

14 July 2008

Mr Graeme Samuel  
Chairman  
Australian Competition and Consumer Commission  
GPO Box 520  
Melbourne Vic 3000

Dear Mr Samuel

**Re Public Submission to ACCC Grocery Inquiry by the Australian Bureau of Statistics**

On 17<sup>th</sup> March 2008, Mr Tom Leuner, Director of the Grocery inquiry at the ACCC, asked the Australian Bureau of Statistics to provide a submission explaining how the ABS food price index measures are derived and how the figures should be interpreted. He also asked for comments on the international comparison of food prices.

The body of this submission focuses on those specific issues. Attached to the submission is a copy of A Guide to the Consumer Price Index: 15<sup>th</sup> Series – 2005 which provides a more detailed explanation of the CPI and addresses a range of issues related to the interpretation and use of the CPI.

The ABS hope the Commission finds this useful and looks forward to assisting the Commission further in its inquiry. The ABS has no concerns with the submission being made available publicly. For further assistance please contact Ms Judy Henson, Acting Head of Prices Branch on (02) 6252 6043, or [judy.henson@abs.gov.au](mailto:judy.henson@abs.gov.au)

Yours sincerely

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# Public Submission to ACCC Grocery Inquiry by the Australian Bureau of Statistics (ABS) on 14 July 2008

## Introduction

1 On 17<sup>th</sup> March 2008, Mr Tom Leuner, Director of the Grocery inquiry at the ACCC, asked the Australian Bureau of Statistics to provide a submission explaining how the ABS food price index measures are derived and how the figures should be interpreted. He also asked for comments on the international comparison of food prices.

2 The body of this submission focuses on those specific issues. Attached to the submission is a copy of *A Guide to the Consumer Price Index: 15<sup>th</sup> Series* which provides a detailed explanation of how the Australian CPI is constructed and addresses a range of issues related to the interpretation and use of the CPI.

3 The submission comprises four parts. Part A outlines the key issues in calculating the food price index, Part B discusses some issues in interpreting the Australian data and covers both the CPI and other ABS price indexes that cover food and/or grocery prices, Part C looks at the international comparison of food prices, and Part D concludes with references to ABS publications that may contain additional material of interest to the Commission.

## A. Calculation of the Food price index

### *General*

4 The food price index of most relevance to the current inquiry is that for the Food (excluding meals out and takeaway foods) component of the Australian Consumer Price Index (CPI).

5 The CPI is designed to provide a general measure of price inflation, through measurement of the changes in prices faced by private households living in the six State capital cities plus Canberra and Darwin. Movements in prices faced by those households are assumed to be representative of those experienced by the household sector as a whole, although households living outside the capital cities may face different price levels.

6 In constructing the CPI, what is required is a measure of ‘pure’ price change. That is, the measure needs to abstract from any apparent changes in prices attributable to changes in the quantities of different items purchased and changes in the quality of individual items purchased.

7 The measurement of price change for an individual, specific item (e.g. Granny Smith apples purchased from a particular store) is a relatively straightforward exercise. It would generally be agreed that an estimate of the average price per kilogram in each period would be all that is required. Price change between any two periods would simply be calculated by direct reference to the respective average prices.

8 However, problems arise if the objective is to provide a measure of the average rate of change in food prices as a whole. The calculation of a ‘true’ average price is both complicated and of little real meaning. For example, consider the problem of calculating and interpreting an average price for two commodities as diverse as apples and cakes.

9 The general solution is to measure the rate of price change for individual, specific items and then to average these to obtain an overall rate of price change. In calculating the

overall average it is necessary to recognise that some items account for a greater share of household expenditure than others and price changes for these items should have a greater influence on the average than price changes for items that account for a smaller share of household expenditure.

10 Although the CPI weights are expressed in terms of expenditure shares, it is not the expenditure shares that are held constant in the CPI from period to period. What are held constant are the quantities of goods and services underpinning these expenditures (where expenditure is the product of quantity and price). Presentation of weights in expenditure terms reflects the fact that it is simply not possible to present quantity weights in a meaningful way. The actual determinant of the relative share given to each item in the CPI is their relative contribution to total household expenditure in the base period. Thus, if the weight (as derived from household expenditure data from the Household Income and Expenditure Survey (HIES) in the base period) of bread is three times as large as household expenditure on butter, then a 10% price increase for bread should have a similar impact on the CPI as a 30% price increase for butter.

11 However, the reality is that the actual expenditures of individual households change over time in response to many factors including changes in prices (particularly relative prices); changes in incomes; changes in family composition (including ages of family members); changes in tastes and preferences and the availability of products (including the emergence of new items). Further, within a calendar year, expenditures can change from month to month due to seasonality of either supply (seasonal availability of produce) or demand (e.g. chocolate at Easter). Changes over time in the purchasing patterns of households in aggregate are additionally affected by changes in the demographic profile of the population at large (e.g. increases in the proportion of older Australians).

12 Thus the key issues to be addressed in constructing a food price index are:

- a) Deriving a system of weights;
- b) Selecting representative items and outlets;
- c) Measuring price change for individual items; and
- d) Treatment of seasonal items.

Each of these and the ABS solution is discussed below.

### *Deriving a system of weights*

13 The weighting system for a price index is primarily intended to ensure that those items that account for a larger share of consumer expenditure have a similarly larger influence on the measured average rate of price change. However, the weighting system must also ensure comparison of prices on a 'like with like' basis while coping with the reality of changing expenditure patterns and item availability. Theoretically, there are two key approaches that could be adopted – a fixed utility approach and a fixed basket (or quantity) approach.

14 A fixed utility approach (which is often referred to as a cost of living index) would involve devising a set of fixed utility weights which would allow the index to measure the change over time in the minimum expenditure that would be required to purchase a basket of goods and services capable of providing the same utility (or satisfaction). The items priced would be allowed to change from period to period but the level of utility would not. While this may represent a theoretically desirable approach to measuring price change, it is not one that is feasible to use in practice as it is not possible to measure the level of utility provided by any particular basket, or to identify different baskets that provide the same level of utility.

15 Therefore, in constructing consumer price indexes national statistical offices use the fixed basket approach, which does not allow the quantities of the individual items to change when measuring period to period price change. The benefit of this approach is that it unambiguously results in a measure that compares like with like. The downside of this approach is that it does not allow for item substitutions, which consumers are able to make while maintaining utility. This may lead to an overstatement of the rate of price growth compared to a theoretical, but immeasurable, fixed utility approach. Other factors, such as the work done in keeping the sample of items and the outlets relevant, may have off-setting impacts.

16 The weights for the Australian CPI are derived, in the first instance, from the HIES, which is the only authoritative source of data on the expenditures of different household types in each of the capital cities. The HIES provides information on the expenditures of households over a full year. In the case of food (excluding meals out and takeaway foods), this expenditure is divided into 6 subgroups which are further divided into 24 expenditure classes (see Appendix 1 of the Attachment for a list).

17 The HIES is now conducted at 6 yearly intervals with the last one being in respect of 2003-04. Due to the time required to process and validate the data from each HIES, the new weights can only be introduced to the CPI with some delay. The weights based on the 2003-04 HIES were introduced in September quarter 2005 (to measure price change from June quarter 2005). The next HIES is scheduled for 2009-10 with updated CPI weights to be introduced in September quarter 2011. The new item weights are introduced in such a way that the index reflects only pure price change and not differences in the old and new weights.

18 Although the weights in the CPI are expressed in terms of expenditure shares, it is important to note that because these weights are applied to measures of price change (rather than price levels) the effect is to hold constant the underlying quantity weights. This is why the CPI can be described in terms of a representative basket of goods and services that is re-priced each quarter with the CPI simply measuring how the cost of the overall basket changes over time in response to changes in the prices of individual items.

19 In reality, the relative expenditure shares of individual items in the CPI basket will change over time in response to differences in relative price changes. Although it may appear attractive to use point of sale data to update weights at a high frequency, ensuring that the resulting measures capture only pure price change proves to be difficult in practice.

#### *Selecting representative items and outlets*

20 While the HIES plays a critical role in estimating the weights for each of the 24 food expenditure classes, these still represent too high a level of aggregation for the purpose of identifying precisely which items are to be priced and from where. For example, although the HIES can provide an estimate of the total expenditure by households in Melbourne on bread, it doesn't provide information on the types and brands of bread purchased or the outlets from which they were purchased.

21 Section 4 'Calculating the CPI' (page 20) of the Attachment provides a detailed explanation of the procedures used by the ABS to further subdivide the HIES expenditure estimates and to select the specific items and outlets included in the price samples.

#### *Measuring price change for individual items*

22 The day to day task of measuring price change for individual items has the single greatest bearing on the quality of the overall measure of price change.

23 While changes to the overall coverage of the CPI basket and updating of the expenditure class level weights are only undertaken following a HIES, the individual items actually available in stores are constantly changing. This imposes a need to be able to adjust the fine level item samples to ensure that they remain representative of consumer behaviour while preserving the principle of measuring only pure price change. For example, while the weight for the Bread expenditure class is held fixed between basket updates, the specific brands and varieties of bread that are priced each period may need to be updated to keep pace with changes in the marketplace.

24 There is also a requirement to take account of any (perhaps subtle) changes in the quality of what may otherwise be considered as continuing items. Identifying these changes to item specifications and adjusting observed prices to eliminate quality differences or otherwise excluding the observations from index calculations, accounts for a significant proportion of the cost of compiling the CPI each quarter.

25 Some changes are relatively easy to deal with while others prove more difficult if not intractable. A marginal change in say the weight of a can of tomato soup from 440gms to 400gms can be handled by reference to the price per gram. If the list or observed price is unchanged, the quality adjusted price will record an increase of  $440/400$  or 10%.

26 Quality changes due to either a change in brand or the ingredients, pose more difficult measurement problems for which we generally have no ready solution and are forced to treat the change as if it were a change in sample. Some item categories are particularly prone to a high rate of turnover in the specific brands or varieties available, and we are constantly adjusting our samples, again ensuring sample changes are introduced in such a way that the index reflects only pure price change and not differences between the cost of the old and new samples – note that this can be considered as a guiding principle in calculating the CPI.

27 The application of this principle can be best illustrated by reference to a simple though contrived example of how the calculation of a price index for apples may have changed over time. The example assumes that initially only prices of Red Delicious apples are available, then an expanded set including Pink Lady and Gala, and finally back to only Red Delicious and Gala. For simplicity, it is assumed that in each period the quantities are equal (or at least unknown but assumed not to differ significantly). The example can be taken to relate to either a change in sample initiated by the ABS or to an actual change in the marketplace.

*Table 1: Example calculation of a price index for Apples*

	Time Period				
	0	1	2	3	4
Prices					
Red Delicious	1.56	2.04	2.21	2.36	2.65
Pink Lady		3.80	4.09	4.93	
Gala		2.60	2.80	2.85	3.10
Simple average	1.56	2.81	3.03	3.38	2.88
Matched averages					
Periods 0 and 1	1.56	2.04			
Periods 1 and 2		2.81	3.03		
Periods 2 and 3			3.03	3.38	
Periods 3 and 4				2.61	2.88
Period to period % changes, using					
Simple averages		80.3	7.8	11.4	-14.9
Matched averages		30.8	7.8	11.4	10.4
Price index, using					
Simple averages	100.0	180.3	194.4	216.6	184.2
Matched averages	100.0	130.8	141.0	157.1	173.4

28 The table above illustrates two possible methods for calculating price change. The first method (simple averages) simply makes use of the average of all prices available in each period while the second method measures period to period price change based only on the prices of those specific items available in both periods.

29 The second method, which is generally referred to as a ‘matched sample’ approach, is the one that is used to calculate the CPI. The first method sometimes referred to as the ‘unit value’ method represents an approach better suited to tracking changes in expenditure (or revenue), particularly if the quantities purchased (sold) in each period are known. The deficiency of the first method as a measure of price change is even more starkly illustrated if it is assumed that the prices of the different varieties do not change over time, but they do differ from each other.

30 It should also be clear from the above, that there is no unambiguous single average price associated with a price index for any time period. For any item, there is always the potential for there to be two average prices for each time period – the average price for the sample that matches the previous period and the average price for the sample that matches the following period. If this was not the case, there would be little need for price indexes as all requirements could be satisfied by the calculation of a series of average prices.

31 It is also worth noting that the principle of matched samples is, in practice, also applied to outlets. In other words, even the average price of Red Delicious apples used to measure period to period price movement is constructed by reference to a matched set of outlets, so changes to samples of outlets (e.g. more or less supermarkets) do not of themselves affect the level of the index.

### *Treatment of seasonal items*

32 The use of a basket that contains all of the goods and services acquired over a full year plays a significant role in ensuring the quarter to quarter price movements are on a like with like basis while maximising the item coverage of the index. This can be most readily appreciated by considering how items that are only purchased (or available) at certain times of the year might be treated in a price index.

33 The simplest option would be to exclude all seasonal items from the index and measure price change only by reference to those items available all year round. Such an approach would exclude many varieties of fresh fruit and vegetables, seafood, Easter eggs, and Christmas turkeys to name but a few examples. Although an index that excludes these seasonal items may still provide a reliable indicator of medium to long term price change, it is unlikely to have the same level of credibility and command the same level of respect as an index that includes them.

34 Inclusion of seasonal items in the basket increases the item coverage of the basket but complicates the task of measuring price change. The key issue is deciding what should be done when an item is out of season (or otherwise unavailable). To simply calculate an average price that excludes the out of season item in one period and then compare that to an average price in another period that includes the now out of season item would provide an erroneous measure of price change. Imagine that the only change between two periods is that the most expensive item is no longer available, but the prices of all other items remain unchanged. An approach that is based on simply comparing the average prices of items actually purchased (sold) would show a price fall when in fact there is no evidence that any prices have changed. The ABS handles seasonal items in the CPI by imputing their prices when they are not available using a technique referred to as class mean imputation. This involves using the price behaviour of similar (or closely related) items to estimate the prices for the seasonally unavailable items.

