can of tomato soup may consist of only two characteristics: the brand name, and the weight of the can. However, the specification for a travel service such as a bus fare would have three characteristics: the concessional status of the traveller (e.g. adult, student, child, pensioner); the specific bus route including the origin of the journey and its destination; and the time of the journey (e.g. peak or off–peak).

7.5 The preferred practice in pricing goods for the CPI is to price identical specifications (i.e. the same brand name, size or model of product) at all outlets in all capital cities. The nature of many goods and services, however, often makes this impossible. In practice, products fall into one of two categories.

(i) *National standard.* These products are available in all capital cities, and at the vast majority of respondent outlets. They can be readily and clearly defined by characteristics such as make, model, and size as a specification for use nationally. ABS field officers have no latitude in choosing the product for pricing. Examples include motor vehicles, and the major brands of breakfast cereals.

(ii) *Respondent standard.* These products can be readily defined by form and function, but a multitude of brands and models may exist making it impossible to guarantee that any one example of the product will be available Australia wide. A generic description is provided in sufficient detail to ensure that the field officers will be able to locate an example of the product. This example must be consistent with the quality of those chosen in other outlets within the same city, and broadly consistent with those in other cities. An example of the required type of product is chosen at each respondent outlet, and its defining characteristics are added to the generic description for future use at that respondent. Examples of these products are beer, daily newspapers, and furniture.

SELECTING THE SAMPLE OF OUTLETS FOR PRICING

7.6 Consumers purchase the goods and services priced in the CPI from a wide variety of retail outlets. Examples of these outlets include supermarkets, department stores, hotels, motor vehicle dealerships, doctors' surgeries, electricity and gas shopfronts, travel agencies, schools, and child care centres. For every item selected for pricing, the main types of outlets from which the CPI population group buys the items need to be identified so that the ABS can select representative samples of these outlets.

SELECTING THE SAMPLE OF OUTLETS FOR PRICING *continued*

7.7 In selecting outlets for inclusion in samples for the CPI, the following factors are taken into account.

- The importance of the expenditure class relative to others in the CPI. In general, the more important the item is (i.e. the larger the expenditure weight), the larger the sample.
- The number of suppliers of the good or service in the city concerned. Generally, the larger the number of suppliers, the larger the sample. In some cases, however, there may be only one supplier, such as a city council or transport authority.
- The degree of dispersion in prices among outlets. Where the expected dispersion in prices is large, the sample should be large too. For example, a large sample of fruit and vegetables outlets is usually needed. However, with newspapers, a small sample is sufficient because standard prices are generally adhered to.
- The geographical spread of outlets. As far as possible, the samples are selected to cover the main areas in which households from the CPI population group are known to make their purchases.
- The ownership of retail chains. Large retail chains frequently have an Australia–wide or state–wide pricing policy. In these cases, pricing one outlet in the chain would be considered sufficient to obtain a representative estimate of price movement for that chain. However, the usual procedure is to have a few observations in the samples commensurate with their market shares.

CHANGES TO OUTLET SAMPLES

7.8 The samples of respondents are reviewed regularly to ensure that they remain representative of the CPI population group's sources for purchases. Events such as company takeovers, new retailers entering the market, existing chain organisations opening new outlets, or new shopping complexes opening up can all lead to the need to change the samples of respondents so that they continue to be representative of the CPI population group's purchases. Changes to the sample of respondents or specifications are carried out using the splicing process discussed in Chapter 4.

PRICE COLLECTION PROCEDURES

8.1 Several methods are used to obtain prices. Most prices are collected by personal visits to the selected respondents. These personal visits are made by trained and experienced ABS field officers, who observe actual marked prices as well as discuss with the retailers matters such as discounts, special offers and volume–selling items on the day. The field officers record all this information on the spot in handheld computers. The regular personal visits by field officers to the retail outlets also enable the field officers to continually actively monitor market developments such as market shares or possible quality changes. This information is used in maintaining the representativeness of the samples, making quality change assessments and so on.

8.2 Once items have been selected for pricing, they are organised into groups called collections. Each collection contains products that are generally sold by outlets of the one type, or are usually located together within a store. An example of a collection would be a white goods collection. This would contain refrigerators, washing machines, dishwashers and clothes dryers. Respondents that sell any of these products are likely to sell most of them. Additionally, these products are usually located in the same area of a big store.

8.3 The main benefits from grouping items into collections are:

- maintaining representative samples is easier as generally all potential respondents are able to supply all prices; and
- the effort required by field officers in making all of their many visits is minimised.

8.4 The grouping of items into collections is pragmatic. This is done for similar reasons to ordinary consumers who are faced with difficulties moving around large cities. Items are not formed into collections for ease of index estimation. The collection and use of prices for alcoholic drinks is a good example of this. Alcoholic beverages are sold in two ways:

- as individual drinks for consumption on licensed premises; and
- in containers for consumption off the premises.

8.5 Therefore CPI field officers collect prices for all types of alcoholic drinks from hotels and bottle shops and once collected the prices are re–sorted into the CPI compiler's perspective, that is categorised into beer, wine and spirits for use in index estimation.

8.6 The ABS does not use list prices or recommended retail prices without first checking that these are the prices charged to customers by respondents. Special and discounted prices are taken into consideration when these are generally available to the buying public. An important test of whether these prices can validly be used in compiling the CPI is whether the goods are of a quality identical to that in the item specifications (e.g. the goods are not damaged or superseded stock). Another test is that the goods are available in quantities sufficient for shoppers generally to buy them on the pricing date (i.e. supplies are not limited to so–called early–bird shoppers, or purchases subject to some other restriction).

8.7 Although special and discounted retail prices are readily observable for most goods, it is not necessarily so for large and expensive durables. Take motor vehicles as an example. The prices of motor vehicles may not be advertised widely and may be disguised with bonuses, trade–ins, factory cash–back offers and a package of extra

PRICE COLLECTION PROCEDURES *continued*

features included for the list price of the vehicle. In these cases, substantial effort, including interviews with senior sales staff, is made to ensure that full particulars of the transactional prices are obtained.

8.8 Where prices are set centrally and do not vary by location, the prices are collected from the supplier's head office. Postage charges are a good example of this.

MISSING OBSERVATIONS

8.9 Sometimes it is not possible to collect the price of an item in a particular period. This can be caused by various circumstances, with a common one being that the item is out of stock in the outlet sampled. Paragraphs 4.57 – 4.60 in this manual describe several ways of dealing with temporarily missing price observations. The procedure most commonly used in the Australian CPI is to impute a movement for the missing item based on the price movements of the other items in the sample. The implicit assumption behind this procedure is that if it had been possible to collect the price of this item, its price would have changed in line with similar items. Mostly this is a reasonable assumption and will provide an acceptable outcome for the index. However, this method is inappropriate when a product has no close substitutes or its price is collected annually. In these cases, a more appropriate method of imputation is to repeat the previous price.

EDITING BY FIELD OFFICERS

8.10 Editing commences during price collection by field officers. The handheld computer used to collect the prices has facilities designed to help the field officers edit the information as it is being collected. Examples of these edit checks are:

- immediate calculation of the percentage change in price for the item;
- a facility for storing annotations about the price, such as notes from a discussion that they may have had with the store's staff about a change in the price; and
- a facility for entering an edit symbol that describes the change in price. The edit symbol must be consistent with the price movement. For example, if a price fall for an item occurs because it is on special, the edit symbol accompanying the recording of the price will identify that this is the reason for the price fall.

8.11 Further editing checks, mainly to do with overall consistency, are performed back in the office.

QUALITY ADJUSTMENT BY FIELD OFFICERS

8.12 Field officers are able to enter all the information necessary for quality adjustment to prices into the handheld computers.

8.13 If the field officers find that they do not have all the information needed to apply a quality adjustment, then the record is annotated and dealt with by the index compilers in the CPI central office.

CHECKING BY COMPILING STAFF

8.14 The collected prices undergo further checking by the staff responsible for compiling the index. Where prices are found to be unusual (for instance, where movements are not considered representative) or not within expectations (i.e. inconsistent with knowledge gained from other sources), they are generally referred back to the field officer for verification.

8.15 Investigations are conducted to enable quality adjustments to be performed on records identified by field officers as having quality changes which were not immediately quantifiable.

PRICING BASIS

8.16 The weighting pattern for the Australian CPI is based on the acquisitions concept (see Chapter 2) and so for consistency the pricing of goods and services is also based on this conceptual approach. Mostly the acquisition of a good or service occurs at the same time as the payment and so any price movements are recorded then. There are some goods and services where payment for, and acquisition of, the good or service do not coincide. In these cases, prices are recorded at the time that the good or service is acquired, and not when the payment is made. Examples where this can happen include the following:

- *Goods and services invoiced periodically after consumption* (such as electricity and telecommunications and home–delivered newspapers). Price movements are introduced into the index calculation from the date at which the price change is effective. Providers are therefore approached for price information regularly to obtain current charges and dates of effect for planned price changes.
- *Goods and services paid for with loans* (for instance, motor vehicles). For index purposes, the price recorded is the full transactional price of the product at the time of acquiring it. The method and timing of payment are irrelevant under an acquisitions approach.
- *Goods and services regularly paid for in advance* (for instance, airfares, club memberships and magazine subscriptions). For index calculation purposes the price is included when the good or service is actually acquired (e.g. date of the flight for airline travel, or the commencement date for a magazine subscription) and not the date on which the payment is made. However, prices are collected at the time payment would normally be made. For example, a ticket for domestic airline travel is typically paid for about a month before the departure date. So, for example, in June we collect the price for a domestic flight during July, and it is that price which is used in the September quarter CPI.

PRICE COLLECTION FREQUENCY

8.17 As the CPI is compiled quarterly, the prices of most goods and services in the regimen are collected once each quarter. Prices of goods and services that are considered to be volatile (i.e. likely to change more than once during a quarter) are collected more frequently. A few items are priced only once a year, either because that is the known frequency that prices are reviewed (e.g. council rates) or because of seasonal availability (e.g. football matches). The general approach is to price each item as frequently as is necessary to ensure that reliable measures of quarterly price change can be calculated. Information about the frequency of collection for the various products in the index is included in the following detailed descriptions of each CPI group. These sections describe in more detail the price collection methodology used in each of the eleven CPI groups. A brief description is provided of the group's index structure, the products priced, the frequency of collection and the types of outlets from which the prices are collected. Collection issues specific to each group are also highlighted.

FOOD

8.18 This group includes all expenditure on food and non–alcoholic beverages purchased for human consumption (pet food, for example, is included in the Recreation group). At the time of the 15th series review, the group accounted for about 15 per cent by value of the CPI basket. Table 8.1 below shows the structure of the Food group, examples of the products priced and data sources.

8.1 FOOD GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price information*
FOOD		
Dairy and related products		***Supermarkets, convenience stores***
Milk	Fresh and flavoured milk	
Cheese	Cheese including sliced and grated	
Ice cream and other dairy products	Ice cream in tubs or cartons, yoghurt and dairy snacks	
Bread and cereal products		***Supermarkets, convenience stores, bakeries, cake retailers***
Bread	Bread fresh or packaged	
Cakes and biscuits	Cakes, pastries and biscuits	
Breakfast cereals	Grain based breakfast cereals	
Other cereal products	Flour, rice and pasta	
Meat and seafoods		***Supermarkets, butchers, fish markets, delicatessens***
Beef and veal	Fresh and chilled cuts of beef and veal including mince	
Lamb and mutton	Fresh and chilled cuts of lamb	
Pork	Fresh and chilled cuts of pork	
Poultry	Fresh and frozen pieces and whole chickens	
Bacon and ham	Loose and packaged bacon and ham	
Other fresh and processed meat	Loose and packaged sausages, salami and other processed meats	
Fish and other seafood	Fresh, frozen and canned seafoods	
Fruit and vegetables		***Supermarkets, fresh produce markets***
Fruit	Fresh, dried and canned fruit	
Vegetables	Fresh, frozen and canned vegetables	
Non-alcoholic drinks and snack food		***Supermarkets, convenience stores, take away outlets***
Soft drinks, waters and juices	Containers of soft drink, water, cordial, fruit and vegetable juices	
Snacks and confectionery	Potato chips, nuts, chocolates, lollies, gum, water based ice confectionery and individual serve milk–based ice confectionery	
Meals out and take away foods		***Restaurants, cafes, take away outlets (including outlets with tables)***
Fast food outlets (including outlets with tables)		
Restaurant meals	Meals consumed in restaurants, hotels, cafes, etc. with full table service	
Take away and fast foods	Meals prepared for immediate consumption without full table service, including home delivered	
Other food		***Supermarkets, convenience stores***
Eggs	Fresh hen's eggs	
Jams, honey and sandwich spreads	Jams, honey and sandwich spreads	
Tea, coffee and food drinks	Tea bags, instant coffee and chocolate based food drinks	
Food additives and condiments	Sugar, spices, sauces and salad dressings	
Fats and oils	Butter, margarine and cooking oils	
Food n.e.c.	Foods not classified above, including canned and packet soups, baby foods, prepared meals (fresh and frozen requiring cooking/heating)	

Specific issues

PRICE COLLECTION

8.19 In general, prices for processed foods are collected quarterly, but prices for fresh foods are collected monthly as they tend to fluctuate more.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

Bread

8.20 The prices of packaged loaves of bread tend to fluctuate markedly and so are priced monthly. Loaves of freshly baked bread are priced quarterly. Products such as bread rolls, which are sold by the piece rather than by weight, are excluded as it is difficult to ensure that they are priced to a constant quality. Price movements for similar products are used to represent price movements for these products. For example, price movements for bread rolls are represented by the movements in prices for loaves of bread.

Fresh fruit and vegetables

8.21 Most fresh fruit and vegetables are priced throughout the year. Seasonal items, such as peaches, plums, grapes mandarins and mango, are not available in all months of the year. Price movements for seasonal items are imputed from price movements of substitute products, in this case other fruit or vegetables.

Meals out and take away foods

8.22 Restaurant meals are priced at a variety of restaurant types with different levels of service and food styles. Entrees, main meals and desserts are priced separately; and to ensure adequate coverage, main meals based on several types of meat dishes and a variety of entrees and desserts, are priced.

8.23 Sometimes the distinction between an eat–in restaurant meal and a take away meal can be blurred. For example, some take away food establishments provide tables on their premises for customers to consume their food, despite their main business being a take away food outlet. A general rule used to distinguish between restaurant and take away meals is that table service is provided with restaurant meals. Where table service is not provided with meals consumed at the tables provided by an establishment, purchases will be treated as take away meals in the CPI.

SEASONALITY

8.24 Some items in the Food group have seasonal patterns, especially fresh meat, fresh seafood and fresh fruit and vegetables. When an item is out of season and unavailable, the price of the item is normally moved forward in line with changes observed in the prices of close substitutes or items in the same expenditure class. For example, citrus fruits consists of two different types of fruit: mandarins and oranges. If mandarins are out of season, then the price movement for citrus fruits generated by changes in prices of oranges is used to impute the price of mandarins.

8.25 Sometimes products that are out of season are still available, although the product may be of poor quality and in short supply. Field officers will not accept prices in these circumstances and will treat the product as though it were unavailable.

Specific issues continued

QUALITY ADJUSTMENTS

8.26 Quality adjustments are frequently required for items priced within the Food group. Food sold in packages (e.g. breakfast cereals) often undergo changes in packaging sizes and content mixture. To ensure that these items are priced to constant quality, the collected prices are quality adjusted to remove the effects of these changes.

8.27 Products in the Food group are also subject to regular market innovations; for example, new ingredients added to a food product, or a new formula used for an established food item. In these cases, it is sometimes difficult to decide whether to treat the innovation as a quality adjustment to an existing product, or to assume that a new product has been put on the market. Generally, the choice of treatment will depend on analysis based on sales and market information and close monitoring of the modified products for an extended period.

8.28 Parts of the Food group where quality is an important issue are fresh meat, seafood and vegetable products. Mincemeat, for example, is usually available as standard or premium grade, and considerable care is taken by field officers to ensure that comparable grades are priced in each period. Regular assessments of the consumption of each grade are also conducted to ascertain which grade should be priced. Prices of most meats are taken from the prices displayed in the shops which are usually quoted per kilogram. However, some particular cuts of meat are sold as an item or per piece. In these cases, where the weight of the item is available (e.g. a leg of lamb) the weight of the item and the associated price are collected to enable a per–kilogram comparison, so removing any price variations caused by weight differences. Where the weight is not available for items sold per piece (e.g. kebabs) the price of an individual piece is accepted. Similarly, some vegetables (e.g. cauliflower and lettuce) are also sold as a whole or half item and not by weight. To ensure that price comparisons for these items are on a constant quality basis, a per–kilogram price is estimated by the field officer. Several pieces of the vegetables are weighed to determine an average weight and the price is divided by the average weight to derive the per–kilogram price.

8.29 Assessing the quality change in restaurant meals and take away foods can be very difficult as there is no reliable indicator of changes in the quality of the meals. Prices of meals tend to remain the same between one pricing period and another, but side salads and vegetables may be adjusted to meet seasonal availability, or the weight of cuts of meat in the meals may be varied because of price changes in the meat industry. Field officers will note any changes of this nature where possible and will attach comments to the prices to highlight these situations so that quality adjustments can be made if considered necessary.

8.30 Another quality issue with meals and take away foods is the treatment of so–called meal deals. Although these are frequently the most popular product sold, the items in the meal deal are priced separately because identifying the quality change for the meal deal as a whole can often be difficult. For example, the items within the meal deal can be varied or the meal deal can be cancelled entirely and these changes would present problems in calculating price movements based on the constant quality concept. Many of these meal deals are promotions used to launch products and so new meal deals are only included in the list of items to be priced when they have a proven sales record or when they are the only option available to customers.

ALCOHOL AND TOBACCO

8.31 The Alcohol and tobacco group includes expenditure on all types of beverages containing alcohol such as beer, wine and spirits; and all products containing tobacco such as cigarettes, cigars and pipe tobacco. The Alcohol and tobacco group accounted for just under 7 per cent of the CPI basket at the time of the 15th series review.

8.32 The table below shows the structure of the Alcohol and tobacco group, examples of products priced and the data sources.

8.2 ALCOHOL AND TOBACCO GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
ALCOHOL AND TOBACCO		
Alcoholic drinks		
Beer	Beer in cans and bottles	Bars, clubs, bottle shops, supermarkets, convenience stores
Wine	Bottled or cask wine, per glass	Restaurants, bottle shops, supermarkets, convenience stores
Spirits	Whisky, rum, brandy	Bars, clubs, bottle shops, supermarkets, convenience stores
Tobacco	Cigarettes, cigars, pipe tobacco	Tobacconists, supermarkets, convenience stores, service stations

Specific issues

PRICE COLLECTION

8.33 Nearly all alcoholic drinks are priced monthly, whether they are consumed on the premises of the retailer or consumed elsewhere. The exception is alcoholic drinks purchased in restaurants because these prices tend to be more stable. Tobacco products are also priced monthly. Field officers collect the prices of all the products in this group.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

Alcoholic drinks

8.34 Alcoholic products are often sold on special where large discounts are offered on a few products for a short time only. Prices of alcoholic drinks are also affected by seasonal celebrations; for example, during the Christmas holiday period and the running of the Melbourne Cup. To ensure that price fluctuations caused by special prices and seasonal celebrations are captured in the CPI, all alcoholic drinks, except those sold in restaurants, are priced monthly.

8.35 Alcohol products priced are selected according to geographical market share and purchasing patterns of the consumers. For example, Australian consumers have a definite preference for particular brands of beer that vary from city to city, and even with each city. Brands are selected according to analysis of their local market shares and prices collected using a respondent standard approach. Field officers seek advice from the local retailers to determine which particular brands are most representative of the purchasing decisions of the consumers in that local area.

Specific issues continued

Areas requiring special pricing procedures continued

Cigarettes and tobacco

8.36 The brands of cigarettes, cigars and pipe tobacco selected for pricing are based on their shares of the retail tobacco market.

Excise duty on alcohol and tobacco

8.37 In accordance with the indexation provisions of the *Excise Tariff Act 1921* and the *Customs Tariff Act 1987*, the rates of customs and excise duties on spirits, beer and tobacco products are changed twice yearly in line with movements in the CPI. The new rates take effect from 1 February and 1 August each year. Any price change caused by the change in the rate of customs or excise duty is collected as part of the general price movement of alcoholic and tobacco products.

QUALITY ADJUSTMENT

Alcoholic drinks

8.38 Prices of alcoholic drinks are adjusted where necessary to ensure that price comparisons are on a constant quality basis. Producers of alcoholic drinks will sometimes make no changes to the prices of their products, but will make specification changes that will affect the quality of these products. Examples of these changes include changing the alcoholic content of a product or modifying the packaging to change the volume. Adjustments will be made to take into account these specification changes to ensure that the concept of pricing to constant quality is maintained. However, no quality adjustment is made to wine for changes in its alcoholic content as this depends on the fermentation process and the climate during the growing season.

Cigarettes and tobacco

8.39 Prices of cigarettes are quality adjusted where necessary and quality is measured by the quantity of tobacco or the number of sticks in each packet. If a significant change in the tobacco content of a particular specification is identified, the price will be adjusted to remove the effect of the quality change.

CLOTHING AND FOOTWEAR

8.40 Conceptually, the Clothing and footwear group includes expenditure on clothing, footwear, accessories such as watches and jewellery and services such as dry cleaning and shoe repair services. The Clothing and footwear group accounted for just under 4 per cent of the CPI basket at the time of the 15th series review.

8.41 The following table shows the structure of the Clothing and footwear group, examples of products priced and the data sources.

8.3 CLOTHING AND FOOTWEAR GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
CLOTHING AND FOOTWEAR		
Men's clothing		
Men's outerwear	Suits, coats, pullovers, jeans, business and casual shirts, T-shirts and shorts	Department stores, discount clothing stores, specialty menswear stores, sports stores
Men's underwear, nightwear and socks	Briefs, singles, pyjamas and socks	Department stores, discount clothing stores, specialty menswear stores
Women's clothing		
Women's outerwear	Dresses, skirts, pants, shirts, knitwear, T-shirts, jeans and jackets	Department stores, discount clothing stores, specialty women's clothing stores
Women's underwear, nightwear and hosiery	Bras, briefs, nightwear, hosiery and slips	Department stores, discount clothing stores, specialty women's stores
Children's and infants' clothing		
Children's and infants' clothing	Pants, shorts, T-shirts, skirts, underwear, pyjamas and school clothing	Department stores, discount clothing stores, speciality children's clothing stores
Footwear		
Men's footwear	Men's dress shoes, casual shoes, sports shoes, and slippers	Department stores, specialty shoe stores, sports stores
Women's footwear	Women's dress shoes, casual shoes, sandals, sports shoes and slippers	Department stores, specialty shoe stores, sports stores
Children's footwear	Children's school shoes, dress shoes, general sport shoes and hiking boots	Department stores, specialty shoe stores, sports stores
Accessories and clothing services		
Accessories	Items complementary to clothing, including watches, jewellery, wallets, luggage and backpacks	Department stores, specialty luggage stores, jewellery stores
Clothing services and shoe repair	Clothing and footwear services including dry cleaning, shoe repairs and Laundromat services	Specialty shoe repair stores, dry cleaners, laundromats

Specific issues

PRICE COLLECTION

Clothing

8.42 The prices of some items of clothing – for example, women's outerwear – are collected monthly because they change frequently. All other items of clothing are priced quarterly. Prices observed during clearance sales are ignored unless the product concerned is available in sufficient quantities for all prospective customers on the day.

8.43 Much of women's seasonal clothing, in particular, depends on fashion. Consequently, from season to season, the individual products show significant physical changes. The women's outerwear structure and specifications have been defined so that the quality variations in fabric and detailing of the new season's stock are accounted for by obtaining the brand, fabric composition and description details of the new items. These design parameters facilitate the enrolment of replacement specifications and the assessment of quality.

Footwear

8.44 The range of footwear priced includes business shoes, casual and fashion footwear, school shoes and sports shoes. Prices are collected quarterly from specialist footwear retailers and from large department stores and sports stores with footwear sections.

Specific issues continued

Price collection continued

Accessories and clothing services

8.45 Accessories comprise personal effects such as jewellery, watches, wallets, suitcases and backpacks. Examples of items classified under clothing services are dry cleaning and shoe repairs. Prices of items in this subgroup are collected quarterly by field officers at retail outlets such as jewellers, department stores and clothing repairers.

