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Information Paper

House Price Indexes: Concepts, Sources and Methods, Australia

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Brian Pink
Australian Statistician

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PREFACE

AIM OF THIS PUBLICATION

The Established House Price Index (HPI) is one of a suite of price indexes released by the ABS. Other price indexes include the Consumer Price Index, the Producer and International Trade Price Indexes and the Labour Price Index.

The purpose of this publication is to provide a description of the concepts, sources and methods behind the HPI. It includes discussion of some general issues relating to the measurement of house prices and provides background on the stratification method used to control for the effect of changes in the composition and number of houses sold within each city. This publication also includes information on how to use price indexes and provides an overview of other data series and price indexes related to housing which are produced by the ABS and published with the HPI.

The last publication of this type was *A Guide to House Price Indexes, Australia 2006* (cat. no. 6464.0). This Concepts, Sources and Methods publication supercedes the Guide in that it covers recent changes in the stratification method and weights. It also provides more information on how the HPI is calculated and on price index concepts in general.

RELEASE OF HOUSE PRICE INDEX DATA

The HPI is compiled and published quarterly in *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0). The publication is currently released approximately five weeks after the end of the reference quarter. Each quarterly issue of this publication announces the release dates for the subsequent four quarterly issues; i.e. the publication dates for these statistics are finalised and announced about twelve months in advance.

ABS CONTACTS

Comments and requests for further information about the HPI should be directed to:

Mark Dubner
Assistant Director
Prices Branch
Australian Bureau of Statistics
GPO Box 796
Sydney NSW 2001
Phone: 02 9268 4448
Fax: 02 9268 4710
Email: mark.dubner@abs.gov.au

Brian Pink
Australian Statistician

CHAPTER 1 INTRODUCTION

OVERVIEW OF THE HOUSE PRICE INDEX

1.1 The HPI measures price change of the stock of established houses over time. While other price indexes produced by the ABS provide a weighted average of the price changes in a group of goods or services, the HPI specifically measures prices of established, detached houses in each of the capital cities in Australia. Separate indexes are produced for each capital city, and these indexes are combined to produce a weighted average index of the eight capital cities.

1.2 The HPI is compiled quarterly by the ABS for quarters ending 31 March, 30 June, 30 September and 31 December each year. The quarterly index numbers are published approximately five weeks after the end of each quarter in the publication: *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0).

1.3 The index numbers published for the two most recent quarters are regarded as preliminary and are revised in subsequent publications as more data are collected.

1.4 The standard procedure for constructing price indexes is to select a sample of representative items and to re-price the identical items through time (a matched sample). This approach is not viable in the case of established houses as the observable prices in each period invariably relate to a different set of houses.

1.5 The approach taken by the ABS is that price observations are grouped into clusters ('stratified') based on similarities in the housing stock. Period to period changes in the median price for each cluster are weighted together according to the importance of the cluster at the capital city level.

1.6 The prices of individual houses, or groups of houses, do not all change at the same rate. Also, the set of houses being sold will change between periods. Therefore, the HPI for a particular period will reflect the weighting of the component clusters of the index and the measured price behaviour of each cluster.

STRUCTURE OF THIS PUBLICATION

1.7 Chapters 2 and 3 provide an overview of the purpose, uses and history of the HPI.

1.8 Chapter 4 provides some information on price index concepts, index formulas commonly used, and how these relate to the approach taken in the HPI.

1.9 Chapter 5 discusses various conceptual approaches to measuring changes in house prices.

1.10 Chapters 6 to 9 provide detailed information on the HPI, including its scope and coverage, the sources of data for weights and how they are calculated, the sources of house price data, how transactions are measured and at what point in time.

1.11 Chapter 10 provides information on how results of periodic reviews and changes to weights are incorporated into price indexes. This includes a description of index concepts such as index reference period and chain linking.

1.12 Chapter 11 brings together information from preceding chapters to describe how the index is calculated in practice. It includes a description of the stratification method used in the index, the two stage approach to produce the HPI and the consequent revision practices.

1.13 Chapter 12 describes how the HPI is released by the ABS and provides users with some guidance on interpretation of index numbers.

STRUCTURE OF THIS PUBLICATION *continued*

1.14 Chapter 13 lists the principal price indexes produced by the ABS. It also provides an overview of other data series and price indexes related to housing which are produced by the ABS and published with the HPI.

1.15 Appendix 1 provides the capital city level weighting pattern underlying the HPI and the project home price index. Appendix 2 provides some information related to the use of ABS price indexes for the purpose of contract price indexation. Appendix 3 provides a list of references.

OTHER HPI INFORMATION

1.16 The quarterly publication *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0) includes explanatory notes which provide limited information on the concepts, sources and methods of all the published series. The December 2008 issue of the publication provides an appendix describing changes to the weights and stratification method implemented in that quarter.

1.17 Other publications:

- *Information Paper: Renovating the Established House Price Index, November 2005* (cat. no. 6417.0)
- *Research Paper: Refining the Stratification for the Established House Price Index* (Methodology Advisory Committee), June 2008 (cat. no. 1352.0.55.093)

CHAPTER 2 PURPOSE AND USES OF HOUSE PRICE INDEXES

WHAT THE ESTABLISHED HOUSE PRICE INDEX DOES

2.1 The objective of the HPI is to inform the community, policy makers and other users about price change of established houses in Australia. This is achieved by producing an accurate and timely measure of the contemporary rate of change in the prices of the stock of established houses, including the land component, in the eight capital cities. The national HPI is a weighted average of the indexes for the eight capital cities.

2.2 Price movements in the HPI are measured quarterly, however the index series allows for movements to be calculated across other time periods, such as annually. The level of the index in a particular period indicates the change in price of the stock of established houses from the index reference period, at which time the index was set to 100.0.

2.3 It is important to note that the capital city indexes measure price movements over time in each city individually; they do not measure differences in price levels between cities. Having a higher index level in one city compared with another simply means that the price change since the index reference period has been greater in the first city.

FACTORS THAT INFLUENCE CHANGES IN HOUSE PRICES

2.4 The rate of change of house prices differs across geographical locations, and is influenced by a range of factors present at a particular time. These factors include, but are not restricted to, supply and demand, income levels, desirability of location, supporting infrastructure, availability and affordability of credit, government levies and/or financial support, and demographic distribution.

2.5 While the HPI measures the effects of the multitude of influences on house prices, it cannot determine the contribution (or lack thereof) of particular factors.

USES OF HOUSE PRICE INDEXES

2.6 The HPI in its current form derives from an historical measure in the Consumer Price Index (described in Chapter 3) which was discontinued. This resulted in the publication of the HPI in its own right.

2.7 The principal use of HPIs is as economic indicators. There is a wide-spread interest in house prices, which are viewed as one measure of the wealth of a nation and the capacity of its citizens to participate in and contribute to economic growth.

2.8 The International Monetary Fund's 2006 publication *Financial Soundness Indicators Compilation Guide* notes, in the introduction to Chapter 9: Real Estate Price Indices, that it is important to maintain these measures in order to monitor exposure to risk.

> 'During an upswing in real estate prices, real estate may be used as collateral for extensions of credit for further purchases. But once conditions begin to reverse, such exposure can cause the downturns in economic activity, credit, and real estate prices to become mutually reinforcing.' (International Monetary Fund, 2006, p. 101).

2.9 Other uses of price indexes in the commercial realm include property valuations, forecasting, and measuring investment returns or risks.

INITIAL HOUSE PRICE MEASURES

3.1 The HPI was originally designed to meet the specific data requirements for the construction of a price measure for mortgage interest charges, which were included in the Consumer Price Index (CPI) from 1986 to 1998. The pricing point used was the date of final settlement of the house purchase as that was the time at which mortgage interest started to be charged. The weighting patterns appropriate for mortgage interest charges were housing finance commitments. House prices were obtained from a range of sources, with varying coverage within each of the eight capital cities. The main sources of data were the State/Territory[1] Land Titles Office or Valuers-General (VGs) Office, or equivalent[2], and the State Real Estate Institutes.