## **B Interpreting the figures**

### *Published average prices*

35 Although, as Table 1 above makes clear, it is not possible to construct a measure of pure price change from a single series of point in time estimates of average prices, it is of course possible to produce estimates of average prices as a by-product of the CPI.

36 In recognition of the widespread interest in data on average prices that can be used to gain some insights into the differences in price levels across cities, the ABS publishes average price data for a small subset of items priced for the CPI in *Average Retail Prices of Selected Items* (ABS Cat. No. 6403.0.55.001). Unfortunately, despite the strong warnings against this practice, some users continue to use average price data to construct measures of price change over time. The average price data is simply not fit for this purpose. The only fit for purpose measures of price change over time are the published price indexes.

37 To illustrate the potential for drawing the wrong conclusions from using the average price data in this way consider the data in the following table which compares the published average price data and the price index for eggs in Melbourne between March quarter 2005 and March quarter 2008.

*Table 2: Average Retail Prices and CPI Index for eggs in Melbourne*

	March 2005	March 2008	Percentage change
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Eggs - Average retail prices	\$3.06	\$4.62	51.0%
Eggs - CPI price index	172.0	200.4	16.5%

38 Using the average price data would lead to the conclusion that egg prices had increased by 51.0% whereas the true measure of price change given by the CPI price index is only 16.5%. The majority of the difference between the two average prices can be attributed to changes in the sample (different outlets, new brands and varieties or quality improvements) used to compile the CPI and reflects the effort the ABS puts in to ensure that these samples are as representative of contemporary consumer behaviour as possible. In the case of eggs, the most significant change to the sample over this period has been an increase in the sample of free range eggs priced.

39 There is also a temptation to simply sum the published average prices for each city to form an overall 'basket price' to be used to construct measures of average price level differences across cities. Use of the data in this way is flawed in two respects. Firstly, the number of items for which average prices are published is simply too small. Secondly, this approach takes no account of the relative importance of items. The ABS is unable to provide meaningful average price data for a broader range of items or the quantity data that would be necessary to allow meaningful aggregation of the existing data.

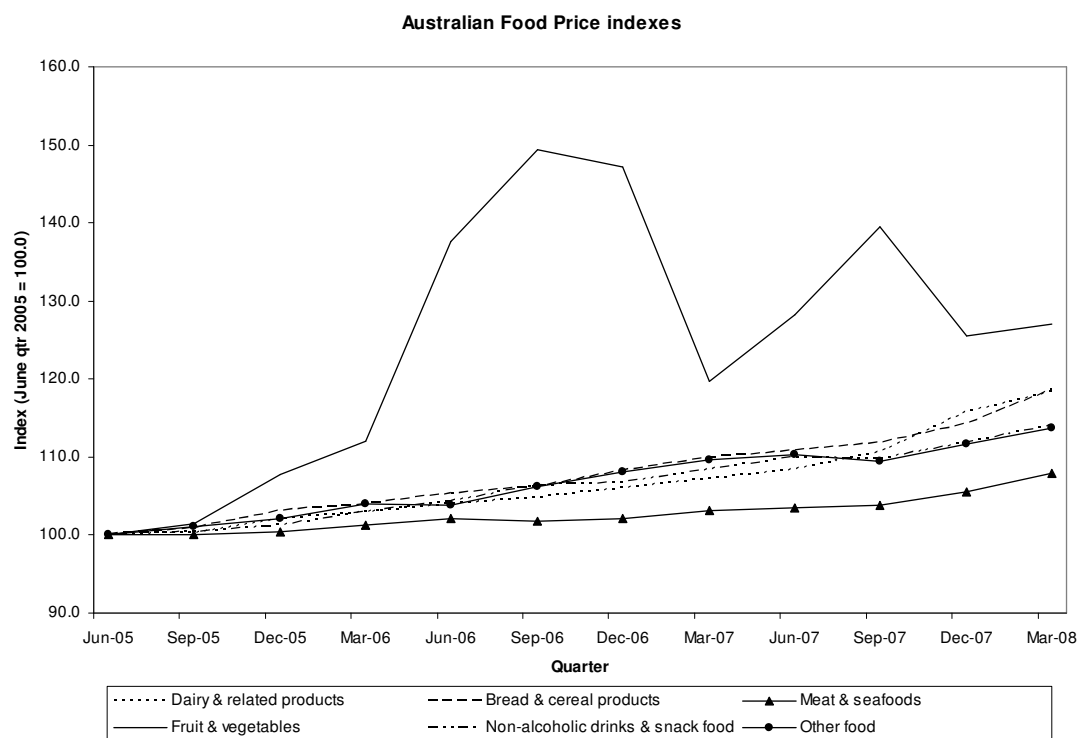
#### *Recent behaviour of food prices in Australia*

40 The ACCC Issues Paper focuses on changes in Australian food prices since March quarter 2005. Given the most recent update to the CPI basket was introduced in September quarter 2005, to measure price change from June quarter 2005, a more appropriate starting point for such an analysis is June quarter 2005.

41 The following chart shows the price behaviour of the major components of the Food price index since June quarter 2005.



Figure 1: Australian Food Price Indexes



42 Figure 1 shows that all components have exhibited price growth since June quarter 2005 with the largest increase being for fruit and vegetables (27.1%), followed by bread and cereal products (18.7%), dairy and related products (18.3%), non-alcoholic drinks and snack food (14.1%), other food (13.8%) and meat and seafood (8.0%).

43 While most components have displayed relatively steady increases over this period, it is clear that prices of fruit and vegetables have behaved quite differently; being significantly affected by domestic climatic conditions. Although much has been made of the well known impact cyclone Larry had on the Australian banana crop, with changes in banana prices exerting the single greatest influence on the aggregate measure of fruit and vegetable prices over this period, banana prices alone do not tell the whole story.

44 The following table provides a brief explanation of the major causes of movement in the Fruit and vegetable price index by quarter from December quarter 2005 to March quarter 2008. This information is taken from the analysis and comments which accompanied the relevant CPI releases.

Table 3: Reasons for change in the price index for Fruit and vegetables.

Quarter	Explanation of price change
December 2005	The rise in food prices was largely as a result of vegetables (+6.8%) and fruit (+5.8%). The rise in vegetable prices was due to adverse weather in major growing areas affecting supplies, particularly of potatoes, broccoli, onions and tomatoes. Poor weather also impacted on supplies of pears, apples and oranges, pushing fruit prices up overall.
March 2006	The rise in vegetable prices (+7.9%) was due to adverse weather in major growing areas in eastern Australia, together with some seasonal shortages affecting supplies and quality of some vegetables, in particular, lettuces, cauliflower, cabbages and

<i>Quarter</i>	<i>Explanation of price change</i>
	potatoes. Fruit prices decreased slightly (-0.8%) providing a minor offset.
June 2006	<p>The rise in fruit prices (+52.0%) was mainly attributable to an increase of approximately 250% in the price of bananas due to shortages created by cyclone Larry in March 2006. Prices also rose for citrus fruit, apples, melons and strawberries, in part reflecting increased demand for alternatives to bananas. The fruit expenditure class contributed 0.79 index points to the change in the All Groups CPI in June quarter 2006 and 0.90 index points to the through the year change.</p> <p>Vegetables had a very small price change (+0.2%).</p>
September 2006	<p>The rise in food prices was largely due to fruit (+20.5%) with a partially offsetting fall in the price of vegetables (-5.3%) associated with plentiful supplies of salad vegetables and leafy green vegetables.</p> <p>The rise in fruit prices reflected strong price increases for a number of fruit. Price rises for bananas, which began following Cyclone Larry, continued with the average price recorded for September quarter being 45% higher than the average recorded for June quarter. Melons, apples and pears also showed rises. The rise in fruit prices contributed 0.48 index points to the increase in the CPI in the September quarter.</p>
December 2006	<p>The rise in food prices was largely due to vegetables (+4.1%) offset by price falls in fruit (-5.2%). The increase in vegetable prices resulted from adverse weather conditions, including hailstorms in southern Queensland and a cold snap in eastern Australia, leading to supply shortages for many vegetables.</p> <p>The fall in fruit prices was largely due to the lower quarterly average price of bananas (-19%) following an increase of 406% over the June and September quarters. Prices remained high in October and early November before falling consistently through the remainder of the quarter. With the exception of melons, prices for all other fruit increased.</p>
March 2007	<p>The fall in fruit prices (-33.8%) was again largely due to the lower quarterly average price of bananas which fell by a further 73% in the March quarter. Banana prices are now at levels similar to those of March quarter 2006. Prices of most other fruit also fell throughout the quarter, with a small number of offsetting price rises, notably apples (+4.8%) and citrus fruit (+3.6%).</p> <p>Vegetable prices increased (+1.9%) due to a combination of drought, hailstorms and frosts last November.</p>
June 2007	<p>The main contributors to the rise in food prices for the quarter were fruit (+8.4%) and vegetables (+6.1%). The rise in fruit prices was due to significant increases in banana prices (with supplies affected by colder weather in the growing areas), berries, melons and stone fruits. Apples provided the only significant offsetting price fall in fruit.</p> <p>The rise in vegetable prices was associated with price increases in fresh vegetables, particularly salad vegetables, due to drought in the early part of the quarter followed by heavy rain in the latter part.</p>
September 2007	<p>The main contributors to the rise in food prices for the quarter were fruit (+9.6%) and vegetables (+7.9%). Bananas were the main driver of the rise in fruit prices. Banana prices rose in July, and then fell in August and September. Significant offsetting price falls were observed for citrus fruit and berries. The rise in vegetable prices was due mainly to price increases for fresh vegetables, particularly salad vegetables. Unseasonal weather and disease were reported as factors contributing to price rises in both fruit and vegetables.</p>
December 2007	<p>The small fall in food prices this quarter was due to falls in fruit (-13.5%) and vegetables (-6.9%). Fruit was in plentiful supply due to good conditions reported in</p>

<i>Quarter</i>	<i>Explanation of price change</i>
	most growing areas. Price falls were observed across a range of fruit, most significantly bananas, but also rockmelons, watermelons and strawberries. Some offsetting rises were observed for oranges, apples, mandarins and pears.  The fall in vegetable prices was due to the plentiful supply of some vegetables resulting from generally good conditions in growing areas, combined with widespread specials. The largest fall was observed for lettuce, with lesser falls for tomatoes and cauliflower. Partially offsetting these falls were rises for potatoes, pumpkin and onions.
March 2008	The rise in the food index is due to increases in almost all categories of food, including vegetables (+2.9%). There was a small fall in fruit (-0.6%) mostly due to plentiful supplies of grapes, peaches and bananas.

45 Some have argued that the ABS should have adjusted the way the CPI is calculated over this period to explicitly discount the impact of banana prices by taking account of the reduction in the quantity of bananas purchased following the cyclone Larry induced increase in their price. There are a number of reasons why such action would not represent good statistical practice.

46 The threshold issue is of course determining in some reasonable way what the new weight should be and, if the quantity (weight) of bananas is to be reduced, should the quantities of anything else be increased (and, if so, what and by how much)?

47 However, even if this issue could be satisfactorily resolved and it was possible to estimate new annual consumption quantities, the new weights could only be introduced after at least the initial price increase had been recorded (unless the CPI was to be revised) – refer to the earlier discussion of the way in which weight changes are introduced to the CPI (in paragraphs 13-19 above). The practical consequence of such action is that bananas would have a higher weight when prices were rising and a lower weight when prices subsequently return to ‘normal’ meaning that over the longer term the index as a whole would be at a higher level than it should.

48 It is generally agreed that two of the most important attributes of a price index are:

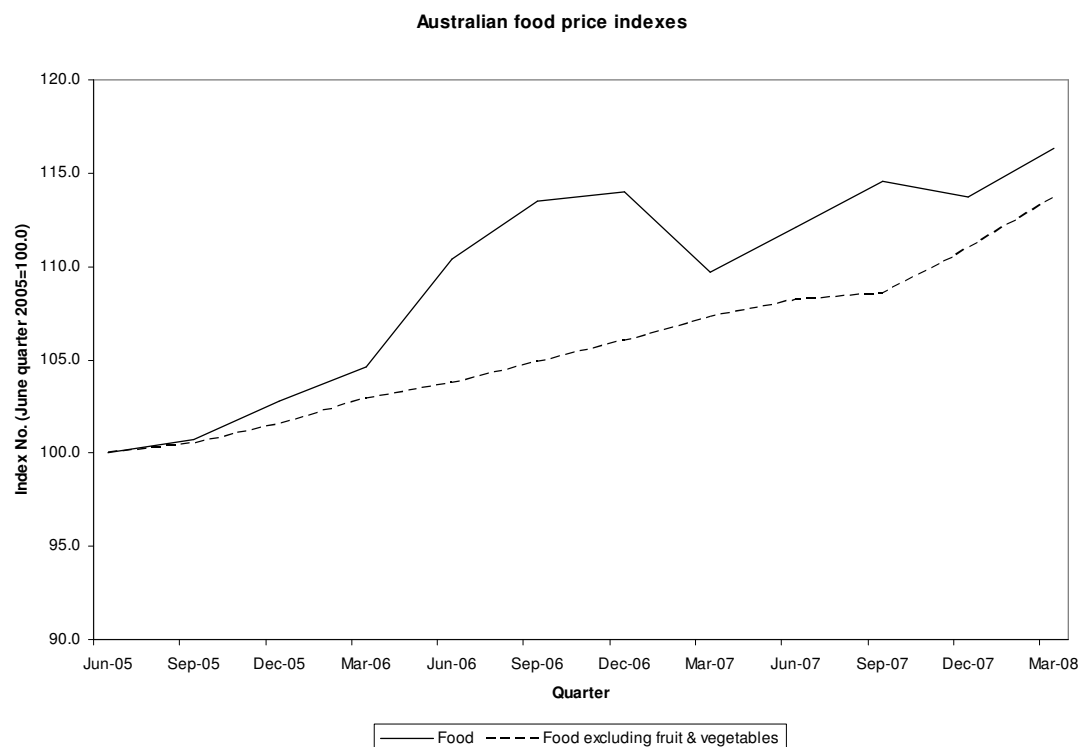
1. That if no prices change, then neither should the index; and
2. If all prices return to the same level as in some prior period, then the index should also return to the same level.