'SPECIAL' PRICES

8.46 Sale or special prices for items of clothing are acceptable for the CPI provided:

- the item is not being discontinued;
- a full size and colour range is available;
- the special price requires no reciprocal commitment from the customer (e.g. to make a bulk purchase); and
- the promotional price applies for the full day on which the field officer visits the store.

8.47 Specials on clothing and footwear may be offered because the item is being discontinued. In these cases, where there is only a limited range of the product available at the sale price, the drop in price is ignored, as it would not be representative of genuine price changes. Specials are closely monitored, especially to check whether the prices are widely available across the range of the product or limited to certain items only.

SEASONAL ITEMS

8.48 A significant proportion of clothing items (when weighted by expenditure) are seasonal. As a result, each quarter there are many prices that need to be imputed for out–of–season items. Prices for these out–of–season items are moved in line with changes observed in prices of similar items that are available.

SAMPLE SELECTION AND MAINTENANCE

8.49 Clothing respondents are largely selected and weighted using a top–down approach. The initial phase of this process is to identify and weight market niches for the different ranges of clothes. Outlets such as retail chains and store franchises are then chosen to represent those niches based on their market shares. This approach allows the ABS to maintain a stable structure of retail clothing stores. However, the clothing specifications are under continual review as many of these products have short life cycles.

QUALITY ADJUSTMENT

8.50 Quality adjustments to items of clothing are determined on the basis of changes in fabrics, makes and detailing. The principal difficulty faced by the ABS is the high frequency of stock turnover for women's outerwear and the potential difficulty assessing each instance of possible quality change. Moreover, because changes in women's outerwear are so frequent, retailers are likely to time price changes (particularly price increases) to coincide with the introduction of a new range. This retailing practice is problematic from a CPI perspective because specification changes often appear significant enough to require detailed assessment to measure price change on a constant

Specific issues continued

QUALITY ADJUSTMENT *continued*

quality basis. However, genuine quality changes (i.e. not those that are purely cosmetic) are typically marginal and typically much less than the price changes that occur at the same time (usually because of discounting of garments that are about to be superseded). So although prices for women's outerwear have a tendency to move around abruptly and unevenly, the genuine quality changes that often punctuate these price changes tend to be insignificant. Quality changes in items of clothing priced in the CPI are observed by field officers who recommend when quality adjustments are required.

HOUSING

8.51 Conceptually, the Housing group includes all expenditure on rents, utilities, purchase and maintenance of dwellings and other expenditure on shelter–related goods and services. At the time of the 15th series review, the group accounted for nearly 20 per cent of the CPI basket of goods and services.

8.52 The table below shows the structure of the Housing group, examples of products priced and data sources.

8.4 HOUSING GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
HOUSING		
Rents		
Rents	Rent paid to private and government landlords, including public housing authorities, Defence Housing Authority	Real estate agents, State housing authorities, Centrelink, Department of Defence (in Darwin)
Utilities		
Electricity	Electricity charges and connection fees	Electricity providers in each capital city
Gas and other household fuels	Mains and bottled gas including connection fees, and other household fuels such as firewood and heating oil	Gas providers, private wood suppliers, fuel companies
Water and sewerage	Water supply and sewerage charges	City councils, water authorities
Other housing		
House purchase	New homes (excluding land) and major improvements to existing homes, and fixed appliances such as hot water systems and dishwashers	Project house builders, hardware stores, specialist gas and electricity shopfronts, department stores, electrical and appliance stores
Property rates and charges	State and local council property-based rates and charges except water and sewerage	City and suburban councils
House repairs and maintenance	Material and labour costs for repairs and maintenance to dwellings	Building suppliers, hardware stores, ABS data

Specific issues

PRICE COLLECTION

Rents

8.53 This subgroup covers payments made by households as rent for both privately owned and government–owned dwellings. Rental payments for holiday homes are excluded as these are classified under Domestic holiday travel and accommodation in the Recreation group. Prices for a sample of rented dwellings within each capital city are collected every quarter, with the sample stratified according to location, dwelling type and size of dwelling based on the most recent Census of Population and Housing.

Specific issues continued

PRICE COLLECTION *continued*

8.54 Rental payments for privately owned dwellings in the metropolitan areas of each capital city are obtained from real estate agents under a matched sample approach, i.e. prices are collected for the same sample of private rental dwellings every quarter. Social security recipients who rent privately owned dwellings can claim Commonwealth Rental Assistance (CRA). The amount of assistance they receive is determined according to each family's circumstances and the amount of rent they pay above a threshold. As CRA is a subsidy directly related to the rents of privately owned dwellings, it is in scope of the CPI. In accordance with the indexation provisions of the *Social Security Act 1991*, rental thresholds and maximum assistance rates are updated in March and September each year in line with movements in the CPI. Price movements in rents paid by households receiving CRA will reflect the timing of these updates. During other periods of the year, the price movements for those households receiving CRA will broadly align with price changes for private rents.

8.55 Government rents charged to pensioners and other welfare recipients are set as a proportion of income. As these incomes are known, rents for government–owned properties are derived from information provided by the state and territory housing authorities. Consequently, price movements can be readily estimated. Occasionally, the proportion used to set rents is changed. Again this is public knowledge and so is readily available for use in estimating price movements.

Utilities

8.56 Electricity, gas, water and sewerage charges are obtained quarterly from the energy authorities and local councils, and both concessional and standard rates are priced. Current charges are applied to estimates of annual consumption of electricity, gas and water to derive the annual payment in the current quarter's prices. Connection fees, delivery and similar charges are included as part of the price of the utility service. Governments and councils occasionally impose levies on customers of these services as a means of raising money for some possibly unrelated services such as ambulance services. As these levies are considered an inescapable cost of obtaining the original service they are counted as a part of the cost of the original service.

8.57 Prices for other household fuels (such as firewood and bottled gas) are collected quarterly from retail outlets selling these products.

Other housing

8.58 Pricing of house purchases is limited to transactions in newly constructed owner–occupied houses. Project home builders are approached to obtain prices for a few specified types and models of project homes. The types of project homes selected are those most commonly constructed in each capital city. For marketing purposes, many builders provide bonus deals which can include upgrades to fittings, extra features, or even extra rooms. These bonuses change frequently and, because of this, new homes are priced monthly.

Specific issues continued

PRICE COLLECTION *continued*

8.59 Extensions and renovations are conceptually part of this expenditure class, but no prices specifically relating to these activities are collected as their prices are assumed to move similarly to those of new houses. However, expenditure on extensions and renovations is included in the weight for this expenditure class.

8.60 Property rates and charges are normally set using a rating year and so are only priced annually. Examples of items priced are general rates, land taxes and garbage and other collection fees. Where concessional and standard rates exist, both rates are priced.

8.61 Prices for house repairs and maintenance work performed by tradespeople are not collected as prices for complete tasks. Rather, price movements for materials are obtained by pricing various materials used in house repair and maintenance, and the labour component is estimated using data from *Labour Price Index, Australia* (cat. no. 6345.0)

SUBSIDIES

8.62 Some classes of home buyers (e.g. first home buyers) may be eligible for government subsidies directly related to the house purchase. Adjustments are made to the prices collected to reflect the differing transactional prices paid by different types of home buyers.

QUALITY

8.63 Conceptually, when a change in the quality of a rented dwelling occurs (e.g., a capital improvement – such as a new garage – is made to the dwelling) a price adjustment will be required to account for the quality change. Information to assist in making adjustments for these quality changes is obtained from the real estate agents who supply the price. Collecting information on quality changes for government – owned rented dwellings has not been feasible because the improvement in quality is usually not directly reflected in the rental charges. In practice, the effect of the quality changes is deemed to be minor and no quality adjustments are applied to government – owned rented dwellings.

8.64 Significant maintenance tasks on rented dwellings (for instance, the laying of new carpet) are normally carried out infrequently. Hence the rental increases to recover these costs occur irregularly rather than continuously. Since the work was carried out to return the dwelling to its original standard and, given that no quality adjustments are made to take account of the deterioration of the dwelling, some large increases in rents are accepted without any quality adjustment.

HOUSEHOLD CONTENTS AND SERVICES

8.65 Conceptually, the Household contents and services group covers expenditure on all goods and services used in the operation and regular use of dwellings; plus personal goods and services, including those delivered outside the home. At the time of the 15th series review, the group accounted for just under 10 per cent of the CPI basket of goods and services.

8.66 The table below shows the structure of the Household contents and services group, examples of products priced and data sources.

8.5 HOUSEHOLD CONTENTS AND SERVICES GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
HOUSEHOLD CONTENTS AND SERVICES		
Furniture and furnishings		
Furniture	Household furniture (including outdoors)	Furniture stores, department stores, BBQ and outdoor specialty stores
Floor and window coverings	Floor and window coverings, including tiles	Furniture stores, carpet and tile specialists, fabric stores, department stores
Towels and linen	Bathroom, bedroom, table and kitchen linen, blankets and pillows	Department stores, homewares stores, fabric stores
Household appliances, utensils and tools		
Major household appliances	Purchase and repair of all major household appliances not permanently fixed such as refrigerators and washing machines	Department stores, furniture stores, electrical and appliance stores
Small electric household appliances	Purchase of smaller electrical appliances such as toasters and kettles	Department stores, furniture stores, electrical and appliance stores
Glassware, tableware and household utensils	Dinner sets, cutlery, stoneware, steak knives, pots, pans, cookware, brooms and mops	Department stores, homewares stores
Tools	Lawnmowers, garden tools, electric drills and paint brushes	Department stores, hardware stores
Household supplies		
Household cleaning agents	Laundry soaps and powders, bleach, disinfectants and cleaners	Supermarkets
Toiletries and personal care products	Cosmetics, toothpaste, shampoo, soaps, body deodorants, nappies, shavers and hairdryers	Department stores, supermarkets, pharmacies
Other household supplies	Other items used in households, including toilet paper, insect repellent, garbage bags and garden supplies	Supermarkets, hardware stores, nurseries
Household services		
Child care	Full-time and part-time child care	Community and private child care centres, family day care providers
Hairdressing and personal care services	Hairdressing services	Hairdressers
Other household services	Includes house cleaning, lawn mowing, gardening and pest control services	House cleaning, gardening and pest control service providers

Specific issues

PRICE COLLECTION

8.67 All products covered by this group are priced quarterly. Large products (such as lounge suites, beds and refrigerators) are normally offered with an extra charge for home delivery. For CPI purposes, these delivery fees are included in the price of the article as for most consumers they are an inescapable cost of purchasing these items.

8.68 Household services are often charged by the hour. This is not an appropriate pricing measure for CPI purposes, as it makes no allowance for improvements in the efficiency of service provision. Respondents are requested to provide prices for completed jobs to overcome this problem. The chosen task is re–priced for the same type of client every quarter. Prices for both casual and permanent clients are obtained.

8.69 Prices obtained for child care services cover full–time and part–time care. Respondents are selected from each of the community based, private company, and family based day care sectors of the industry.

SUBSIDIES

8.70 Parents with children in approved child care centres are eligible to claim a Child Care Benefit (CCB) based on income as well as the Child Care Tax Rebate (CCTR). This is modelled by the ABS, and the model is adjusted annually to reflect changes in benefit rates and tax rebates, and quarterly to reflect changes in aggregate income levels using data from *Labour Price Index, Australia* (cat. no. 6345.0). (Incomes are indexed quarterly as any change in a family's circumstances affects their benefit immediately regardless of when the Family Assistance Office (FAO) is notified[26].) As the new CCB rates are applicable from 1 July each year, the estimated benefits typically increase in September quarter and then usually decline over the subsequent three quarters reflecting the effect of rises in aggregate incomes. The CCB and CCTR are subsidies directly related to child care services and so the price of child care in the CPI is equal to the gross fee payable by the parents, less the amount of CCB and CCTR that they receive.

QUALITY ADJUSTMENT

8.71 Furniture presents a problem in pricing to constant quality as, for example, the quality of construction may change, but may not be noticeable from a casual inspection. Fashion also plays a large part in new models without modifying the practical utility of the product to the consumer. Without a change in utility, changes in fashion do not result in prices being adjusted for quality changes.

8.72 Products such as cleaning agents often have their formulas changed and as a result their prices change. If the change to formulas is driven by legislation (e.g. changes to poisons laws to improve child safety) then no adjustment to prices for quality is made. Similarly, if the change to the product is for the benefit of the community (e.g. introduction of biodegradable cleaning agents) then no adjustment for quality is made. Quality adjustment is only made where there is a demonstrated change in the efficiency of the product to perform the service for which it is purchased.

8.73 Services, including those provided to households, are hard to price repeatedly to a constant quality. To meet CPI requirements, respondents are asked to select a property and to provide a costing for the provision of a completed job for a popular service to that property. This overcomes problems with simple measures such as hourly rates (where, for example, more experienced people can perform a given task more quickly).

8.74 Personal care services are difficult to adjust for changes in quality. For example, trying to assess the change in the quality of a haircut is subjective. As a result, quality adjustments are rarely applied to personal care services.

8.75 Changes in the quality of child care are also difficult to assess because of the subjective nature of measuring effects such as changes in experienced staff. Therefore, no quality adjustments are made for these changes.

đĆ At the beginning of each financial year families report their expected annual income to the Family Assistance Office (FAO). Expected and actual incomes are reconciled at the end of each financial year and, for families where the two differ, a refund or additional payment will result. The quarterly indexation of incomes for the purposes of the CPI provides an estimate of changes in benefits as they accrue.

HEALTH

8.76 The Health group includes all expenditure relating to health products and services. This group accounted for nearly 5 per cent of the CPI basket in value at the time of the 15th series review.

8.77 The table below shows the structure of the Health group, examples of products priced and the data sources.

8.6 HEALTH GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
HEALTH		
Health services		
Hospital and medical services	Medical insurance, doctors' and specialists' fees, other medical practitioner fees, and hospital charges	Department of Health and Ageing, Medicare Australia, medical clinics, health insurance providers, hospitals
Optical services	Opticians' fees, optical frames and lenses	Department of Health and Ageing, Medicare Australia, optometrists
Dental services	Dentists' fees	Dental clinics
Pharmaceuticals		
Pharmaceuticals	PBS and non-PBS prescription medicines, analgesics, cold-relief products, antacid, vitamins, band-aids, antiseptic, sunscreen, skin treatment and smoking cessation products	Department of Health and Ageing, Medicare Australia, pharmacies, supermarkets and grocery stores, other retail outlets

Specific issues

PRICE PRACTICES

8.78 With the exception of health insurance, items covered by this group are priced quarterly. Health insurance prices are collected monthly. Gross prices are recorded for services not subsidised; e.g. physiotherapy, chiropractic and hospital services. The prices collected for subsidised services such as hospital and medical services, optical services and purchases of medicines under the Pharmaceutical Benefits Scheme (PBS) are recorded as net prices (i.e. gross prices less any subsidies) – see areas requiring special pricing procedures for more information. Dental services are priced as advertised by the dental practice. Pharmaceutical products not specified under the PBS are priced using their actual (gross) prices as displayed in the store.

8.79 Health insurance is included in the Health group because it relates to health services and medical service costs can be readily substituted with health insurance costs. Conceptually, the cost of the insurance service charge should be recorded with other non–life insurance's within the Financial and insurance services group. However, this is not practicable due to difficulties in estimating the insurance service charge component of the observed price (i.e. gross insurance premium less any claims). See insurance (in the Financial and insurance services group) below.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

8.80 Under the PBS, consumers pay a standard, subsidised price for medicines until they reach a specified level of expenditure (the safety net limit) during a calendar year. Once this limit is reached, all further purchases of medicines are at a greatly reduced price. Some groups of consumers eligible for concessional prices (e.g. age pensioners) are required to satisfy much smaller safety net provisions and are entitled to pay a concessional price until the safety net is exceeded, at which point PBS medicines are

Specific issues continued

AREAS REQUIRING SPECIAL PRICING PROCEDURES *continued*

free. Therefore, concessional prices are part of the price sample and are used in index estimation. Price information for prescribed medicines covered by the PBS is obtained from the Department of Health and Ageing (DoHA). The prices are weighted according to the progressive number of drug prescriptions sold at the reduced prices during the four quarters of the year. As a greater proportion of the population exceeds the PBS safety net through the year, the ratio of reduced prices to standard prices increases, leading to a distinct seasonal pattern in price movements for PBS drugs. Data to estimate the proportion of the population exceeding the safety is sourced from Medicare Australia on a monthly basis.

8.81 Medical services subject to subsidies under the Medicare Benefits Schedule (MBS) are measured utilising administrative data. The sample of services measured in the CPI includes those deemed as representative of the reference population. Data is obtained quarterly and includes pricing data for services provided, bulk billing and rebate information for each service. Medicare rebates are reviewed annually with the new rebates introduced on 1 November of each year. Net prices are calculated by the ABS accounting for all subsidies and safety net rebates.

SUBSIDIES

8.82 Some health services are subsidised under the Medicare rebate scheme and these subsidies are factored in during the pricing of health care services for the CPI. Data relating to the amount of subsidies for health services are obtained quarterly to enable the subsidised prices to be calculated. The medical expenses tax offset, which is available to taxpayers whose medical expenses exceed a prescribed level in an income year, is out of scope of the CPI, and so does not affect the prices recorded for CPI purposes

ADJUSTING FOR QUALITY

8.83 The quality of many health care products and services is constantly improving, and these improvements should be taken into account during pricing to maintain the concept of pricing to constant quality. Unfortunately, identifying and quantifying quality change in health care services is often quite difficult in practice; and so the prices collected for health care services are normally not adjusted for changes in quality unless the change is significant, and there are reasonable means of quantifying the quality change.

TRANSPORTATION

8.84 The Transportation group includes all expenses related to owning and operating private motor vehicles and travel by public transport within the capital cities. It does not cover public transport used for inter city travel: this is covered in the Recreation group. The Transportation group accounted for about 13 per cent of the CPI basket in value at the time of the 15th series review.

8.85 The following table shows the structure of the Transportation group, examples of products priced and the data sources.

8.7 TRANSPORTATION GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
TRANSPORTATION		
Private motoring		
Motor vehicles	Purchase of new cars and motor cycles	Car dealerships and motorcycle dealerships
Automotive fuel	Unleaded petrol, premium unleaded petrol, diesel, LPG	Petrol stations
Motor vehicle repair and servicing	Crash repairs, panel beating, and motor-vehicle maintenance	Insurance companies, motor vehicle service centres, mobile automotive mechanics
Motor vehicle parts and accessories	Separately purchased parts and accessories including motor oils and tyres	Car dealerships, car part and accessories stores
Other motoring charges	Registration and licence fees, parking fees and tollway charges	Carparks, city councils and other government bodies
Urban transport fares		
Urban transport fares	Bus, train, ferry, tram and taxi fares, not for holiday travel	Government transport authorities; taxi, bus, train and tram companies

Specific issues

PRICE COLLECTION

8.86 Prices for all goods and services in the Transportation group are collected quarterly, except for motor vehicles and automotive fuel.

8.87 Prices of new cars are collected monthly. Cars included in the price sample cover a broad selection of two and four wheel drive models across the spectrum of prices. All taxes and levies on the purchase of a car, other than vehicle registration and compulsory third party insurance, are added to the price of the motor vehicle as they are inescapable costs of purchasing the vehicle. Registration is included in the Other motoring charges expenditure class and comprehensive and compulsory third party insurance are included in Insurance services in the Financial and insurance services group.

8.88 Automotive fuel prices are obtained as a sample of electronic funds transfer transactions conducted in each capital city. Prices from outlets across all areas of each capital city are obtained each day, including weekends and public holidays. Prices are recorded for a range of automotive fuel types.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

8.89 Motor vehicles are very seldom sold at the recommended retail (or list) price. There is often a bonus of some kind offered (e.g. free air conditioning, a drive away price, or a heavily discounted accessories package) as part of the deal, or just simple haggling over the price. Since actual transactional prices are required for the CPI, field officers determine an estimate of the average value of these deals from discussions with car dealers.

8.90 To price public transport, fares for a sample of representative journeys are collected, in preference to prices of various ticket types or zones. A mix of ticket types (e.g. single, periodical, concessional and multi trip tickets) is then used to price these journeys.

Specific issues continued

QUALITY ADJUSTMENT

8.91 Whenever any specification change is made to a vehicle that affects its motoring performance, economy, comfort, safety, or durability, an adjustment should be made to the car's reported price. In practice, these quality adjustments are made at the time that new models are released.

8.92 Quality adjustments for motor vehicles are based on consumer utility and measures are derived from a variety of sources, including:

- Industry conducted market research to determine consumers' perceived values for new accessories or improved feature; and
- Price lists for options which may in future be offered as standard accessories.

8.93 Consistency of adjustment practices is maintained across vehicles and over time, but allowance is made for changing community perceptions of utility.

8.94 No adjustments are made to prices for public transport for changes in the quality of the service, such as improved or degraded timetables, better seating, or the addition of air conditioning to public buses.

COMMUNICATION

8.95 The Communication group covers all expenditure on postal and telecommunication services. The Communication group accounted for approximately 3 per cent of the CPI basket at the time of the 15th series review.

8.96 The table below shows the structure of the Communication group, examples of products priced and the data sources.

8.8 COMMUNICATION GROUP INDEX STRUCTURE

Group, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
COMMUNICATION		
Postal	Stamps and postal delivery charges	Australia Post
Telecommunication	Local, long distance and international calls, mobile phone services, connection fees and internet services	Telecommunication service providers

Specific issues

PRICE COLLECTION

8.97 Prices for postal services are collected monthly. They cover a range of postal charges including those for standard letters, parcels in the most common sizes, and international mail. The prices are collected centrally as the charges apply nationally.

8.98 Prices for telecommunication services are also collected centrally as prices for particular services normally do not vary between cities. Price collection is conducted monthly from a sample of telecommunication providers.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

8.99 Presently it is difficult for the ABS to price bundled packages to constant quality because charging rates are linked to frequency of use or duration of the telephone calls and the rate of discount is variable. Broader bundling, where single suppliers provide packages which combine different types of services (e.g. telephone services, subscription television services and broadband internet services) is also a cause for concern. It is very

Specific issues continued

AREAS REQUIRING SPECIAL PRICING PROCEDURES *continued*

difficult to determine the price movement of the components in the bundle separately, as well as identifying and adjusting for quality change according to each particular type of service. This problem is particularly troublesome when the services overlap different CPI groups. The ABS is monitoring these developments and is investigating a new way of dealing with them using a confidentialised sample of consumers' telephone and utility bills.

ADJUSTING FOR QUALITY

8.100 One of the most difficult issues relating to the pricing of telecommunication services is attempting to price them to constant quality. For example, some providers use the voice over IP technology, but others do not. At present the ABS is not quality adjusting for these differences.

RECREATION

8.101 All expenditure on recreational products, sporting and recreational activities and holiday travel and accommodation is in the Recreation group. The Recreation group accounted for just under 12 per cent of the CPI basket at the time of the 15th series review.