3.2 When mortgage interest was removed from the CPI in 1998 as part of the 13th Series CPI Review, the ABS continued to publish the price index of established houses because of user interest in the series. This time series is available in Table 10 of *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0) on the ABS website <www.abs.gov.au>. The series commences in June quarter 1986 and concludes in June quarter 2005.

SUBSEQUENT DEVELOPMENTS

3.3 The current series of the HPI is the product of two reviews, the first in 2004 significantly changed the methodology, and the second in 2007 provided some further refinements.

3.4 The HPI in its current form was first published for the September quarter 2005, with the series backdated to March quarter 2002. In the December quarter 2008 issue, updated weights and a refined stratification method were introduced and linked to the existing series at March quarter 2008.

3.5 The original series is published for historical purposes for users who may be interested in an indicator of established house price movements over a longer period than is available using the current methodology. Note that because of the different methodologies used to calculate this historical series and the current HPI series, it is recommended that caution be exercised when the historical series is used as a proxy for back-casting (or linking to) the current HPI series for periods prior to March quarter 2002 (see Chapters 10 and 12 for further information).

2004 REVIEW

3.6 The ABS commenced a review of the HPI in 2004. The objectives of the review were to:

- determine specific user requirements for an updated HPI;
- identify possible data sources that were consistent and comprehensive;
- assess the costs and the strengths and weaknesses of these alternative data sources; and
- develop a strategy to deliver an improved HPI.

3.7 Four important aspects of the data series were identified as needing to be changed or improved:

- the timeliness of the HPI release – to be closer to the reference quarter;
- the time at which prices are recorded – from settlement date to the date of exchange of contracts;

1 State/Territory is referred to as 'State' for the remainder of this publication.
2 These data sources are referred to as 'VGs' for the remainder of this publication.

2004 REVIEW *continued*

- the effects of changes in the composition of sales – to be reduced; and
- the coverage of the index – to include 'other dwellings' (townhouses, units and apartments), and dwellings covering the regions in each State outside the capital cities.

3.8 The need to re-examine the weighting methodology of the index was not explicitly identified in the review, but was undertaken as part of the ABS' established index review strategy.

3.9 As a result of the implementation of the review recommendations, the HPI is now released closer to the reference quarter. The time at which prices are recorded (the pricing point) has been changed to the date of exchange of contracts, and the effects of compositional change have been reduced through an improved stratification method. The underlying weights in the index were updated to reflect stock weights, based on the latest Census house count data available.

3.10 The ABS decided to concentrate initially on improving the index for detached houses only. The aim of developing new indexes for other residential dwellings (units, townhouses, apartments etc.) was viewed as a longer term objective. Likewise, the ABS decided it could not yet move towards producing rest of state HPIs each quarter.

3.11 A number of users also expressed a strong desire for the ABS to release average prices (mean and/or median) for each city in addition to the price index. The ABS feels that it is not possible to publish stratified price level measures that will be meaningful. However, unstratified or 'raw' measures of median house prices have been made available. In addition, the number of established houses transacted in each city each quarter is available. These results are published in Tables 7 and 8 of 6416.0, and are revised each quarter as necessary as additional data are acquired.

3.12 The September quarter 2005 issue of 6416.0 was the first to incorporate the changes outlined above. For a more detailed discussion on the outcomes of this review, refer to *Information Paper: Renovating the Established House Price Index* (cat. no. 6417.0).

2007 REVIEW

3.13 A second review of the HPI commenced in 2007. As a result, the method of stratification used to compile the index was refined and the housing stock weights were updated using quantity data from the 2006 Census of Population and Housing (the most recent Census). These changes were introduced in the December quarter 2008 issue of 6416.0.

3.14 Details of the concepts, sources and methods underlying the compilation of the current HPI series are described in the following chapters.

FUTURE DEVELOPMENTS

3.15 The current weights, based on the 2006 Census, will be updated once data become available from the 2011 Census. At that time the ABS will also assess the performance of the stratification method. In addition, the ABS will investigate ways to update the weighting between Census collections: besides ensuring that weights keep up to date with changes in the stock of houses (such as development of new suburbs), it would also provide a more frequent opportunity to implement improvements in stratification.

FUTURE DEVELOPMENTS *continued*

3.16 The ABS is also planning to address one improvement identified by the 2004 review which has not yet been acted upon: that the coverage of the index be expanded to include "other dwellings". The aim of providing rest of state indexes remains a longer term objective. For the immediate future, geographic scope continues to be restricted to the eight capital cities, and calculation of a weighted average.

CHAPTER 4 PRICE INDEX THEORY

OVERVIEW

4.1 This chapter describes the price index theory underpinning the HPI. A more comprehensive exploration of price index theory can be found in corresponding chapters of *Information Paper: Consumer Price Index: Concepts, Sources and Methods, 2009* (cat. no. 6461.0) and *Producer and International Trade Price Indexes: Concepts, Sources and Methods, 2006* (cat. no. 6429.0).

4.2 As the name indicates, the HPI is presented as a price index. Price indexes provide a convenient and consistent way of presenting price movement information that overcomes problems associated with averaging across diverse items. An index number on its own has little meaning. The value of a price index stems from the fact that index numbers for any two periods can be used to directly calculate price change between those periods. For example, the HPI Sydney index number of 97.2 in December quarter 2008 informs the user that Sydney house prices have fallen by 2.8% from the base year 2003–04 (when the index was set to 100.0).

CONCEPT OF A PRICE INDEX

Comparing prices

4.3 There are many situations where there is a need to compare two (or more) sets of observations on prices. For example, households may want to compare prices of goods and services today with an earlier time period, and therefore could refer to the CPI. With regard specifically to house prices, a home buyer may want to be able to compare movements in a city over time, or an economist may want to compare house price movements between countries over time to analyse a country's economic performance.

4.4 The most common comparison is between sets of prices at two times (temporal indexes). The times can be adjacent or many periods apart. Another application is to compare prices between regions or countries for the same time (spatial indexes).

4.5 In some situations, the price comparisons might only involve a single commodity. Here it is simply a matter of directly comparing the two price observations. For example a family selling their house might want to assess how the price recommended by their real estate agent compares with the price when they purchased it.

4.6 In other circumstances, the required comparison is of prices across a range of commodities. Although comparisons can readily be made for individual or identical items, a method is required for combining prices across a diverse range of items allowing for differences in the items. For the CPI or Producer Price Index (PPI), items may come in different units or quantities of measurement. In the context of the HPI, the composition of the set of houses sold every quarter varies in terms of location and physical characteristics.

4.7 For HPIs, there are a variety of methodological approaches for addressing this issue of compositional change in the derivation of representative prices or price movements (see Chapter 5). Further, for the HPI as for the CPI and PPI, price indexes play an important role in combining these prices or movements into aggregate measures.

The basic concept

4.8 A price index is a measure of changes in a set of prices over time. Price indexes allow the comparison of two sets of prices for a common item or group of items. In order to compare sets of prices, it is necessary to designate one set the 'reference' set and the other the 'comparison' set. The reference price set is used as the 'base' period for constructing the index and is generally given an index value of 100.0.

The basic concept continued

4.9 For example, suppose for a single item the average of prices in a set (set 1) was $300,000 and for set 2 was $600,000. Then designating set 1 as the reference set gives an index of 200.0 (600,000 / 300,000 x 100) for the comparison set 2. Designating set 2 as the reference set gives an index of 50.0 (300,000 / 600,000 x 100) for set 1.