49 Consideration of these two axioms is central to any decisions made about the methods used to measure price change in the CPI and the use of a fixed annual basket approach satisfies these requirements.

50 While the ABS appreciates that what the CPI measures is not always appropriate for the many uses made of it, a high priority is placed on ensuring we follow consistent, clearly described, internationally recognised standards and practice to the fullest extent possible. What is important in this regard, is that what the CPI does measure can be clearly articulated and users are provided with sufficient information to assist in modifying the index to better suit their purposes or, to at the very least, appreciate the extent to which the CPI measure might differ from what they are seeking.

51 The following chart compares the Food index with an index excluding fruit and vegetables.

Figure 2: Australian food price indexes with and without fruit and vegetables



52 Figure 2 shows that the prices of food excluding fruit and vegetables have increased by 13.7% between June quarter 2005 and March quarter 2008, while the inclusion of fruit and vegetable prices increases the aggregate rate of change to 16.3%.

### Producer price indexes

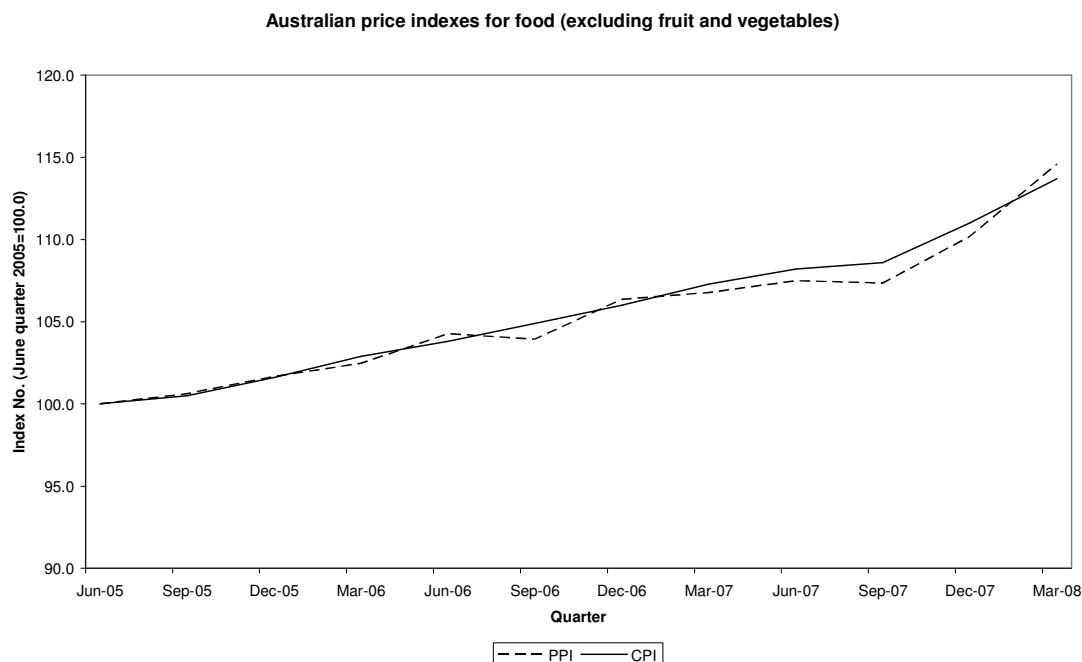
53 In addition to compiling the CPI, the ABS compiles a suite of Producer Price Indexes (PPI). While the CPI measures changes over time in the prices paid by households for the goods and services that they acquire, the PPIs measure the change over time in both the prices paid by producers for their inputs (i.e. materials used) and the prices they receive for their outputs (i.e. articles produced). These indexes are published in *Producer Price Indexes, Australia* (ABS Cat. No. 6427.0).

54 Of most relevance to the current inquiry from these indexes, would be a measure of the change in prices received by Australian manufacturers of food products from the suite of Articles Produced by Manufacturing Industries (APMI) indexes. The procedures used to construct these price indexes are largely identical to those used to compile the CPI. It should be noted that the PPI basket weights are derived from the Australian Input Output tables. They are constructed on a net sector basis (which means that in the case of articles produced by manufacturers, they exclude sales to other manufacturers for further use in the production process), but the situation is similar to the exclusion of sales of second hand goods in the CPI. A major point of departure in the case of the APMI indexes, is that the pricing basis is manufacturers' selling prices, exclusive of excise taxes and GST.

55 The following chart compares the changes in food prices paid by households (from the CPI) with changes in prices received by food manufacturers (from the PPI) from June quarter 2005 to March quarter 2008. To provide as great an alignment of the commodity coverage as possible the CPI food series is adjusted to exclude fruit and vegetables (because the majority

relate to fresh produce, which does not pass through manufacturers on the way to retailers) and the PPI series is adjusted to exclude beverages and tobacco (because the PPI series for beverages is significantly influenced by alcoholic beverages which are excluded from the CPI food series as is tobacco).

Figure 3. CPI and PPI APMI food indexes



56 Figure 3 shows that over the comparison period, the retail prices paid by households for food track fairly closely with the ex-factory prices received by producers although the series do diverge from time to time.

57 Producer price indexes for Articles Produced by Manufacturing Industries at a finer level of commodity disaggregation can be found in tables 10 and 11 of the publication *Producer Price Indexes, Australia* (ABS Cat. No. 6427.0). Price indexes for Materials Used in Manufacturing Industries can be found in table 14 of the same publication.

58 The publication *International Trade Price Indexes, Australia* (ABS Cat. No. 6457.0) contains index numbers for Sections of the Standard International Trade Classification (SITC) and by End Use Class of the United Nations' Classification by Broad Economic Categories (BEC). Timeseries spreadsheets for the relevant tables (3, 4 and 6) are available on the ABS website.

## C The international comparison of food prices

59 The ACCC Issues Paper presents some comparisons of food price inflation in Australia relative to OECD countries as a whole. The comparisons are based on data sourced from the OECD, showing price changes for the Food group as defined by the Classification of Individual Consumption According to Purpose (COICOP). The item coverage of the COICOP Food group corresponds to the Australian CPI Food group excluding meals out and takeaway foods`.

60 A comparison of rates of change in prices paid by households for Food across countries is informative. However there is some potential for misinterpretation if the

measures themselves are not well understood. The procedures followed by all countries in producing their CPIs are for all intents and purposes the same as those used by the ABS.

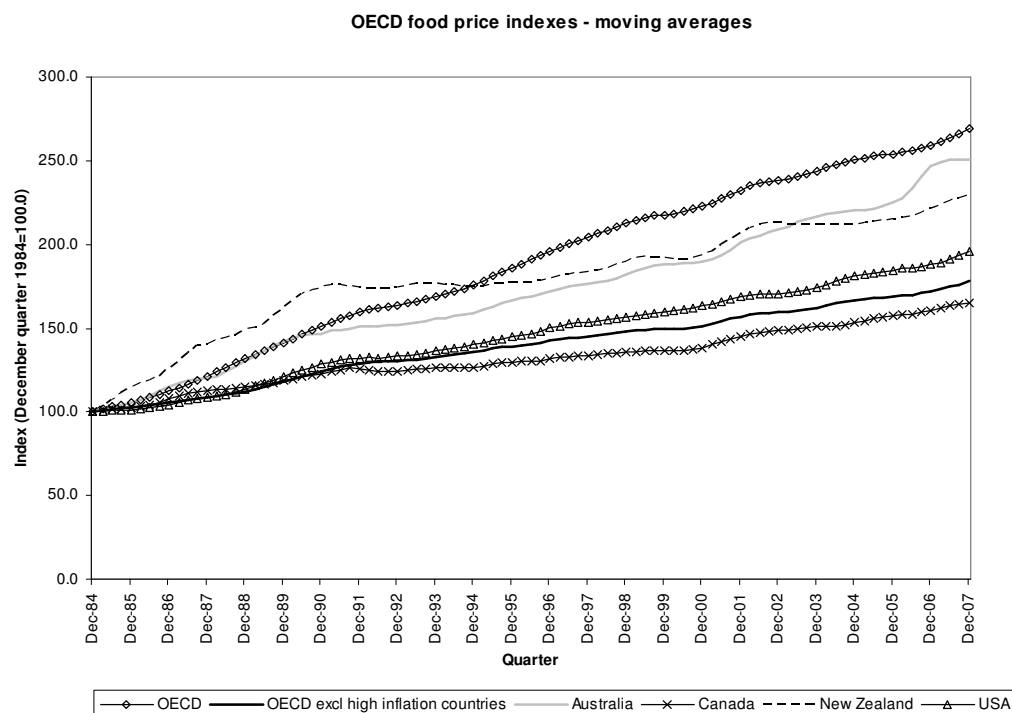
61 That is, the individual measures are constructed by essentially re-pricing a fixed annual basket of goods and services that are representative of those purchased by households in the respective countries. Therefore, it follows that the measures are based on the consumption or expenditure patterns peculiar to each country and domestic price change. As such, the differences in the composition of the baskets across countries can be expected to be generally greater than those across time in individual countries due to differences in tastes, preferences, etc. For example, Asian countries are likely to have proportionally more expenditure on rice compared with Australia.

62 The construction of multi country indexes (or averages) can therefore present problems and using them to benchmark individual country performances can sometimes result in comparisons that are difficult to fully interpret or understand. For these reasons it is often useful to also make comparisons directly with other countries, particularly those that can be regarded as having markets that operate in a similar fashion to our own and populations with similar tastes and preferences.

63 Cross country comparisons of rates of price change of this type can also be affected by the choice of base period. For example, with all other things being equal, the fact that prices in one country are at a seasonal high at the same time as prices in another country are at a seasonal low would suggest that that time period does not represent a suitable base for cross country comparisons. If food prices are being compared this situation is more likely if the comparison is across countries from different climatic zones, such as the southern and northern hemispheres. To minimise the potential for such influences, it would be preferable to construct a 4 quarter moving average of each index (which effectively eliminates the seasonal element, but introduces a phase shift) and re-referencing these indexes to a common starting point.

64 The following chart presents food price indexes on the basis discussed above, re-referenced to the 4 quarter moving average ending December quarter 1984 = 100.0, including indexes for Canada, New Zealand (NZ) and the United States of America (USA).

Figure 4: OECD Moving Average of Food Price Indexes



65 Although this long term series does not tell a vastly different story to the chart shown in the Issues Paper, it provides a better context. The long term evolution of food prices in the USA and Canada follow similar paths that are not too dissimilar to the average of ‘OECD countries excluding high inflation countries’ (with Canada below the average and the USA above).

66 The behaviour of food prices in Australia and New Zealand is similar in so far as prices appear to be much more volatile displaying periods of high rates of change at various points over the comparison period (though generally at different points in time). The differences in observed behaviour between the two island countries and those of North America might point to the existence of different market arrangements due to customs regulations and the ability to readily source produce from other countries in times of shortages in the domestic market.

### C. Further information

67 The Commission may also wish to refer to the following ABS publications that are available free of charge from the ABS website.

- *Australian Consumer Price Index: Concepts, Sources and Methods*, 2005 (cat. no. 6461.0)
- *Average Retail Prices of Selected Items, Eight Capital Cities* (cat. no. 6403.0.55.001)
- *Business Indicators, Australia* (cat. no. 5676.0)
- *Consumer Price Index, Australia* (cat. no. 6401.0)
- *Consumer Price Index: Historical Weighting Patterns (1948 to 2005)* (cat. no. 6431.0)
- *Experimental Price Index for Retail Trade Margins, 2003 to 2006* (cat. no. 6402.0)

- *Information Paper: Consumer Price Index with Reserve Bank of Australia Consumer Price Measures, Australia, 2007* (cat. no. 6401.0.55.002).
- *Information Paper: Introduction of the 15th Series Australian Consumer Price Index 2005* (Reissue) (cat. no. 6462.0)
- *International Trade Price Indexes, Australia* (cat. no. 6457.0)
- *Producer Price Index, Australia* (cat. no. 6427.0)
- *Producer and International Trade Price Indexes: Concepts, Sources and Methods 2006* (cat. no. 6429.0)



Attachment 1 – A Guide to the Consumer Price Index 15<sup>th</sup> Series – 2005 (ABS Cat. No. 6440.0)

The purpose of this guide is to provide a broad overview of the CPI; how to use the CPI; and how the CPI is calculated. This publication is also available online at <http://www.abs.gov.au>

# **A GUIDE TO THE CONSUMER PRICE INDEX**

**15th Series**

**Dennis Trewin  
Australian Statistician**

**AUSTRALIAN BUREAU OF STATISTICS**

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## CONTENTS

SECTION	Page
1 Introduction	1
2 What is the CPI?	2
Overview of the 15th series CPI	3
How is the CPI used?	5
The CPI basket of goods and services	5
The relative importance of CPI items	7
Collecting prices for the CPI	8
Changes in quality	9
Periodic reviews of the CPI	10
How does the CPI relate to me?	11
Example: Adjusting for quality	12
3 Using the CPI	13
Interpreting index numbers	14
Analysing the CPI	15
Some examples on using the CPI	17
4 Calculating the CPI	20
Overview	20
Subdividing the basket	21
Collecting price data	23
Estimation of price movements for elementary aggregates	23
Calculating the current cost of the basket	26
5 Further information	28
Contacting the ABS	28
ABS publications on prices	28
APPENDIXES	
1 Weighting pattern for the CPI - June quarter 2005	30
2 Types of goods and services priced in the 15th Series CPI	33
3 Price indexes and contract price indexation	37
Glossary	43

## SECTION 1: INTRODUCTION

*CPI a widely used economic indicator released quarterly*

The Consumer Price Index (CPI) is an important economic indicator. It provides a general measure of changes in prices of consumer goods and services purchased by Australian households. The CPI is used for a variety of purposes, such as in the development and analysis of government economic policy, the adjustment of some government benefits and in individual contracts. Because of this, the CPI directly or indirectly affects all Australians.