8.102 The following table shows the structure of the Recreation group, examples of products priced and the data sources.

8.9 RECREATION GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
RECREATION		
Audio, visual and computing		
Audio, visual and computing equipment	Equipment including televisions, DVD players, DVD recorders, cameras, video cameras, computer hardware and sound systems including repairs	Electrical and appliance stores, department stores, websites of computer vendors
Audio, visual and computing media and services	Media including pre-recorded DVS, CDs, computer software and photographic media; all forms of stationery; services such as DVD rental, photographic media processing and pay television	Electrical and appliance stores, department stores, stationery stores, video-hire outlets, Pay TV companies.
Books, newspapers and magazines		
Books	Adults' and children's fiction and non-fiction, hardback and paperback	Bookshops, department stores, internet
Newspapers and magazines	Newspapers and magazines	Newsagents, internet
Sports and other recreation		
Sports and recreational equipment	Golf, tennis, bicycles and fishing equipment	Sports equipment stores
Toys, games and hobbies	Game consoles and games, toys, board games and hobby materials	Department stores, toy stores
Sports participation	Fees and charges for playing sport including lessons, ground fees, gym fees	Clubs, organisations providing sporting activities
Pets, pet foods and supplies	Pet supplies including pet food	Supermarkets
Pet services including veterinary	Services to care for animals including veterinary	Veterinary clinics
Other recreational activities	Other recreation and entertainment expenses including admission fees to spectator sport, cinema and live theatre, hobby courses	Cinemas, concert halls, theatres, TAFEs, community centres
Holiday travel and accommodation		
Domestic holiday travel and accommodation	Air, sea, bus and rail travel, car hire, holiday units, caravan parks, hotel and motel accommodation in Australia	Airlines, bus, car rental, ferry companies, railways, airlines, holiday accommodation companies
Overseas holiday travel and accommodation	Air fares and package tour charges for holidays and accommodation overseas	Airlines, holiday tour providers, foreign country data

Specific issues

PRICE COLLECTION

8.103 Most products in this group are priced quarterly. The exceptions are holiday travel and accommodation, computing equipment and software and newspapers and magazines, all of which are priced monthly. Prices for newspapers and magazines, computing equipment and software, vehicle hire, overseas tours and domestic air fares are collected centrally. Prices for all other products are collected locally. Field officers collect prices for domestic holiday accommodation from providers in their own state even though many of these prices are used to calculate indexes for the other capital cities.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

Audio, visual and computing equipment

8.104 The ABS does not directly price computing equipment purchased by the CPI population group because of the complexity of pricing these products. Instead, the price movement is estimated using a model. This method was introduced in September Quarter 2005 and is described in detail in *The Introduction of Hedonic Price Indexes for Personal Computers* (cat. no. 6458.0).

Specific issues continued

Areas requiring special pricing procedures continued

Books, newspapers and magazines

8.105 Book prices for the CPI are based on the actual purchase prices paid by consumers and not the recommended retail prices stated on the books. Books sold through book clubs and mail order firms are often discounted, but the discounts are normally based on the total value of book purchases. If the discounts do not relate specifically to a particular book, they are not recorded for the CPI.

Sports and other recreation

8.106 Toys and games are influenced by fashion, making it difficult to price a particular toy over a long period. To deal with this problem the ABS tries to price classic toys and games. Regular discussions are held with retailers to ensure that the most appropriate items are priced.

Holiday travel and accommodation

8.107 Prices for domestic holiday travel and overseas holiday travel are influenced by different factors. For example, changes in foreign currency exchange rates are likely to affect overseas travel prices quite significantly, but will have only a small effect on domestic travel prices. In contrast, Australian school holidays have a major effect on the cost of holiday accommodation within Australia, but have no direct effect on the price of overseas holiday accommodation.

8.108 Most holiday travel, particularly airfares, is booked in advance. Prices for airfares also tend to vary depending on how far ahead they are booked, the day of the week, and the time of day that the trip is taken. As the Australian CPI is compiled on an acquisitions basis, airfares are collected in advance (at the time of payment), but are only used in the CPI in the quarter in which the trip is undertaken. Airfares are normally offered with extra fees, charges and taxes added to the base fare e.g. passenger service charges, and noise and insurance levies. For CPI purposes, these additional fees, charges, levies and taxes are included in the price of the airfare as they are an inescapable cost of purchasing the airline travel. Foreign country index numbers are adjusted by the exchange rates to reflect the exchange rate impact on accommodation expenses to Australian holiday travellers.

QUALITY ADJUSTMENT

Audio, visual and computing equipment

8.109 Audio and visual products change styles and models frequently. These changes quite often improve the quality of the products. Where the product currently priced for the CPI is changed, an adjustment is made to ensure that the concept of pricing to constant quality is maintained.

8.110 Computers are also likely to continue experiencing significant technological and quality improvements, and conceptually these changes will need to be reflected in the CPI prices. The ABS's hedonic computer price index captures the quality improvements for computers by forming functions that relate the price of the product to its characteristics.

Specific issues continued

Quality adjustment continued

Books, newspapers and magazines

8.111 Collecting book prices on a constant quality basis over an extended period of time can be a problem for particular types of books, for instance, fiction books. Books on the top ten best seller lists are used as a guide for selecting books for pricing, but the popularity of these titles is likely to decline over time. When that happens a replacement with similar quality and specifications will be required. However, books in the top ten best seller lists are usually not comparable with one another and finding a suitable replacement is difficult. One of the strategies the ABS uses to minimise the problem is to price books by popular authors who have been producing best selling novels for a long period. The ABS regularly contacts publishing houses to obtain current volume selling titles.

Sports and other recreation

8.112 Measuring the change in quality of recreational activities such as attending a concert or watching a movie is very subjective as the change in utility resulting from a better concert or movie is likely to differ from person to person. However, the variation in utility is thought to be small and so no quality adjustments are made. Items that have a time component (e.g. club memberships) will be adjusted if the time component of the service being bought changes significantly.

Holiday travel and accommodation

8.113 Measuring quality change in holiday travel is also a subjective task. For example, it is difficult to gauge the quality change resulting from improved or degraded seating in aeroplanes, or better quality hotel rooms being included in holiday and airfare tour packages. Quality adjustments are generally not applied to holiday travel items unless the quality change is significant and there are reasonable means of quantifying the change.

SEASONAL FACTORS

8.114 Certain types of books and some types of sports or recreational activities are affected by seasonal factors and are available for certain periods of the year only. For example, many university textbooks are only available at the beginning of the academic year. In this case, the prices of university textbooks in other pricing periods are imputed based on the prices of similar items that are available. With annual subscriptions, prices are carried forward until the same quarter in the following year when the subscription is priced again.

EDUCATION

8.115 The Education group includes all expenditure on primary, secondary and tertiary education and preschool services. It accounted for just under 3 per cent of the CPI basket at the time of the 15th series review.

8.116 The table below shows the structure of the Education group, examples of products priced and the data sources.

8.10 EDUCATION GROUP INDEX STRUCTURE

Group, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
EDUCATION		
Preschool and primary education	Private and government preschool and primary education fees	Preschools, child-care centres, private and government primary schools
Secondary education	Private and government secondary education fees	Private and government secondary schools
Tertiary education	Private and government tertiary education fees	Tertiary education institutions

Specific issues

PRICE COLLECTION

8.117 Prices for preschool education are collected from traditional preschools and from child care centres that provide preschool education. Unlike fees charged by the traditional preschools, fees paid for preschool care offered through child care centres are eligible for the child care rebate. Eligibility for the rebate is determined by family income and prices are adjusted to a subsidised basis using a model to estimate the effect of the subsidy on prices paid.

8.118 Fees for primary and secondary education are collected from both governments and private schools. Prices are collected at the start of the school year as fees are only reviewed annually. The fees are divided into tuition fees and other fees. Other fees are charges which are associated with attending the school, but which are not for tuition although they must be paid. Examples of these fees are book fees, payments for school excursions, contributions to school building funds, camp fees and fees for swimming lessons.

8.119 Tertiary education fees are collected from universities and colleges of Technical and Further Education (TAFE). Fees are divided into course fees and administrative fees. Common items included in administrative fees are institutional enrolment fees, book and library fees and fees for activities supported by student associations.

8.120 The Australian Government charges all tertiary students a student contribution fee under the *Higher Education Support Act* (HESA). For CPI purposes, the student contribution is treated as a cost directly related to tertiary education and so is included as part of tertiary education fees. The data about student contributions are obtained from tertiary institutions.

SUBSIDIES

8.121 Child care benefits are payments made by the Australian Government to assist working parents to meet the cost of leaving their children in preschools (operated by child care centres) while they are at work. For CPI purposes, the child care benefit payable for preschool care is deemed to be a subsidy directly related to the cost of preschool education and where applicable is deducted from the gross fee.

QUALITY ADJUSTMENT

8.122 Applying quality adjustment to educational services can be subjective as the factors determining the quality of the services are difficult to measure. Factors affecting the quality of education include the standard of teaching and the quality of the equipment provided to students. These factors can have an effect on the quality of the

Specific issues continued

QUALITY ADJUSTMENT *continued*

service, but no quality adjustments are made for these because it is hard to measure them accurately.

8.123 The introduction of new charges or fees is an area where quality adjustment is sometimes applied. If the extra charge or fee is accompanied by an improvement in the quality of education, the change in quality will need to be adjusted out in accordance with the concept of pricing to constant quality. A typical example is when a school decides to introduce a building fee to cover the construction of a new extension to the school building. If the building extension results in a better learning environment which improves the quality of the students' education, the fee increase will be quality adjusted. In many cases, however, it is difficult to determine whether the new fee is related entirely to a change in the quality of education or is a pure price rise, or a combination of both. For this reason, the treatment of new fees and charges is decided on a case by case basis.

FINANCIAL AND INSURANCE SERVICES

8.124 Services priced in this group include expenditure on financial services and general insurance services. The Financial and insurance services group accounted for approximately 9 per cent of the CPI basket at the time of the 15th series review.

8.125 The table below shows the structure of the Financial and insurance services group, examples of items priced and the data sources.

8.11 FINANCIAL AND INSURANCE SERVICES GROUP INDEX STRUCTURE

Group, subgroup, expenditure class	*Examples of products priced*	*Outlets/sources of price collection*
FINANCIAL AND INSURANCE SERVICES		
Financial services		
Deposit and loan facilities	Explicit fees and charges on deposit and loan facilities; financial institutions' interest margins on households' deposits and loans	Financial institutions
Other financial services	Commissions or fees charged by real-estate agents; taxes on transfers of real estate	Real-estate agents; state and territory revenue offices
Insurance services		
Insurance services	Motor vehicle insurance (comprehensive and compulsory third party), and households house and contents insurance	Insurance companies

Specific issues

PRICE COLLECTION

8.126 Financial services are priced monthly. Changes to explicit fees and charges and changes to the conditions of operation of the sampled deposit and loan facilities are obtained from the financial institutions in the CPI sample. Data used in the pricing of other financial services are collected from real estate agents and state and territory revenue offices.

8.127 Included under insurance services are motor vehicle insurance and household's house and contents insurance, but not health insurance which is classified under the Health group. To monitor price movements in insurance services, representative ranges of different risk categories are priced for insurance cover and are collected quarterly. The risks vary because of the different demographic characteristics of the insured consumers or because of where they live. For example, young men driving highly powered cars are

considered a higher risk for motor vehicle insurance than middle aged people driving family sedans. For contents insurance, inner city locations are generally considered riskier than suburban locations. Taxes and duties on insurance services (e.g. stamp duties) are collected as part of the premium because they are an inescapable cost of purchasing the insurance service.

AREAS REQUIRING SPECIAL PRICING PROCEDURES

Deposit and loan facilities

8.128 Financial institutions in the CPI sample provide monthly data about average balances and interest by product and in aggregate. These data are used to calculate a current period interest rate margin for each of the sampled products. The margin rates are then applied to the account balances to compute the current period amounts that would be paid as interest margins. The price index is constructed by comparing the change over time in these margin amounts.

8.129 Fees for each sampled product are also updated each month and a total annual amount payable is calculated for each sampled account for each month. The exception is establishment or application fees on home loans. Changes in the average establishment fee charged to new accounts each month are used, which take into account any discounting or waiving of these fees.

Other financial services

8.130 Real estate agents provide information on a sample of residential property sales (representative of the sale prices in each agent's area) for each of the three months in a calendar quarter. A regression technique is then used to estimate a relationship between property values and commission rates. Each quarter, these property values are indexed by a four–quarterly moving average of the CPI. The sample of properties is updated on a regular basis. Legal fees and Stockbroking fees are currently not priced directly but are indexed by the movement in Real estate fees.

Insurance

8.131 Because of the practical difficulties in estimating the insurance service charge as premiums net of claims, the gross insurance premium is used to measure the price movement. The assumption underlying this practice is that the cost of the insurance service is proportional to the premium. However, occasionally factors that influence the gross premium, but not the insurance service charge, may change. For example, a natural disaster may raise significantly the proportion of consumers making claims. However, the individual cost of servicing these claims would not be affected. Following the event, companies may raise gross premiums to recover the unexpected claim payments.

Specific issues continued

QUALITY ADJUSTMENT

8.132 To ensure that the requested insurance cover is of constant quality over time, the values of the contents, properties and vehicles represented by the specifications are updated quarterly to maintain a real level of value. The ABS regularly discusses these valuations with insurance companies to ensure that representative insured valuations are used for pricing.

QUALITY

9.1 The objective of the CPI is to measure pure price change over time, so ideally identical goods and services should be priced from one period to the next. This is called pricing to constant quality. However, in practice, new products appear on the market frequently and replace older products. These new products have different attributes (or quality). For price index purposes, it is necessary to measure these changes in quality, and to remove any change in price attributable purely to the change in quality from the inflationary movement in the price.

9.2 The concept of quality used in the Australian CPI is based on the notion of consumer utility. Quality change is measured by reference to the expected value to the consumer of the changes. Although it is not always possible to achieve this in practice, it is the principal guideline in making decisions about quality change.

9.3 The term quality embraces all those characteristics in a good or a service that a household values or from which it derives utility. Thus the problem is to identify those characteristics that households value, to make an estimate of the value of those characteristics, and to measure the change in those characteristics so that their effect can be removed when calculating price movements. When used in this context, quality encompasses all attributes of a product, including quantity.

9.4 Sometimes the adjustment for quality change is simple. A common case, as demonstrated in the following example, is when only the volume or weight of an item changes.

9.5 Suppose there is a price sample for medium sized tins of tomato soup from three respondents, each of which reports their most popular brand. Now suppose in the current period, the size of the can of soup sold by respondent A drops from 440g to 400g with no change in the sizes of the cans sold by the other respondents. The price data and index calculations for this elementary aggregate are shown in Table 9.1 below.

QUALITY *continued*

9.1 PRICE ADJUSTMENT FOR CHANGE IN QUANTITY

	Base period	*Previous period*	*Current period*
Prices			
Prices with no quality adjustment			
Respondent A	1.50	1.75	1.70
Respondent B	1.75	2.00	2.05
Respondent C	1.25	1.30	1.40
Arithmetic mean	1.50	1.68	1.72
Prices after quality adjustment			
Respondent A	1.36	1.59	1.70
Respondent B	1.75	2.00	2.05
Respondent C	1.25	1.30	1.40
Arithmetic mean	1.45	1.63	1.72
Geometric mean formula			
Price relatives with no quality adjustment			
Respondent A	1.000	1.167	1.133
Respondent B	1.000	1.143	1.171
Respondent C	1.000	1.040	1.120
Geometric mean	1.000	1.115	1.141
Price relatives after quality adjustment			
Respondent A	1.000	1.167	1.247
Respondent B	1.000	1.143	1.171
Respondent C	1.000	1.040	1.120
Geometric mean	1.000	1.115	1.178
Index			
With no quality adjustment	100.0	111.5	114.1
After quality adjustment	100.0	111.5	117.8
RAP Formula			
Period to period price movment			
With no quality adjustment		12.0%	2.4%
After quality adjustment		12.0%	5.5%
Index			
With no quality adjustment	100.0	112.0	114.7
After quality adjustment	100.0	112.0	118.3

9.6 If no allowance is made for the smaller can size in the current period, the price of the can from respondent A would show a fall of 2.9 per cent ((1.70 – 1.75)/1.75 x 100). What is required for the base and previous periods are the prices that would have been paid in those periods for the identical item that was priced in the current period. These are estimated by multiplying the base and previous period prices by the ratio of the current period quality (can size of 400g) to the previous period quality (can size of 440g). The result is that the geometric mean of the price relatives is 1.178 in the current period once allowance is made for the quality change, and not 1.141.

9.7 Similar adjustment procedures can be used for other quality changes, the only issue being how to determine a suitable quality measure. For example, changes in the alcoholic content of spirits could be allowed for simply by adjusting the price proportionally for the change in the alcoholic content. More difficult would be the handling of changes in the meat content of sausages or the salt content of margarine.

9.8 Of course, there are limits to the application of this approach. For example, it would be inappropriate to replace a medium sized can of tomato soup with a large or small sized can since price typically falls per unit of weight with significant increases in the container size. Rather, different elementary aggregates should exist for any significantly different container sizes.

QUALITY *continued*

9.9 The situation becomes more complicated when there are technical changes to goods. Consider an improvement in the fuel economy of a motor vehicle brought about by, say, some modification to the engine. If there were no other changes in the vehicle (its power, speed capabilities etc.), then an estimate could be made of the fuel savings that would accrue over the effective life of the vehicle, and the vehicle's price adjusted accordingly. It is implicitly assumed that the household values the saving of $1 in fuel cost as much as they do $1 of income.

9.10 In some cases, there may be overlapping prices for the item with the quality change, and the item it replaces. For example, suppose in period *t* there are price observations on a standard resolution TV that is included in the TV price sample, and a comparable TV with a higher screen resolution. The standard resolution TV ceases to be available in period *t*+1. Suppose the price observations are as follows:

Item	*Period t*	*Period t+1*
Standard resolution TV	$400	n.a.
High resolution TV	$500	$550

9.11 A price for the standard TV in the price sample in period t+1 can be imputed by using the price movement of the high resolution TV, that is $440 ($400 × 550/500). This approach relies on an assumption that the difference in price between the standard and high resolution TVs in Period *t* is due entirely to quality differences. The price change between periods *t* and *t*+1 for the high resolution model can then be assumed to represent the price movement that would have occurred if the standard resolution model had been available for pricing.

9.12 This approach to quality adjustment is suitable so long as the price difference between the TVs in period *t* is representative of the difference in utility households derive from the two TVs. This could be expected in a competitive market and where the better feature has been available for some time. It would not be appropriate if the price of the item, which is phased out in period *t*+1, is not a normal price (e.g. it could be a run out special). It also may not be appropriate if the feature is new, raising the possibility that household's perception of the utility derived from the feature may not have stabilised or the manufacturer is trying to extract a price premium for the new feature.

9.13 If there are no overlapping prices, or those prices are not normal, then quality adjustment becomes more difficult. It might be possible to use the last available price of the replaced item or to use estimates of differences in manufacturing costs. Again, using manufacturing costs will only be appropriate if costs broadly correlate with consumer utility.

9.14 There are other circumstances where the use of price differentials as indicators of quality differentials may not be appropriate. Examples include items that are heavily subsidised or regulated, such as public education and pharmaceuticals.

9.15 For more complex quality adjustment needs, statistical techniques such as hedonics may be used. The hedonic technique involves the use of a regression equation – the hedonic function – in which prices from an array of different varieties of a product are the dependent variables, and the characteristics of that product are the independent

QUALITY *continued*

(or explanatory) variables. The estimated parameters from the regression provide implicit prices for each of the price determining characteristics of the good. In simple terms, hedonic modelling divides a good or service into its component characteristics, and uses these characteristics as explanatory variables for the price.[27]

9.16 Although this form of modelling is intuitively appealing, large amounts of data and many calculations are required, and this is expensive. An additional problem is that hedonic techniques are not readily able to deal with quality changes that are not easily quantifiable, such as the handling characteristics of a car, the quality of medical care, or whether a variety of clothing is in or out of fashion.

9.17 For some types of quality change, it is doubtful if any accurate measure of the change can be calculated. For example, consider changes in motor vehicles in such characteristics as road holding, safety, cabin space and type of wheels. In the case of services, consider changes in medical operating procedures (e.g. keyhole surgery) that involve less pain and a speedier recovery, or educational services making a greater use of computers. In these cases it may be necessary to make subjective adjustments or no quality adjustments at all.

9.18 One important area of quality change is that arising from governmental regulations. It is ABS practice that, unless these changes clearly affect the level of household utility, they are not treated as quality changes. An example of this practice is that any higher price for motor vehicles occasioned by mandatory pollution requirements is regarded as a price increase, not a quality improvement.

9.19 An important issue is whether a change to an item should be regarded as a quality change to an existing item or the creation of a new item. The simpler approach is to assume that the item is new, and to splice it into an existing price sample. However, a splice implicitly assumes that the difference in quality is equivalent to the price difference. Clearly, if it is assessed that a price differential is not a reliable indicator of quality or household utility differentials, then some other appropriate quality adjustment should be made.

NEW GOODS AND SERVICES

9.20 From time to time, major changes in existing products and services take place, or new products and services become available on the retail market and begin to account for a significant share of household expenditure. Some examples in recent years are MP3 players and electronic games. In these cases, careful consideration is given to whether these new goods or services should be priced for the CPI.

9.21 If a new product or service is deemed to be a completely different category of product (i.e a new expenditure class) from any of the goods and services already included in the CPI, its inclusion would be considered only during one of the periodic reviews of the index. The inclusion of television sets in the 1960s is a good example of this. However, where a new product or service falls within the definition of an existing expenditure class (e.g. the introduction of colour television sets, or mobile telephones), the issue is when and how to start measuring its price movements for the CPI. Normally, the decision is made after considering the following factors.

đą The ABS has developed hedonic price indexes for computers. Details are provided in *Information Paper: The Introduction of Hedonic Price Indexes for Personal Computers* (cat. no. 6458.0).

NEW GOODS AND SERVICES *continued*

- The product's share of the market. This has to be substantial before there is any point in introducing a new item;
- Whether the product is firmly established, and expected to become a permanently significant item of expenditure, or is merely enjoying high sales temporarily because of novelty value; and
- Whether a normal price structure has been established, that is a price structure that is not unduly influenced by factors such as prestige, novelty value, or scarcity of the product.

9.22 In general, a conservative approach is taken when dealing with the introduction of new goods and services into the CPI. They are introduced into existing expenditure classes only after it is deemed that they have become widely available to the buying public, have become a permanent part of household expenditure, and their price structures are free from premiums attributable to novelty value or scarcity. All introductions of new items are handled by splicing the new item into the index so that its introduction does not affect the level of the index.

INTRODUCTION

10.1 The CPI has been described as a basket of goods and services which is notionally purchased each quarter. As prices change from one quarter to the next so too will the total cost (or price) of the basket. Of the various ways in which a CPI could be described, this description conforms closely with the procedures actually followed.

10.2 Using this description, the CPI can be thought of as being constructed in five major steps:

(i) subdividing the total expenditure into individual items for which price samples can be selected;

(ii) collecting price data;

(iii) estimating price movements for individual items;

(iv) calculating the current period cost of the basket; and

(v) calculating index numbers and points contribution.

10.3 This chapter provides a stylised account of the steps above. It also indicates how analytical indexes are calculated, and describes the ABS rounding practices.

SUBDIVIDING THE BASKET

Expenditure aggregates

10.4 Based mainly on the results of the ABS Household Expenditure Survey (HES), estimates are obtained for total annual expenditure of private households in each capital city for each of the ninety expenditure classes in the CPI. As these estimates are for the expenditure of households in aggregate, they are referred to as expenditure aggregates.

10.5 Expenditure aggregates are derived for well defined categories of household expenditure (e.g. bread), but are still too broad to be of direct use in selecting samples of products for pricing. For this purpose, expenditure aggregates need to be subdivided into as fine a level of commodity detail as possible. As the HES is generally not designed to provide such fine level estimates, it is necessary to supplement the HES data with information from other sources such as other official data collections and industrial data. The processes involved are illustrated below using a hypothetical example for the Bread expenditure class of the CPI.

10.6 Suppose that, based on information reported in the HES, the annual expenditure on bread by all private households in a particular city is estimated at $8 million. Further, suppose that some industrial data exist on the market shares of various types of bread. In combination, these two data sources can be used to derive expenditure aggregates at a much finer level of detail than that available from the HES alone. The hypothetical results are shown in Table 10.1 below.

10.7 The next stage in the process involves determining the types of bread for which price samples should be constructed. This is not a simple exercise, and relies on the judgement of the prices statisticians. In reaching decisions about precisely which items to include in price samples, a balance needs to be struck between the cost of data collection (and processing) and the accuracy of the index. Factors taken into account include the significance of individual items, the extent to which different items are likely to exhibit similar price behaviour, and any practical problems with measuring prices to constant quality.

Expenditure aggregates continued

10.1 DISAGGREGATION OF EXPENDITURE DATA

	Market Share	*HES data*	*Derived expenditure aggregates*
Type of bread	%	$'000	$'000
1 White, sandwich, sliced	30	-	2 400
2 White, sandwich, unsliced	2	-	160
3 White high fibre	20	-	1 600
4 White high top	3	-	240
5 Wholemeal	10	-	800
6 Multigrain	15	-	1 200
7 Bread rolls	15	-	1 200
8 Specialty	5	-	400
Total Bread	**100**	**8 000**	**8 000**

10.8 In this example, a reasonable outcome would be to decide to construct pricing samples for varieties 1, 3, 5 and 6. Separate price samples would not be constructed for items 2 and 4 because of their small market share relative to the others. Pricing samples would also not be constructed for bread rolls and specialty breads (items 7 and 8) as they would prove difficult to price to constant quality because these items are usually sold by number and not by weight.