4.10 The method for aggregating and comparing price change across a range of commodities usually involves values.

4.11 Values of sales of products are determined by both the prices of the goods or services and the quantities of the goods or services being sold. Therefore, by fixing the quantities of the different items being measured, the change in value in a certain period will be attributable to the change in prices of the items. In CPI or PPI terms, the fixed quantities are called a 'basket'. In the HPI, corresponding references are to the 'housing stock'.

4.12 Beginning with the fixed quantities, price indexes can be constructed for different points in time. Typically, the method is to nominate one set of prices as the reference prices and to revalue the quantities of items purchased in the reference period by prices in the second period. The ratio of the revalued housing stock, in the case of the HPI, to the value of the housing stock in the reference period provides a measure of the price change between the two periods.

REFINING THE CONCEPT

4. 13 The value of an individual item is the product of price and quantity:

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

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

4.14 Changes in the value of the same item at different points in time can reflect changes in the actual price, changes in the quantity involved, or a combination of both price and quantity changes. Decomposition of a change in a value can be illustrated using equation 4.1, as in the following example.

4.15 Suppose the price of representative houses in a particular suburb are $200,000 at a particular time. Suppose further that the price rises to $250,000 at a later time. The movement in the price of houses from the first to the later period is obtained from the ratio of the price in the second period to the price in the first period, that is $250,000/$200,000 = 1.25 or an increase of 25% in the price. If exactly the same quantity of houses were sold in the two periods, the value of the sales would rise by 25%. However, if the number sold in the first period was 10 houses, and the number sold in the second period was 12 houses, the quantity would also have risen, by 12/10 = 1.20 or 20%. In these circumstances, the total value of sales of houses increases from $2,000,000 in the first period (10 houses at $200,000 per house), to $3,000,000 in the second period (12 houses at $250,000 per house), an overall increase in value of $1,000,000, or 50%. The overall increase in value is the product of the ratios of the change in price and the change in quantity (1.25 x 1.20 = 1.50).

4.16 For an individual item, the ratio between the price in the current period and the price in the reference period is called a price relative. A price relative shows the change in price for one item only.

REFINING THE CONCEPT continued

4.17 In terms of the formula in equation 4.1:

$v_1 = p_1$ ($200,000) $\times q_1$ (10 houses) = $2,000,000 and

$v_2 = p_2$ ($250,000) $\times q_2$ (12 houses) = $3,000,000

where

v_1 is the value in period 1; p_1 is the price per house in period 1; q_1 is the quantity in period 1;

v_2 is the value in period 2; p_2 is the price per house in period 2; q_2 is the quantity in period 2.

The ratio between the prices in the two periods, p_2 and p_1 ($250,000/$200,000 = 1.25) is the price relative ($= p_2/p_1$)

4.18 It is only necessary to have observations on two of the three components of equation 4.1 in order to analyse contributions to change in the value. If, for example, observations were only available on value and price, estimates of the quantity could be derived by dividing the value observations by price.

4.19 Now consider the case of price and quantity (and value) observations for houses in many suburbs. The quantities and prices of houses sold in different suburbs are likely to show different movements between periods. Answers are required to questions like: 'what is the change over time in the quantity of houses sold; and what has been the contribution of price changes in the various suburbs to changes in the value of all houses over time?' Answering these questions is the task of index numbers – to summarise the information on sets of prices and quantities into single measures to assist in understanding and analysing changes.

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

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

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

where V_t is the value of all items in period t and V_0 is their value in period 0 (the base period). Based on equation 4.1, V_t can be represented as:

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

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

Major index formulas

4.22 One widely used class of price indexes is obtained by defining the index as the percentage change between the periods compared in the total cost of producing (or purchasing) a fixed set of quantities, generally described as a "basket." The meaning of such an index is easy to grasp and to explain to users.

4.23 In presenting index number formulas a simple starting point is to compare two sets of prices (sometimes called bilateral indexes). Consider price movements between two time periods, where the first period shall be denoted as period 0 and the second period as period t (period 0 occurs before period t). In order to calculate the price index, the quantities need to be held fixed at some point in time. The initial question is what period should be used to determine the basket (or quantities). The options are to use:

(1) The quantities of the first or earlier period;
(2) The quantities of the second (or more recent) period; or
(3) A combination (or average) of quantities in both periods

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

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

4.25 Approach two above is referred to as a Paasche price index and it answers the question 'how much would it have cost in the first period, relative to the second period, to purchase the same basket as was purchased in the second period'. The third approach above, a combination of the other two approaches, is used in the Fisher Ideal price index and the Törnqvist price index. These types of indexes are described in greater detail in the CPI and PPI Concepts, Sources and Methods publications.

4.26 When the periods being compared are far apart (e.g. over a long time series), Laspeyres and Paasche indexes can show a quite large divergence due to the fact that by using current quantities, the Paasche index can reflect substitution behaviour (e.g. in a consumer price index, consumers will shift consumption away from expensive items over time). The Fisher Ideal and Törnqvist indexes try to overcome some of the inherent difficulties of using a set of quantities fixed at either the earlier or the more recent period. In the absence of any firm indication that either period is better to use, then a combination of the two is a sensible compromise.

4.27 In practice, the Laspeyres formula has the advantage that the index can be extended to include another period's price observations when available, as the weights are held fixed at some earlier base period. Therefore, only prices have to be collected on a regular basis. On the other hand, the Paasche, Fisher, and Törnqvist price indexes require collection of both current period price observations and current period weights before the index can be extended. It is much less costly and time consuming to calculate a time series Laspeyres index than a time series of Paasche, Fisher, and Törnqvist price indexes.

Major index formulas continued

4.28 The Laspeyres formula is expressed above in terms of quantities and prices. In practice quantities might not be observable or meaningful for some price indexes (for example, how would the quantities of legal services, public transport and education be measured?). Thus in practice the Laspeyres formula can be estimated using value shares to weight price relatives – this is numerically equivalent to the formula 4.4 above.

4.29 To derive the price relatives form of the Laspeyres index, multiply the numerator of equation 4.4 by p_{i0}/p_{i0} and rearrange as follows:

$$I_t = \frac{\Sigma\left(\frac{p_{i0}}{p_{i0}} p_{it} q_{i0}\right)}{\Sigma p_{i0} q_{i0}} \times 100 \qquad (4.5)$$

$$= \frac{\Sigma \frac{p_{it}}{p_{i0}} p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} \times 100 \qquad (4.6)$$

$$= \Sigma \frac{p_{it}}{p_{i0}} \left(\frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}}\right) \times 100 \qquad (4.7)$$

The term in parenthesis in equation 4.7 represents the value share of item *i* in the index reference (or commonly labelled, base) period, w_{i0}. Let:

$$w_{i0} = \frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} = \frac{v_{i0}}{\Sigma v_{i0}} \qquad (4.8)$$

then the Laspeyres formula may be expressed as:

$$I_t = \Sigma w_{i0} \left(\frac{p_{it}}{p_{i0}}\right) \times 100 \qquad (4.9)$$

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

Generating index series over more than two periods

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

(i) Select one period as the base and separately calculate the movement between that period and each other period, which is called a fixed base or direct index; or

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

4.32 The use of fixed weights (as in a Laspeyres type formula) over an extended period of time is not a sound index construction practice. For example, weights in the CPI have to be changed to reflect changes in the expenditure patterns of households over time.

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

THE APPROACH USED IN THE HOUSE PRICE INDEX

4.34 In the discussion above it was shown how various price index formulae reflect different options as to the period in which the quantities are determined.

THE APPROACH USED IN THE HOUSE PRICE INDEX *continued*

4.35 The approach used in HPI is that of the Laspeyres index. Being a Laspeyres index, the quantities underlying the HPI are fixed in the index reference period or weight reference period. An adaptation of the price relative form of the Laspeyres index is used in the HPI, however because quantities are observable, the first form of the formula 4.7 can be used, rather than the second form involving the value share, formula 4.9.