CPI figures are produced by the Australian Bureau of Statistics (ABS) for each quarter (three months ending March, June, September and December) and are typically released within one month of the end of the quarter. They appear in the publication *Consumer Price Index, Australia* (cat. no. 6401.0). In addition, key CPI results appear on the ABS website <http://www.abs.gov.au>

*CPI introduced in 1960. Now comprises 15 linked series*

The CPI was first compiled in 1960 (with index numbers backcast to 1948). It was initially designed to measure quarterly changes in retail prices of goods and services purchased by metropolitan wage earner households. The CPI was preceded by five series of retail price indexes compiled by the (then) Commonwealth Bureau of Census and Statistics. These series were titled the A, B, C, and D Series, and the Interim Retail Price Index respectively. The C Series Index, which began in 1921, was the principal retail price index in Australia prior to the introduction of the CPI.

The introduction of the CPI heralded a change in the approach to measuring retail price movements. Instead of the former emphasis on long-term, fixed-weight indexes, the CPI comprises a series of shorter-term indexes which are chain linked together to form a continuous long-term series. This approach allows changes in expenditure patterns to be reflected in the CPI. The CPI now comprises fifteen linked indexes.

*This guide*

The purpose of this guide is to provide a broad overview of the CPI; how to use the CPI; and how the CPI is calculated. It takes into account changes made with the introduction of the 15th series CPI in the September quarter 2005 and is suitable for general users. This publication is also available online at <http://www.abs.gov.au>

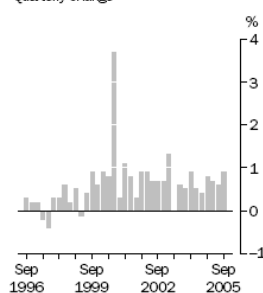
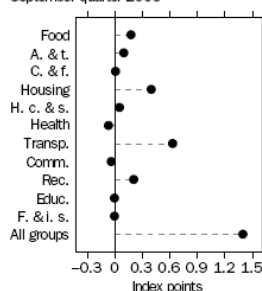
## SECTION 2: WHAT IS THE CPI?

SEPTEMBER QUARTER 2005

**6401.0****CONSUMER PRICE INDEX**

AUSTRALIA

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**All Groups**  
Quarterly change**Contribution to quarterly change**  
September quarter 2005

For further information about these and related statistics, contact Steve Whennan on Canberra (02) 6252 6251 or the National Information and Referral Service on 1300 135 070.

**KEY FIGURES****WEIGHTED AVERAGE OF EIGHT CAPITAL CITIES**

	<i>Jun Qtr 2005 to Sep Qtr 2005</i>	<i>Sep Qtr 2004 to Sep Qtr 2005</i>
	<i>% change</i>	<i>% change</i>
Food	0.8	3.3
Alcohol and tobacco	1.0	3.5
Clothing and footwear	0.2	-1.8
Housing	1.4	3.9
Household contents and services	0.3	0.8
Health	-1.1	4.6
Transportation	3.3	5.9
Communication	-0.7	-1.0
Recreation	1.2	1.4
Education	0.0	6.3
Financial and insurance services	0.1	..
<b>All groups</b>	<b>0.9</b>	<b>3.0</b>
All groups excluding Housing and Financial and insurance services	1.0	3.0

.. not applicable

**KEY POINTS****THE ALL GROUPS CPI**

- rose 0.9% in the September quarter 2005 compared with 0.6% in the June quarter.
- rose 3.0% through the year to September quarter 2005.

**OVERVIEW OF CPI MOVEMENTS**

- Contributing most to the overall increase this quarter were automotive fuel (+11.6%), house purchase (+1.2%), domestic holiday travel and accommodation (+3.4%), property rates and charges (+5.0%), beer (+1.8%), overseas holiday travel and accommodation (+2.0%), fruit (+3.0%), restaurant meals (+1.4%), rents (+0.6%), electricity (+1.7%) and water and sewerage (+3.0%).
- Partially offsetting these increases were falls in pharmaceuticals (-4.8%), deposit and loan facilities (-0.7%), audio, visual and computing equipment (-1.7%) and telecommunication (-0.7%).
- Using the points contribution data presented in table 7, the All groups CPI would have risen 0.5% in the September quarter 2005 if the effect of automotive fuel was excluded.

## OVERVIEW OF THE 15TH SERIES CPI

Consistent with the 13th and 14th series, the 15th series CPI has been specifically designed *as a general measure of price inflation for the household sector as a whole*. The CPI measures the changes in the price of a fixed basket of goods and services acquired by household consumers.

*CPI measures price change of  
a fixed basket of goods and  
services*

The simplest way of thinking about the CPI is to imagine a basket of goods and services comprising items bought by Australian households. Now imagine the basket is purchased each quarter. As prices change from one quarter to the next, so too will the total price of the basket. The CPI is simply a measure of the changes in the price of this fixed basket as the prices of items in it change.

*CPI reference population is all  
metropolitan private  
households*

The CPI measures price changes relating to the spending pattern of all metropolitan private households. This group is termed 'the CPI population group', and includes a wide variety of subgroups such as wage and salary earners, the self-employed, self-funded retirees, age pensioners, and social welfare beneficiaries. The term 'metropolitan' means the six State capital cities, Darwin and Canberra. The current series CPI population group represents about 64% of all Australian private households.

Ideally the CPI population group should encompass all Australian households, but this is not possible due to the substantial additional resources that would be required to collect prices outside the capital cities. ABS research has shown that, in general, price movements (as distinct from price levels) are similar across regions.

*Base period index number is  
100.0*

The price of the CPI basket in the reference base period is expressed as an index by assigning it a value of 100.0 and the prices in other periods are expressed as percentages of the price in the base period. For example, if the price of the basket had increased by 35% since the base year, then the index would be 135.0; similarly, if the price had fallen by 5% since the base year, the index would stand at 95.0. The current reference base period for the CPI is 1989–90, although some component series have a base period other than 1989–90.

*CPI does not measure price  
levels*

It is important to remember that the CPI measures price movements (i.e. percentage changes) and not actual price levels (dollar amounts). For instance, the index for Breakfast cereals of 143.4 and for Bread of 186.6 in the September quarter 2005 does not mean that Bread is more expensive than Breakfast cereals. It simply means that the price of Bread has increased at about twice the rate of the price of Breakfast cereals since the base period.

*CPI is not a purchasing power  
or cost-of-living measure*

Although the CPI is also commonly referred to as a measure of changes in purchasing power or a cost-of-living index, in an economic context these terms are not strictly interchangeable with a measure of price inflation. Their measurement would require separate, purpose built indexes. A single index cannot be expected to adequately fulfil all these roles.

An index designed to measure changes in the purchasing power of household incomes would need to be concerned with changes in the costs of all expenditures made from household income. Such a measure would include

items like income tax and interest payments.

A true cost-of-living index, among other things, would need to be concerned with changes in standards of living and with the substitutions that consumers make in order to maintain their standard of living when faced with changing market conditions (for instance, buying chicken rather than beef when beef prices are high).

The CPI on the other hand is constructed by reference to a basket consisting only of actual goods and services acquired by households. Further, as the composition of this basket is held fixed from period to period, it cannot accurately reflect changing consumer preferences and substitutions made in response to changes in relative prices.

In recognition of the widespread interest in the extent to which the impact of price change varies across different groups in the community, the ABS compiles and publishes analytical indexes specifically designed to measure changes in living costs for four selected population subgroups: Employee households; Age pensioner households; Other government transfer recipient households; and Self-funded retiree households. The indexes are released annually in *Australian Economic Indicators* (cat. no. 1350.0)

These indexes represent the conceptually preferred measures for assessing the impact of changes in prices on the disposable incomes of households. In other words, these indexes are particularly suited for assessing whether or not the disposable incomes of households have kept pace with price changes. The most notable difference between these indexes and the CPI is that the living cost indexes include interest charges but do not include new house purchases, while the CPI includes new house purchases but does not include interest charges.

## HOW IS THE CPI USED?

*The CPI is used as a macroeconomic indicator and for adjusting dollar values*

The CPI affects almost all Australians because of the many ways in which it is used. The two most common uses of the CPI are:

- as a macroeconomic indicator. The CPI, and other index series derived from CPI data, are used by the Government and economists to monitor and evaluate levels of inflation in the Australian economy. Inflation (and inflationary expectations) play a major role in determining various aspects of Government economic policy, and in the business and investment decisions of private firms and individuals;
- as a means of maintaining dollar values. The value of many types of fixed payments such as social welfare benefits can be reduced over time when prices rise. The CPI is often used to adjust these payments to counter the effects of inflation. This process is referred to as 'indexation'. Indexation arrangements are also often applied to such things as rental agreements, insurance cover and child support payments.

*There are many different price indexes available*

Although the CPI is the best known price index, it is but one of many produced by the ABS. Examples of other price indexes include:

- producer price indexes;
- labour price indexes;
- house price indexes;
- chained price indexes produced in conjunction with the Australian national accounts.

Having determined that a price index is required for a particular application it is important to carefully consider the range of available indexes and select the index which best meets the specific requirement. While the ABS can provide technical and statistical guidance, it does not provide advice on indexation practices and it cannot tell users which index they should use. These are matters for users to determine.

A general description of the range of issues that should be taken into account by parties considering an indexation clause have been published in, *“Price Indexes and Contract Price Indexation.”* This article is available on the ABS website, as Appendix 2 in the *CPI Concepts Sources and Methods* (cat. no. 6461.0) and as Appendix 3 in this Guide.

## THE CPI BASKET OF GOODS AND SERVICES

*CPI basket based on 2003–04  
HES data*

The composition of the CPI basket is based on the pattern of household expenditure in the 'weighting base period', which is 2003-04 for the 15th series CPI. Information on the spending habits of Australian households during 2003-04 was obtained from the Household Expenditure Survey (HES) conducted by the ABS. The HES results provide the starting point for selecting the basket of goods and services to be priced for the CPI.

*CPI basket includes items  
representative of all consumer  
goods and services*

For practical reasons, the basket cannot include every item bought by households, but it does include all the important kinds of items. It is not necessary to include all the items people buy since many related items are subject to similar price changes. The idea is to select representative items so that the index reflects price changes for a much wider range of goods and services than is actually priced. Examples of the types of items included in the basket are shown in Appendix 2.

When determining what items are to be priced for the CPI basket, various factors are taken into consideration. Items:

- must be representative of purchases made by the CPI population group;
- must have prices which can be associated with an identifiable and specific commodity or service (e.g. a 420g can of baked beans, or adult general admission to a league football game); and
- are not excluded on the basis of moral or social judgements. For example, some people may regard the use of tobacco or alcohol as socially undesirable, but both are included in the CPI basket because they are significant items of household expenditure and their prices can be accurately measured.



Income-based taxes, however, are not included in the CPI because they cannot be clearly associated with the purchase or use of a specific good or service.

*Financial services*

Financial services provided by financial institutions and services associated with the acquisition and disposal of shares and real estate have been introduced into the CPI in the 15th series. Financial service costs are of two broad types: direct and indirect. Direct costs include fees and charges on credit cards, bank accounts, and service fees such as commissions charged by real estate agents. Indirect costs are essentially the interest margins applying to deposits and borrowings of households with financial institutions.

*The CPI groups*

The total basket is divided into 11 major groups, each representing a specific set of commodities:

- Food
- Alcohol and tobacco
- Clothing and footwear
- Housing
- Household contents and services
- Health
- Transportation
- Communication
- Recreation
- Education
- Financial and insurance services

These groups are divided in turn into 33 subgroups, and the subgroups into 90 expenditure classes. An expenditure class is a grouping of similar items, such as various types of motor vehicles.

See Appendix 1 (page 30) for a full list of groups, subgroups and expenditure classes and the figure on page 20 for an illustration of the CPI structure.

THE RELATIVE  
IMPORTANCE OF CPI  
ITEMS

The overall (or All groups) CPI provides a measure of the average rate of price change. In calculating an average measure of this type it is necessary to recognise that some items are more important than others. Price changes for the more important items should have a greater influence on the average than price changes for less important items. For example, if household expenditure on bread is three times as large as expenditure on cheese, then a 10% price increase for bread should have a similar impact on the CPI as a 30% price increase for cheese.

*CPI weights*

Measures of expenditure on each of the 90 CPI expenditure classes are obtained primarily from the HES. However, some adjustments are made to HES data to account for known instances of underreporting (the most notable being for alcohol and tobacco) and any other anomalies. The adjusted HES data are then used to derive a 'weight' for each expenditure class. The weights for the 15th series CPI expenditure classes at June quarter 2005 prices are shown in Appendix 1.

The weights reflect the relative expenditures of the CPI population group as a whole and not those of any particular type and size of household. As such, the weights are said to reflect expenditures of households on average and **not** the expenditure of an average household.

The description of the CPI as measuring the change in price of a *fixed* basket of goods and services requires some qualification.

*Basket is fixed in terms of underlying quantities at the expenditure class*

First, although the weights are expressed in terms of expenditure shares, it is not the expenditure shares that are held constant (or fixed) from period to period. What is held constant are the quantities of goods and services underpinning these expenditures (where expenditure is the product of quantity and price). Presentation of weights in expenditure terms reflects the fact that it is simply not possible to present quantity weights in a meaningful way. The relative expenditure shares of items will change over time in response to changes in relative prices.

*Weights below the expenditure class can be varied*

Second, while the implicit quantity weights are held constant at the expenditure class level, the weights of items within an expenditure class (e.g. different grades of bread) can be varied between periodic reviews to reflect changed purchasing patterns. Any weight changes are introduced into the CPI in such a way as to not affect the level of the index.