Elementary aggregates must have a price sample

10.9 When no more information is available to disaggregate the expenditure values any further, the resulting product definitions are called elementary aggregates. Each elementary aggregate has its own price sample. Ideally, all the products in an elementary aggregate (and there should only be a few) would be homogeneous goods or services, and would be substitutes for each other. In the Australian CPI, there are approximately 1,000 elementary aggregates for each of the eight capital cities. This gives around 8,000 price samples nationally. The expenditure aggregates for the items that are not explicitly priced are reallocated across the elementary aggregates of closely related goods or services under the assumption that the price movements for these products are similar.

10.10 In the bread example, the reallocation is carried out in two stages. First, the expenditure aggregate for unsliced white sandwich loaves is added to sliced white sandwich loaves resulting in an elementary aggregate for white sandwich loaves (as being white bread and sandwich loaves makes them likely to experience similar price movements). White high top loaves would be treated similarly. In the second stage, the expenditure aggregates for bread rolls and specialty breads, which have no closely matching characteristics with any of the other types of bread, would be allocated proportionally across the remaining elementary aggregates under the assumption that the average movement in prices for all other bread types is the best estimate. The outcome of this process is presented in Table 10.2.

10.11 In summary, the rationale for this allocation is as follows. Price behaviour of item 2 (white, sandwich, unsliced) is likely to be best represented by the price behaviour of item 1 (white, sandwich, sliced). Items 4 (white high top) and 3 (white high fibre) are treated similarly. The price behaviour for items 7 (bread rolls) and 8 (specialty bread) is likely to be best represented by the average price behaviour of all other breads.

Elementary aggregates must have a price sample continued

10.2 OUTCOME OF ELEMENTARY AGGREGATE RATIONALISATION

Bread Type	*Initial*	*Stage 1*	*Stage 2*	*Elementary aggregate*
1	2,400	2,560	3,200	White sandwich
2	160	-	-	
3	1,600	1,840	2,300	White high fibre
4	240	-	-	
5	800	800	1,000	Wholemeal
6	1,200	1,200	1,500	Multigrain
7	1,200	1,200	-	
8	400	400	-	
Total	**8,000**	**8,000**	**8,000**	

Determining outlet types

10.12 The next step is to determine the outlet types (respondents) from which the prices will be collected. In order to accurately reflect changes in prices paid by households for bread, prices need to be collected from the types of outlets from which households normally purchase bread. Data are unlikely to be available on the expenditures at the individual elementary aggregate level by type of outlet. It is more likely that data will be available for expenditure on bread in total by type of outlet. Suppose industrial data indicate that supermarkets account for about 80 per cent of bread sales, and bakery outlets the remainder. A simple way to construct a pricing sample for each elementary aggregate that is representative of household shopping patterns is to have a ratio of four supermarkets for every bakery.

COLLECTING PRICE DATA

Selecting respondents

10.13 When the pricing samples are worked out, ABS field staff decide from which individual outlets the prices will be collected. The respondents are chosen to be representative of the types of outlets (in the example above, supermarkets and bakeries) taking into account the demographic characteristics of the city, and the numbers required for the sample. Prices are collected from any particular respondent on the same day in each collection period (e.g. the first Monday of each month).

Selecting items to price

10.14 When a pricing sample contains respondent standard specifications, the field staff will decide which specific items are most representative of the required type of product. Usually they do this by consulting with the manager of the outlet. Using the bread example above, at one outlet they might decide that a 680g sliced white sandwich loaf best represents white sandwich bread, but at another outlet it might be a 700g white sandwich loaf. Once selected, the same item will be priced at that respondent so long as it remains the most representative example of the product.

10.15 An important part of the price collection process is the continual monitoring of the items for quality change. In the bread example, quality change could occur with (say) a change in the size (weight) of the loaf of bread. In this case, the price movement attributable to the change in loaf size would be removed to derive a pure price movement for the loaf.

ESTIMATING PRICE MOVEMENTS FOR ELEMENTARY AGGREGATES

10.16 Price relatives are calculated for each price in the sample, and mostly the geometric mean of these is used in the calculations. The ratio of the current period's geometric mean of price relatives to the previous period's geometric mean of price relatives provides the change in the average price for the elementary aggregate. Using the hypothetical bread example, Table 10.3 shows price relatives being used to estimate the price movement for bread. These estimates of price movements are used to revalue the expenditure aggregates to current period prices by applying the period to period price movement to the previous period's expenditure aggregate for each elementary aggregate. The updated expenditure aggregate provides an estimate of the cost of acquiring the base period quantity of the elementary aggregate's products in the current period.

10.3 ESTIMATING PRICE MOVEMENT FOR AN ELEMENTARY AGGREGATE

	PRICE RELATIVE IN		
	Period 1	*Period 2*	*Price movement %*
White sandwich loaf			
Supermarket A	1.025	1.030	0.5
Supermarket B	1.030	0.950	-7.8
Supermarket C	1.040	1.065	2.4
Supermarket D	0.980	1.100	12.2
Bakery	1.100	1.250	13.6
Geometric mean	1.034	1.075	4.0

CALCULATING THE CURRENT COST OF THE BASKET

10.17 The price updated expenditure aggregates for the elementary aggregates are then summed to derive the current cost of the basket of goods and services (or any portion of the basket) . Index numbers are calculated from the expenditure aggregates at every level of the index. The table below shows the calculation of the expenditure value for the total of bread (an expenditure class in this example).

10.4 AGGREGATION OF EXPENDITURE AGGREGATES FOR EXPENDITURE CLASS

Elementary aggregate (Description)	*Expenditure aggregate $'000* Period 1	*Percentage change %* Period 1 to Period 2	*Expenditure aggregate $'000* Period 2
White sandwich	3200	4.0	3328
White high fibre	2300	3.5	2381
Wholemeal	1000	0.0	1000
Multigrain	1500	1.7	1526
Total	**8000**	**2.9**	**8235**

CALCULATING INDEX NUMBERS AND POINTS CONTRIBUTIONS

10.18 Table 10.5 shows the calculation of index numbers and points contribution. It is assumed that index numbers already exist for the link period (June quarter 2005 for the 15th series CPI) and period 1. Assume the expenditure aggregate for Cereals has been calculated using the same method as that for Bread so that the two can be added and a movement calculated for Bread and Cereals. Similarly, assume the expenditure aggregates for period 2 have been calculated for Other foods and Non–food so that expenditure aggregates can be calculated for Food and All groups.

10.19 When a price index has not been linked, indexes for any component can be calculated simply by dividing the current period expenditure aggregate by its expenditure aggregate in the reference period (when the index is set to 100.0). However, the CPI has been linked several times since its reference base (1989–90) and the index numbers must be calculated from

$$I_{LP} \times \frac{V_{CP}}{V_{LP}} \qquad (10.1)$$

where I_{LP} is the index number in the link period (June quarter 2005 for the 15th series CPI), and V_{CP} and V_{LP} are the expenditure aggregates in the current period and link periods respectively. Thus the index number for Bread in period 2 is given by 108.0 x 8235 / 6500 = 136.8.

Points contributions are also calculated using the expenditure aggregates. In any period, the points contribution of a component to the All groups index number is calculated by multiplying the All groups index number for the period by the expenditure aggregate for the component in that period, and dividing by the All groups expenditure aggregate for that period. This can be stated algebraically as

$$I_t^{AG} \times \frac{V_t^i}{V_t^{AG}} \qquad (10.2)$$

Where I_t^{AG} is the index for All groups in period t, I_t^i is the expenditure aggregate for component i in period t and is V_t^{AG} the expenditure aggregate for All groups in period t.

10.20 In the example in Table 10.5 below, the points contribution for Bread in period 2 is calculated as 141.3 * (8235 / 144268) = 8.07.

10.21 The change in index points contribution for a component between any two periods is found by simply subtracting the points contribution for the previous period from the points contribution for the current period. For example, the change in index points contribution for Bread between periods 1 and 2 is 8.07 – 7.84 = 0.23.

10.22 The CPI publication does not show the expenditure aggregates, but rather the index numbers derived from the expenditure aggregates. Expenditure aggregates vary considerably in size, and showing them would make the publication difficult to read and interpret. Index numbers and points contributions are a better way to present the information.

CALCULATING INDEX NUMBERS AND POINTS CONTRIBUTIONS *continued*

10.5 AGGREGATION OF EXPENDITURE AGGREGATES FOR ENTIRE INDEX

	Link period	*Period 1*	*Period 2*
EXPENDITURE AGGREGATES ($)			
All groups	**122,500**	**138,100**	**144,268**
Food	**32,500**	**40,100**	**41,368**
Bread and cereals	***12,500***	***15,000***	***15,515***
Bread	6,500	8,000	8,235
Cereals	6,000	7,000	7,280
Other foods	***20,000***	***25,100***	***25,853***
Non-food	**90,000**	**98,000**	**102,00**
MOVEMENT IN EXPENDITURE AGGREGATES (PERIOD 1 TO PERIOD 2)			
All groups			**1.045**
Food			**1.032**
Bread and cereals			***1.034***
Bread			1.029
Cereals			1.04
Other foods			***1.03***
Non-food			**1.05**
INDEX NUMBERS			
All groups	**120.0**	**135.3**	**141.3**
Food	**115.0**	**141.9**	**146.4**
Bread and cereals	***110.0***	***132.0***	***136.5***
Bread	108.0	132.9	136.8
Cereals	113.0	131.8	137.1
Other foods	***117.0***	***146.8***	***151.2***
Non-food	**125.0**	**136.1**	**142.9**
POINTS CONTRIBUTION			
All groups	**120.0**	**135.3**	**141.3**
Food	**31.84**	**39.29**	**40.52**
Bread and cereals	***12.24***	***14.7***	***15.2***
Bread	6.37	7.84	8.07
Cereals	5.88	6.86	7.13
Other foods	***19.59***	***24.59***	***25.32***
Non-food	**88.16**	**96.01**	**100.78**

Note: It is assumed the reference base period precedes period 1.

SECONDARY INDEXES

10.23 A range of analytical indexes are also published reusing data from the CPI. Examples of these are the All groups excluding (each of the groups in turn), Goods and Services, Tradables, Non–tradables, and Market goods and services (with exclusions). These are called secondary indexes as they use the same weights (or expenditure aggregates) as the CPI, and are compiled by summing the appropriate value aggregates. For example, in the table above, the starting point for compiling an index for All groups

SECONDARY INDEXES
continued

excluding Bread and cereals would be to add up the value aggregates for Other foods and Non–food and then calculate index values as described previously.

TERTIARY INDEXES

10.24 A further range of analytical indexes are compiled from the price samples collected for the CPI. Price indexes compiled under the outlays approach are published annually for four population subgroups: employees; age pensioners; self funded retirees; and recipients of other government transfer. These indexes, unlike the secondary indexes, have their own weighting patterns. For each component in the population subgroup indexes, the movement in the corresponding CPI index is used to update the expenditure aggregate and index number for the population subgroup. The purpose of the population subgroup indexes is to show any differences in the price changes faced by each of the four demographic groups arising from their differing expenditure patterns.

CONSUMER PRICE INDEX ROUNDING CONVENTIONS

10.25 To ensure consistency from one publication to the next, the ABS uses a set of rounding conventions or rules for calculating and presenting the results. These conventions strike a balance between maximising the usefulness of the information for analytical purposes, and retaining a sense of the underlying precision of the estimates. These conventions need to be taken into account when CPI data is used for analytical or other special purposes.

10.26 Index numbers are always published relative to a base of 100.0. Index numbers and percentage changes are always published to one decimal place, and the percentage changes are calculated from the rounded index numbers. Index numbers for periods longer than a single quarter (e.g. for financial years) are calculated as the simple arithmetic average of the rounded quarterly index numbers.

10.27 Points contributions are published to two decimal places. Change in points contributions is calculated from the rounded points contributions. Rounding differences can arise in the points contributions where different levels of precision are used.

INTRODUCTION

11.1 As discussed in detail in Chapter 4, there are a number of different types of bias that may affect price indexes. The ABS applies significant effort to address these biases. Some aspects, such as quality change, have been addressed elsewhere. This chapter looks at the way the ABS deals with two other aspects of bias:

- the way the ABS maintains the sample to ensure that it remains representative of goods and services being acquired by contemporary households; and
- the selection of the appropriate index number formula.

LIMITATIONS OF FIXED BASKET PRICE INDEXES

11.2 The development of a price index by reference to a fixed basket of goods and services has several advantages. First, the concept is easy to understand: price the same basket of goods and services at two different periods, and compare the total price of the basket. Secondly, and perhaps more importantly, by fixing both the items within the basket and their quantities, the resulting values provide a measure of pure price change that is free from compositional changes. Of course, in application this process is more complex than the basket analogy would suggest. So, although the ABS uses a fixed basket to construct its consumer price index, in practice it finds that the transactions occurring in the market place are frequently changing. This observation results in a dilemma, namely how can a price index use a fixed basket to measure pure price change, and at the same time remain both contemporary and representative of the market as a whole.

ABS STRATEGY FOR REVIEWING AND MAINTAINING PRICE INDEXES

11.3 The ABS has a policy of continually assessing the samples of consumer goods and services that it uses in the CPI. Sample maintenance is indicated where minor problems are identified such as the need to find replacements for items or respondents. Sample maintenance is conducted regularly throughout the year. Where the sample assessment indicates that changes to the index structure or the distribution of the weights are required, a sample review is undertaken. Essentially, a sample review involves selecting a component of the CPI (it could be one or more expenditure classes, or part of an expenditure class) and subjecting it to detailed examination. The review determines what changes should be made to the items priced, the outlets they are sourced from and the weights to be applied to the commodities and outlets.

CHOOSING AN INDEX NUMBER FORMULA

11.4 As different index number formulae produce different results, the ABS has to decide which formula to use. The usual way is to evaluate the performance of a formula against a set of desirable mathematical properties or tests. This is the so–called axiomatic approach. Although it is certainly useful, a few practical issues need to be considered as well, such as the relevance of the tests for the application at hand; the importance of a particular test (some tests are more important than others); and even if an index formula fails a test, how close in practice is the index likely to be to the best measure.

11.5 The range of tests developed for index numbers has expanded over the years. Diewert (1992) describes twenty tests for weighted index formulae, and Diewert (1995) provides seventeen tests for equally weighted (or elementary) index formulae, and attributes the tests to their authors. It is beyond the scope of this chapter to describe all the tests, but several important ones are shown below. Many of the tests apply to both types of formulae.

CHOOSING AN INDEX NUMBER FORMULA
continued

- *Time reversal* This test requires the index formula to produce consistent results whether it is calculated from period 0 to period 1 or from period 1 to period 0. More specifically, if the price observations for period 0 and period 1 are changed around then the resulting price index should be the reciprocal of the original index.
- *Circularity* (often called transitivity). This is a multiperiod test (essentially a test of chaining). It requires that the product of the price index obtained by going from period 0 to period 1 and from period 1 to 2 is the same as going directly from period 0 to period 2.
- *Permutation or price bouncing* This test requires that, if the order of the prices in either period 0 or period 1 (or both) is changed, but not the individual prices, the index number should not change. This test is appropriate in situations where there is considerable volatility in prices; for example, because of seasonal factors or sales competition.
- *Commensurability* This test requires that if the units of measurement of the item are changed (e.g. from kilograms to tonnes), then the price index should not change.
- *Factor reversal test* This test is not appropriate for the elementary index formulae. It requires that the product of the price index number for any period, and an index of quantity obtained from the formula by interchanging the price and quantity terms, should equal the ratio of expenditure in that period to the base period expenditure.[28]

11.6 The Fisher Ideal index formula passes the tests on time reversal, circularity, commensurability, and factor reversal; whereas the Laspeyres and Paasche only pass the test of commensurability.

11.7 Regarding the three equally weighted price index formulas discussed in Chapter 4, the APR fails the first three tests, the RAP fails the commensurability test, but the GM approach passes all tests. Of Diewert's seventeen tests for elementary index formulas, the RAP passes fifteen tests and the GM sixteen tests.

11.8 Although the equally weighted GM appears to have considerable appeal as an elementary index formula, there are some situations in which it produces an undesirable result. The GM cannot handle zero prices which might occur, for example, if the government introduced a policy to subsidise fully a particular good or service. In addition, the GM may not produce acceptable movements when a price falls sharply. For example, consider a price sample of two items, each selling for $10 in one period, with the price of one of the items falling to $1 in the second period. The GM produces an index of 31.6 for the second period (assuming it was 100 in the first period), a fall of around 68 per cent. Because the GM maintains equal expenditure shares in each period, it effectively gives a larger weight to lower prices.[29]

11.9 Only in recent years has the GM formula become more widely accepted in official circles for compiling consumer price indexes. For example, Canada switched to using geometric means in the late 1980s; the United States introduced the GM formula for items making up about 61 per cent of its CPI in January 1999; and Australia began

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đ¬ Diewert (1992, p. 222) notes that some researchers have objected to this test, and he does not include it in his list of twenty tests.

2× The RAP and APR formulae both give an index of 55.0 in this case.

CHOOSING AN INDEX NUMBER FORMULA
continued

introducing the formula in the December quarter 1998. (However, where there is a likelihood of zero occurring in the price sample the geometric mean is inappropriate, and the ABS generally uses the relative of average prices (RAP) formula instead.) Furthermore, the GM formula is prescribed by the European Union for calculation of price sample means in its Harmonised Indices of Consumer Prices (HICP). There appear to be two reasons for the slow take–up of the GM approach. One is that before the use of computers in compiling official indexes, calculation of geometric means was a very laborious task. A second reason is the perceived difficulty in explaining the measure to users of the statistics.

11.10 There is another aspect to indexes that is worth considering, although it is not rated as a test in the literature. In most countries the CPI is produced at various levels of aggregation. Typically there are three or more levels between the lowest published level, and the total of all goods and services. In practice it is desirable that the same result is obtained whether the total index is compiled directly from the lowest level or in a staged way using progressively higher levels of aggregation. Diewert (1978) shows that the fixed weighted Laspeyres and Paasche indexes may be aggregated consistently, and the Fisher and Törnqvist indexes are (very) closely consistent.[30]

3Ç The aggregation property of the Laspeyres and Paasche indexes allows them to be broken down into points contributions which is very useful for analysing the relative significance of items in the index, and their contributions to changes in the aggregate index. However, Diewert (2000) has a way to decompose superlative indexes.

REFERENCE PERIODS

12.1 The *Weight reference period* is the period of the expenditure data used to calculate the value aggregates (or weights). The weight reference period or weighting base period for the 15th Series CPI is 2003–04.

12.2 The *Price reference period* is the period whose prices are compared with the prices in the current period. It is the period whose prices appear in the denominators of the price relatives.

12.3 The *Index reference period* is the period in which all index numbers in the CPI have a value of 100.0 (with the possible exception of any items that have been newly introduced into the CPI since the base period).

RE–REFERENCING

12.4 The ABS changes the index reference period (a process known as re-referencing) of the CPI from time to time, but not frequently. This is because frequently changing the reference base is inconvenient for users, particularly those who use the CPI for contract escalation. Also re–referencing may result in loss of detail in historic data, especially for long series. Since the March quarter 1992, the CPI uses an index reference base of 1989–90 = 100.0. In the June quarter 1982 the index reference base was changed from 1966–67=100.0 to 1980–81=100.0. The ABS has produced historical index numbers on the current base, so normally there is no need for users to do their own calculations.

12.5 The conversion of an index series from one index reference base to another involves calculating the ratio of the index numbers for the base period from the two series, and applying this to the index numbers. For example, consider converting the Clothing group index for Perth from an index base of 1980–81=100.0 to 1989–90=100.0 (see Table 12.1 below for the data). The index number for the group for 1989–90 on an index reference base of 1980–81 was 185.6 (rounded to one decimal place). Thus the conversion factor is 0.5388 (100.0/185.6) so that the March quarter 1989 index number on an index base of 1989–90=100.0 is 95.4 (177.0×0.5388).

12.1 CONVERTING REFERENCE BASES, PERTH CLOTHING GROUP

	BASE	BASE
	1980-81=100.0	*1989-90=100.0*
Mar 1989	177.0	95.4
Jun 1989	182.7	98.4
Sep 1989	181.5	97.8
Dec 1989	186.4	100.4
Mar 1990	185.8	100.1
Jun 1990	188.6	101.6
1989–90	**185.6**	**100.0**
Sep 1990	189.2	101.9
Dec 1990	194.1	104.6
Mar 1991	195.3	105.2
Jun 1991	196.5	105.9
Sep 1991	197.1	106.2
Dec 1991	199.5	107.5

Note: Conversion factor: 1980-81 base to 1989-90 base = 100.0/185.6 = 0.5388

RE–REFERENCING *continued*

12.6 Similar procedures are used to convert the current index base to a 1980–81 base. For example, the December quarter 1991 index for the Clothing group for Perth was 107.5 which, when multiplied by the conversion factor of 1.856 (185.6/100.0), gives an index number of 199.5 on the reference base of 1980–81=100.0. It should be noted that a different conversion factor will apply for each index and city; that is, the factor for the Clothing group for Perth will differ from the factor for Automotive fuel for Perth, and for the Clothing group for Hobart.

12.7 Re–referencing should not be confused with rebasing. Re–referencing does not change the relative movements between periods. However rebasing involves introducing new weights and recalculating the aggregate index for each period which will affect the relative movements between periods.

CHAINING INDEXES

12.8 The use of fixed weights (as in a Laspeyres formula) over a long period of time is clearly not sound practice. For example, weights in a consumer price index have to be changed to reflect changing consumption patterns. Consumption patterns change in response to longer term movements in relative prices, changes in preferences, and the introduction of new goods (and the displacement of older style goods).

12.9 There are two options in these situations if a fixed weighted index is used. One is to hold the weights constant over as long a period as seems reasonable, starting a new index each time the weights are changed. This means that a longer term series is not available. The second is to update the weights more frequently and to chain to produce a long term series. The latter is the more common practice.

12.10 The behaviour of the alternative index formulas under chaining are explored in Table 12.2 below. In period 3, prices and quantities are returned to their base period values and in period 4 the base period prices and quantities are shuffled between items. The period 3 situation is sometimes described as time reversal and the period 4 situation as price bouncing.

12.11 Under the three formulae, the index number under direct estimation returns to 100.0 when prices and quantities of each item return to their base period levels. However, the chained index numbers do not (although the chained Fisher Ideal index might generally be expected to perform better than the chained Laspeyres or Paasche).

12.12 This situation poses a quandary for prices statisticians when using a fixed weighted index. There are obvious attractions in frequent chaining. However, chaining in a fixed weighted index can sometimes lead to biased estimates. This can occur if there is seasonality or cycles in the price, and chaining coincides with the top and bottom of each cycle. For this reason it is generally accepted that indexes should not be chained at intervals less than annual. In effect, the conceptual underpinning of chaining is that the traditionally expected inverse relationship between prices and quantities actually applies in practice (i.e. growth in quantities is higher for those items whose prices increase less than those of other items). The System of National Accounts, 1993 describes the practical situations in which chaining works best.

CHAINING INDEXES

continued

12.2 A CLOSER LOOK AT CHAINING

Item	*Period 0*	*Period 1*	*Period 2*	*Period 3*	*Period 4*
			PRICE ($)		
1	10	12	15	10	15
2	12	13	14	12	10
3	15	17	18	15	12
			QUANTITY		
1	20	17	12	20	10
2	15	15	16	15	20
3	10	12	8	10	15
			INDEX NUMBER		
Index formula					
Laspeyres					
period 0 to 1	100.0	114.2			
period 1 to 2		100.0	112.9		
period 2 to 3			100.0	78.8	
period 3 to 4				100.0	107.5
chain	100.0	114.2	128.9	101.6	109.2
direct	100.0	114.2	130.2	100.0	107.2
Paasche					
period 0 to 1	100.0	113.8			
period 1 to 2		100.0	112.3		
period 2 to 3			100.0	76.8	
period 3 to 4				100.0	93.8
chain	100.0	113.8	127.8	98.2	92.1
direct	100.0	113.8	126.9	100.0	93.8
Fisher					
period 0 to 1	100.0	114.0			
period 1 to 2		100.0	112.6		
period 2 to 3			100.0	77.8	
period 3 to 4				100.0	100.4
chain	100.0	114.0	128.4	99.9	100.3
direct	100.0	114.0	128.5	100.0	100.4

INTRODUCTION

13.1 This chapter describes the information published by the Consumer Price Index area of the ABS. It also explains how to interpret index numbers. For example, it explains the differences between index points and percentage changes, how to determine the major movers in the CPI, and how to construct index series from components of the CPI.