4.36 HPI employs a stratification approach to deal with the issue of changes in the composition of houses sold every quarter. In this approach houses are grouped into clusters. The item i in the index formulae corresponds to individual clusters (e.g. there are 11 clusters in Adelaide), rather than individual houses.

4.37 Because the purpose of the HPI is to measure changes in the price of the housing stock, the quantities used are the total housing stock in the weight reference period, rather than the number of sales in this period. The quantity for each item/cluster in the index is the total number of houses in the cluster.

4.38 The price relative for a cluster is calculated from the ratio of the median price of individual observations for that cluster in the current period to the median price in the previous period. As all houses are not transacted in each period, the prices attained from the sales of houses are used to represent the prices of all houses.

4.39 A Laspeyres index is being used for the HPI as it is not practical to calculate current weights every period (as required by other methods) – the current period housing stock is not readily available.

4.40 The weights for the HPI are updated periodically to reflect changes in the stock of houses, and indexes produced with the new weights are chain linked to those produced with the earlier weights.

4.41 Following chapters in this publication provide more information on how some of the concepts described above are applied in practice to the HPI. For example, clusters of houses are the item in the price index formula for which price change is measured every quarter: Chapter 5 describes how the cluster is a feature of a method adopted for dealing with changes in the composition of houses sold every quarter. Chapter 7 provides more information on weights used in the HPI and their sources. Chapters 8 and 9 provide information on the sources of price information, and on the median price, which is the particular form of the price observation used in HPI calculation. Chapter 10 provides more information on chain linking and Chapter 11 brings all this together to describe how the HPI is calculated in practice.

CHAPTER 5 HOUSE PRICE INDEXES

INTRODUCTION

5.1 This chapter compares various approaches used in measuring changes in house prices, including the approach chosen for the HPI. The application of price index theory (Chapter 4) to the calculation of the HPI is detailed in Chapter 11, with supporting detail contained in Chapters 6 to 10.

DEFINITION

5.2 House price indexes measure the inflation or deflation of the price of houses over a period of time. The indexes describe the change in prices between a specific period and a base period, allowing comparisons of price movements between time periods and also between geographical regions.

PURPOSE

5.3 While the purpose of the HPI is to provide an accurate measure of the contemporary rate of change in the prices of the stock of established houses in the eight capital cities, other price indexes are constructed to meet different user requirements. A number of other measures of housing-related prices compiled by the ABS are published in 6416.0 (Table 5). These indexes are discussed in Chapter 13.

5.4 In Australia, a range of other house price indexes are compiled by industry bodies and economic research firms. The methodologies and conceptual approaches used to construct these indexes differ according to factors such as the intended use of the index, the sources of the house price data used, and the resources available to collect and process the house price data.

5.5 Users should familiarise themselves with the stated purpose of their index of choice to ensure that it is suitable for their particular requirements. Familiarity with the different methodologies used to construct the indexes should also inform the user's choice. An overview of some typical approaches to index construction is provided below.

CONCEPTUAL APPROACHES

5.6 The standard procedure for constructing price indexes is to select a sample of representative items and to re-price the identical items through time (a matched sample). This approach is not viable in the case of established houses as the observable prices in each period invariably relate to a different set of houses. In other words, the sales prices observed for any pair of consecutive quarters are completely independent datasets.

5.7 While there is not yet an international standard for constructing housing price indexes, the OECD–IMF Workshop on 'Real Estate Price Indexes', held in Paris in 2006, provided an opportunity for developed nations, particularly from Europe, to document and present their current practices in this realm (Diewert, 2006)[1].

5.8 Additionally, a discussion of different methods of constructing real estate price indexes, and an overview of the constraints experienced by national statistical offices in constructing representative measures is contained in the International Monetary Fund's (IMF's) *Financial Soundness Indicators: Compilation Guide* (2006) – Chapter Nine: Real Estate Price Indices. The following extract from that guide (paragraph 9.4) is instructive:

1 The Paris workshop indentified the need for an international manual or handbook of methods for real estate price indexes. A manual is under development and scheduled for release by the OECD in mid 2011.

CONCEPTUAL APPROACHES *continued*

'Constructing representative real estate price indices is challenging. Difficulties can arise because real estate markets are heterogeneous, both within and across countries, and illiquid. There may be no unambiguous market price. Moreover, such diversity and lack of standardization results in the need to gather a wide range of data to compile indices that are characteristic of the various market segments; this would contribute to high data collection costs and may require greater technical sophistication. Representative real estate prices in residential and commercial markets can be hard to measure accurately given the small samples that are often available, as there may be disparate prices for apparently similar properties and prices may be volatile.' (IMF, 2006, p. 101)

COMPARISON OF CONCEPTUAL APPROACHES

5.9 The central issue is how to utilise prices for an essentially heterogeneous set of dwellings to construct measures of price change for homogeneous sets of dwellings, and compile and release the results in a timely manner. There are three general approaches that might be used to achieve this: hedonics; repeat sales; and stratification.

Hedonic price indexes

5.10 The hedonic approach views products (such as dwellings) as bundles of characteristics that are not individually priced, as the consumer buys the bundle as a single package. Through the use of regression techniques, the objective is to "unbundle" the characteristics to estimate how much they contribute to the total price.

5.11 There are several ways in which this approach can be employed in practice. A hedonic technique has recently been introduced with respect to pricing computers in the 15th Series CPI. Details of the methods used for computers are set out in *Information Paper: The Introduction of Hedonic Price Indexes for Personal Computers, 2005* (cat. no. 6458.0). A similar approach could be adopted for housing although, of course, the type and number of price-determining characteristics would be different. A feature of the hedonics approach is that it generally makes use of more price data than other approaches.

5.12 The effectiveness of hedonics is critically dependent on the availability of data on the price-determining characteristics. Analysis by the ABS has shown that the single most price-determining characteristic is location, followed by an indication of the socio-economic conditions of the area[1], and the physical characteristics of the dwelling (such as outer-wall construction, overall size, number of rooms, number of bathrooms). While various characteristics are included in datasets for some cities, sufficient data is not available for timely production of the index using hedonic methods (see Chapter 8 for more information on timeliness of data sources). It would be necessary to collect considerable amounts of supplementary data. Due to the cost of collecting and processing this data, the ABS considers that the hedonic approach is not viable at this time.

Repeat Sales

5.13 The repeat sales approach controls for compositional change by maintaining a historical record of property sales. When properties are sold repeatedly over time, price changes between successive sales dates are calculated. Regression techniques are used to calculate the overall price index for each quarter.

á The analysis used the ABS' Socio-Economic Index for Areas (SEIFA) which ranks geographic areas according to their social and economic conditions. For further information, refer to *Information Paper: An Introduction to Socio-Economic Indexes for Areas (SEIFA), 2006* (cat. no. 2039.0).

Repeat Sales continued

5.14 To be effective, this approach requires a long time series of price data for individual properties, given their infrequent turnover. As the methodology is premised on the assumption that the 'quality' of the individual properties is constant over time, this approach may be more suited to some property types than others (e.g. units), or require supplementary information on property renovations. The nature of the estimation technique also means that at least the tail end of the series is subject to potentially significant revision. At the present time, the ABS does not have ready access to the data required for this method.

Stratification

5.15 The stratification approach involves grouping the observations for the 'most similar' dwellings into clusters, to enable the derivation of a representative sale price for the cluster (usually the median price). The objective is to optimise the physical homogeneity of dwellings within each cluster, while ensuring a sufficient number of observations to produce a reliable median price.

5.16 The effectiveness of the stratification approach is determined by the degree of stratification possible and the availability of stratification variables. It may not be feasible to employ fine level stratification if there are insufficient observations to produce reliable movements for each cluster.