*Update of fixed weights*

The underlying quantity weights for CPI expenditure classes are updated at approximately five yearly intervals with the timing generally linked to the availability of HES data. The introduction of new weights resulting from these updates is signalled by the commencement of a new CPI series (e.g. the 15th series CPI was introduced in September quarter 2005). Updating the weights is a key objective of the overall CPI review process. CPI reviews are discussed on page 10.

## COLLECTING PRICES FOR THE CPI

The collection of prices in each capital city is largely carried out by trained field staff operating out of the various offices of the ABS, while some prices are collected by special surveys out of the Canberra office.

*CPI goods and services priced at many different types of outlets*

Prices are collected in the kinds of retail outlets and other places where metropolitan households purchase goods and services. This involves collecting prices from many sources such as supermarkets, restaurants, travel agents and schools. Prices are collected via personal visit, telephone or internet as appropriate.

*CPI based on 100,000 price quotations each quarter*

Prices for items such as rail transport services, electricity and gas supply and telephone services are collected from the authorities concerned. Information on rents is obtained from property management companies and from government housing commissions. In total, around 100,000 separate price quotations are collected each quarter.

The frequency of price collection by item varies as necessary to obtain

reliable price measures. Prices of some items are volatile (i.e. their prices may vary many times each quarter) and for these prices frequent price observations are necessary to estimate a reliable average quarterly price. Each month prices are collected at regular intervals for goods such as petrol, fresh meat, fruit and vegetables, and women's outerwear.

For most other items price volatility is not a problem and prices are collected once a quarter. There are a few items where prices are changed at infrequent intervals, for example education services where prices are set once a year. In these cases the frequency of price collection is modified accordingly.

*Prices collected are what people actually pay*

The prices used in the CPI are those that any member of the public would have to pay to purchase the specified good or service. Any taxes levied on goods or services (such as the GST) are included in the CPI price. Similarly, prices include any subsidy or assistance provided directly by government (e.g. Child Care Benefit, Medicare). Sale prices, discount prices and 'specials' are reflected in the CPI so long as the items concerned are of normal quality (i.e. not damaged or shopsoiled), and are offered for sale in reasonable quantities. Any concessions available to particular groups of the population (such as age pensioners) are also taken into account where significant.

The measurement of price inflation has implications for pricing certain items in the CPI. Of particular note are financial services and general insurances (other than hospital and medical). The pricing of financial services is described in *Information Paper: Experimental Price Indexes for Financial Services 1998-2003* (cat. no. 6413.0). For general insurance, where the objective is to price the insurance service rather than the total premiums paid, see Keith Woolford "Treatment of Insurance Services in the Australian Consumer Price Index", *Australian Economic Indicators*, October 2000 (cat. no. 1350.0) for further information.

To ensure that price movements are representative of the experiences of metropolitan households, the brands and varieties of the goods and services which are priced are generally those which sell in greatest volume.

## CHANGES IN QUALITY

In concept quality embraces all the attributes of an item which consumers would consider before making a purchase. For example in the case of tinned tomato soup it would include the volume or weight of the contents as well as the concentration and flavour.

*Prices adjusted for changes in quality*

As the CPI aims to measure price changes for a fixed basket of goods and services over time, identical or equivalent items must be priced in successive periods. However, products do change; their components or ingredients may change resulting in an improvement or degradation in quality. As the characteristics of products are altered, the statisticians responsible for the price index attempt to separate the effects of a quality change from any underlying price changes so that the CPI measures 'pure' price change. A simple example of quality adjustment is shown on page 12.

*Quality change can be difficult to measure*

The requirement to take account of changes in quality, to ensure that the index reflects only pure price change, often poses difficult measurement problems and in some cases is impossible in practice. For example, while it is fairly easy to monitor changes in rail or bus ticket prices, it is difficult to attach a dollar value to changes in the quality (e.g. frequency or punctuality of the service).

## PERIODIC REVIEWS OF THE CPI

*CPI reviewed at five-yearly intervals*

Like any other long-standing and important statistical series, the CPI is reviewed from time to time to ensure that it continues to meet community needs. The ABS undertakes these reviews at approximately five yearly intervals with timing generally (though not necessarily) linked to the availability of results from the HES.

An important objective of these reviews is to update item weights to reflect changes in the range of available goods and services and changes in household spending patterns. They also provide an opportunity to reassess the scope and coverage of the index and other methodological issues.

Following these reviews, the new CPI series is linked to the old to form a continuous series. This linking is carried out in such a way that the resulting continuous series reflects only pure price change and not differences in the cost of the old and new baskets.

The reference base period for the CPI is also updated, but at less frequent intervals. Changes in reference base periods have no effect (other than rounding) on percentage changes, which are calculated from the index numbers.

*Major review conducted in 1998*

The last significant review of the CPI resulted in the 13th series of the index being introduced in respect of September quarter 1998. A major outcome of that review was the decision that the CPI would change from a measure of the change in living costs of employee households to a general measure of price inflation for the household sector. Consequently the population coverage was expanded from wage and salary earner households to include all metropolitan households. Weights were revised to reflect expenditure patterns from the 1993-94 HES.

*14th Series Review in 2000*

The 14th series CPI was introduced in September quarter 2000 after a minor review. The item weights were revised in line with 1998-99 HES expenditure patterns and a new utility based commodity classification was introduced to address issues arising from the introduction of The New Tax System (TNTS).

*15th Series Review in 2005*

The 15th series CPI introduced in September quarter 2005 was also a minor review. The item weights were revised in line with 2003-04 HES expenditure patterns and 'Financial services' were included in the index.

## HOW DOES THE CPI RELATE TO ME?

*CPI unlikely to reflect the price experience of individual households*

The CPI is designed to measure changes in retail prices experienced by metropolitan private households in aggregate. The composition of the basket and the relative importance of items in it relate to this population group as a whole - it represents the expenditures of all in-scope households, not the expenditure pattern of the average household or of any particular household type or size. The basket comprises all consumer goods and services acquired over a twelve month period. It includes items acquired infrequently by an individual household (e.g. major electrical appliances, new motor vehicles), items that are acquired almost daily by all households (e.g. bread and milk) and items that are only available at certain times of the year. The basket includes, for example, both rent payments of renting households and the amounts paid by owner-occupier households for the purchase of their principal residence — clearly no individual household can incur both expenses at the same time. Therefore, changes in the CPI are unlikely to reflect exactly the price experience of any particular household.

The CPI does not measure those changes in living costs which may be experienced by individual households as a direct consequence of their progression through the life cycle. For example younger households may incur a higher proportion of their expenditure on housing and child care while those households entering the older age groups may incur increasing expenditure on medical services. However, changes in the demographic make-up of households in aggregate and differences in expenditure patterns will affect the pattern of total household expenditure recorded in the HES. In turn, these changes will be incorporated in the weighting pattern in the CPI.

*CPI cannot be used to measure price levels*

The CPI is not designed to measure price levels; rather its purpose is to measure changes in prices over time. While price levels in country regions often differ from those in metropolitan areas (some higher and others lower), the factors influencing price movements generally tend to be similar. Therefore the CPI can be expected to provide a reasonable indication of the changes in prices in Australia as a whole in the longer term.

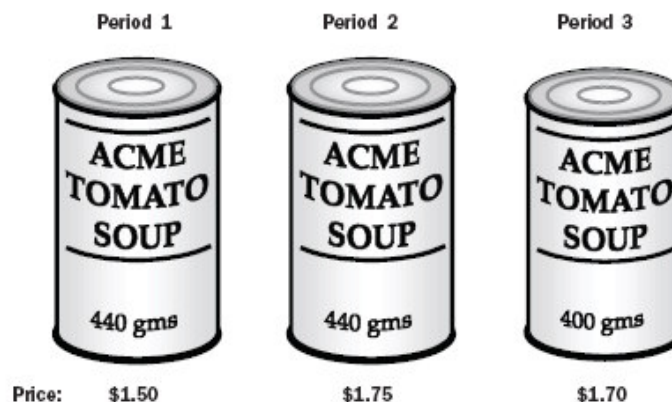
Similarly, the CPI cannot be used to compare price levels between capital cities. For example, the fact that the CPI All groups index in the September quarter 2005 for Adelaide (153.4) was higher than in Perth (147.8) does not indicate that Adelaide was more expensive to live in than Perth. Rather, it indicates that prices in Adelaide had risen more than in Perth since 1989-90.

At the end of the day, the CPI is most useful as an *indicator* of price movements, whether it be for specific items, a particular city, or the economy as a whole. The CPI is not a precise measure of individual household price experiences.

## EXAMPLE: ADJUSTING FOR QUALITY

To illustrate the process used to adjust for changes in the quality of items priced in the CPI, consider the case of a change in the size of a can of tomato soup. In this example, Acme brand tomato soup is priced in three periods (1, 2 and 3) and the size of the can is reduced from 440gms to 400gms between

period 2 and period 3:



Using the observed prices produces the following measures of price change:

<u>Period 1 to Period 2</u>	<u>Period 2 to Period 3</u>	<u>Period 1 to Period 3</u>
$(1.75 - 1.50) / 1.50 \times 100$	$(1.70 - 1.75) / 1.75 \times 100$	$(1.70 - 1.50) / 1.50 \times 100$
= 16.7%	= -2.9%	= 13.3%

However, this does not provide a measure of 'pure price' change because the item priced in period 3 is not identical to the item priced in the previous periods. What is required for period 3 is the 'price that would have been paid for the item that was priced in period 2'. This price can be estimated by adjusting the period 3 price by the ratio of the item's weight in period 2 to its weight in period 3, giving a quality adjusted price of \$1.87 ( $\$1.70 \times 440/400$ ).

Using this adjusted price in period 3 results in the following correct measures of price change:

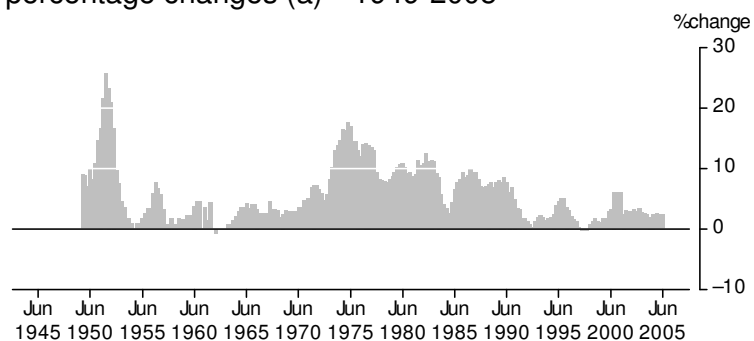
<u>Period 1 to Period 2</u>	<u>Period 2 to Period 3</u>	<u>Period 1 to Period 3</u>
$(1.75 - 1.50) / 1.50 \times 100$	$(1.87 - 1.75) / 1.75 \times 100$	$(1.87 - 1.50) / 1.50 \times 100$
= 16.7%	= 6.9%	= 24.7%

After adjusting for the reduction in quality between periods 2 and 3, the fall in the observed price of 2.9% has been translated into a pure price increase of 6.9%. Similarly, the measure of price change between periods 1 and 3 has been increased from 13.3% to 24.7%.

## SECTION 3

## USING THE CPI

## HISTORY OF THE CONSUMER PRICE INDEX, Annual percentage changes (a)—1949-2005



Note: (a) Percentage change from corresponding quarter of previous year

Source: *Consumer Price Index, Australia*  
(cat. no. 6401.0)

## INTERPRETING INDEX NUMBERS

### *Why use index numbers?*

Deriving useful price measures for single, specific items such as Granny Smith apples is a relatively straightforward exercise. An estimate of the average price per kilogram in each period is sufficient for all applications. Price change between any two periods would simply be calculated by direct reference to the respective average prices.

However, if the requirement is for a price measure that covers a number of diverse items, the calculation of a 'true' average price is both complicated and of little real meaning. For example, consider the problem of calculating and interpreting an average price for two commodities as diverse as apples and motor vehicles. Because of this, price measures such as the CPI are typically presented in index number form.

### *Description of a price index*

Price indexes provide a convenient and consistent way of presenting price information that overcomes problems associated with averaging across diverse items. The index number for a particular period represents the average price in that period relative to the average price in some base period for which, by convention, the average price has been set to equal 100.0.

A price index number on its own has little meaning. For example, the CPI All groups index number of 149.8 in the September quarter 2005 says nothing more than the average price in September quarter 2005 was 49.8% higher than the average price in the base year 1989–90 (when the index was set to 100.0). The value of index numbers stems from the fact that index numbers for any two periods can be used to directly calculate price change between the two periods.

### *Percentage change is different to a change in index points*

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 the September quarter 2004 and the September quarter 2005. The same procedure is applicable for any two periods.

#### Index numbers:

September quarter 2005	149.8
less September quarter 2004	145.4
equals change in index points	4.4

$$\text{Percentage change} = 4.4/145.4 \times 100 = 3.0\%$$

### *Movements in the CPI best measured using percentage changes*

For most applications, movements in price indexes are best calculated and presented in terms of percentage change. Percentage change allows comparisons in movements that are independent of the level of the index. For example, a change of 2 index points when the index number is 120 is equivalent to a percentage change of 1.7%, but if the index number was 80 a change of 2 index points would be equivalent to a percentage change of 2.5%—a significantly different rate of price change. Only when evaluating



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

*Percentage changes are not additive*

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 one year and the June quarter of the following year typically will not 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 and increasing it by 10% (multiplying by 1.1) each period. After four periods, the index will equal 146.4 delivering an annual percentage change of 46.4%, not the 40% given by adding the four quarterly changes of 10%.

*Calculating index numbers for periods longer than quarters.*

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 particular quarters. Because a quarterly index number can be interpreted as representing the average price during the quarter, index numbers for periods spanning more than one quarter can be calculated as the simple (arithmetic) average of the relevant quarterly indexes. For example, an index number for the year 2004 would be calculated as the arithmetic average of the index numbers for the March, June, September and December quarters of 2004.