INFORMATION PAPERS

13.2 The CPI is reviewed and re–weighted every five or six years. The last major review of the CPI resulted in the 13th series of the index which was introduced in the September quarter 1998. Several important changes were made to the index at that time. The most important of these was to change the CPI from a measure of living costs of employee households to a general measure of price inflation for households. As part of this major review, the ABS published three Information Papers:

- *Issues to be Considered During the 13th Series Australian Consumer Price Index Review* (cat. no. 6451.0);
- *Outcome of the 13th Series Australian Consumer Price Index Review* (cat. no. 6453.0); and
- *Introduction of the 13th Series Australian Consumer Price Index* (cat. no. 6454.0).

13.3 These papers describe the review process, the issues considered, the review outcomes, and the re–weighting process, and outline the changes from the previous series.

13.4 The 14th series of the CPI was introduced in the September quarter 2000, after a minor review completed early in 2000. The changes introduced in the 14th series were considered necessary to address issues arising from the introduction of The New Tax System (TNTS) on 1 July 2000. As part of the review process the ABS published Information Papers describing the changes:

- *Price Indexes and The New Tax System* (cat. no. 6425.0); and
- *Introduction of the 14th Series Australian Consumer Price Index* (cat. no. 6456.0).

13.5 The 15th series CPI introduced in September quarter 2005 was also a minor review. The item weights were revised in line with expenditure patterns identified in the 2003–04 Household Expenditure Survey (HES), and a new subgroup called Financial services was introduced into the index. Once again, ABS published an Information Paper describing the changes:

- *Introduction of the 15th Series Australian Consumer Price Index* (cat.no. 6462.0).

PUBLISHED STATISTICS

13.6 The CPI is compiled quarterly by the ABS for quarters ending on 31 March, 30 June, 30 September, and 31 December each year. The data are typically released on the fourth Wednesday after the end of the reference quarter, depending on public holidays, but no later than the last Wednesday of the month after the end of the reference quarter, in the publication *Consumer Price Index, Australia* (cat. no. 6401.0).

13.7 The statistics are published in several different ways. Although they are available as printed publications, the main mechanism for dissemination of ABS data is through the ABS web site www.abs.gov.au. The web site provides free of charge:

- the main findings from the statistical releases;
- a version of the publications in PDF format which may be downloaded;
- all publication tables in Microsoft Excel format; and

PUBLISHED STATISTICS *continued*

- a range of additional tables (data cubes) containing all available indexes in Microsoft Excel format.

Quarterly and annual data

13.8 The CPI is published for both quarters and financial years. The index number for a financial year is the simple arithmetic average (mean) of the index numbers for the four quarters of that year. Index numbers for calendar years are not published by the ABS, but can be calculated as the simple arithmetic average of the quarterly index numbers for the year concerned.

Equitable access

13.9 The statistics are made available simultaneously to all interested parties through these releases. To ensure equitable access to the data, all statistics are embargoed until 11.30 a.m. (Canberra time) on the day of release, and before then no information about the price indexes is publicly available.

13.10 The 11.30 a.m. embargo and simultaneous access to the statistics applies to both the electronic and hardcopy releases.

Revisions

13.11 The ABS strives for accuracy in all of its publications. The accuracy of the CPI is of particular importance to the ABS, and in recognition of the use of the CPI in determining economic policy and in contract price indexation, the ABS makes an effort to eliminate the need for revision. However, if revision is required, the ABS's revisions policy is based on the Resolution on Consumer Price Indices issued by the International Labour Organization in 2003:

"*When it is found that published index estimates have been seriously distorted because of errors or mistakes made in their compilation, corrections should be made and published. Such corrections should be made as soon as possible after detection according to publicly available policy for correction. Where the CPI is widely used for adjustment purposes for wages and contracts, retrospective revisions should be avoided to the extent possible.*"

INTERPRETING INDEX NUMBERS

Index points and percentage changes

13.12 Movements in indexes from one period to any other period can be expressed either as changes in index points or as percentage changes. The following example illustrates these calculations for the All groups CPI (weighted average of the eight capital cities) between September quarter 2007 and the September quarter 2008. The same procedure is applicable for any two periods.

Index numbers:	
September quarter 2008	166.5
less September quarter 2007	158.6
equals change in index points	7.9
Percentage change	7.9 / 158.6 x 100 = 5.0%

13.13 For most applications, movements in price indexes are best calculated and presented as percentage changes. Percentage change allows comparisons in movements that are independent of the level of the index. For example, a change of 2.0 index points when the index number is 120.0 is equivalent to a change of 1.7 per cent. But if the index number were 80.0, a change of 2.0 index points would be equivalent to a change of 2.5 per cent, a significantly different rate of price change. Only when evaluating change from

Index points and percentage changes continued

the base period of the index will the points change be numerically identical to the percentage change.

13.14 The percentage change between any two periods must be calculated, as in the example above, by direct reference to the index numbers for the two periods. Adding the individual quarterly percentage changes will not result in the correct measure of longer term percentage change. That is, the percentage change between (say) the June quarter of one year and the June quarter of the following year will not necessarily equal the sum of the four quarterly percentage changes. The error becomes more noticeable the longer the period covered, and the greater the rate of change in the index. This can readily be verified by starting with an index of 100.0 and increasing it by 10 per cent (multiplying by 1.1) each period. After four periods, the index will equal 146.4 delivering an annual percentage change of 46.4 per cent, not the 40.0 per cent obtained by adding the four quarterly changes of 10.0 per cent.

13.15 Although the CPI is compiled and published as a series of quarterly index numbers, its use is not restricted to the measurement of price change between quarters. A quarterly index number can be interpreted as representing the average price during the quarter (relative to the base period), and index numbers for periods spanning more than one quarter can be calculated as the simple (arithmetic) average of the quarterly indexes. For example, an index number for the calendar year 2004 is the arithmetic average of the index numbers for the March, June, September and December quarters of 2004.

13.16 This characteristic of index numbers is particularly useful. It allows average prices in one year to be compared with those in any other year. It also enables prices in (say) the current quarter to be compared with the average prices prevailing in a previous year.

13.17 The quarterly change in the All groups CPI represents the weighted average price change of all the items included in the CPI. Publication of index numbers and percentage changes for components of the CPI are useful in their own right. However, these data are often not sufficient to enable important contributors to total price change to be reliably identified. What is required is some measure that encapsulates both an item's price change and its relative importance in the index.

13.18 If the All groups index number is thought of as being derived as the weighted average of the indexes for all its components, then in concept the index number for a component multiplied by its weight to the All groups index results in what is called its points contribution. This relationship only applies if all the components have the same reference base, and there has been no linking of component series since the base period. However, the Australian CPI has been linked several times since its reference base (1989–90), and therefore a more practical method for calculating points contribution is used.

13.19 The published points contributions are calculated using the expenditure aggregates. In any period, the points contribution of a component to the All groups index number is calculated by multiplying the All groups index number for the period by the expenditure aggregate for the component in that period, and dividing by the All groups expenditure aggregate for that period. Calculating points contribution using published data may give a different result to the points contribution derived using

Index points and percentage changes continued

expenditure aggregates. Also, building up from the individual products' points contribution may give a different result from taking the All groups index number and subtracting the points contribution for those products. The reasons for these differences are the different levels of precision used in the calculations.

13.20 The change in a component item's points contribution from one period to the next provides a direct measure of the contribution to the change in the All groups index resulting from the change in that component's price. In addition, information on points contribution, and points contribution change, is of immense value when analysing sources of price change, and for answering what–if type questions. Consider the following data extracted from the September quarter 2005 CPI publication.

13.1 SELECTED VALUES FROM CPI PUBLICATION, SEPTEMBER QUARTER 2005

Item	*June qtr*	*Sept. qtr*	*Change*
INDEX NUMBERS			
			Percent change
All groups	148.4	149.8	0.9
Automotive fuel	182.6	203.7	11.6
POINTS CONTRIBUTION			
			Points change
All groups	148.4	149.8	1.4
Automotive fuel	5.62	6.26	0.65

13.21 Using only the index numbers themselves, the most that can be said is that between the June and September quarters 2005, the price of automotive fuel increased by more than the overall CPI (by 11.6% compared with an increase in the All groups of 0.9%). The additional information on points contribution and points change can be used to make further analyses.

- *Calculate the effective weight for automotive fuel in the June and September quarters* (given by the points contribution divided by the All groups index). For June, the weight is calculated as 5.62 / 148.4 x 100 = 3.8 per cent, and for September as 6.26 / 149.8 x 100 = 4.2 per cent. Although the underlying quantities are fixed, the effective weight in expenditure terms has increased because the price of automotive fuel is increasing by more than the prices of all other items in the CPI basket (on average).
- *Calculate the percentage increase that would have been observed in the CPI if all prices other than those for automotive fuel had remained unchanged* (given by the points change for automotive fuel divided by the All groups index number in the previous period). For September quarter 2005 this is calculated as (6.26 – 5.62) / 148.4 x 100 = 0.4 per cent. In other words, an 11.6 per cent increase in automotive fuel prices in September quarter 2005 would have resulted in an increase in the overall CPI of 0.4 percentage points.

Index points and percentage changes continued

- *Calculate the average percentage change in all other items excluding automotive fuel* (given by subtracting the points contribution for automotive fuel from the All groups index in both quarters, and then calculating the percentage change between the resulting numbers. This represents the points contribution of the other items.) For this example, the numbers for All groups excluding automotive fuel are:
  June, 148.4 – 5.62 = 142.8; September, 149.8 – 6.26 = 143.5; and the percentage change, (143.5 – 142.8) / 142.8 x 100 = 0.5 per cent. In other words, prices of all items other than automotive fuel increased by 0.5 per cent on average between the June and September quarters 2005.
- *Estimate the effect on the All groups CPI of a forecast change in the prices of one of the items* (given by applying the forecast percentage change to the item's points contribution, and expressing the result as a percentage of the All groups index number). For example, if prices of automotive fuel were forecast to increase by 25 per cent in December quarter 2005, then the points change for automotive fuel would be 6.26 x 0.25 = 1.6, which would deliver an increase in the All groups index of 1.6 / 149.8 x 100 = 1.1 per cent. In other words, a 25 per cent increase in automotive fuel prices in December quarter 2005 would have the effect of increasing the CPI by 1.1 per cent. Another way commonly used to express this is to say that automotive fuel would contribute 1.1 percentage points to the change in the All groups CPI.

13.22 The following questions and answers illustrate the uses that can be made of the CPI.

Question 1:

- What would $200 in the calendar year 2000 be worth in September quarter 2005?

Response 1:

- This question is best interpreted as How much would need to be spent in September quarter 2005 to purchase what could be purchased in the year 2000 for $200? As no specific commodity is mentioned, what is required is a measure comparing the general level of prices in September quarter 2005 with the general level of prices in the calendar year 2000. The All groups CPI would be an appropriate choice. Because CPI index numbers are not published for calendar years, two steps are required to answer this question. The first is to derive an index for calendar year 2000. The second is to multiply the initial amount by the ratio of the index for September quarter 2005 to the index for 2000. The index for 2000 is obtained as the simple arithmetic average of the quarterly indexes for March (125.2), June (126.2), September (130.9) and December (131.3) 2000, giving 128.4. The index for September quarter 2005 is 149.8.

The answer is then given by: $200 x 149.8 / 128.4 = $233.33

Question 2:

- Data from the Household Expenditure Survey show that average weekly expenditure for each household on the purchase of motor vehicles increased from $42.64 in 1998–99 to $49.47 in 2003–04 (i.e. an increase of 16 per cent). Does this mean that households, on average, purchased 16 per cent more motor vehicles in 2003–04 than they did in 1998–99?

Index points and percentage changes continued

Response 2:

- This is an example of one of the most valuable uses that can be made of price indexes. Often the only viable method of collecting and presenting information about economic activity is in the form of expenditure or income expressed dollars. Although monetary aggregates are useful in their own right, economists and other analysts are frequently concerned with questions about volumes; for example, whether more goods and services have been produced in one period compared to another period. Comparison of monetary aggregates alone is not sufficient for this purpose as dollar values can change from one period to another caused by either changes in quantities or changes in prices or both.

13.23 To illustrate this, consider a simple example of expenditure on oranges in two periods. The product of the quantity and the price gives the expenditure in a period. Suppose that in the first period ten oranges were purchased at a price of $1.00 each, and in the second period fifteen oranges were purchased at a price of $1.50 each. Expenditure in period *1* would be $10.00 and in period *2* $22.50. Expenditure has increased by 125 per cent, yet the volume (i.e. the number of oranges) has only increased by 50 per cent with the difference being accounted for by a price increase of 50 per cent. In this example all the price and quantity data are known, so volumes can be compared directly. Similarly, if prices and expenditures are known, quantities can be derived.

13.24 However what if the actual prices and quantities are not known?. If expenditures are known, and a price index for oranges is available, the index numbers for the two periods can be used as if they were prices to adjust the expenditure for one period to remove the effect of the price change. If the price index for oranges was equal to 100.0 in the first period, the index for the second period would equal 150.0. Dividing expenditure in the second period by the index number for the second period, and multiplying this result by the index number for the first period provides an estimate of the expenditure that would have been observed in the second period had the prices remained as they were in the first period. This can easily be demonstrated using the oranges example:

$22.50/150.0 x 100.0 = $15.00 = 15 x $1.00

13.25 So, without ever knowing the actual volumes (quantities) in the two periods, the adjusted second period expenditure ($15.00), can be compared with the expenditure in the first period ($10.00) to derive a measure of the proportional change in volumes: $15/$10 = 1.50, which equals the ratio obtained directly from the comparison of the known volumes.

13.26 We now return to the question about expenditure on motor vehicles recorded in the HES in 1998–99 and 2003–04. As the HES data relate to the average expenditure of Australian households, the ideal price index would be one that covers the retail prices of motor vehicles for Australia as a whole. The price index that comes closest to meeting this ideal is the index for the Motor vehicles expenditure class of the CPI for the weighted average of the eight capital cities. The Motor vehicles index number for 1998–99 is 105.9 and for 2003–04 it is 103.1. Using these index numbers, recorded expenditure in 2003–04 ($49.47) can be adjusted to 1998–99 prices as follows: $49.47 x 105.9 / 103.1 = $50.81.

Index points and percentage changes continued

13.27 The adjusted 2003–04 expenditure of $50.81 can then be compared to the expenditure recorded in 1998–99 ($42.64) to deliver an estimate of the change in volumes. This indicates a volume increase of 19.2%.

Constructing special index series

13.28 Although the ABS produces a wide range of indexes from the CPI, there may be occasions when none of these exactly suit a user's special requirement. In this case the user may wish to construct their own index based on component indexes of the CPI. For example, suppose a researcher is interested in how petrol prices moved relative to the price of all other consumer goods and services since 1987. As the All groups CPI includes Automotive fuel, it is not the ideal measure for comparative purposes, so the researcher wishes to compile an All groups CPI excluding the Automotive fuel index.

13.29 The index can be compiled directly by using index points contributions (see examples above), and then indexing the points contributions to 1989–90=100.0. However, index points contributions are not typically published or available as a historical series, so it is necessary to work with the published index numbers. In addition, for CPI components that have a small weight, the use of index numbers can be more precise.

13.30 In constructing a series of this type, allowance should be made for the change in weights with each CPI series. Relevant data and weights from the CPI series are shown in Table 13.2.

13.2 INDEX VALUES AND WEIGHTS FOR LINKING EXAMPLE(a)

	CPI PUBLISHED INDEXES 8 CAPITAL CITIES							
	ALL GROUPS	*Automotive fuel*	*Weight (link quarter) Automotive fuel*	*11th series*	*12th series*	*13th series*	*Link factor*	*Composite index*
Dec 1986	79.8	90.4	4.79	79.3				79.3
Mar 1987	81.4	92.3		80.9				80.9
Jun 1987	82.6	89.6		82.2				82.2
Sep 1987	84.0	89.1		83.7				83.7
Dec 1987	85.5	92.8		85.1				85.1
Mar 1988	87.0	93.3		86.7				86.7
Jun 1988	88.5	87.6		88.5				88.5
Sep 1988	90.2	87.1		90.4				90.4
Dec 1988	92.0	85.0		92.4				92.4
Mar 1989	92.9	85.0		93.3				93.3
Jun 1989	95.2	92.1		95.4				95.4
Sep 1989	97.4	93.5		97.6				97.6
Dec 1989	99.2	97.9		99.3				99.3
Mar 1990	100.9	104.2		100.7				100.7
Jun 1990	102.5	104.3		102.4				102.4
Sep 1990	103.3	109.8		103.0				103.0
Dec 1990	106.0	132.7		104.7				104.7
Mar 1991	105.8	112.2		105.5				105.5
Jun 1991	106.0	106.0		106.0				106.0
Sep 1991	106.6	111.9		106.3				106.3
Dec 1991	107.6	111.5		107.4				107.4
Mar 1992	107.6	110.1		107.5				107.5
Jun 1992	107.3	110.6	4.70	107.1				107.1
Sep 1992	107.4	115.3			107.1		1.0000	107.1
Dec 1992	107.9	114.7			107.0			107.0
Mar 1993	108.9	110.9			107.6			107.6
Jun 1993	109.3	112.0			108.8			108.8
Sep 1993	109.8	112.2			109.2			109.2
Dec 1993	110.0	113.1			109.7			109.7
Mar 1994	110.4	108.3			109.8			109.8
Jun 1994	111.2	113.5			110.5			110.5
Sep 1994	111.9	114.2			111.1			111.1
Dec 1994	112.8	111.5			111.8			111.8
Mar 1995	114.7	113.7			112.9			112.9
Jun 1995	116.2	115.7			114.7			114.7
Sep 1995	117.6	120.0			116.2			116.2
Dec 1995	118.5	118.3			117.5			117.5
Mar 1996	119.0	117.7			118.5			118.5
Jun 1996	119.8	121.3			119.1			119.1
Sep 1996	120.1	118.8			119.7			119.7
Dec 1996	120.3	122.0			120.2			120.2
Mar 1997	120.5	123.9			120.2			120.2
Jun 1997	120.2	121.9			120.3			120.3
Sep 1997	119.7	120..9			120.1			120.1
Dec 1997	120.0	122.3			120.0			120.0
Mar 1998	120.3	117.0			120.5			120.5
Jun 1998	121.0	118.0	4.04		121.1	121.1	1.0000	121.1
Sep 1998	121.3	115.4				121.1		121.1
Dec 1998	121.9	113.7				122.2		122.2

(a) Base period of all indexes 1989–90 = 100.0

Constructing special index series continued

13.31 Now since the CPI is a fixed weighted index,

$$I_{AG} = W_{Af} I_{Af} + W_{Ag-Af} I_{Ag\text{-}Af}$$

where *I* is index, w is weight (expressed as a proportion) and in the subscripts Ag is All groups, Af is Automotive fuel. Noting $w_{Ag\text{-}Af} = 1\text{-}w_{Af}$ the desired index number can be estimated as:

Constructing special index series continued

$$I_{Ag-Af} = \frac{I_{Ag} - W_{Af} I_{Af}}{1 - W_{Af}}$$

13.32 When the 11th series CPI was introduced in the December quarter 1986, Automotive fuel had a weight of 4.79 per cent and an index of 90.4, and the All groups CPI was 79.8. Thus the index for All groups excluding Automotive fuel is calculated as 79.3 for that quarter. The fuel weight is held at 4.79 per cent until the June quarter 1992 when the 12th series CPI was introduced. The All groups excluding Automotive fuel index is calculated for the June quarter 1992 using both 11th series and 12th series CPI weights. This allows calculation of a link factor given by:

Link factor = (Index calculated using 11th series weight) / (Index calculated using 12th series weight)

13.33 The link factor is then applied to the index numbers calculated using the 12th series weights. In this case the link factor is 1.0. However, depending on the series being constructed, this may not always be so.

Precision and rounding

13.34 To ensure consistency from one publication to the next, the ABS uses a set of rounding conventions or rules for calculating and presenting the results. These conventions strike a balance between maximising the usefulness of the information for analytical purposes, and retaining a sense of the underlying precision of the estimates. Users need to consider these conventions when using the CPI for analytical or other special purposes.

13.35 Index numbers are always published relative to a base of 100.0. Index numbers and percentage changes are always published to one decimal place, and the percentage changes are calculated from the rounded index numbers. Index numbers for periods longer than a single quarter (e.g. for financial years) are calculated as the simple arithmetic average of the rounded quarterly index numbers.

13.36 Points contributions are published to two decimal places. Change in points contributions is calculated from the rounded points contributions. Rounding differences can arise in the points contributions where different levels of precision are used.

INTRODUCTION

14.1 The objective of this final chapter is to help improve users' knowledge and understanding of the array of Australian price statistics, and to facilitate the selection of the most appropriate measures for particular applications, such as the analysis of inflation, indexation, and business contract adjustment.

14.2 The CPI is part of a broader system of price statistics. There are a range of other price indexes that apply to different sectors of the economy. This chapter describes the other price measures produced by the ABS, both the direct measures of price change, and derived measures.

PRINCIPAL PRICE INDEXES

14.3 There are six principal price indexes in the system of economic statistics: the producer price indexes (PPIs), the consumer price index (CPI), the house price index (HPI), the export price index (EPI), the import price index (IPI), and the labour price index (LPI). These are well known and closely watched indicators of macro economic performance and the purchasing power of money, and are used as deflators in providing summary measures of the volume of goods and services produced and consumed. Consequently, these indexes are not only important tools in the design and conduct of the monetary and fiscal policy of the government, but also are of great utility in economic decisions throughout the private sector. These price indexes provide an integrated and consistent view of price developments in production, consumption, and international transactions in goods and services.

14.4 The ABS also produces two sets of quarterly price indexes on an outlays basis

- *Pensioner and Beneficiary Living Cost Indexes* (cat. no. 6467.0), which provides an index for age pensioners and other households whose principal source of income is government benefits, and
- *Analytical Living Cost Indexes for Selected Australian Household Types* (cat. no. 6463.0), which provides indexes for four population subgroups:
  - employees;
  - age pensioners;
  - self–funded retirees; and
  - other government transfer payment recipients.

DIRECT MEASURES OF PRICE CHANGE

14.5 All the principal price indexes described above are direct measures of price change; that is, they are derived through collecting and directly using price data. Each of these is described in the following paragraphs.

14.6 *Producer price indexes (PPIs)* measure the changes in the prices of goods and services as they either leave the place of production or enter the production process.

14.7 The ABS compiles a suite of quarterly input and output price indexes for different sectors of the Australian economy. As well as indexes relating to fairly narrowly defined components of the economy (such as the materials used in house building), more broadly based indexes are produced that cover significant parts of the economy. In particular, the Stage of Production price indexes cover the whole of the economy for each of the three stages of production (preliminary, intermediate, and final commodities). These measures show both the changes in the prices that producers receive for their outputs, as well as the changes in prices that producers pay for their material inputs. The following indexes are the major PPIs released by the ABS.

DIRECT MEASURES OF PRICE CHANGE *continued*

- Stage of Production (SOP) Producer Price Indexes — presented by stage of production, industry of origin and destination within the economy;
- Materials Used in Manufacturing Industries (MUMI) – an input price index;
- Articles Produced by Manufacturing Industries (APMI) – an output price index;
- Materials Used in House Building – an input price index;
- Selected output of Division E - Construction – an output price index;
- Materials Used in Coal Mining – an input price index;
- Selected output of Division I - Transport, postal and warehousing
- Selected output of Divisions J - Information media and telecommunications, Division O - Public administration and safety, and Division S - Other services – an output price index;
- Selected output of Division L - Rental, hiring and real estate services – an output price index;
- Selected output of Division M - Professional, scientific and technical services – an output price index;
- Selected output of Division N - Administrative and support services – an output price index;
- Property and business services industries – an output price index;
- Copper Materials Price Indexes; and
- Asphalt Supplied and Placed.