Method chosen

5.17 Given the absence of a comprehensive national dataset to enable the use of either the hedonics or repeat sales approaches, the only option currently available in practice to construct an HPI which controls for compositional effects is the stratification approach. While stratification can deal with compositional effects, it will not adjust for quality changes such as the size of the dwellings increasing over time.

5.18 Chapter 11 provides more detail on the practical application of the stratification method.

5.19 Further insight into the merits and limitations of various methodologies for calculating house price movements in the Australian context can be obtained from Hansen (2006).

SCOPE

6.1 For the HPI, an established house is defined as a free standing/detached residential dwelling on its own block of land regardless of age, i.e. including new houses sold as a house and land package as well as second-hand houses. Price changes, therefore, relate to changes in the total price of houses and land.

6.2 The scope for the HPI is restricted to those dwellings where the primary purpose is residential (i.e. excluding commercial properties) regardless of ownership or tenure of the occupants (i.e. including government-owned properties and properties owned by private landlords).

6.3 The definition of structure type for the purpose of the HPI is consistent with ABS classifications: the *Functional Classification of Building, 1999* (cat. no. 1268.0.55.001), which is used in building activity statistics; and the Dwelling Structure Classification which is used in the Census of Population and Housing (refer to *Census Dictionary, 2006* (cat. no. 2901.0)).

6.4 Examples of dwelling types in scope are:

- Ordinary detached house;
- House with office;
- House with flat; and
- Rural residential houses (within a capital city and not part of a farming business).

6.5 Examples of dwelling types not in scope are:

- Flats;
- Apartments;
- Terrace houses;
- Townhouses; and
- House with farm engaged in primary production.

6.6 HPI processing identifies the out of scope dwelling types of flats, units and apartments in the sets of price data provided to the ABS and these sales records are removed from the calculation of price change for all cities. It should be noted, however, that for Sydney, Brisbane, Hobart and Darwin it is currently not practical to identify and remove some other out of scope dwelling types (e.g. townhouses and terraces). Work is currently underway to address this issue.

GEOGRAPHIC COVERAGE

6.7 Houses within capital city statistical divisions (SD), as defined in the *Australian Standard Geographical Classification (ASGC)* (cat. no. 1216.0) are included.

6.8 Coverage is limited to those suburbs which existed within SD boundaries at the time of the Census used to determine the weights of the HPI.

INTRODUCTION

7.1 Price indexes use weights to dictate the relative importance of items in the aggregate measure of price movement.

7.2 In HPI compilation, the price relatives of the median prices of the clusters are multiplied by the weights of each cluster to derive a weighted average index number. Therefore, the contribution of a particular cluster's price movement to the movement of the capital city index will be determined by its relative importance in the construction of that index.

7.3 Weights in this instance are value weights: the value of the stock of houses in each cluster. The stock of houses used in the value weights are a fixed quantity: they are held constant from period to period.

HOUSE PRICE INDEX COMPARED TO OTHER INDEXES

7.4 Price indexes such as the Consumer Price Index (CPI) and Producer Price Index (PPI) use a variety of weighting practices. At the lowest level of the index (referred to in CPI and PPI as the "elementary aggregate" level) a sample of individual price observations for particular items are combined each period to enable a period to period measure of price change for the item. This measure of elementary aggregate price movement can be calculated as a ratio of average prices, as an unweighted geometric mean of price relatives, or as a weighted arithmetic mean of price relatives. Choice of method is dependent on assumptions relating to the behaviour of the consumer or producer, and other factors such as availability of weighting information. For more information refer to the CPI and PPI Concepts, Sources and Methods publications (cat. nos. 6461.0 and 6429.0 respectively).

7.5 These lower level price movements are subsequently weighted up the index structure. Weightings are derived to take into account whether the index is an input index (expenditure on goods and services being consumed or used) or output index (revenue from goods or services being produced), and reflect the importance of the good or service in the market covered by the index.

7.6 Weights are usually fixed at the published level of the index, and are reviewed periodically. Below the published level of the index weights can be varied at any time, and often are.

7.7 Compared to the CPI and PPI, the structure of the HPI is quite simple. The lowest level of the index, the elementary aggregate level, corresponds to the clusters which constitute each capital city. For each cluster there is only one price observation each quarter used to calculate its quarterly movement: this is the median price of all transactions observed in that cluster. As it is not possible to price the same house each quarter, a sample of observed house prices are used to measure the price change, and from this sample, a single median price is calculated to represent price of houses in this homogenous grouping of houses (cluster).

7.8 The elementary aggregate (cluster) level of the index is not published. The next level of aggregation is the capital city, and then the eight capital city weighted average.

7.9 Within each capital city, the housing stock has been allocated to particular clusters according to the stratification methodology which maximises the homogeneity of the cluster as well as the number of transactions observed each period. Some clusters will have greater weights than other clusters, reflecting the distribution of housing with

HOUSE PRICE INDEX COMPARED TO OTHER INDEXES *continued*

particular characteristics across the city. For example, a cluster which groups houses which are large, of high quality, and close to the water will have a small weight if these types of houses make up a small proportion of the total value of housing stock in a city. Suburbs are the building blocks of the clusters, and all suburbs in a city at the weight reference period (see below) are allocated to clusters.

7.10 After a review of the stratification method in 2007 the number of clusters changed (as did the suburbs allocated to them). A new set of weights was introduced into the HPI in December quarter 2008 to reflect the new clusters and an updated stock of houses.

SOURCES OF DATA FOR WEIGHTS

7.11 The HPI is compiled using weights calculated as the value of the stock of established houses. The quantities (stock) of houses used in this calculation are derived from the count of separate houses recorded in the Census of Population and Housing. The HPI series commencing in March quarter 2002 used house counts from the 2001 Census, and house counts from the 2006 Census were used in the new set of weights introduced after the 2007 review.

7.12 An initial value of the established housing stock in each cluster is estimated by aggregating suburb counts of detached houses to the cluster level and valuing them at base period or link period prices. In other words, the quantity of houses in each cluster is multiplied by a measure of the average price of houses in the cluster at the base period or link period. Refer to Chapters 10 and 11 for further information on this process in practice.

7.13 As discussed earlier in Chapter 4, the approach used in HPI is that is that of the Laspeyres index. Therefore, it is important to understand that it is not the stock values that are held constant from period to period in the compilation of the index. What is held constant is the number of houses underpinning these values. The price relatives of the median prices of the clusters for the current and previous quarters are used to price update (inflate or deflate) these stock values for each cluster in each city. Algebraically, this produces the same outcome as weighting together prices for each cluster in each quarter using quantities as the weights but it is much easier to implement operationally.

7.14 The weighting patterns of the clusters in each capital city (below the published level of the index) are not released to users.

WEIGHTED EIGHT CAPITAL CITY INDEX

7.15 The weighted average of the eight capital city indexes represents the aggregated movement of the capital cities, according to their relative importance.

7.16 Just as cluster value weights are aggregated to derive the value for each city, these city value weights are then aggregated to the eight capital city level of the index. The weighted eight capital city index is derived as the sum of the price updated values of each capital city divided by the sum of the base period or link period values of each capital city, multiplied by the base period or link period index number.

7.17 Appendix 1 details the weighting pattern of the eight capital cities index.

WEIGHT REFERENCE PERIOD

7.18 The weight reference period is the time period to which the weights relate. For reasons of stability and representativity, the weight reference period is frequently a year or even longer period.

WEIGHT REFERENCE PERIOD *continued*

7.19 The accuracy and reliability of a price index are determined, in large part, by the weighting structure. For this reason, the choice of the period covered by the weights is crucial. The period chosen to be the weight reference period is selected because:

- the economic activity over the period is reasonably normal/stable and representative of likely future activity;
- it is not too distant from the link period (the period where the weights are introduced to the index series; and
- the required data are available.