This characteristic of index numbers is particularly useful. It allows for comparison of average prices in one year (calendar or financial) with those in any other year. It also enables prices in say the current quarter to be compared with the average prevailing in some prior year.

## ANALYSING THE CPI

The quarterly change in the All groups CPI represents the weighted average price change of all the items included in the CPI. While publication of index numbers and percentage changes for components of the CPI are useful in their own right, these data are often not sufficient to enable important contributors to overall 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.

*Points contribution and points contribution change*

If the All groups index number is thought of as being derived as the weighted average of indexes for all its component items, the index number for a component multiplied by its weight to the All groups index results in what is called its 'points contribution'. It follows that 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.

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:

Item	Index numbers		Percent change	Points contribution		Points change
	June qtr	September qtr		June qtr	September qtr	
All groups	148.4	149.8	0.9	148.4	149.8	1.4
Automotive fuel	182.6	203.7	11.6	5.62	6.26	0.64

#### Using points contributions

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:

- Calculate the effective weight for Automotive fuel in the June and September quarters** (given by the points contribution for Automotive fuel divided by the All groups index). For June, the weight is calculated as  $5.62/148.4 \times 100 = 3.8\%$  and for September as  $6.26/149.8 \times 100 = 4.2\%$ . Although the underlying quantities are held fixed, the effective weight in expenditure terms has increased due to the prices of Automotive fuel 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  $0.64/148.4 \times 100 = 0.4$ . In other words, a 11.6% increase in Automotive fuel prices in September quarter 2005 would have resulted in an increase in the overall CPI of 0.4 percentage points.
- 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 which represent the points contribution of the ‘other’ items). For the above 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,  $(143.5 - 142.8)/142.8 \times 100 = 0.5\%$ . In other words, prices of all items other than Automotive fuel increased by 0.5% 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 items 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% in December quarter 2005, then the points change for Automotive fuel would be  $6.26 \times 0.25 = 1.6$ , which would deliver an increase in the All groups index of  $1.6/149.8 \times 100 = 1.1\%$ . In other words, a 25% increase in Automotive fuel prices in December quarter 2005 would have the effect of

increasing the CPI by 1.1%. Another way commonly used to express this impact is ‘Automotive fuel’ would contribute 1.1 percentage points to the change in the CPI.

#### *ABS rounding conventions*

To ensure consistency in the data produced from the CPI, it is necessary for the ABS to adopt a set of consistent rounding conventions or rules for the calculation and presentation of data. The conventions strike a balance between maximising the usefulness of the data for analytical purposes and retaining a sense of the underlying precision of the estimates. These conventions need to be taken into account when using CPI data for analytical or other special purposes.

Index numbers are always published to a reference base of 100.0. Index numbers and percentage changes are always published to one decimal place, with the percentage changes being calculated from the rounded index numbers. Points contributions are published to two decimal places, with points contributions change being calculated from the rounded points contributions. Index numbers for periods longer than a single quarter (e.g. for financial years) are calculated as the simple arithmetic average of the relevant rounded quarterly index numbers.

#### **SOME EXAMPLES ON USING THE CPI**

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

**Question:** *What would \$200 in 2000 be worth in September quarter 2005?*

#### *CPI can be used to compare money values over time*

**Response:** This question is best interpreted as asking ‘How much would need to be spent in September quarter 2005 to purchase what could be purchased in 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 calendar 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 2000. The second is to multiply the initial dollar amount by the ratio of the index for September quarter 2005 to the index for 2000.

The index for calendar 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 rounded to one decimal place. The index for September quarter 2005 is 149.8.

The answer is then given by:

$$\$200 \times 149.8/128.4 = \$233.33.$$

**Question:** *Household Expenditure Survey data show that average weekly expenditure per 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%). Does this mean that households, on average, purchased 16% more motor vehicles in 2003–04 than they did in 1998–99?*

#### *Indexes used should be representative of specific items*

**Response:** 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 in

monetary units (e.g. dollars). While monetary aggregates are useful in their own right, economists and other analysts are frequently concerned with questions related to volumes, for example, whether more goods and services have been produced in one period compared with another period. Comparing monetary aggregates alone is not sufficient for this purpose as dollar values can change from one period to another due to either changes in quantities or changes in prices (most often a combination).

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 any period. Suppose that in the first period 10 oranges were purchased at a price of \$1.00 each and in the second period 15 oranges were purchased at a price of \$1.50 each. Expenditure in period one would be \$10.00 and in period two \$22.50. Expenditure has increased by 125%, yet the volume (number of oranges) has only increased by 50% with the difference being accounted for by a price increase of 50%. 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.

But 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 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 by reference to the oranges example:

$$\$22.50/150.0 \times 100.0 = \$15.00 = 15 \times \$1.00$$

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 quantities.

We now return to the question on expenditure on motor vehicles recorded in the HES in 1998-99 and 2003-04. As the HES data relates 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 which 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:

$$\$49.47/103.1 \times 105.9 = \$50.81$$

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%.

**Question:** *What would be the impact of a 10% increase in vegetable prices on the All groups CPI in the September quarter 2005?*

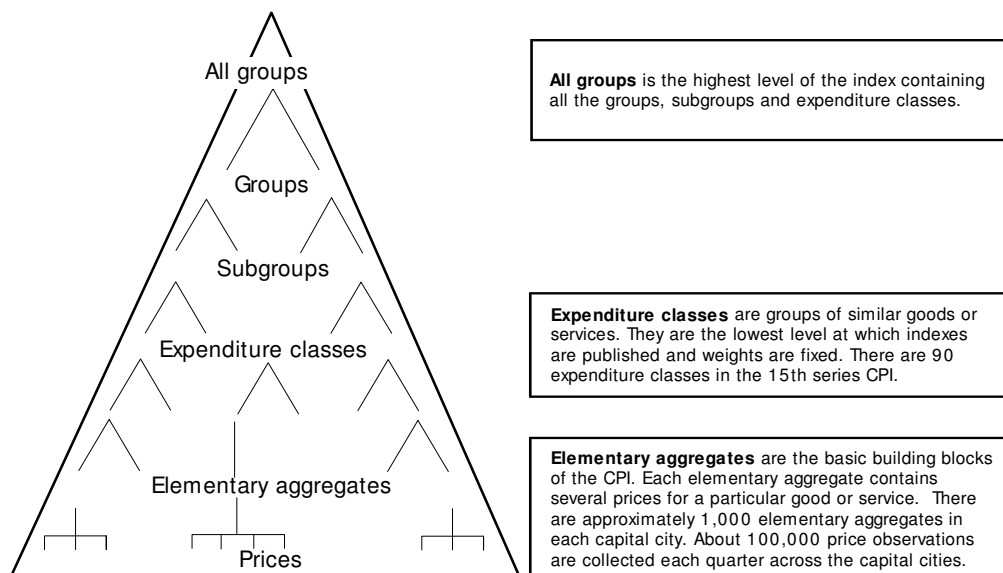
*Forecasting impact of price  
changes on the CPI*

**Response:** Two pieces of information are required to answer this question; the All groups index number for September quarter 2005 (149.8), and the September quarter 2005 points contribution for Vegetables (1.71).

An increase in vegetable prices of 10% would increase vegetables points contribution by  $1.71 \times 10/100 = 0.17$  index points which would result in an All groups index number of 150.0, an increase of 0.1%.

## SECTION 4: CALCULATING THE CPI

### CONSUMER PRICE INDEX STRUCTURE



### OVERVIEW

The CPI has previously been described in terms of a basket of goods and services which is '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 most closely with the procedures actually followed.

Using this description, the construction of the CPI can be thought of as being done in four major steps:

1. subdividing the total expenditure into individual items for which price samples can be selected;
2. collecting price data;
3. estimating price movements for individual items; and
4. calculating the current period cost of the basket.

## SUBDIVIDING THE BASKET

### *Expenditure aggregates*

Based mainly on the HES, estimates are obtained for total annual expenditure of private households in each capital city for each of the 90 expenditure classes in the CPI. As these estimates relate to the expenditure of households in aggregate, they are referred to as 'expenditure aggregates'.

While these expenditure aggregates are derived for well defined categories of household expenditure (e.g. bread), they are still too broad to be of direct use in selecting price samples. 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 industry data. The processes involved are illustrated below by reference to a stylised example for the Bread expenditure class of the CPI.

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 \$8m. Further, suppose that there exists separately some industry data 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 results are shown in the following table.

<i>Type of bread</i>	<i>Market Share</i>	<i>HES data</i>	<i>Derived expenditure aggregates</i>
	%	\$' 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

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

problems associated with measuring prices to constant quality.

In this example, a reasonable outcome would be to decide to construct price samples for items 1, 3, 5 and 6. Separate price samples would not be constructed for items 2 and 4 due to their relatively small market share. Price samples would also not be constructed for items 7 and 8 (bread rolls and specialty breads) as they would prove difficult to price to constant quality due to the tendency for these items to be sold by number rather than weight.

*Elementary aggregates must have a price sample*

The items for which it is decided to construct specific price samples are referred to as 'elementary aggregates'. (There are approximately 1,000 elementary aggregates for each of the eight capital cities, or approximately 8,000 price samples at the national level.) The expenditure aggregates for the items that are not to be explicitly priced are reallocated across the elementary aggregates in such a way as to best preserve the representativeness of the price samples. In this example, this would be done in two stages. First, the expenditure aggregate for item 2 would be allocated to item 1 and the expenditure aggregate for item 4 would be allocated to item 3. In the second stage, the expenditure aggregates for items 7 and 8 would be allocated, on a proportional basis, across the four elementary aggregates. This process is illustrated in the following table.

Type of bread	Expenditure aggregates			Elementary aggregate
	Initial	Stage 1	Stage 2	
	\$'000	\$'000	\$'000	
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	—	
<b>Total</b>	<b>8,000</b>	<b>8,000</b>	<b>8,000</b>	

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). Similarly for items 4 and 3. Price behaviour for items 7 and 8 (bread rolls and specialty bread) is likely to be best represented by the average price behaviour of all other breads.

*Determining outlet types*

Having settled on the items for which price samples are to be constructed, the next step is to determine the outlet types (respondents) from which prices will be collected. In order to accurately reflect changes in prices paid by households for bread, prices need to be collected from the various types of outlets from which households purchase bread. Data are unlikely to be available on the



expenditure 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 industry data indicates that supermarkets accounted for about 80% of bread sales and hot bake outlets the remainder. A simple way to construct the price sample for each elementary aggregate that is representative of household shopping patterns is to have a ratio of four prices from supermarkets to every hot bake price.

## COLLECTING PRICE DATA

### *Selecting respondents*

When price samples have been determined, ABS field staff determine from which individual supermarkets and hot bakes the prices will be collected. The individual outlets are chosen to be representative of the two types of outlets taking into account many perspectives. For example, the outlets should be representative of the socio-economic characteristics of the city. The prices are collected each quarter from the same respondents for the same items.

### *Selecting items to price*

When a respondent is first enrolled in the collection process the field staff will determine, in conjunction with the outlet management, which specific items are best representative of each elementary aggregate. For example, at one outlet it might be decided that the 680gm sliced white sandwich loaf is best representative of white sandwich bread; at another outlet it might be a 700gm white toast sliced sandwich loaf.

An important part of the ongoing price collection process is the monitoring of the items for quality change. In the stylised bread example quality change could occur in various ways. A possible quality change would be a change in the size (weight) of the loaf of bread. In this case prices would be adjusted to derive a pure price for the item along the lines illustrated in the example on page 12. Individual item prices are also compared with prices collected in the previous period to check their accuracy and to verify any large movements.

## ESTIMATION OF PRICE MOVEMENTS FOR ELEMENTARY AGGREGATES

Price samples are constructed for the sole purpose of estimating price movements for each elementary aggregate. These estimates of price movements are required to revalue the expenditure aggregates to current period prices in much the same way as illustrated in the example on using price indexes (see page 17). This is achieved by applying the period to period price movement to the previous period's expenditure aggregate for each elementary aggregate. It provides an estimate of the cost of acquiring the base period quantity of the elementary aggregate in the current quarter.

### *Four options for calculating price movement*

There is no single correct method for calculating the price movement for a sample of observations. Four commonly used methods are described below, using as an example price observations from two periods for multigrain bread.

<i>Price observations in</i>		<i>Price</i>	<i>Estimates of</i>
<i>Period 1</i>	<i>Period 2</i>		
\$	\$		

	(a)	(b)	(b)/(a)	
<b>Outlet data</b>				
<b>Supermarket A</b>	<b>1.50</b>	<b>1.80</b>	1.200	..
<b>Supermarket B</b>	<b>1.60</b>	<b>1.90</b>	1.188	..
<b>Supermarket C</b>	<b>1.85</b>	<b>1.50</b>	0.811	..
<b>Supermarket D</b>	<b>1.75</b>	<b>1.50</b>	0.857	..
<b>Hot bake</b>	<b>2.00</b>	<b>2.20</b>	1.100	..
<i>Average prices</i>				
Arithmetic mean	1.74	1.78	..	..
Geometric mean	1.73	1.76	..	..
Four methods of calculating price movement:				
<i>Relative of average prices</i>				
Arithmetic mean	..	..	..	1.023
Geometric mean	..	..	..	1.017
<i>Average of price relatives</i>				
Arithmetic mean	..	..	..	1.031
Geometric mean	..	..	..	1.017

The differences between the four methods involve choices as to:

- whether the price movement for the sample is calculated as the average of each period's prices or as the average of price movements between periods for each item; and
- the type of average used.

The two commonly used forms of average are the arithmetic mean and the geometric mean. For a sample of  $n$  price observations, the arithmetic mean is the sum of the individual prices divided by the number of observations, while the geometric mean is the  $n^{\text{th}}$  root of the product of the prices. For example, the arithmetic mean of 4 and 9 is 6.5, while the geometric mean is 6 (the geometric mean is always less than or equal to the arithmetic mean).