14.8 *International trade price indexes* measure the changes in the prices of goods either as they cross the customs frontier entering Australia or leaving Australia bound for another country. ABS produces two international trade price indexes:

- Import Price Index (IPI) – an input price index; and
- Export Price Index (EPI) – an output index.

14.9 *House price index (HPI)* measures the selling prices of houses in each of the eight capital cities. The information is presented in the form of price indexes constructed separately for established houses and for project homes. The index for project homes is compiled for use in calculating the house purchase expenditure class of the CPI. The index for established houses, although not contributing to the CPI, is compiled and published along with the project homes index in recognition of the widespread interest in information specifically relating to housing prices.

14.10 The valuation basis of the HPI is purchasers' prices. The HPI is published quarterly in *House Price Index, Eight Capital Cities* (cat. no. 6416.0).

14.11 *Labour price index (LPI)* measures changes in the price of labour services resulting from market pressures, and is unaffected by changes in the quality and quantity of work performed. Wages and salaries account for the majority of expenditure on labour costs, and an index of wage prices is published quarterly. Non–wage costs (such as superannuation, workers' compensation, payroll tax and paid holiday leave) cover the remaining part of labour costs. A non–wage price index is published annually, and when combined with the wage price index, the overall labour price index is the outcome.

14.12 As the LPI relates to labour costs incurred by employers in both the private and public sectors, the valuation basis for the LPI is purchasers' prices. Employers primarily engaged in agriculture, forestry and fishing are outside the scope of the LPI.

DIRECT MEASURES OF PRICE CHANGE *continued*

14.13 The LPI is published quarterly in *Labour Price Index, Australia* (cat. no. 6345.0).

DERIVED MEASURES OF PRICE CHANGE

National accounts price indexes

14.14 The Australian National Accounts include implicit price deflators (IPDs), and chain price indexes.

14.15 IPDs are obtained by dividing a current price value by the chain volume measure expressed in dollar terms. Thus IPDs are derived measures (hence the term implicit) and are not normally the direct measures of price change by which current price estimates are converted to volume measures. They reflect both changes in the prices between the two periods and changes in the composition of the aggregate between those periods.

14.16 Because the composition of an aggregate often changes from period to period, IPDs do not compare the price of a constant basket of goods and services between any two periods (except in comparing the base period with any other period). IPDs calculated from quarterly aggregates may be particularly affected by changes in the physical composition of those aggregates. As much of the quarter to quarter change in the physical composition is of a seasonal nature, IPDs derived from seasonally adjusted data are normally more reliable measures of price change than those calculated from unadjusted data. Even so, seasonally adjusting the series may not completely eliminate the effect of seasonal changes on the derived IPDs.

14.17 IPDs are available for Gross Domestic Product; exports of goods and services; imports of goods and services; and domestic final demand, and its four major components. They are published quarterly as part of *Australian National Accounts: National Income, Expenditure and Product* (cat. no. 5206.0), and *Balance of Payments and International Investment Position, Australia* (cat. no. 5302.0).

14.18 In contrast, the chain price indexes in the Australian National Accounts provide estimates of pure price change. They are annually re–weighted chain Laspeyres price indexes. These indexes encompass the whole of the economy. The chain price index most akin to the CPI is the index for Household Final Consumption Expenditure (HFCE). The main differences between the two are that the chain index for HFCE is re–weighted annually, and is broader in scope encompassing expenditure by all resident households and non–profit institutions serving households. For example, HFCE includes an estimate of expenditure on gambling, which is not included in the CPI, and it imputes rental payments for owner occupiers.

14.19 An annually chained price index weights price changes together using the previous year's weights for each quarter of the current year. The chain price indexes are calculated from the deflators used to derive the volume estimates, weighted together in the same way and at the same level of detail as the chain volume estimates. In those cases where quantity revaluation is used to derive volume estimates, the implicit price deflator at a detailed level of disaggregation is used in constructing the chain price indexes to minimise the effect of any compositional change.

Which price series should I use?

14.20 Quarter to quarter movements in fixed weighted price indexes are generally consistent with those for chain price indexes, for indexes with similar coverage. In general, for short term analysis of price change, the choice of index formula (fixed weighted or current weighted) has limited effect. Overall, the chain price indexes are

Which price series should I use? continued

considered the most suitable indexes for measuring actual price change, as the effects of compositional change are excluded from these indexes whereas IPDs are affected by compositional change. For more information on the use of price indexes, see Appendix 1.

APPENDIX 1 PRICE INDEXES AND CONTRACT PRICE INDEXATION

INTRODUCTION

1 Price indexes published by the Australian Bureau of Statistics (ABS) provide summary measures of the movements in various categories of prices over time. They are published primarily for use in Government economic analysis.

2 Price indexes are also often used in contracts by businesses and government to adjust payments and/or charges to take account of changes in categories of prices (Indexation Clauses).

3 This paper sets out a range of issues that should be taken into account by parties considering including an Indexation Clause in a contract using an ABS published price index.

THE ROLE OF THE ABS IN RESPECT OF INDEXATION CLAUSES

4 Although the ABS acknowledges that the various price indexes it publishes are used by businesses and government to adjust payments and/or charges, it neither endorses nor discourages such use.

5 The role of the ABS as the central statistical authority for the Australian government includes publishing price index data, and broadly explaining the underlying methodology and general limitations on such data. The ABS may provide information about what price indexes are published by it, but will not recommend or comment on the use (or otherwise) of the price indexes. In addition, the ABS does not advise, comment or assist in preparing or writing contracts and nor does it provide advice on disputes arising from contract interpretation.

IMPORTANT DISCLAIMER

6 This paper is intended to summarise information about the various price indexes currently published by the ABS and some of the issues which should be considered by persons in deciding to use such price indexes in Indexation Clauses. It is a brief description only and is not a comprehensive or exhaustive description of price indexes or of the issues which should be considered by persons in deciding to use price indexes or Indexation Clauses.

7 Neither the ABS, the Commonwealth of Australia, nor their employees, advisers or agents will in any way be liable to any person or body for any cost, expense, loss, claim or damage of any nature arising in any way out of or in connection with the statements, opinions or other representations, actual or implied, contained in or omitted from this paper or by reason of any reliance thereon by any person or body. This paper is not business, investment, legal or tax advice and persons should seek their own independent professional advice in respect of all matters in connection with the use of price indexes published by the ABS and their use in Indexation Clauses.

8 No representation or assurance is given that any ABS published price indexes are accurate, without error or appropriate for use by persons or that the ABS will continue to publish any of the price indexes, publish them at a particular time or that the methodologies for their determination will not be changed or that they will be suitable for use in any Indexation Clauses.

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?

9 The *Consumer Price Index (CPI)* is regarded as Australia's key measure of inflation. It is designed to provide a general measure of price inflation for the Australian household sector as a whole. The CPI measures changes over time in the prices of a wide range of consumer goods and services acquired by Australian metropolitan households and it is published quarterly, three to four weeks after the end of the reference quarter. It is revised only in exceptional circumstances, such as to correct a significant error. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?
continued

10 Several *Producer Price Indexes (PPIs)* are produced and published. Economy wide indexes are presented within a stage of production framework together with a set of indexes relating to specific industries (selected manufacturing, construction, mining and service industries). PPIs can be constructed as either output measures or input measures. Output indexes measure changes in the prices of goods and/or services sold by a defined sector of the economy while input indexes measure changes in the prices of goods and/or services purchased by a particular economic sector. PPIs are published quarterly, three to four weeks after the end of the reference quarter. Once published, the PPIs are revised infrequently, sometimes to incorporate improved methods in one or more of the components and occasionally to correct an error. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

11 The *International Trade Price Indexes* are intended to broadly measure changes in the prices of goods imported into Australia (the *Import Price Index (IPI)*) and goods exported from Australia (the *Export Price Index (EPI*)). The prices measured in the indexes exclude import duties, and exclude freight and insurance charges incurred in shipping goods between foreign and Australian ports. As the prices used in the indexes are expressed in Australian currency, changes in the relative value of the Australian dollar and overseas currencies can have a direct impact on price movements for the many commodities that are bought and sold in currencies other than Australian dollars. Both the IPI and EPI are published quarterly, three to four weeks after the end of the reference quarter. The IPI and EPI are not often revised. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

12 The *Labour Price Index (LPI)* broadly measures annual changes in the price of labour in the Australian labour market. The Wage Price Index (WPI) broadly measures changes in the wages paid by Australian businesses to employees and it is compiled and published quarterly, about six to seven weeks after the end of the reference quarter. The non–wage price indexes and the aggregate labour price index are only produced annually in respect of financial years ending 30 June. Individual indexes are compiled for various combinations of State/Territory, sector (private/public), and broad industry groups. The 'headline' wage price index is that for the total hourly rates of pay, excluding bonuses, for Australia, and it is published in original, seasonally adjusted and trend terms. The seasonally adjusted and trend series for some quarters are revised as extra quarters are included in the series analysed for seasonal influences, but the non–seasonally adjusted (i.e. original) series is not revised in normal circumstances. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

13 The *House Price Index (HPI)* is designed to provide a measure of the inflation or deflation in the price of the stock of established houses over time. Separate indexes are produced for each capital city in Australia, and these indexes are combined to produce a weighted average index of the eight capital cities. The HPI is published quarterly, approximately five weeks after the end of the reference quarter. The figures published for the two most recent quarters are regarded as preliminary and are revised in subsequent publications as more data is collected. As is the case with all price indexes,

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?
continued

the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

14 The *Pensioner and Beneficiary Living Cost Index (PBLCI)* is designed to assess the impact of changes in out-of-pocket living expenses of households whose principal source of income is from government pensions and benefits. The main conceptual difference between the living cost indexes and the CPI are that the ALCIs and PBLCI are constructed on an outlays basis, compared with the CPI which is constructed on an acquisitions basis. The PBLCI is published quarterly, approximately seven weeks after the end of the reference quarter. It is revised only in exceptional circumstances, such as to correct a significant error. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

15 *The Analytical Living Cost Indexes (ALCIs)* are designed to measure the impact of changes in out-of-pocket living expenses of four Australian household types; employee, age pensioner, other government transfer recipient and self-funded retiree households. The ALCIs are an analytical series produced as a by-product of the CPI, with the main conceptual difference being the ALCIs are constructed on an outlays basis, while the CPI is constructed on an acquisitions basis. The ALCI is published quarterly, approximately seven weeks after the end of the reference quarter. It is revised only in exceptional circumstances, such as to correct a significant error. As is the case with all price indexes, the reference base (i.e. the period in which the index is set equal to 100.0) will be changed periodically. The index number levels for all periods will be changed by this process and it may also result in differences, due to rounding, between the percentage changes published on the old base and those on the new base.

16 Price indexes covering a wide range of economic transactions are produced as part of the National Accounts. Two types of national accounts based price index are published. The first type is referred to as *chain price indexes* which are calculated for all expenditure components and subcomponents of *Gross Domestic Product (GDP)*. The components are: government consumption, household consumption, private capital formation, public capital formation, and imports and exports of goods and services. Chain price indexes are also calculated for GDP and other macroeconomic aggregates such as Domestic Final Demand and Gross National Expenditure. Chain price indexes use as their weights the volumes of expenditure in the previous financial year (ending 30 June). The second type of price index is referred to as implicit price deflators (IPDs) which are compiled at the same levels as for the chain price indexes but which use for their weights the volumes of expenditure in the current period. IPDs have long been used to provide macro economic measures of price change and are usually used in seasonally adjusted form. Both chain price indexes and IPDs are compiled quarterly and are published roughly two months after the reference period. Unlike the other price indexes listed above, the National Accounts price indexes are often revised, sometimes to a significant extent. In addition, they are re–referenced to a new base year every year, so the level of the index changes regularly, although the percentage changes for earlier periods are not normally affected by this process, other than for rounding differences. These two characteristics are important considerations if National Accounts price indexes are to be used in contracts.

GENERAL MATTERS TO CONSIDER WHEN WRITING INDEXATION CLAUSES

17 Considerable care should be taken when considering and using Indexation Clauses. Appropriate professional advice should be obtained when considering the use of an Indexation Clause or any ABS published price indexes.

18 The following are some general matters to consider when considering an ABS published price index in an Indexation Clause. It is not an exhaustive list. These matters are provided subject to the disclaimer outlined above.

- *Establish the base payment, selling or purchase price subject to indexation.* Specify the item subject to indexation as precisely as possible (e.g. rent, wage rate, commodity, etc.). Provide the effective date (e.g. quarter or year) of this base price, because it is the period from which the base payment, etc. will be indexed. Indicate the relationship between the effective date of the base payment, etc. and the price index being used in the indexation (e.g. a contract coming into effect on 5 January 2005 could have a price indexed using the most recent available quarterly data (in this case, September quarter 2004) as its starting point or by using the 2003–04 financial year as the starting point, depending on the intent of the parties).
- *Select an appropriate index or indexes.* The index or indexes selected will affect the price change recorded and should be chosen carefully to best represent the item subject to indexation and the intention of the parties.
- *Clearly identify the selected index and cite an appropriate source.* The Indexation Clause of a contract should identify the selected index by its complete title and any identifying code. For example, in the case of the CPI, it should be specified whether the index to be used is the All groups CPI, or a selected sub component index of the CPI, and also whether it is the weighted average of the eight capital cities or for a particular city. In the case of PPIs, the broad alternatives that could be specified are stage–of–production, or commodity, or industry based indexes. The specific component index being used should be explicitly identified. For LPIs, the broad characteristics that could be specified are national, state or industry group indexes. Contracting parties should cite specific index series rather than table numbers and/or table titles in their indexation contracts because table numbers and the contents of tables are subject to change.
- *State the frequency of price adjustment.* The Indexation Clause should specify the frequency at which price adjustments are to be made, such as quarterly, half yearly, annually etc. It may be useful to set out the method to be used in calculating the indexation factor, particularly if the indexation is half–yearly or annually. For example, different results are generally obtained for annual estimates calculated as the change in the latest quarter over the same quarter of the preceding year (e.g. June quarter 2004 over June quarter 2003) compared with those calculated as the average of the latest four quarters over the average of the preceding four quarters (e.g. the average of the four quarters from September quarter 2003 to June quarter 2004 over the average of the four quarters from September quarter 2002 to June quarter 2003). Similar issues apply to half yearly changes.
- *Provide for renamed, varied or discontinued price indexes.* Occasionally price indexes can be reviewed or restructured, which may result in some component index series being renamed, discontinued or the timing of the publication of the index changed. Sometimes an index is permanently discontinued (for example, when a commodity declines in market importance). Indexation Clauses should contain a default mechanism for determining an equivalent appropriate index or price adjustment mechanism should this occur.

GENERAL MATTERS TO CONSIDER WHEN WRITING INDEXATION CLAUSES *continued*

- *Provide for potential revisions to the price index data.* The quarterly and annual movements recorded by the ABS price indexes are not often revised (apart from the seasonally adjusted wage price index and trend wage price index, which can be revised as extra terms are added to the end of the series). Generally, situations in which revisions do occur include correcting an error that has arisen in the data first published. It could be useful for parties to set out agreed procedures to deal with the possibility of revisions occurring. For example, an Indexation Clause could state that a price is to be indexed by the percentage change first published in the relevant (indexation) series for each period covered by the contract, or it could be indexed by the latest available data at the point at which the indexation clause takes effect.
- *Avoid locking indexes used for Indexation Clauses into any particular reference base period.* Occasionally the reference base period of a price index (i.e. the period in which the index is set equal to 100.0) can be changed. This will result in a change in the index level from that which was previously available. Relative movements of any series over time, however, are not generally affected by a reference base change (except for rounding differences). Indexation Clauses should be drafted so that the parties to them are not adversely affected by a change to the reference base period of a price index.
- *Define the formula for the price adjustment calculation.* Often the change in payments or price is directly proportional to the percentage change in the selected index between two specified time periods. The following CPI example, which has a reference base year of 1989–90 = 100.0, illustrates the computation of percentage change:

Index number for the All Groups CPI for Sydney in 2003–04		= 144.1
less index number for the corresponding series in 2002–03		= 141.1
Change in index points		= 3.0
Percentage change	3.0/141.1 x 100	= 2.1%

- *Allow for negative price movements.* Any potential variations from the recorded price movements should be explicitly set out. For example, in some Indexation Clauses, there is no change in the contract price in a period in which there is a fall in the price index being used for indexation. In some cases, there will be a catch up once the index rises again.

APPENDIX 2 WEIGHTING PATTERN FOR THE CPI – JUNE QUARTER 2005

A2.1 WEIGHTING PATTERN, 15TH SERIES CPI —JUNE QUARTER 2005, EIGHT CAPITAL CITIES

PERCENTAGE CONTRIBUTION TO THE ALL GROUPS CPI JUNE QUARTER 2005

	Group	*Subgroup*	*Expenditure Class*
FOOD	**15.44**		
Dairy and related products		**1.19**	
Milk			0.55
Cheese			0.32
Ice cream and other dairy products			0.31
Bread and cereal products		**1.72**	
Bread			0.63
Cakes and biscuits			0.71
Breakfast cereals			0.20
Other cereal products			0.18
Meat and seafood's		**2.42**	
Beef and Veal			0.50
Lamb and mutton			0.26
Pork			0.16
Poultry			0.48
Bacon and Ham			0.23
Other fresh and processed meat			0.38
Fish and other seafood			0.41
Fruit and vegetables		**2.11**	
Fruit			0.95
Vegetables			1.15
Non-alcoholic drinks and snack food		**1.96**	
Soft drinks waters and juices			0.91
Snacks and confectionery			1.05
Meals out and take away foods		**4.56**	
Restaurant meals			2.00
Take away and fast foods			2.56
Other food		**1.49**	
Eggs			0.10
Jams, honey and sandwich spreads			0.15
Tea, coffee and food drinks			0.24
Food additives and condiments			0.27
Fats and oils			0.19
Food n.e.c.			0.54
ALCOHOL AND TOBACCO	**6.79**		
Alcoholic drinks		**4.38**	
Beer			1.93
Wine			1.57
Spirits			0.87
Tobacco		**2.41**	
Tobacco			2.41
CLOTHING AND FOOTWEAR	**3.91**		
Men's clothing		**0.75**	
Men's outerwear			0.64
Men's underwear, nightwear and socks			0.11
Women's clothing		**1.41**	
Women's outerwear			1.13
Women's underwear, nightwear and hosiery			0.27
Children's and infants' clothing		**0.40**	
Children's and infants' clothing			0.40
Footwear		**0.64**	
Men's footwear			0.18
Women's footwear			0.34
Children's footwear			0.12
Accessories and clothing services		**0.72**	
Accessories			0.56
Clothing services and shoe repair			0.16

A2.1 WEIGHTING PATTERN, 15TH SERIES CPI —JUNE QUARTER 2005, EIGHT CAPITAL CITIES *continued*

PERCENTAGE CONTRIBUTION TO THE ALL GROUPS CPI JUNE QUARTER 2005

	Group	*Subgroup*	*Expenditure Class*
HOUSING	**19.53**		
Rents		**5.22**	
Rents			5.22
Utilities		**3.10**	
Electricity			1.63
Gas and other household fuels			0.70
Water and sewerage			0.77
Other housing		**11.21**	
House purchase			7.87
Property rates and charges			1.16
House repairs and maintenance			2.18
HOUSEHOLD CONTENTS AND SERVICES	**9.61**		
Furniture and furnishings		**3.13**	
Furniture			1.96
Floor and window coverings			0.78
Towels and linen			0.39
Household appliances utensils and tools		**1.76**	
Major household appliances			0.67
Small electric household appliances			0.27
Glassware, tableware and household utensils			0.47
Tools			0.35
Household Supplies		**2.91**	
Household cleaning agents			0.33
Toiletries and personal care products			1.18
Other Household Supplies			1.40
Household Services		**1.81**	
Childcare			0.45
Hairdressing and personal care services			0.75
Other household services			0.60
HEALTH	**4.70**		
Health services		**3.56**	
Hospital and medical services			2.77
Optical services			0.12
Dental services			0.67
Pharmaceuticals		**1.14**	
Pharmaceuticals			1.14
TRANSPORTATION	**13.11**		
Private motoring		**12.38**	
Motor vehicles			4.90
Automotive fuel			3.78
Motor vehicle repair and servicing			1.99
Motor vehicle parts and accessories			0.68
Other motoring charges			1.02
Urban transport fares		**0.73**	
Urban transport fares			0.73
COMMUNICATION	**3.31**		
Communication		**3.31**	
Postal			0.11
Telecommunication			3.20

A2.1 WEIGHTING PATTERN, 15TH SERIES CPI —JUNE QUARTER 2005, EIGHT CAPITAL CITIES *continued*

PERCENTAGE CONTRIBUTION TO THE ALL GROUPS CPI JUNE QUARTER 2005

	Group	*Subgroup*	*Expenditure Class*
RECREATION	**11.55**		
Audio, visual and computing		**2.92**	
Audio, visual and computing equipment			1.53
Audio, visual and computing media and services			1.38
Books, newspapers and magazines		**0.85**	
Books			0.44
Newspapers and magazines			0.41
Sport and other recreation		**3.72**	
Sport and recreational equipment			0.55
Toys, games and hobbies			0.51
Sports participation			0.73
Pets, pet food and supplies			0.40
Pet Services including veterinary			0.44
Other recreational activities			1.09
Holiday travel and accommodation		**4.06**	
Domestic holiday travel and accommodation			2.27
Overseas holiday travel and accommodation			1.79
EDUCATION	**2.73**		
Education		**2.73**	
Preschool and primary education			0.53
Secondary education			0.94
Tertiary education			1.26
FINANCIAL AND INSURANCE SERVICES	**9.31**		
Financial services		**7.81**	
Deposit and Loan Facilities			4.47
Other Financial Services			3.34
Insurance services		**1.50**	
Insurance services			1.50
ALL GROUPS(a)	**100.00**	**100.00**	**100.00**

(a) Percentages may not add due to rounding.

APPENDIX 3 TRADABLES, NON-TRADABLES AND VOLATILE ITEMS

INTRODUCTION

1 *All groups, tradables component:* comprises all items whose prices are largely determined on the world market.

2 *All groups, non–tradables component:* comprises all items whose prices are largely determined in the domestic market. It comprises all items not included in the All groups, tradables component.

3 *All groups, excluding volatile items:* comprises the All groups CPI excluding Fruit and vegetables and Automotive fuel.

4 *Market goods and services, excluding volatile items:* in addition to the items excluded from the series All groups, excluding volatile items, this series also excludes Utilities, Property rates and charges, Child care, Health, Other motoring charges, Urban transport fares, Postal, and Education.

TRADABLES AND NON–TRADABLES

5 The tradables component comprises all items whose prices are largely determined on the world market. A commodity is defined as tradable if a significant proportion of its domestic output is exported or if a significant proportion of its demand for domestic consumption is imported. For the purpose of this analysis, the most current input–output data is used and an arbitrary threshold of 10 per cent is used to determine whether an industry is exportable or importable. All commodities which are classified as importable and/or exportable form part of the tradable component. The non-tradable component consists of the remaining commodities.

6 The following table shows, for each CPI group, which expenditure classes are classified as tradable and which are classified as non–tradable. In aggregate, fifty expenditure classes, accounting for approximately 42 per cent of the CPI by weight, are classified as tradable. The remaining forty expenditure classes, accounting for approximately 58 per cent of the CPI by weight, are classified as non–tradable.