7.20 The weight reference period and the link period used in a price index formula are rarely the same period in practice. As mentioned above, the weight reference period is frequently a year. New weights are introduced during a specific quarter, known as the link period. For this reason, weights are price updated to account for price changes between the weight reference period and the link period.

7.21 The weight reference period for the current series of the established house price index is 2006, and the link period is March quarter 2008.

UPDATING WEIGHTS

7.22 The current weights, based on the 2006 Census, will be updated once data becomes available from the 2011 Census. At that time, the ABS will also re-examine the existing clusters to determine whether they need to be revised for any of the cities.

7.23 Investigations will be conducted to identify alternative sources of housing stock estimates, which would allow the weighting of the HPIs to be updated between Census collections. This would also provide more frequent opportunities to implement improvements in stratification. Chapter 11 outlines the processes involved in index reviews, and re-referencing and re-linking indexes.

INTRODUCTION

8.1 The HPI measures price change of the stock of established houses in the eight capital cities. Ideally, the HPI would be compiled using the current and historical market prices of the entire stock of houses. In practice, market prices for any particular period are only available for those houses that are actually traded (sold/purchased) in the period. Such sales account for only a very small proportion of the total housing stock in any quarter and so it is necessary to draw inferences about the price behaviour of the whole stock from these small samples. The assumption behind this procedure is that the median sales price of the houses traded each quarter is indicative of the median price of all houses.

8.2 To allow the compilation and publication of a more timely estimate of price change, the preliminary estimates of the two most recent quarters in the series contain a sample of mortgage lenders' data to supplement the available data from Valuers–General (VGs), which is provided progressively over time as properties are settled and transactions are registered. The index is therefore not a measure of every house sale transaction in a given period. This sampling approach is consistent with methodological practice across the suite of ABS price indexes.

8.3 The preliminary estimates for the two most recent quarters, referred to as the leading indicator series, are revised as more data are progressively received from the VGs. The third most recent quarter in any publication is calculated from VGs data only and will not be subject to further revision once published. The index numbers derived only from VGs data are referred to as the benchmark series.

PROVIDERS

Valuers-General

8.4 Each property transaction, regardless of type or location, is registered to enable the relevant State government authority to maintain a record of property ownership and to facilitate other legislated functions, such as land valuations for council ratings, and the collection of taxes and duties.

8.5 The most obvious source of comprehensive information on house prices are the State Valuers–General offices. The data held by these agencies represent the ABS' preferred source for compiling the HPI because they provide the most comprehensive dataset currently available on house sales. The information contained in these records varies between jurisdictions. While all include details of the transaction (date, price, etc.), in some jurisdictions, information about the physical characteristics of the property is also available.

Mortgage Lenders

8.6 A more timely data source which is used to supplement the VGs data is property loan applications from mortgage lenders. A large percentage of house sales involve mortgages, and such applications are generally processed shortly after the exchange of contracts. Loan documents and the systems used by most mortgage lenders do not capture the actual date of exchange. However, the recorded loan application approval date has proven to be a satisfactory proxy for the date of exchange.

8.7 While not all mortgage lenders are included in the HPI sample, the coverage does include major banks and is representative of the market.

8.8 All records relating to individual transactions are treated with confidentiality and stored securely. Only aggregate information (e.g. price indexes) is released.

Mortgage Lenders continued

8.9 It should be noted that VGs and mortgage lenders are included in the HPI sample on an on-going basis. That is, there is no 'rotation' of providers, which reduces the complexities that otherwise would be involved with managing the compositional change that would arise.

LIMITATIONS

8.10 A disadvantage of the VGs administrative datasets is the lengthy delays experienced before all data become available. Different jurisdictions have different legislation governing the reporting requirements of parties to property transfers. In general, the requirement is for the property transfer to be registered within 60–90 days of settlement. When combined with a lag between exchange of contracts and final settlement of 4 to 6 weeks on average, but up to 3 or 4 months in some cases, the delay between the date of contracts being exchanged and all transactions relating to a particular month being received by the ABS can be 6 months or more.

8.11 A further concern about obtaining reliable price measures is that properties with higher prices generally take longer to settle. The consequence is that details received by the ABS relating to the property sales in a particular quarter are distributed in a biased way. In general, the median price of properties exchanged in a particular quarter increases as the dataset becomes more complete. The resulting bias in early reported data is always downwards but its magnitude is not consistent, either between cities or over time within any one city. As a result, it is necessary to obtain an almost complete dataset for each quarter before it is possible to determine the most accurate measure of median house prices for each cluster. As noted above, it takes several months for all transactions relating to a particular quarter to be finally settled, recorded by the relevant State agency and then passed on to the ABS.

8.12 Some mortgage lenders' data also have a shortcoming in that loan documents do not necessarily record the actual sale price of the property, rather these records sometimes contain the security valuation amount, which can differ markedly from the sale price. Though the most obvious of these records are identified and excluded, the median prices derived from mortgage lenders data can differ from median prices derived from the complete VGs dataset.

8.13 The additional data provided by the sample of mortgage lenders allow compilation and publication of a more timely estimate of price change. The preliminary estimates for the two most recent quarters, the leading indicator series, are therefore revised as more VGs transaction data are progressively received. Where the same sales are recorded in VGs and mortgage lenders' data, the VG record is used.

BIASES

8.14 As stated above, different States have different legislation in place concerning the length of time in which an owner must register the property title transfer. Further, there is a bias in early VGs data caused by the tendency of properties with higher prices to take longer to settle and therefore appear in the VGs dataset. The VGs data available for the two most recent quarters are biased downwards because of this tendency for cheaper properties to be settled more quickly than relatively expensive properties.

Reducing biases

8.15 The method used to calculate price relatives serves to counter the effects of this bias on the composition of the sets of price data collected every quarter. Price relatives are determined only by comparing current benchmark medians (BM) with previous benchmark medians and current leading indicator medians with previous leading indicator medians. Thus, in the leading indicator series, medians from the current second preliminary estimates (P2) quarter are compared with medians from the previous second preliminary estimates quarter, and medians from the current first preliminary estimates (P1) quarter are compared with medians from the previous first preliminary estimates quarter. Using this approach, price relatives are derived from datasets which have a similar proportion of VGs and mortgage lenders' data.

8.16 In a particular processing cycle where period *t* is the most recent quarter, the price relatives for the benchmark and the two leading indicator quarters can be represented algebraically as follows:

$$\frac{P_{it-2,BM}}{P_{it-3,BM}}, \frac{P_{it-1,P2}}{P_{it-2,P2}}, \frac{P_{it,P1}}{P_{it-1,P1}} \qquad (8.1)$$

8.17 For example, suppose that September quarter is the most recent quarter in an index production cycle, period *t*. September quarter will be the first preliminary estimate (P1) of the indicator series, June quarter (period *t-1*) will be the second preliminary estimate (P2) of the indicator series, and March quarter (period *t-2*) will be the benchmark series (BM). In the previous production cycle June quarter was P1, March quarter was P2 and December quarter (period *t-3*) was benchmark. The September quarter price relatives will be calculated by dividing the September quarter P1 median by the June quarter P1 median. The June quarter price relatives will be calculated by dividing the June quarter P2 median by the March quarter P2 median. The March quarter price relatives will be calculated by dividing the March quarter BM median by the December quarter BM median.

INTRODUCTION

9.1 The HPI is compiled using median prices of observed transactions for each cluster. This chapter describes some issues associated with collecting transaction prices and determining median prices.

TRANSACTION PRICES

9.2 Price is defined as the value placed on a product at the point of transaction.

9.3 The HPI measures the transaction prices agreed upon by vendor and purchaser. That is, it does not take account of or include any taxes and subsidies.