#### *Relative of arithmetic mean prices*

Based on these options, one method is to construct a ratio of the arithmetic average prices in the two periods. In the above example the arithmetic average of prices in period 1 is \$1.74 and in period 2 it is \$1.78, giving a relative of 1.023 ( $1.78/1.74$ ) or a percentage change of 2.3%. This method is called the 'relative of arithmetic mean prices' (RAP), sometimes referred to as the 'Dutot' index formula.

#### *Arithmetic mean of price relatives*

A second method is to calculate the price movement between periods for each individual item and then take the arithmetic average of these movements. The price movement for each item must be expressed in relative terms (i.e. period 2 price divided by period 1 price as shown in the second column from the right in the above table). In the example above the arithmetic average of the price relatives is 1.031, a price change of 3.1%. This method is called the 'arithmetic mean of price relatives' (APR), sometimes referred to as the 'Carli' index formula.

#### *Geometric means*

A third method is to construct a ratio of the geometric mean of prices in each

period. The geometric mean of the sample prices in period 1 is \$1.73 and in period 2 it is \$1.76 giving a relative of 1.017 ( $1.76/1.73$ ) or a percentage change of 1.7%.

The fourth method is to calculate the geometric mean of the price movements for each individual item. Again, the price movements must be in the form of price relatives. In the above example, the geometric mean of the price relatives is 1.017, indicating a price increase of 1.7%, the same as using the ratio of the geometric mean of prices in each period.

In fact the geometric mean will always produce the same result whether the relative of mean prices or the mean of relative prices is used. These methods are simply referred to as the geometric mean (GM), sometimes called the 'Jevons' index formula.

*Geometric mean is the preferred method*

The method of calculating price change at the elementary aggregate level is important to the accuracy of the price index. The arithmetic average of price relatives (APR) approach has been shown to be more prone to (upward) bias than the other two methods. In line with various overseas countries, the ABS is using the geometric mean formula for calculating elementary aggregate index numbers where practical in the 15th series of the CPI. Where the geometric mean is not appropriate the relative of arithmetic mean prices (RAP) is used. The reasoning behind using geometric means is outlined below.

*Geometric mean allows for substitution*

At the elementary aggregate level of the index it is usually impractical to assign a specific weight to each individual price observation. The three formulas described above implicitly apply equal weights to each observation, although the bases of the weights differ. The geometric mean applies weights such that the expenditure shares of each observation are the same in each period. In other words the geometric mean formula implicitly assumes households buy less (more) of items that become more (less) expensive relative to the other items in the sample. The other formulas assume equal quantities in both periods (RAP) or equal expenditures in the first period (APR), with quantities being inversely proportional to first period prices. The geometric mean therefore appears to provide a better representation of household purchasing behaviour than the alternative formula in those elementary aggregates where there is likely to be high substitutability in consumption within the price sample.

*Geometric mean not appropriate for all elementary aggregates*

The geometric mean cannot be used to calculate the average price in all elementary aggregates. It cannot be used in cases where the price could be zero (i.e. the cost of a good or service is fully subsidised by the government). It is also not appropriate to use geometric means in elementary aggregates covering items between which consumers are unable to substitute. An example of this is local government rates where it is not possible to switch from a high rate area to a low rate area without physically moving location.

CALCULATING THE  
CURRENT COST OF  
THE BASKET

Once price movements are calculated for each elementary aggregate, they can be used to derive the expenditure aggregates that are then summed to derive the current cost of the basket. It is from the expenditure aggregates that index numbers are calculated at any level of the index. The stylised example above is continued to show the process for the Bread expenditure class.

<i>Elementary</i>	<i>Expenditure</i>		<i>Price</i>	<i>Expenditure</i>
<i>Aggregate</i>	<i>aggregate</i>		<i>Movement</i>	<i>aggregate</i>
	<i>Period 1</i>	<i>Period 1 to Period 2</i>		<i>Period 2</i>
	<i>\$'000</i>		<i>(a)</i>	<i>\$'000</i>
White sandwich	3,200		1.025	3,280
White high fibre	2,300		1.015	2,334
Wholemeal	1,000		1.020	1,020
Multigrain	1,500		1.017	1,526
<b>Total</b>	<b>8,000</b>		<b>—</b>	<b>8,160</b>

(a) Geometric mean of price relatives

The expenditure aggregates are revalued to period 2 prices by applying the movements between period 1 and period 2. The expenditure aggregate for the expenditure class Bread is the sum of the expenditure aggregates for the elementary aggregates comprising the expenditure class. Summing the elementary aggregates says that in period 2 it would cost \$8.160m to buy the volume of Bread in period 1 that cost \$8m. The price change for Bread between period 1 and 2 is simply the ratio of these expenditure aggregates, that is, a price increase of 2.0% (8.160/8). Thus if the price index for bread was 100.0 in period 1, it would be 102.0 in period 2.

The derivation of the expenditure class movement as shown above is mathematically equivalent to a weighted average of the price movements for the individual elementary aggregates, that is, a weighted version of the mean of price relatives formula discussed above. In this case period 1 expenditure aggregates are the weights. The same formula is used at higher levels of the index.

Similar procedures are used to derive price movements at higher levels of the CPI. For example, the current period cost of purchasing items in the Bread and cereal products subgroup of the CPI is obtained by summing the current period expenditure aggregates of the expenditure classes Bread, Cakes and biscuits, Breakfast cereals and Other cereal products. The ratio of the current and previous period expenditure aggregates for the Bread and cereal products subgroup gives the price movement for the subgroup.

Points contributions (see page 15) are also calculated using the expenditure aggregates. The current period points contribution of a CPI component, for example the expenditure class Bread, is the current period expenditure aggregate for Bread relative to the expenditure aggregate for the All groups CPI multiplied by the current period All Groups index number.

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. The published index numbers and points contributions are a convenient presentation of the information.

## SECTION 5: FURTHER INFORMATION

### CONTACTING THE ABS

All ABS publications are now available on the ABS website:  
<http://www.abs.gov.au>.

A full list of statistical publications produced by the ABS is detailed in the  
*Catalogue of Publications and Products, Australia* (cat. no. 1101.0),

If you want to know more about the CPI write to:

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### ABS PUBLICATIONS ON PRICES

#### *Consumer Price Indexes*

“Analytical Living Cost Indexes for Selected Australian Household Types”,  
*Australian Economic Indicators* (cat. no. 1350.0)—annual

*Consumer Price Index* (cat. no. 6401.0)—quarterly

*Average Retail Prices of Selected Items, Eight Capital Cities* (cat. no.  
6403.0.55.001)—quarterly

*Information Paper: Experimental Price Indexes for Financial Services 1998-  
2003* (cat. no. 6413.0)

*Experimental Price Indexes for Financial Services* (cat. no. 6413.0.55.001)

*House Price Indexes: Eight Capital Cities* (cat. no. 6416.0)—quarterly

*Information Paper: An Analytical Framework for Price Indexes in Australia*  
(cat. no. 6421.0)

*Information Paper: Price Indexes and The New Tax System 2000* (cat. no.  
6425.0)

*Consumer Price Index: 15<sup>th</sup> Series Weighting Pattern* (cat. no. 6430.0)

*A Guide to the Consumer Price Index: 14th Series* (cat. no. 6440.0)

*Information Paper: Feasibility of Constructing Price Indexes for Special  
Population Groups* (cat. no. 6445.0)

*Consumer Price Index: Concordance with Household Expenditure  
Classification, Australia* (cat. no. 6446.0.55.001)

	<p><i>Information Paper: Issues to be Considered During the 13th Series Australian Consumer Price Index Review</i> (cat. no. 6451.0)</p> <p><i>Information Paper: Outcome of the 13th Series Australian Consumer Price Index Review</i> (cat. no. 6453.0)</p> <p><i>Information Paper: Introduction of the 13th Series Australian Consumer Price Index</i> (cat. no. 6454.0)</p> <p><i>Consumer Price Index Standard Data Report: Capital Cities Index Numbers by Expenditure Class</i> (cat. no. 6455.0.55.001)</p> <p><i>Information Paper: Introduction of the 14th Series Australian Consumer Price Index</i> (cat. no. 6456.0)</p> <p><i>Australian Consumer Price Index: Concepts, Sources and Methods</i> (cat. no. 6461.0)</p> <p><i>Information Paper: Introduction of the 15th Series Australian Consumer Price Index</i> (cat. no. 6462.0)</p>
Producer Price Indexes	<p><i>Information Paper: Review of the Import Price Index and Export Price Index, Australia</i> (cat. no. 6424.0)</p> <p><i>Producer Price Indexes, Australia</i> (cat. no. 6427.0)—quarterly</p> <p><i>Information Paper: Price Index of Domestic Final Purchases, Australia</i> (cat. no. 6428.0)</p> <p><i>International Trade Price Indexes, Australia</i> (cat. no. 6457.0)—quarterly</p> <p><i>Information Paper: The Introduction of Hedonic Price Indexes for Personal Computers</i> (cat. no. 6458.0)</p>
Labour Price Indexes	<p><i>Labour Price Index, Australia</i> (cat. no. 6345.0)—quarterly</p> <p><i>Labour Price Index: Concepts, Sources and Methods</i> (cat. no. 6351.0.55.001)</p>
Household Expenditure Survey	<p><i>Household Expenditure Survey, Australia: User Guide</i> (cat. no. 6527.0)</p> <p><i>Household Expenditure Survey, Australia 1998–99: Detailed Expenditure Items</i> (cat. no. 6535.0)</p> <p><i>Household Expenditure Survey, Australia 2003–04, Detailed Expenditure Items</i> (cat. no. 6535.0.55.001)</p>
Indexation	<p>“Price Indexes and Contract Price Indexation”, Appendix 2 in <i>Concepts Sources and Methods</i> (cat. no. 6461.0)</p>

APPENDIX 1  
2005

## WEIGHTING PATTERN FOR THE CPI – JUNE QUARTER

		15th Series Percentage contribution to the All groups CPI June quarter 2005	
	<i>Group</i>	<i>Subgroup</i>	<i>Expenditure class</i>
<b>FOOD</b>	<b>15.44</b>		
<b>Dairy and related products</b>		<b>1.19</b>	
Milk			0.55
Cheese			0.32
Ice cream and other dairy products			0.31
<b>Bread and cereal products</b>		<b>1.72</b>	
Bread			0.63
Cakes and biscuits			0.71
Breakfast cereals			0.20
Other cereal products			0.18
<b>Meat and seafoods</b>		<b>2.42</b>	
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
<b>Fruit and vegetables</b>		<b>2.11</b>	
Fruit			0.95
Vegetables			1.15
<b>Non-alcoholic drinks and snack food</b>		<b>1.96</b>	
Soft drinks waters and juices			0.91
Snacks and confectionery			1.05
<b>Meals out and takeaway foods</b>		<b>4.56</b>	
Restaurant meals			2.00
Takeaway and fast foods			2.56
<b>Other food</b>		<b>1.49</b>	
Eggs			0.10
Jams, honey and sandwich spreads			0.15
Tea, coffee and food drinks			0.24
Food additives & condiments			0.27
Fats and oils			0.19
Food n.e.c.			0.54
<b>ALCOHOL AND TOBACCO</b>	<b>6.79</b>		
<b>Alcoholic drinks</b>		<b>4.38</b>	
Beer			1.93
Wine			1.57
Spirits			0.87
<b>Tobacco</b>		<b>2.41</b>	
Tobacco			2.41
<b>CLOTHING AND FOOTWEAR</b>	<b>3.91</b>		
<b>Men's clothing</b>		<b>0.75</b>	
Men's outerwear			0.64
Men's underwear, nightwear and socks			0.11



15th Series Percentage contribution to the All groups CPI June quarter 2005			
	<i>Group</i>	<i>Subgroup</i>	<i>Expenditure class</i>
<b>Women's clothing</b>		<b>1.41</b>	
Women's outerwear			1.13
Women's underwear nightwear and hosiery			0.27
<b>Children's and infants' clothing</b>		<b>0.40</b>	
Children's and infants' clothing			0.40
<b>Footwear</b>		<b>0.64</b>	
Men's footwear			0.18
Women's footwear			0.34
Children's footwear			0.12
<b>Accessories and clothing services</b>		<b>0.72</b>	
Accessories			0.56
Clothing services and shoe repair			0.16
<b>HOUSING</b>	<b>19.53</b>		
<b>Rents</b>		<b>5.22</b>	
Rents			5.22
<b>Utilities</b>		<b>3.10</b>	
Electricity			1.63
Gas and other household fuels			0.70
Water and sewerage			0.77
<b>Other housing</b>		<b>11.21</b>	
House purchase			7.87
Property rates and charges			1.16
House repairs and maintenance			2.18
<b>HOUSEHOLD CONTENTS AND SERVICES</b>	<b>9.61</b>		
<b>Furniture and furnishings</b>		<b>3.13</b>	
Furniture			1.96
Floor and window coverings			0.78
Towels and linen			0.39
<b>Household appliances utensils and tools</b>		<b>1.76</b>	
Major household appliances			0.67
Small electric household appliances			0.27
Glassware, tableware and household utensils			0.47
Tools			0.35
<b>Household Supplies</b>		<b>2.91</b>	
Household cleaning agents			0.33
Toiletries and personal care products			1.18
Other Household Supplies			1.40
<b>Household Services</b>		<b>1.81</b>	
Childcare			0.45
Hairdressing and personal care services			0.75
Other household services			0.60
<b>HEALTH</b>	<b>4.70</b>		
<b>Health services</b>		<b>3.56</b>	
Hospital and medical services			2.77
Optical services			0.12
Dental services			0.67
<b>Pharmaceuticals</b>		<b>1.14</b>	
Pharmaceuticals			1.14

15th Series Percentage contribution to the All groups CPI June quarter 2005			
	<i>Group</i>	<i>Subgroup</i>	<i>Expenditure class</i>
<b>TRANSPORTATION</b>	<b>13.11</b>		
<b>Private motoring</b>		<b>12.38</b>	
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
<b>Urban transport fares</b>		<b>0.73</b>	
Urban transport fares			0.73
<b>COMMUNICATION</b>	<b>3.31</b>		
<b>Communication</b>		<b>3.31</b>	
Postal			0.11
Telecommunication			3.20
<b>RECREATION</b>	<b>11.55</b>		
<b>Audio, visual and computing</b>		<b>2.92</b>	
Audio, visual and computing equipment			1.53
Audio, visual & computing media and services			1.38
<b>Books, newspapers and magazines</b>		<b>0.85</b>	
Books			0.44
Newspapers and magazines			0.41
<b>Sport and other recreation</b>		<b>3.72</b>	
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
<b>Holiday travel and accommodation</b>		<b>4.06</b>	
Domestic holiday travel and accommodation			2.27
Overseas holiday travel and accommodation			1.79
<b>EDUCATION</b>	<b>2.73</b>		
<b>Education</b>		<b>2.73</b>	
Preschool and primary education			0.53
Secondary education			0.94
Tertiary education			1.26
<b>FINANCIAL AND INSURANCE SERVICES</b>	<b>9.31</b>		
<b>Financial services</b>		<b>7.81</b>	
Deposit and loan facilities			4.47
Other financial services			3.34
<b>Insurance services</b>		<b>1.50</b>	
Insurance services			1.50
<b>ALL GROUPS</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

## APPENDIX 2

## TYPES OF GOODS AND SERVICES PRICED IN THE 15TH SERIES CPI

The following table gives an indication of the types of items that are priced and where particular items are classified in the CPI structure (e.g. soy milk is classified as belonging to the expenditure class Milk and cream).