A3.1 TRADABLES AND NON-TRADABLES

TRADABLES	*NON-TRADABLES*
Food	**Food**
Cheese	Milk
Ice cream and other dairy products	Bread
Other cereal products	Cakes and biscuits
Beef and veal	Breakfast cereals
Lamb and mutton	Poultry
Pork	Bacon and ham
Other fresh and processed meat	Restaurant meals
Fish and other seafood	Take away and fast foods
Fruit	Eggs
Vegetables	Jams, honey and sandwich spreads
Soft drinks, waters and juices	
Snacks and confectionery	
Tea, coffee and food drinks	
Food additives and condiments	
Fats and oils	
Food n.e.c.	
Alcohol and tobacco	**Alcohol and tobacco**
Wine	Beer
Spirits	
Tobacco	

A3.1 TRADABLES AND NON-TRADABLES *continued*

TRADABLES	*NON-TRADABLES*
Clothing and footwear	**Clothing and footwear**
Men's outerwear	Clothing services and shoe repair
Men's underwear, nightwear and socks	
Women's outerwear	
Women's underwear, nightwear and hosiery	
Children's and infants' clothing	
Men's footwear	
Women's footwear	
Children's footwear	
Clothing accessories and jewellery	
Fabrics and knitting wool	
Housing	**Housing**
	Rents
	Electricity
	Gas and other household fuels
	Water and sewerage
	House purchase
	Property rates and charges
	House repairs and maintenance
Household contents and services	**Household contents and services**
Furniture	Household services
Floor and window coverings	Hairdressing and personal care services
Towels and linen	Child care
Major household appliances	
Small electric household appliances	
Glassware, tableware and household utensils	
Tools	
Household cleaning agents	
Toiletries and personal care products	
Other household supplies	
Health	**Health**
Pharmaceuticals	Hospital and medical services
	Optical services
	Dental services
Transportation	**Transportation**
Motor vehicles	Motor vehicle repair and servicing
Automotive fuel	Other motoring charges
Motor vehicle parts and accessories	Urban transport fares
Communication	**Communication**
	Postal
	Telecommunication
Recreation	**Recreation**
Audio, visual and computing equipment	Sports participation
Audio, visual and computing media and services	Pet services including veterinary
Books	Other recreational activities
Newspapers and magazines	Domestic holiday travel and accommodation
Sports and recreational equipment	
Toys, games and hobbies	
Pets, pet foods and supplies	
Overseas holiday travel and accommodation	
Education	**Education**
	Preschool and primary education
	Secondary education
	Tertiary education

TRADABLES AND NON–TRADABLES *continued*

A3.1 TRADABLES AND NON-TRADABLES *continued*

TRADABLES	*NON-TRADABLES*
Financial and insurance services	**Financial and insurance services**
	Deposit and loan facilities
	Other financial services
	Insurance services

ALL GROUPS EXCLUDING "VOLATILE ITEMS"

7 The All groups excluding 'volatile items' series comprises the All groups CPI excluding the Fruit, Vegetables and Automotive fuel expenditure classes.

MARKET GOODS AND SERVICES, EXCLUDING 'VOLATILE' ITEMS

8 The series *Market goods and services, excluding volatile items* excludes the following expenditure classes.

- Fruit and vegetables;
- Automotive fuel;
- Electricity;
- Gas and other household fuels;
- Water and sewerage;
- Property rates and charges;
- Child care;
- Hospital and medical services;
- Optical services;
- Dental services;
- Pharmaceuticals;
- Other motoring charges;
- Urban transport fares;
- Postal;
- Preschool and primary education;
- Secondary education; and
- Tertiary education.

APPENDIX 4 ILO RESOLUTION CONCERNING CONSUMER PRICE INDICES

INTRODUCTION

This appendix has been extracted from the website of the International Labour Organization (ILO). It reproduces the resolution concerning consumer price indices adopted by the Seventeenth International Conference of Labour Statisticians, 2003. The resolution can be found at

http://www.ilo.org/public/english/bureau/stat/download/res/cpi2.pdf.

It is also reproduced at annex 3 of the international Consumer Price Index Manual published by the ILO.

RESOLUTION II

Resolution concerning consumer price indices

PREAMBLE

The Seventeenth International Conference of Labour Statisticians,

Having been convened at Geneva by the Governing Body of the ILO and having met from 24 November to 3 December 2003,

Recalling the resolution adopted by the Fourteenth International Conference of Labour Statisticians concerning consumer price indices and recognizing the continuing validity of the basic principles recommended therein and, in particular, the fact that the consumer price index (CPI) is designed primarily to measure the changes over time in the general level of prices of goods and services that a reference population acquires, uses or pays for,

Recognizing the need to modify and broaden the existing standards in the light of recent methodological and computational developments to enhance the usefulness of the international standards in the provision of technical guidelines to all countries,

Recognizing the usefulness of such standards in enhancing the international comparability of the statistics,

Recognizing that the CPI is used for a wide variety of purposes and that governments should be encouraged to identify the (priority) purposes a CPI is to serve, to provide adequate resources for its compilation, and to guarantee the professional independence of its compilers,

Recognizing that the (priority) objectives and uses of CPI differ among countries and that, therefore, a single standard could not be applied universally,

Recognizing that the CPI needs to be credible to observers and users, both national and international, and that better understanding of the principles and procedures used to compile the index will enhance the users' confidence in the index,

Agrees that the principles and methods used in constructing a CPI should be based on the guidelines and methods that are generally accepted as constituting good statistical practices;

Adopts, this third day of December 2003, the following resolution which replaces the previous one adopted in 1987:

The nature and meaning of a consumer price index

1. The CPI is a current social and economic indicator that is constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use or pay for consumption.

2. The index aims to measure the change in consumer prices over time. This may be done by measuring the cost of purchasing a fixed basket of consumer goods and services of constant quality and similar characteristics, with the products in the basket being selected to be representative of households' expenditure during a year or other specified period. Such an index is called a fixed-basket price index.

The nature and meaning of a consumer price index continued

3. The index may also aim to measure the effects of price changes on the cost of achieving a constant standard of living (i.e. level of utility or welfare). This concept is called a cost-of-living index (COLI). A fixed basket price index, or another appropriate design, may be employed as an approximation to a COLI.

The uses of a consumer price index

4. The CPI is used for a wide variety of purposes, the two most common ones being: (i) to adjust wages as well as social security and other benefits to compensate, partly or completely, for changes in the cost of living or in consumer prices; and (ii) to provide an average measure of price inflation for the household sector as a whole, for use as a macro- economic indicator. CPI subindices are also used to deflate components of household final consumption expenditure in the national accounts and the value of retail sales to obtain estimates of changes in their volume.

5. CPIs are also used for other purposes, such as monitoring the overall rate of price inflation for all sectors of the economy, the adjustment of government fees and charges, the adjustment of payments in commercial contracts, and for formulating and assessing fiscal and monetary policies and trade and exchange rate policies. In these types of cases, the CPI is used as more appropriate measures do not exist at present, or because other characteristics of the CPI (e.g. high profile, wide acceptance, predictable publication schedule, etc.) are seen to outweigh any conceptual or technical deficiencies.

6. Given that the CPI may be used for many purposes, it is unlikely that one index can perform equally satisfactorily in all applications. It may therefore be appropriate to construct a number of alternative price indices for specific purposes, if the requirements of the users justify the extra expense. Each index should be properly defined and named to avoid confusion and a "headline" CPI measure should be explicitly identified.

7. Where only one index is compiled, it is the main use that should determine the type of index compiled, the range of goods and services covered, its geographic coverage, the households it relates to, as well as to the concept of price and the formula used. If there are several major uses, it is likely that compromises may have to be made with regard to how the CPI is constructed. Users should be informed of the compromises made and of the limitations of such an index.

Scope of the index

8. The scope of the index depends on the main use for which it is intended, and should be defined in terms of the type of households, geographic areas, and the categories of consumer goods and services acquired, used or paid for by the reference population.

9. If the primary use of the CPI is for adjusting money incomes, a relevant group of households, such as wage and salary earners, may be the appropriate target population. For this use, all consumption expenditures by these households, at home and abroad, may be covered. If the primary use of the CPI is to measure inflation in the domestic economy, it may be appropriate to cover consumption expenditures made within the country, rather than the expenditures of households resident within the country.

10. In general, the reference population for a national index should be defined very widely. If any income groups, types of households or particular geographic areas are excluded, for example, for cost or practical considerations, then this should be explicitly stated.

11. The geographic scope refers to the geographic coverage of price collection and of consumption expenditures of the reference population and both should be defined as widely as possible, and preferably consistently. If price collection is restricted to particular areas due to resource constraints, then this should be specified. The geographic coverage of the consumption expenditure may be defined either as covering consumption expenditure of the resident population (resident consumption) or consumption expenditure within the country (domestic consumption).

Scope of the index continued

12. Significant differences in the expenditure patterns and/or price movements between specific population groups or regions may exist, and care should be taken to ensure that they are represented in the index. Separate indices for these population groups or regions may be computed if there is sufficient demand to justify the additional cost.

13. In accordance with its main purpose, the CPI should conceptually cover all types of consumer goods and services of significance to the reference population, without any omission of those that may not be legally available or may be considered socially undesirable. Where appropriate, special aggregates may be constructed to assist those users who may wish to exclude certain categories of goods or services for particular applications or for analysis. Whenever certain goods or services have been excluded from the index, this should be clearly documented.

14. Goods and services purchased for business purposes, expenditures on assets such as works of art, financial investment (as distinct from financial services), and payments of income taxes, social security contributions and fines are not considered to be consumer goods or services and should be excluded from the coverage of the index. Some countries regard expenditures on the purchase of houses entirely as a capital investment and, as such, exclude them from the index.

Acquisition, use or payment

15. In determining the scope of the index, the time of recording and valuation of consumption, it is important to consider whether the purposes for which the index is used are best satisfied by defining consumption in terms of "acquisition", "use", or "payment". [31] The "acquisition" approach is often used when the primary purpose of the index is to serve as a macroeconomic indicator. The "payment" approach is often used when the primary purpose of the index is for the adjustment of compensation or income. Where the aim of the index is to measure changes in the cost of living, the "use" approach may be most suitable. The decision regarding the approach to follow for a particular group of products should in principle be based on the purpose of the index, as well as on the costs and the acceptability of the decision to the users who should be informed of the approach followed for different products. Because of the practical difficulties in uniformly defining consumption and estimating the flow of services provided by other durable goods in terms of "use", it may be necessary to adopt a mixed approach, e.g. "use" for owner-occupied housing and "acquisition" or "payments" basis for other consumer durables.

16. The differences between the three approaches are most pronounced in dealing with products for which the times of acquisition, use and payment do not coincide, such as owner-occupied housing, durable goods and products acquired on credit.

17. The most complex and important of the products mentioned above is owner-occupied housing. In most countries, a significant proportion of households are owner-occupiers of their housing, with the housing being characterized by a long useful life and a high purchase outlay (price). Under the "acquisition" approach, the value of the new dwellings acquired in the weights reference period may be used for deriving the weight (and the full price of the dwelling is included in the CPI at the time of acquisition, regardless of when the consumption is taking place). Under the "payment" approach, the weights reflect the amounts actually paid out for housing (and the prices enter the CPI in the period(s) when the prices are paid). Under the "use" approach the weights are based on the value of the flow of housing services consumed during the weights reference period estimated using an implicit or notional cost (and prices or estimated opportunity costs enter the CPI when the consumption is taking place).

Č1 See Annex 1

Acquisition, use or payment continued

18. Own-account consumption, remuneration in kind and/or goods and services provided without charge or subsidized by governments and non-profit institutions serving households may be important in some countries where the purpose of the index is best satisfied by defining consumption in terms of "use" or "acquisition" (under the payment approach these are out of scope). The inclusion of these products will require special valuation and pricing techniques.

Basket and weights

19. Decisions on the composition of the basket and the weights follow directly from the scope, as well as from the choice between the "acquisition", "use" or "payment" approaches.

20. Once defined, the expenditures that fall within the scope of the index should be grouped into similar categories in a hierarchical classification system, e.g. divisions/groups/classes, for compilation as well as analytical purposes. There should be consistency between the classification used for index compilation and the one used for household expenditure statistics. The CPI classification should meet the needs of users for special subindices. For the purposes of international comparisons, the classification should also be reconcilable with the most recent version of the UN Classification of Individual Consumption According to Purpose (COICOP), at least at its division level.[32]

21. In order to facilitate the analysis and interpretation of the results of the index, it may be desirable to classify goods and services according to various supplementary classifications, e.g. source of origin, durability and seasonality. Calculation of the CPI by using various classifications should generate the same overall results as the original index.

22. The classification should also provide a framework for the allocation of expenditure weights. Expenditures at the lowest level of the classification system, expressed as a proportion of the total expenditure, determine the weights to be used at this level. When the weights are to remain fixed for several years, the objective should be to adopt weights that are representative of the contemporary household behaviour.

23. The two main sources for deriving the weights are the results from household expenditure surveys (HESs) and national accounts estimates on household consumption expenditure. The results from an HES are appropriate for an index defined to cover the consumption expenditures of reference population groups resident within the country, while national account estimates are suitable for an index defined to cover consumption expenditures within the country. The decision about what source or sources to use and how they should be used depends on the main purpose of the index and on the availability and quality of appropriate data.

24. The information from the main source (HESs or national accounts) should be supplemented with all other available information on the expenditure pattern. Sources of such information that can be used for disaggregating the expenditures are surveys of sales in retail outlets, point-of-purchase surveys, surveys of production, export and import data and administrative sources. Based on these data the weights for certain products may be further disaggregated by region and type of outlet. Where the data obtained from different sources relate to different periods, it is important to ensure, before weights are allocated, that expenditures are adjusted so that they have the same reference period.

Č2 See Annex 4.

Basket and weights continued

25. Where the weight reference period differs significantly from the price reference period, the weights should be price updated to take account of price changes between the weights reference period and price reference period. Where it is likely that price updated weights are less representative of the consumption pattern in the price reference period this procedure may be omitted.

26. Weights should be reviewed and if appropriate revised as often as accurate and reliable data are available for this to be done, but at least once every five years. Revisions are important to reduce the impact on the index of product substitutions and to ensure the basket of goods and services and their weights remain representative.[33] For some categories, it may be necessary to update the weights more frequently as such weights are likely to become out of date more quickly than higher-level weights. In periods of high inflation, the weights should be updated frequently.

27. When a new basket (structure or weights) replaces the old, a continuous CPI series should be created by linking [34]together the index numbers based on the new basket of goods and services to those based on the earlier basket. The particular procedure used to link index number series will depend on the particular index compilation technique used. The objective is to ensure that the technique used to introduce a new basket does not, of itself, alter the level of the index.

28. Completely new types of goods and services (i.e. goods and services that cannot be classified to any of the existing elementary aggregates) should normally be considered for inclusion only during one of the periodic review and reweighting exercises. A new model or variety of an existing product that can be fitted within an existing elementary aggregate should be included at the time it is assessed as having a significant and sustainable market share. If a quality change is detected an appropriate quality adjustment should be made.[35]

29. Some products such as seasonal products, insurance, second-hand goods, expenditure abroad, interest, own production, expenditures on purchase and construction of dwellings, etc., may need special treatment when constructing their weights. The way these products are dealt with should be determined by the main purpose of the index, national circumstances and the practicalities of compilation.

30. Seasonal products should be included in the basket. It is possible to use: (i) a fixed weight approach which uses the same weight for the seasonal product in all months using an imputed price in the out-of-season months; or (ii) a variable weights approach where a changing weight is attached to the product in various months. The decision on the approach should be based on national circumstances.

31. The expenditure weights for second-hand goods should be based either on the net expenditure of the reference population on such goods, or the gross expenditure, depending on the purpose of the index.

32. When consumption from own production is within the scope of the index, the weights should be based on the value of quantities consumed from own production. Valuation of consumption from own production should be made on the basis of prices prevailing on the market, unless there is some reason to conclude that market prices are not relevant or cannot be reliably observed, or there is no interest in using hypothetically imputed prices. In this case the expenditures and prices for the inputs into the production of these goods and services could be used instead. The third option is to valuate it by using quality adjusted market prices.

3Č See Annex 1.
Č4 See Annex 2.
Č5ŭŭŭSee Annex 2.

Sampling for price collection

33. A CPI is an estimate based on a sample of households to estimate weights, and a sample of zones within regions, a sample of outlets, a sample of goods and services and a sample of time periods for price observation.

34. The sample size and sample selection methods for both outlets and the goods and services for which price movements over time are to be observed should ensure that the prices collected are representative and sufficient to meet the requirements for the accuracy of the index, but also that the collection process is cost-effective. The sample of prices should reflect the importance, in terms of relative expenditures, of the goods and services available for purchase by consumers in the reference period, the number, types and geographic spread of outlets that are relevant for each good and service, and the dispersion of prices and price changes across outlets.

35. Probability sampling techniques are the preferred methods, in principle, as they permit sound statistical inference and control over the representativity of the sample. In addition, they permit estimation of sampling variation (errors). However, they may be costly to implement and can result in the selection of products that are very difficult to price to constant quality.

36. In cases where appropriate sampling frames are lacking and it is too costly to obtain them, samples of outlets and products have to be obtained by non-probability methods. Statisticians should use available information and apply their best judgement to ensure that representative samples are selected. The possibility of applying cut-off or detailed quota sampling[36] strategy may be considered, especially where the sample size is small. A mixture of probability and non-probability sampling techniques may be used.

37. Efficient and representative sampling, whether random or purposive, requires comprehensive and up-to-date sampling frames for outlets and products. Sample selection can be done either by head office from centrally held sampling frames, or in the field by price collectors, or by a mixture of the two. In the first case, price collectors should be given precise instructions on which outlets to visit and which products to price. In the second case, price collectors should be given detailed and unambiguous guidelines on the local sampling procedures to be adopted. Statistical business registers, business telephone directories, results from the point-of-purchase surveys or from surveys of sales in different types of outlets, and lists of Internet sellers may be used as sampling frames for the central selection of outlets. Catalogues or other product lists drawn up by major manufacturers, wholesalers or trade associations, or lists of products that are specific to individual outlets such as large supermarkets might be used as the sampling frame for selection of products. Data scanned by bar-code readers at the cashier's desk (electronic databases) can be particularly helpful in the selection of goods and services.

38. The sample of outlets and of goods and services should be reviewed periodically and updated where necessary to maintain its representativeness.

Index calculation

39. The compilation of a CPI consists of collecting and processing price and expenditure data according to specified concepts, definitions, methods and practices. The detailed procedures that are applied will depend on particular circumstances.

40. CPIs are calculated in steps. In the first step, the elementary aggregate indices are calculated. In the subsequent steps, higher level indices are calculated by aggregating the elementary aggregate indices.

Č6 See Annex 1.

Elementary aggregate indices

41. The elementary aggregate is the smallest and relatively homogeneous set of goods or services for which expenditure data are defined (used) for CPI purposes. It is the only aggregate for which an index number is constructed without any explicit expenditure weights, although other kinds of weights might be explicitly or implicitly introduced into the calculation. The set of goods or services covered by an elementary aggregate should be similar in their end-uses and are expected to have similar price movements. They may be defined not only in terms of their characteristics but also in terms of the type of location and outlet in which they are sold. The degree of homogeneity achieved in practice will depend on the availability of corresponding expenditure data.

42. An elementary index is a price index for an elementary aggregate. As expenditure weights usually cannot be attached to the prices or price relatives for the sampled products within the elementary aggregate, an elementary index is usually calculated as an unweighted average of the prices or price relatives. When some information on weights is available, this should be taken into account when compiling the elementary indices.

43. There are several ways in which the prices, or the price relatives, might be averaged. The three most commonly used formulae are the ratio of arithmetic mean prices (RAP), the geometric mean (GM) and the arithmetic mean of price relatives (APR). The choice of formula depends on the purpose of the index, the sample design and the mathematical properties of the formula. It is possible to use different formulae for different elementary aggregates within the same CPI. It is recommended that the GM formula be used, particularly where there is a need to reflect substitution within the elementary aggregate or where the dispersion in prices or price changes within the elementary aggregate is large. The GM has many advantages because of its mathematical properties. The RAP may be used for elementary aggregates that are homogeneous and where consumers have only limited opportunity to substitute or where substitution is not to be reflected in the index. The APR formula should be avoided in its chained form, as it is known to result in biased estimates of the elementary indices.

44. The elementary index may be computed by using either a chained or direct form of the formula chosen. The use of a chained form may make the estimation of missing prices and the introduction of replacement products easier.

Upper level indices

45. These price indices are constructed as weighted averages of elementary aggregate indices. Several types of formulae can be used to average the elementary aggregate indices. In order to compile a timely index, the practical option is to use a formula that relies on the weights relating to some past period. One such formula is the Laspeyres-type index, the formula used by most national statistical agencies.

46. For some purposes it may be appropriate to calculate the index retrospectively by using an index number formula that employs both base-period weights and current-period weights, such as the Fisher, Törnqvist or Walsh index. Comparing the difference between the index of this type and the Laspeyres -type index can give some indication of the combined impact of income changes, preference changes and substitution effects over the period in question, providing important information for producers and users of the CPI.

47. Where the change in an upper level index between two consecutive periods such as t-1 and t is calculated as the weighted average of the individual indices between t-1 and t, care should be taken to ensure that the weights are updated to take account of the price changes between the price reference period 0 and the preceding period t-1. Failure to do so may result in a biased index.

Price observations

48. The number and quality of the prices collected are critical determinants of the reliability of the index, along with the specifications of the products priced. Standard methods for collecting and processing price information should be developed and procedures put in place for collecting them systematically and accurately at regular intervals. Price collectors should be well trained and well supervised, and should be provided with a comprehensive manual explaining the procedures they have to follow.

Collection

49. An important consideration is whether the index or parts of the index should relate to monthly (or quarterly) average prices or to prices for a specific period of time (e.g. a single day or week in a month). This decision is related to a number of issues, which include the use of an index, the practicalities of carrying out price collection and the pattern of price movements. When point-in-time pricing is adopted, prices should be collected over a very small number of days each month (or quarter). The interval between price observations should be uniform for each product. Since the length of the month (or quarter) varies, this uniformity needs to be defined carefully. When the aim is monthly (or quarterly) average prices, the prices collected should be representative of the period to which they refer.

50. Attention should also be paid to the time of day selected for price observation. For example, in the case of perishable goods, price observations may need to be collected at the same time on the same day of the week and not just before closing time, when stocks may be low, or sold cheaply to minimize wastage.

51. Price collection should be carried out in such a way as to be representative of all geographical areas within the scope of the index. Special care should be taken where significant differences in price movements between areas may be expected.

52. Prices should be collected in all types of outlets that are important, including Internet sellers, open-air markets and informal markets, and in free markets as well as price-controlled markets. Where more than one type of outlet is important for a particular type of product, this should be reflected in the initial sample design and an appropriately weighted average should be used in the calculation of the index.

53. Specifications should be provided detailing the variety and size of the products for which price information is to be collected. These should be precise enough to identify all the price-determining characteristics that are necessary to ensure that, as far as possible, the same goods and services are priced in successive periods in the same outlet. The specifications should include, for example, make, model, size, terms of payment, conditions of delivery, type of guarantees and type of outlet. This information could be used in the procedures used for replacement and for quality adjustment.

54. Prices to be collected are actual transaction prices, including indirect taxes and non-conditional discounts, that would be paid, agreed or costed (accepted) by the reference population. Where prices are not displayed or have to be negotiated, where quantity units are poorly defined or where actual purchase prices may deviate from listed or fixed prices, it may be necessary for the price collectors to purchase products in order to determine the transaction prices. A budget may be provided for any such purchases. When this is not possible, consideration may be given to interviewing customers about the prices actually paid. Tips for services, where compulsory, should be treated as part of the price paid.

55. Exceptional prices charged for stale, shop-soiled, damaged or otherwise imperfect goods sold at clearance prices should be excluded, unless the sale of such products is a permanent and widespread phenomenon. Sale prices, discounts, cut prices and special offers should be included when applicable to all customers without there being significant limits to the quantities that can be purchased by each customer.

Collection continued

56. In periods of price control or rationing, where limited supplies are available at prices which are held at a low level by measures such as subsidies to the sellers, government procurement, price control, etc., such prices as well as those charged on any significant unrestricted markets should be collected. The different price observations should be combined in a way that uses the best information available with respect to the actual prices paid and the relative importance of the different types of sales.

57. For each type of product, different alternatives for collecting prices should be carefully investigated, to ensure that the price observations could be made reliably and effectively. Means of collection could include visits to outlets with paper forms or hand-held devices, interviews with customers, computer-assisted telephone interviews, mail-out questionnaires, brochures, price lists provided by large or monopoly suppliers of services, scanner data and prices posted on the Internet. For each alternative, the possible cost advantages need to be balanced against an assessment of the reliability and timeliness of each of the alternatives.