PRICING POINTS

9.4 In the Australian context, there are four significant dates related to the purchase of a residential dwelling. A general timeline of the stages of the sale of residential dwellings is as follows:

- verbal agreement to purchase at a negotiated price;
- approval of mortgage financing;
- exchange of contract; and
- settlement of the property sale.

The date of exchange of contract is the preferred date

9.5 For the purposes of measuring price changes for houses, it is desirable to select the earliest date at which the final purchase price is set. The point in time at which the price is first determined is when verbal agreement is reached. However, there is no effective way to capture this information and it is possible for the originally agreed sale price to be renegotiated before the exchange of contracts. Approval of mortgage finance data is limited to those sales that involve mortgages. A house price index constructed on a settlement date basis incorporates a lag in identifying the turning points in housing prices as the settlement date can occur several weeks or months after the exchange of contract. It is for these reasons that, in compiling the HPI, the date of exchange of contract is the preferred date.

Estimating the date of exchange for Adelaide and Darwin

9.6 For most States, the VGs data include information on the date of exchange of contracts. However, the contract exchange date is not captured in either South Australia or the Northern Territory. For Adelaide and Darwin, the ABS estimates the contract exchange date from the settlement date. The estimates are modelled on the relationship between the settlement and exchange dates of price quintiles in Brisbane, where similar administrative arrangements exist. These models are reviewed from time to time to ensure their continuing effectiveness and relevance.

MEDIAN PRICES

9.7 Median prices are used to represent the prices of all houses sold in a cluster in a given period. Therefore, price movements at the cluster level are determined by comparing the median price of the cluster in one period to the median price of the cluster in another period.

9.8 The median price is the value of the middle observation from among an ordered ranking of house prices. Medians are preferred as they are not affected by extreme or outlier values like arithmetic mean or geometric mean calculations, and give the most robust and consistent measure of central tendency. The price relative calculated from two medians is the most reliable measure of price change.

9.9 The weighted movements of the median prices of each cluster contribute to the capital city index movement, as described in Chapter 7.

MEDIAN PRICES *continued*

9.10 It is important to note that due to the compositional differences of the benchmark and leading indicator series, the price relatives from quarter to quarter are determined by comparing current benchmark medians with previous benchmark medians, and current leading indicator series medians with previous leading indicator series medians. For more information refer to Chapter 8.15.

TIMING AND FREQUENCY

9.11 The unstratified dataset of prices is obtained from VGs and a sample of mortgage lenders. Transaction data are provided on a monthly or weekly basis. Files provided may contain details of transactions which exchanged in the current quarter, as well as those which exchanged in earlier quarters and have recently been settled and/or been registered.

9.12 Note that due to provision arrangements and the requirement to publish the indexes in a timely manner, the transaction data for the most recent quarter will be biased towards the first two months of the quarter. A smaller proportion of transactions which exchanged in the third month will have been registered by the relevant authority and subsequently provided to the ABS.

COLLECTION PROCEDURES

9.13 Providers selected in the HPI sample submit a file of new or updated transaction or mortgage records to the ABS' Secure Deposit Box. The format of the files is not standardised, in order to minimise provider burden. Data items provided also vary across providers. Therefore, ABS systems and processes are required to transform the individual files into a standardised dataset for subsequent processing.

PRICE OBSERVATION

9.14 While price observations in the CPI and PPI suites of indexes are carefully selected and monitored to ensure that the same 'specification' is being priced each quarter, this is not possible in the compilation of the HPI. The sample of the housing stock transacted contains houses with different characteristics from quarter to quarter.

9.15 As described in previous chapters, the mechanism which is used to substitute for pricing the same item each period is the choice of index methodology: stratifying the range of price observations collected into clusters of housing stock with similar characteristics and then calculating a representative price for these clusters.

NON-MARKET TRANSACTIONS

9.16 A typical dataset will contain records of transactions which are not representative of the market. These could be categorised as transactions between related parties, such as family members or in divorce settlements, or could be the result of data entry error. Where these transactions can be identified, they are removed from the datasets and therefore do not contribute to cluster median calculations.

MISSING OBSERVATIONS

9.17 As outlined in Chapter 5, the stratification methodology chosen aimed to produce clusters which maximised both the homogeneity of the price-determining characteristics of houses in a cluster, and the number of price observations that could be expected each period, in order to calculate a reliable median.

MISSING OBSERVATIONS *continued*

9.18 However, in practice, some suburbs (the building blocks of the index) are so unique that to include them with other suburbs would produce clusters which do not meet homogeneity requirements. Therefore, some clusters are formed from one or very few suburbs, which means that the number of price observations available each quarter is extremely low, or sometimes nil.

9.19 The price movements of clusters 'missing' observations in a particular quarter are therefore derived using appropriate imputation methodologies during the editing process.

EDITING

9.20 The two processes described above (removing non-market transactions and imputation) are examples of the types of procedures involved in the editing stage of the index compilation process. The former is an example of input editing, while the latter is an example of output editing. Duplicate records within and between data provided by VGs and mortgage lenders are also identified in the input editing stage; these records do not contribute to median price calculations.

9.21 The function of editing is to ensure that the datasets used to compile the index are sound, and that price changes which aggregate to produce the index number are realistic. The price index analyst makes important decisions on the quality of the data and the results produced and takes steps to rectify any issues identified.

QUALITY ADJUSTMENT

9.22 The term 'quality' in the context of a price index refers to the characteristics of a product being priced in each period. Differing products will have different qualities. Also, the qualities of one particular product may not be fixed between time periods.

9.23 Where these changing characteristics are considered to be price-determinant (dimensions, materials, extra features, for example), an assessment is made of the change in quality and the magnitude of the corresponding effect on price. This may be a simple matter where the quality which changes is, say, the volume of liquid in a bottle. However, more subtle differences in qualities are more problematic, such as when a car model is upgraded.

9.24 In these situations, in order to 'price to constant quality' to measure pure price change, an adjustment is made to ensure the correct price relative is derived. There are a number of techniques which can be applied, and these are detailed in the CPI and PPI Concepts, Sources and Methods publications (cats. no. 6461.0 and 6429.0 respectively).

9.25 In the HPI, the stratification method is used to address the fact that each quarter there is a change in the composition of houses sold. Therefore each cluster is assumed to have a fairly homogeneous quality in terms of certain characteristics of the housing stock it includes (these characteristics are described in greater detail in Chapters 5 and 11). It is also desirable that the sets of price observations for each cluster should have a constant or consistent quality in factors like data sources, data provision and processing practices. There may be instances where a perceived change in quality does occur in a cluster from one period to the next. This may be due to data provision changes (such as introduction of a new provider into the sample), or systems processing issues. In these instances, a perceived change in quality of a cluster may prompt a quality adjustment to the cluster median.

CHECKING

9.26 During the collection and processing cycle, checks are made at numerous points to ensure:

- the integrity of the data collected;
- correct transformation in ABS systems;
- accurate median calculation;
- appropriate application of estimation, imputation and quality adjustment techniques; and
- acceptable confrontation of results with market intelligence and expectations.

CHAPTER 10 RE-REFERENCING AND LINKING PRICE INDEXES

INTRODUCTION

10.1 It is important that price indexes produced by the ABS are reviewed regularly to ensure the indexes are contemporary and that index results accurately represent price movements in the market.

10.2 The HPI has been subject to two reviews in its history, the first of which significantly changed the methodology, and the second of which provided some further refinements.

10.3 The changes to methodology which were implemented as a result of the first review produced a 'break' in the index series. This means that the conceptual and structural framework of the indexes were so different that the measurement of the changes in house prices over time were not able to be compared. This is reflected in the different index reference periods.