The mention of an item in the table does not necessarily mean that there is a specific price sample for that item, nor does it mean that all the price samples are specifically listed.

## A2

## LIST OF GOODS AND SERVICES PRICED FOR THE CPI

<i>Group, subgroup, expenditure class</i>	<i>Examples of item coverage</i>
<b>FOOD</b>	
<b>Dairy and related products</b>	
Milk	Fresh milk (including flavoured) and substitutes (e.g. soy milk)
Cheese	All types, including sliced and grated
Ice cream and other dairy products	Ice cream in tubs or carton, powdered and condensed milk, cream, yogurt and dairy snacks
<b>Bread and cereal products</b>	
Bread	All types of bread
Cakes and biscuits	Cakes, pastries and biscuits
Breakfast cereals	All grain based breakfast cereals, including muesli
Other cereal products	All types of flour, rice, pasta and similar grain based products, including bran
<b>Meat and seafoods</b>	
Beef and veal	All cuts of beef and veal; fresh, chilled and frozen, including mince
Lamb and mutton	All cuts of lamb and mutton; fresh chilled and frozen
Pork	All cuts of pork; fresh, chilled and frozen
Poultry	Pieces or whole poultry; fresh, chilled or frozen
Bacon and ham	All styles of bacon and ham; fresh and canned
Other fresh and processed meat	Sausages, salami and other processed meats, game meats, fresh, canned or frozen
Fish and other seafood	All seafoods; fresh, chilled, frozen, canned or processed
<b>Fruit and vegetables</b>	
Fruit	All fruit; fresh and chilled, canned, dried or frozen
Vegetables	All vegetables; fresh and chilled, canned, dried or frozen
<b>Non alcoholic drinks and snack food</b>	
Soft drinks, waters and juices	Carbonated and still non-alcoholic drinks and cordials, including water, fruit and vegetable juices
Snacks and confectionery	Corn and potato chips, nuts, chocolates, lollies, gum, water based ice confectionery, individual serve milk based confectionery
<b>Meals out and take away foods</b>	
Restaurant meals	All meals eaten in restaurants, hotels, cafes etc offering full table service
Take away and fast foods	All take away and delivered meals and fast food suitable for immediate consumption
<b>Other food</b>	
Eggs	Fresh, powdered and preserved eggs or parts of eggs (whites, yolks)
Jams, honey and sandwich spreads	Jams, honey, syrups, sandwich spreads and dips
Tea, coffee and food drinks	Tea (leaves, bags etc) and coffee (instant, ground etc), chocolate based food drinks
Food additives and condiments	Sugar and artificial sweeteners, salt, spices, sauces and pastes and salad dressings
Fats and oils	All 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)

## A2

## LIST OF GOODS AND SERVICES PRICED FOR THE CPI—continued

<i>Group, subgroup, expenditure class</i>	<i>Examples of item coverage</i>
<b>ALCOHOL AND TOBACCO</b>	
<b>Alcoholic drinks</b>	
Beer	Beer of all strengths recognised as alcoholic; bottles, cans and tap; purchases in bar, club, bottle shop and restaurant
Wine	Still and sparkling wine recognised as alcoholic; bottles, casks and glass; purchases in bar, club, bottle shop and restaurant
Spirits	Spirits; bottled, canned and glass; purchased in bar, club and bottle shop
<b>Tobacco</b>	
Tobacco	Cartons and packs of cigarettes, cigars and tobacco
<b>CLOTHING AND FOOTWEAR</b>	
<b>Men's clothing</b>	
Men's outerwear	Men's suits, jumpers, jeans, business and casual shirts, T-shirts and swimwear
Men's underwear, nightwear and socks	Men's briefs, singlets, pyjamas and socks
<b>Women's clothing</b>	
Women's outerwear	Women's dresses, blouses, suits, jeans and coats
Women's underwear nightwear and hosiery	Women's bras, briefs, nightwear, lingerie and hosiery
<b>Children's and infants' clothing</b>	
Children's and infants' clothing	Children's jeans, shorts, T-shirts, socks and underwear
<b>Footwear</b>	
Men's footwear	All men's footwear except sport or game specific footwear
Women's footwear	All women's footwear except sport or game specific footwear
Children's footwear	Children's shoes, sandals, general sports shoes and baby shoes
<b>Accessories and clothing services</b>	
Accessories	Items complementary to clothing including hats, wallets, non-prescription sunglasses, watches, luggage and jewellery
Clothing services and shoe repairs	Clothing and footwear services including dry cleaning, shoe repairs, and dressmaking
<b>HOUSING</b>	
<b>Rents</b>	
Rents	Rent paid to private and government landlords, including housing authorities (e.g. Defence Housing Authority)
<b>Utilities</b>	
Electricity	Electricity charges and connection fees
Gas and other household fuels	Mains and bottled gas including connection fees, and other household fuels such as firewood, briquettes and heating oil
Water and sewerage	Water supply and sewerage charges
<b>Other housing</b>	
House purchase	New homes (excluding land) and major improvements to existing homes, and fixed appliances such as ducted heating, hot water systems and ovens
Property rates and charges	State and local council property based rates and charges except water and sewerage
House repairs and maintenance	Materials and labour costs for repairs and maintenance to dwellings
<b>HOUSEHOLD CONTENTS AND SERVICES</b>	
<b>Furniture and furnishings</b>	
Furniture	All household furniture (including outdoors), lamps, ornaments, pictures and the like
Floor and window coverings	All floor and window coverings, including ceramic and vinyl tiles
Towels and linen	Bathroom, bedroom, table and kitchen linen, blankets and pillows
<b>Household appliances, utensils and tools</b>	
Major household appliances	Purchase, hire and repair of all major household appliances not permanently fixed such as refrigerators and washing machines
Small electric household appliances	Purchase and hire of smaller electrical appliances such as toasters and kettles
Glassware, tableware and household utensils	Dinner sets, cutlery, stoneware, steak knives, pots, pans, cookware, brooms and mops
Tools	Lawnmowers, garden tools, electric drills and paint brushes
<b>A2</b>	<b>LIST OF GOODS AND SERVICES PRICED FOR THE CPI—continued</b>
<i>Group, subgroup, expenditure class</i>	<i>Examples of item coverage</i>

<b>Household supplies</b>	
Household cleaning agents	Laundry soaps and powders, bleach, disinfectants and polishes
Toiletries and personal care products	Cosmetics, toothpaste, shampoo, soaps, body deodorants, nappies, shavers and hairdryers
Other household supplies	Other items used in households, including toilet paper, insect repellent, garbage bags and aluminium foil
<b>Household services</b>	
Childcare	Full-time and part-time care of children by either community, private or family based day care
Hairdressing and personal care services	Includes haircuts, hair removal, weight loss and ear piercing services
Other Household services	Includes house cleaning, lawn mowing, gardening and pest control services; furniture removal and storage
<b>HEALTH</b>	
<b>Health services</b>	
Hospital and medical services	Medical insurance, doctor and specialist fees, other medical and practitioner fees and hospital charges
Optical services	Opticians fees, prescription spectacles and repairs
Dental services	Dentists fees including fillings, dentures and braces
<b>Pharmaceuticals</b>	
Pharmaceuticals	Prescription medicines, vaccines and treatments, cold-relief products, vitamins, band-aids, antiseptic, sunscreen, skin treatment and therapeutic appliances
<b>TRANSPORTATION</b>	
<b>Private motoring</b>	
Motor vehicles	Purchase and long term hire/lease of new cars and motor cycles
Automotive fuel	Unleaded petrol, lead replacement petrol, diesel and LPG
Motor vehicle repair and servicing	Crash repairs, panel beating and routine servicing of motor vehicles
Motor vehicle parts and accessories	Separately purchased parts and accessories for motor vehicles including motor oils and tyres
Other motoring charges	Motor vehicle registration, driver license fees, parking fees, driving lessons and tollway charges
<b>Urban transport fares</b>	
Urban transport fares	Bus, train, ferry, tram and taxi fares, not for holiday travel
<b>COMMUNICATION</b>	
<b>Communication</b>	
Postal	Stamps, prepaid postage envelopes and postal delivery charges
Telecommunication	Local and long distance calls, connection fees, mobile phone services, internet and broadband services
<b>RECREATION</b>	
<b>Audio, visual and computing</b>	
Audio, visual and computer equipment	Equipment including televisions, videos, computer hardware and stereos
Audio, visual and computing media and services	Media including blank and pre-recorded DVDs, CDs, computer software (except games) and photographic media; all forms of stationery; services such as video tape and DVD rental, photographic media processing and pay television
<b>Books, newspapers, magazines</b>	
Books	Fiction, non fiction, hardback and paperback
Newspapers and magazines	Newspapers, comics, magazines and catalogues
<b>Sports and other recreation</b>	
Sports and recreational equipment	Purchase and repair of equipment used in playing sport (including specialist footwear) and for recreation, including camping equipment
Toys, games and hobbies	Console games, musical instruments, toys, board games and hobby materials
Sports participation	Fees and charges for playing sport including lessons, ground fees, gym fees and equipment hire

Pets, pet foods and supplies	Pets, pet foods, aquariums and other items for the housing and care of pets
Pet services including veterinary	Services to care for animals, including veterinary, kennel and stable fees
Other recreational activities	Other recreation and entertainment expenses including admission fees to live events (e.g. cinema, amusement parks etc)
<b>Holiday travel and accommodation</b>	
Domestic holiday travel and accommodation	Air, sea and rail travel, car hire, hotel and motel accommodation and package charges for holidays in Australia
Overseas holiday travel and accommodation	Air, sea and rail travel, car hire, hotel and motel accommodation and package charges for holidays overseas
<b>EDUCATION</b>	
<b>Education</b>	
Preschool and primary education	Private and government preschool and primary education fees
Secondary education	Private and government secondary education fees
Tertiary education	Private and government tertiary education fees
<b>FINANCIAL AND INSURANCE SERVICES</b>	
<b>Financial services</b>	
Deposit and loan facilities	Explicit fees and charges on deposit and loan facilities; financial institution margins applying to deposits and borrowings of households
Other financial services	Commissions or fees charged by stockbrokers and real estate agents; taxes on transfers of real estate
<b>Insurance services</b>	
Insurance services	Comprehensive insurance for dwellings and motor vehicles, compulsory third party motor vehicle insurance services.

## PRICE INDEXES AND CONTRACT PRICE INDEXATION

### INTRODUCTION

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.

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).

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

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.

The role of the ABS as the central statistical authority for the Australian government includes to publish price index data, and to broadly explain 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

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.

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.

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?

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, 3 to 4 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.

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, 3 to 4 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.

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, 3 to 4 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.

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 6 to 7 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, with wage price indexes also being produced for broad occupation 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.

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 sub-components 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 macro-economic 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. Also, 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 DEVELOPING INDEXATION CLAUSES USING A PRICE INDEX**

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.

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, industry group or occupation 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.

• **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, the situations in which revisions do occur include to correct 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 by the parties to them to not be 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 =  $3.0/141.1 \times 100 = 2.1\%$

• **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.

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## GLOSSARY

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.
Cost-of-living (index)	A measure of the change in household income required to maintain a constant level of utility.
CPI	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 90 expenditure classes in the 15h series CPI.
Expenditure aggregate	The current cost in dollars per year of purchasing the same quantity of goods or services as was purchased in the weighting base period by the CPI population group.
Group	The first level of disaggregation of the CPI. There are 11 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%.
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 were the primary source of information for the expenditure weights for the 15th series CPI.
Indexation	The periodic adjustment of a money value according to changes in a price index.
Inflation (deflation)	A term commonly used to refer to changes in price levels. A rise in prices is called inflation, while 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.
Metropolitan	For purposes of the CPI, 'metropolitan' refers to the six State capital cities, Darwin and Canberra

Price index	A composite measure of the prices of items expressed relative to a defined base period.
Price levels	Actual money values in a particular period of 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, non self-care units 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.
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.
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 33 subgroups in the 15th series CPI.
The New Tax System (TNTS)	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.
Transaction prices	The prices actually paid by consumers to acquire goods or services.
Utility	Often defined as the satisfaction derived from consumption of a good or service.
Weight	The measure of the relative importance of an item in the index regimen. 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.