58. Where centrally regulated or centrally fixed prices are collected from the regulatory authorities, checks should be made to ascertain whether the goods and services in question are actually sold and whether these prices are in fact paid. For goods and services where the prices paid are determined by combinations of subscription fees and piece rates (e.g. for newspapers, journals, public transport, electricity and telecommunications) care must be taken to ensure that a representative range of price offers are observed. Care must also be taken to ensure that prices charged to different types of consumers are observed, e.g. those linked to the age of the purchaser or to memberships of particular associations.

59. The collected price information should be reviewed for comparability and consistency with previous observations, the presence of replacements, unusual or large price changes and to ensure that price conversions of goods priced in multiple units or varying quantities are properly calculated. Extremely large or unusual price changes should be examined to determine whether they are genuine price changes or are due to changes in quality. Procedures should be put in place for checking the reliability of all price observations. This could include a programme of direct pricing and/or selective re-pricing of some products shortly after the initial observation was made.

60. Consistent procedures should be established for dealing with missing price observations because of, e.g. inability to contact the seller, non-response, observation rejected as unreliable or products temporarily unavailable. Prices of non-seasonal products that are temporarily unavailable should be estimated until they reappear or are replaced, by using appropriate estimation procedures, e.g. imputation on the basis of price changes of similar non-missing products. Carrying forward the last observed price should be avoided, especially in periods of high inflation.

Replacements

61. Replacement of a product will be necessary when it disappears permanently. Replacement should be made within the first three months (quarter) of the product becoming unavailable. It may also be necessary when the product is no longer available or sold in significant quantities or under normal sale conditions. Clear and precise rules should be developed for selecting the replacement product. Depending on the frequency of sampling and the potential for accurate quality adjustment, the most commonly used alternatives are to select: (i) the most similar to the replaced variety; (ii) the most popular variety among those that belong to the same elementary aggregate; and (iii) the variety most likely to be available in the future. Precise procedures should be laid down for price adjustments with respect to the difference in characteristics when replacements are necessary, so that the impact of changes in quality is excluded from the observed price.

Replacements continued

62. Replacement of an outlet may be motivated if prices cannot be obtained e.g. because it has closed permanently, because of a decline in representativeness or because the outlet no longer cooperates. Clear rules should be established on when to discontinue price observations from a selected outlet, on the criteria for selecting a replacement, as well as on the adjustments that may be required to price observations or weights. Such rules should be consistent with the objectives of the index and with the way in which the outlet sample has been determined.

63. Deletion of an entire elementary aggregate will be necessary if all products in that elementary aggregate disappear from most or all outlets and it is not possible to locate a sufficient number of price observations to continue to compile a reliable index for this elementary aggregate. In such situations, it is necessary to redistribute the weight assigned to the elementary aggregate among the other elementary aggregates included in the next level of aggregation.

Quality changes

64. The same product should be priced in each period as long as it is representative. However, in practice, products that can be observed at different time periods may differ with respect to package sizes, weights, volumes, features and terms of sale, as well as other characteristics. Thus it is necessary to monitor the characteristics of the products being priced to ensure that the impact of any differences in price-relevant or utility-relevant characteristics can be excluded from the estimated price change.

65. Identifying changes in quality or utility is relatively more difficult for complex durable goods and services. It is necessary, therefore, to collect a considerable amount of information on the relevant characteristics of the products for which prices are collected. The most important information can be obtained in the course of collecting prices. Other sources of information on price-relevant or utility-relevant characteristics can be producers, importers or wholesalers of the goods included and the study of articles and advertisements in trade publications.

66. When a quality change is detected, an adjustment must be made to the price, so that the index reflects as nearly as possible the pure price change. If this is not done, the index will either record a price change that has not taken place or fail to record a price change that did happen. The choice of method for such adjustments will depend on the particular goods and services involved. Great care needs to be exercised because the accuracy of the resulting index depends on the quality of this process. To assume automatically that all price change is a reflection of the change in quality should be avoided, as should the automatic assumption that products with different qualities are essentially equivalent.

67. The methods for estimating quality-adjusted prices[37] may be:

(a) Explicit (or direct) quality adjustment methods that directly estimate the value of the quality difference between the old and new product and adjust one of the prices accordingly. Pure price change is then implicitly estimated as the difference in the adjusted prices.

(b) Implicit (or indirect) quality adjustment methods which estimate the pure price change component of the price difference between the old and new products based on the price changes observed for similar products. The difference between the estimate of pure price change and the observed price change is considered as change due to quality difference. Some of these methods are complex, costly and difficult to apply. The methods used should as far as possible be based on objective criteria.

Č7 See Annex 2.

Accuracy

68. As with all statistics, CPI estimates are subject to errors that may arise from a variety of sources.[38] Compilers of CPIs need to be aware of the possible sources of error, and to take steps during the design of the index, its construction and compilation processes to minimize their impact, for which adequate resources should be allocated.

69. The following are some well-known sources of potential error, either in pricing or in index construction, that over time can lead to errors in the overall CPI: incorrect selection of products and incorrect observation and recording of their prices; incorrect selection of outlets and timing of price collection; failure to observe and adjust correctly for quality changes; appearance of new goods and outlets; failure to adjust for product and outlet substitution or loss of representativity; the use of inappropriate formulae for computing elementary aggregate and upper level indices.

70. To reduce the index's potential for giving a misleading picture, it is in general essential to update weights and baskets regularly, to employ unbiased elementary aggregate formulae, to make appropriate adjustments for quality change, to allow adequately and correctly for new products, and to take proper account of substitution issues as well as quality control of the entire compilation process.

Dissemination

71. The CPI estimate should be computed and publicly released as quickly as possible after the end of the period to which it refers, and according to a pre-announced timetable. It should be made available to all users at the same time, in a convenient form, and should be accompanied by a short methodological explanation. Rules relating to its release should be made publicly available and strictly observed. In particular, they should include details of who has pre-release access to the results, why, under what conditions, and how long before the official release time.

72. The general CPI should be compiled and released monthly. Where there is no strong user demand for a monthly series or countries do not have the necessary resources, the CPI may be prepared and released quarterly. Depending on national circumstances, sub-indices may be released with a frequency that corresponds to users' needs.

73. When it is found that published index estimates have been seriously distorted because of errors or mistakes made in their compilation, corrections should be made and published. Such corrections should be made as soon as possible after detection according to publicly available policy for correction. Where the CPI is widely used for adjustment purposes for wages and contracts, retrospective revisions should be avoided to the extent possible.

74. The publication of the CPI results should show the index level from the index reference period. It is also useful to present derived indices, such as the one that shows changes in the major aggregates between: (i) the current month and the previous month; (ii) the current month and the same month of the previous year; and (iii) the average of the latest 12 months and the average of the previous 12 months. The indices should be presented in both seasonally adjusted and unadjusted terms, if seasonally adjusted data are available.

75. Comments and interpretation of the index should accompany its publication to assist users. An analysis of the contributions of various products or group of products to the overall change and an explanation of any unusual factors affecting the price changes of the major contributors to the overall change should be included.

Č8 See Annex 3

Dissemination continued

76. Indices for the major expenditure groups should also be compiled and released. Consideration should be given to compiling indices for the divisions and groups of the COICOP.[39] Sub-indices for different regions or population groups, and alternative indices designed for analytical purposes, may be compiled and publicly released if there is a demand from users, they are judged to be reliable and their preparation is cost effective.

77. The index reference period may be chosen to coincide with the latest weights reference period or it could be established to coincide with the base period of other statistical series. It should be changed as frequently as necessary to ensure that the index numbers remain easy to present and understand.

78. Average prices and price ranges for important and reasonably homogeneous products may be estimated and published in order to support the research and analytical needs of users.

79. Countries should report national CPI results and methodological information to the International Labour Office as soon as possible after their national release.

80. Comparing national CPI movements across countries is difficult because of the different measurement approaches used by countries of certain products, particularly housing and financial services. The exclusion of housing (actual rents and either imputed rents or acquisition of new houses, and maintenance and repair of dwelling) and financial services from the all-items index will make the resulting estimates of price change for the remaining products more comparable across countries. Therefore, in addition to the all-items index, countries should, if possible, compile and provide for dissemination to the international community an index that excludes housing and financial services. It should be emphasized, though, that even for the remaining products in scope, there can still be difficulties when making international comparisons of changes in consumer prices.

Consultations and integrity

81. The compiling agency should have the professional independence, competence and resources necessary to support a high quality CPI programme. The UN Fundamental Principles of Official[40] Statistics and the ILO Guidelines concerning dissemination practices for labour statistics[41] should be respected.

82. The agency responsible for the index should consult representatives of users on issues of importance for the CPI, particularly during preparations for any changes to the methodology used in compiling the CPI. One way of organizing such consultations is through the establishment of advisory committee(s) on which social partners, as well as other users and independent experts, might be represented.

83. In order to ensure public confidence in the index, a full description of the data collection procedures and the index methodology should be prepared and made widely available. Reference to this description should be made when the CPI is published. The documentation should include an explanation of the main objectives of the index, details of the weights, the index number formulae used, and a discussion of the accuracy of the index estimates. The precise identities of the outlets and goods and services used for price collection should not be revealed.

84. Users should be informed in advance of any changes that are going to be made to the scope, weights or methodology used to estimate the CPI.

Č× See Annex 4.

¹0 UN Economic and Social Council, 1994.

¹1 Sixteenth International Conference of Labour Statisticians, 1998.

Consultations and integrity continued

85. Technical guidance on the compilation of consumer price indices is provided in the Consumer price index manual: Theory and practice.[42] This manual should be updated periodically in order to reflect current best practice.

ANNEX 1

Terminology and definitions

(a) "Consumer goods" are goods or services that are used by households for the satisfaction of individual needs or wants.

(b) "Consumption expenditures" are expenditure on consumer goods and services and can be defined in terms of "acquisition", "use", or "payment".

- "acquisition"[43] indicates that it is the total value of the goods and services acquired during a given period that should be taken into account, irrespective of whether they were wholly paid for or used during the period. This approach could be extended to include the estimated values of own -account production and social transfers in kind received from government or non-profit institutions. The prices enter the CPI in the period when consumers accept or agree prices, as distinct from the time payment is made;
- "use" indicates that it is the total value of all goods and services actually consumed during a given period that should be taken into account; for durable goods this approach requires valuing the services provided by these goods during the period. The prices (opportunity costs) enter the CPI in the period of consumption;
- "payment" indicates that it is the total payment made for goods and services during a given period that should be taken into account, without regard to whether they were delivered or used during the period. The prices enter the CPI in the period or periods when the payment is made.

(c) "Scope of the index" refers to the population groups, geographic areas, products and outlets for which the index is constructed.

(d) "Coverage" of the index is the set of goods and services represented in the index. For practical reasons, coverage may have to be less than what corresponds to the defined scope of the index.

(e) "Reference population" refers to that specific population group for which the index has been constructed.

(f) "Weights" are the aggregate consumption expenditures on any set of goods and services expressed as a proportion of the total consumption expenditures on all goods and services within the scope of the index in the weight reference period. They are a set of numbers summing-up to unity.

(g) "Price updating of weights" is a procedure that is used to bring the expenditure weights in line with the Index or price reference period. The price updated weights are calculated by multiplying the weights from the weight reference period by elementary indices measuring the price changes between weight reference and price reference period and rescaling to sum to unity.

(h) "Index reference period" is the period for which the value of the index is set at 100.0.

(i) "Price reference period" is the period whose prices are compared with the prices in the current period. The period whose prices appear in the denominators of the price relatives.

(j) The "weight reference period" is the period, usually a year, whose estimates of the volume of consumption and its components are used to calculate the weights.

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12 Consumer price index manual: Theory and practice (International Labour Office, International Monetary Fund, Organisation for Economic Co-operation and Development, Statistical Office of the European Communities (EUROSTAT), United National Economic Commission for Europe and the World Bank, Geneva, 2004).

13 This definition differs from the one adopted by the 14th ICLS (1987).

Terminology and definitions continued

(k) "Probability sampling" is the selection of a sample of units, such as outlets or products, in such a way that each unit in the universe has a known non-zero probability of selection.

(l) "Cut-off sampling" is a sampling procedure in which a predetermined threshold is established with all units in the relevant population at or above the threshold being eligible for inclusion in the sample and all units below the threshold being excluded. The threshold is usually specified in terms of the size of some relevant variable (such as some percentage of total sales), the largest sampling units being included and the rest excluded.

(m) "Quota sampling" is a non-probability method where the population is divided into certain strata. For each stratum, the number ("quota") of elements to be included in the sample is specified. The price collector simply "fills the quotas", which means, in the case of outlet sampling, that the selection of the outlets is based on the judgement of the price collectors and the specified criteria.

(n) "Imputed expenditures" are the expenditures assigned to a product that has not been purchased, such as a product that has been produced by the household for its own consumption (including housing services produced by owner-occupiers), a product received as payment in kind or as a free transfer from government or non-profit institutions.

(o) "Imputed price" refers to the estimated price of a product whose price during a particular period has not been observed and is therefore missing. It is also the price assigned to a product for which the expenditures have been imputed, see (n).

(p) "Outlet" indicates a shop, market stall, service establishment, internet seller or other place where goods and/or services are sold or provided to consumers for non-business use.

(q) "Linking" means joining together two consecutive sequences of price observations, or price indices, that overlap in one or more periods, by rescaling one of them so that the value in the overlap period is the same in both sequences, thus combining them into a single continuous series.

(r) "Price" is defined as the value of one unit of a product, for which the quantities are perfectly homogeneous not only in a physical sense but also in respect of a number of other characteristics.

(s) "Pure price change" is that change in the price of a good or service which is not due to any change in its quality. When the quality does change, the pure price change is the price change remaining after eliminating the estimated contribution of the change in quality to the observed price change.

(t) "Quality adjustment" refers to the process of adjusting the observed prices of a product to remove the effect of any changes in the quality of that product over time so that pure price change may be identified.

(u) "Consumer substitution" occurs when, faced with changes in relative price, consumers buy more of the good that has become relatively cheaper and less of the good that has become relatively more expensive. It may occur between varieties of the same product or between different expenditure categories.

ANNEX 2

Quality adjustment methods

IMPLICIT QUALITY ADJUSTMENT METHODS

1. The "overlap" method assumes that the entire price difference at a common point in time between the disappearing product and its replacement is due to a difference in quality.

2. The "overall mean imputation" method first calculates the average price change for an aggregate without the disappearing product and its replacement, and then uses that rate of price change to impute a price change for the disappearing product. It assumes that the pure price difference between the disappearing product and its replacement is equal to the average price changes for continuing (non-missing) products.

3. The "class mean imputation" method is a variant of the overall mean imputation method. The only difference is in the source of the imputed rate of price change to period t+1 for the disappearing product. Rather than using the average index change for all the non-missing products in the aggregate, the imputed rate of price change is estimated using only those price changes of the products that were judged essentially equivalent or were directly quality-adjusted.

EXPLICIT QUALITY ADJUSTMENT METHODS

4. The "expert's adjustment" method relies on the judgement of one or more industry experts, commodity specialists, price statisticians or price collectors on the value of any quality difference between the old and replacement product. None, some, or all of the price difference may be attributed to the improved quality.

5. The "differences in production costs" approach relies on the information provided by the manufacturers on the production costs of new features of the replacements (new models), to which retail mark-ups and associated indirect taxes are then added. This approach is most practicable in markets with a relatively small number of producers, with infrequent and predictable model updates. However, it should be used with caution as it is possible for new production techniques to reduce costs while simultaneously improving quality.

6. The "quantity adjustment" method is applicable to products for which the replacement product is of a different size to the previously available one. It should only be used if the differences in quantities do not have an impact on the quality of the good.

7. The "option cost" method adjusts the price of the replacements for the value of the new observable characteristics. An example of this is the addition of a feature that earlier has been a priced option as standard to a new automobile model.

8. A "hedonic" regression method estimates the price of a product as a function of the characteristics it possesses. The relationship between the prices and all relevant and observable price-determining characteristics is first estimated and then results are used in the estimation of the index.

ANNEX 3

Types of errors

- "Quality change error" is the error that can occur as a result of the index's failure to make proper allowance for changes in the quality of goods and services.
- "New goods error" is the failure to reflect either price changes in new products not yet sampled, or given a COLI objective, the welfare gain to consumers when those products appear.
- "Outlet substitution error" can occur when consumers shift their purchases among outlets for the same product without proper reflection of this shift in the data collection for the index.
- "New outlets error" is conceptually identical to new goods error. It arises because of the failure to reflect either price changes in new outlets not yet sampled, or the welfare gain to consumers when the new outlets appear.

Types of errors continued

- "Upper level substitution error" arises when the index does not reflect consumer substitution among the basic categories of consumption owing to the use of an inappropriate method for aggregating elementary aggregates in the construction of the overall index value. Only relevant to a COLI, although an equivalent (representativity error) may be defined from the perspective of the pure price index.
- "Elementary index error" arises from the use of an inappropriate method for aggregating price quotations at the very lowest level of aggregation. The elementary index error can take two forms: formula error and lower level substitution error. The index suffers from formula error if, as a result of the properties of the formula, the result produced is biased relative to what would have been the result if a pure price change could have been estimated. The index suffers from lower level substitution error if it does not reflect consumer substitution among the products contained in the elementary aggregate.
- "Selection error" arises when the sample of price observations is not fully representative of the intended population of outlets or products. The first four types of errors listed above can be seen as special cases of this type of error.

ANNEX 4

Classification of Individual Consumption According to Purpose (COICOP) 14 (breakdown of individual consumption expenditure of households by division and group)

01 Food and non-alcoholic beverages

01.1 Food

01.2 Non-alcoholic beverages

02 Alcoholic beverages, tobacco and narcotics

02.1 Alcoholic beverages

02.2 Tobacco

02.3 Narcotics

03 Clothing and footwear

03.1 Clothing

03.2 Footwear

04 Housing, water, electricity, gas and other fuels

04.1 Actual rentals for housing

04.2 Imputed rentals for housing

04.3 Maintenance and repair of the dwelling

04.4 Water supply and miscellaneous services related to the dwelling

04.5 Electricity, gas and other fuels

05 Furnishings, household equipment and routine household maintenance

05.1 Furniture and furnishings, carpets and other floor coverings

05.2 Household textiles

05.3 Household appliances

05.4 Glassware, tableware and household utensils

05.5 Tools and equipment for house and garden

05.6 Goods and services for routine household maintenance

06 Health

06.1 Medical products, appliances and equipment

06.2 Outpatient services

06.3 Hospital services

Classification of Individual Consumption According to Purpose (COICOP) 14 (breakdown of individual consumption expenditure of households by division and group) continued

07 Transport

07.1 Purchase of vehicles

07.2 Operation of personal transport equipment

07.3 Transport services

08 Communication

08.1 Postal services

08.2 Telephone and telefax equipment

08.3 Telephone and telefax services

09 Recreation and culture

09.1 Audio-visual, photographic and information processing equipment

09.2 Other major durables for recreation and culture

09.3 Other recreational products and equipment, gardens and pets

09.4 Recreational and cultural services

09.5 Newspapers, books and stationery

09.6 Package holidays

10 Education

10.1 Pre-primary and primary education

10.2 Secondary education

10.3 Post-secondary non-tertiary education

10.4 Tertiary education

10.5 Education not definable by level

11 Restaurants and hotels

11.1 Catering services

11.2 Accommodation services

12 Miscellaneous goods and services

12.1 Personal care

12.2 Prostitution

12.3 Personal effects n.e.c.

12.4 Social protection

12.5 Insurance

12.6 Financial services n.e.c.

12.7 Other services n.e.c.

GLOSSARY

ABS	Australian Bureau of Statistics
Aggregation	The process of combining lower level price indexes to produce higher level indexes.
All groups	Highest level of the CPI, containing all the groups, subgroups and expenditure classes.
APR	Arithmetic mean of price relatives – refer to Chapter 4 for the formula.
APRA	Australian Prudential Regulation Authority
COICOP	Classification of Individual Consumption by Purpose
Cost of living index	A measure of the change in household income required to maintain a constant level of utility.
CPI	Consumer Price Index - a general indicator of the rate of change in prices paid by households for consumer goods and services.
CPI basket	A commonly used term for the goods and services priced for the purpose of compiling the CPI.
CPI population group	The subset of the Australian population to which the CPI specifically relates. For the 15th series CPI this is all metropolitan private households.
Elementary aggregate	The lowest level of commodity classification in the CPI, and the only level for which index numbers are constructed by direct reference to price data.
Expenditure class	A group of similar goods or services. The level at which weights are fixed for the life of an index series, and the lowest level for which indexes are regularly published. There are ninety expenditure classes in the 15th series CPI.
Expenditure aggregate	The current cost in dollars per year of purchasing the same quantity of goods and services that were purchased in the weighting base period by the CPI population group.
GM	Geometric mean – refer to Chapter 4 for the formula.
Gross premiums	Total premiums payable by policy holders for general insurance.
Group	The first level of disaggregation of the CPI. There are eleven groups in the 15th series CPI.
Goods and Services Tax (GST)	An ad valorem tax applied to supplies (goods and services produced or delivered) by registered suppliers engaged in taxable activity. The GST is effectively only paid by final consumers. The legislated rate of GST is 10 per cent.
HFCE	Household Final Consumption Expenditure
HEC	Household Expenditure Classification. The classification used to analyse the results of the Household Expenditure Survey.
HESA	Higher Education Support Act
HICP	Harmonised Indices of Consumer Prices is an index structure devised and used by the European Union.
Household Expenditure Survey (HES)	A sample survey conducted by the ABS to determine the expenditure patterns of private households. Data from the 2003-04 HES are the primary source of information for the expenditure weights for the 15th series CPI.
ILO	International Labour Organization
Indexation	The periodic adjustment of a money value according to changes in a price index.
Inflation	A term commonly used to refer to changes in price levels. A rise in prices is called inflation, and a fall is called deflation.
Link factor	A ratio used to join a new index series to an old index series to form a continuous series.
Matched sample	In a matched sample, items that are priced from period to period are identical in all

	respects.
Metropolitan	For purposes of the CPI, metropolitan refers to the six State capital cities, Darwin and Canberra.
PPI	Producer price index
Premium supplements	The value of premium supplements is equal to the total income earned by insurance companies through the investment of their technical reserves.
Price index	A composite measure of the prices of items expressed relative to a defined base period.
Price levels	Actual money values at a particular time.
Price movements	Changes in price levels between two or more periods. Movements can be expressed in money values, as price relatives, or as percentage changes.
Price relative	A measure of price movements: the ratio of the price level in one period to the price level in another.
Private households	Households living in private dwellings. Private dwellings exclude prisons, nursing homes for the aged, defence establishments, hospitals, and other communal dwellings.
Quality Adjustment	The elimination of the effect that changes in the quality or composition of an item have on the price of that item in order to isolate the pure price change.
RAP	Relative of average prices – refer to Chapter 4 for the formula.
RBA	Reserve Bank of Australia
Reference base	The period in which the CPI is given a value of 100.0. The CPI is currently on a reference base of 1989-90. The reference base should not be confused with the weighting period – see Weighting base period below.
Regimen	The selected goods and services priced for the purpose of compiling a price index.
Splicing	A technique used to introduce new items or respondents into the index calculations so that the level of the index is not affected.
Subgroup	A collection of related expenditure classes. There are thirty three subgroups in the 15th series CPI.
Superlative index	A superlative index is one of a small group of indexes that makes equal use of prices and quantities, and treats them in a symmetrical manner in each pair of periods under observation. Examples are the Fisher Index and the Tornqvist Index. Superlative indexes require both price and expenditure values for all periods.
The New Tax System (TNTS)	A package of changes to the taxation and social-welfare system including the introduction of GST, and the changes to business taxation announced in response to the review of business taxation.
Technical reserves	The technical reserves held by general insurance companies include prepayments of premiums, and reserves against outstanding claims.
Transaction prices	The prices actually paid by consumers to acquire goods and services.
Utility	Often defined as the satisfaction derived from consumption of a good or service.
Weight	The measure of the importance of an item in the index regimen relative to the other items. Weights can be expressed in either quantity or value terms. Value weights are used in the CPI.
Weighting base period	The period to which the fixed quantity weights relate. The weighting base period for the 15th series CPI is 2003-04 (see also Reference base.)

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