10.4 The most recent review did not result in further methodological changes, but ensured that the HPI reflected the contemporary nature of the housing market. Therefore, the current series could be linked to the previous series, without a break.

10.5 This chapter explains the concept of an index reference period and describes how to re-reference and link price indexes.

INDEX REFERENCE PERIOD

10.6 The reference period of an index series (also commonly labelled base or reference base) is that period for which the value of the index is set to 100.0. Prices in other periods are expressed as percentages of the price in the reference period. For example, if the HPI had increased 15% since the reference period the index number would be 115.0; similarly, if it had fallen by 15% the index would be 85.0. In the case of the HPI, the index reference period is the 2003–04 financial year (i.e. 2003–04 = 100.0).

10.7 The index reference period of the series compiled under the previous methodology is 1989–90 = 100.0.

10.8 The index reference period should not be confused with the price reference period and the weight reference period. As described in Chapters 4 and 7 respectively, the price reference period is the period whose prices are compared with the prices in the current period, and the weight reference period is the period of the data used to calculate the value weights.

RE-REFERENCING INDEXES

10.9 The derivation of the reference period index number is the arithmetic average of the index numbers for the financial year. That is, September, December, March and June quarters. To re-reference an index series to a particular reference period, the arithmetic average of the index numbers in the period is calculated and divided by 100, and all index numbers in the series are subsequently adjusted by this factor. The arithmetic average of the four quarters in the reference period will now be 100.0. The percentage change between any two periods will be maintained in the re-referenced series.

10.10 When using a number of different price indexes to compare price changes, the user should ensure that the index reference period of each series is the same, re-referencing where necessary.

CHAIN LINKING

10.11 When an index is reviewed to ensure the weights and structure are

CHAIN LINKING *continued*

contemporary, the process of incorporating the new weights and structures into an existing price index is known as chain linking.

10.12 Three steps are involved in the linking process: choosing the link period; price updating the value data; and chaining the new index to the existing index.

Link period

10.13 The link period is the quarter in which the index is calculated on both the old weights and structure and the new weights and structure. The choice of link period is determined by a number of factors, but the aim is to avoid any periods where economic behaviour may be influenced by an abnormal event, such as regulatory changes.

10.14 The international trade price indexes, for example, are linked every year through the June quarter.

10.15 The latest review of the HPI was implemented in December quarter 2008; however, due to the two stage approach to HPI compilation (described in chapter 11.23), the link period which was used was March quarter 2008. This means that indexes for June quarter 2008 (benchmark), September quarter 2008 (P2, second estimate) and December quarter 2008 (P1, first estimate) were calculated from the index for March quarter 2008, but with revised structures and weighting patterns.

Price updating value data

10.16 When linking price indexes to implement a review or re-weight, the link period is usually different from the period for which the new value weights have been calculated (for more information on the weight reference period refer to chapter 7). Therefore it is necessary to price update (revalue) the values from the weight reference period to the price levels of the link period.

10.17 The method for calculating price updated link period values for each cluster in the HPI differs to that of other ABS price indexes due to the fact that for HPI actual quantities for the weight reference period are available. In other indexes a measure of price change between the link period and the weight reference period is derived, and this is multiplied by the value or expenditure weights from the weight reference period. The updated value aggregates are aggregated to determine the upper level value aggregates.

10.18 In the HPI, the updated value of the housing stock is determined by multiplying the house counts obtained from Census data by a measure of average price for the link period (the 'mean-adjusted median') for each cluster. Although the HPI method is different to that employed by other indexes described above, it delivers a mathematically equivalent result. For more information on this process refer to Chapter 11.

10.19 The resulting link period value aggregate is then expressed in terms of prices from the link period and quantities from the weight reference period.

Chain linking through a link period

10.20 Prior to any reviews or re-weights, a price index in the current period is constructed as a multiple of the index in the base period and the ratio of the current value aggregate and the base period value aggregate.

10.21 Subsequent to a review or re-weight, comparisons will be made with the link period rather than the base period. That is, the index will be constructed as a multiple of

Chain linking through a link period continued

the index in the link period and the ratio of the current value aggregate and the link period value aggregate (both with the new weighting pattern).

10.22 It should be noted that the index reference period remains the same – while the weights and structure have been updated, the index series is not broken and price movements relative to the base period may still be determined.

INTRODUCTION

11.1 This chapter will collate and expand on the information provided in previous chapters to describe how the HPI is calculated in practice.

SUBURBS AS BUILDING BLOCKS

11.2 As outlined in the previous chapters, the approach adopted by the ABS to control for compositional effects in measuring price movements is the stratification method. The allocation of suburbs (the building blocks of the indexes) to clusters in each city is determined by the type of stratification implemented.

CLUSTERING

After the 2004 HPI Review

11.3 The 2004 HPI review developed a stratification based on attributes that can be broadly defined as the structural, locational and 'neighbourhood' characteristics of suburbs. An analysis determined that four structural variables, four locational variables and one neighbourhood variable were the most relevant in determining the similarity of suburbs for stratification purposes.

11.4 The structural variables were determined from 2001 Census of Population and Housing data and described the percentage of dwellings in a suburb with particular characteristics, such as number of bedrooms. The locational variables were determined from geographic data and described average distance to facilities, such as the nearest shops, by suburb. The neighbourhood variable was represented by the ABS Socio-Economic Index for Areas (SEIFA[1]), which is a measure, derived from Census data, summarising different aspects of the socio-economic conditions of people living in an area.

11.5 The number of non-SEIFA variables were reduced into two principal components, one each for the structural variables and the locational variables. A process of cluster analysis was then undertaken using these two principal components and SEIFA as variables to select the optimal number of clusters. As there was an aim at the time to publish the HPI at lower levels than the city, this analysis was applied with a constraint to ensure that only suburbs within the same statistical subdivision[2] (SSD) could be grouped together and clusters could not cross SSD boundaries. A detailed description of the changes to the index resulting from the 2004 review is provided in *Information Paper: Renovating the Established House Price Index* (cat. no. 6417.0).

11.6 The HPI was compiled using this clustering methodology from September quarter 2005 to September quarter 2008 (and backcast to March quarter 2002). The index over this period is referred to as Series 1. During this period, further assessments of the capacity of the stratification methodology to control for compositional change were undertaken. Practical considerations became apparent, such as the large number of clusters in some cities. This resulted in median price volatility in some clusters due to the low number of transactions observed during a quarter. Also, investigations by the Reserve Bank of Australia (RBA) published in 2006 suggested that long-term prices of

1 The ABS' Socio-Economic Index for Areas (SEIFA) ranks geographic areas according to their social and economic conditions. For further information, refer to *Information paper: An Introduction to Socio-Economic Indexes for Areas (SEIFA)*, 2006 (cat. no. 2039.0).

2 The Australian Standard Geographic Classification (ASGC) is a set of hierarchical geographic structures. The main structure consists of spatial units in each of the following hierarchical levels: Australia; States/Territories; Statistical Divisions (SDs); Statistical Subdivisions (SSDs); Statistical Local Areas and Census Collection Districts. The HPI weights and structure have been updated most recently using the 2006 edition of the ASGC (which was used in the 2006 Census of Population and Housing). For more information on the ASGC refer to *Australian Standard Geographical Classification (ASGC) (*cat. no. 1216.0).

After the 2004 HPI Review continued

suburbs were a suitable characteristic on which to determine clusters of similar suburbs (Prasad and Richards, 2006).

Improvements to the stratification

11.7 As outlined in the ABS Methodology Advisory Committee (MAC) paper *Refining the Stratification for the Established House Price Index* (cat. no. 1352.0.55.093), published in 2008, four areas for improvement to the stratification were identified:

- remove the constraint of clustering suburbs within statistical subdivision (SSD) boundaries, allowing suburbs in geographically diverse areas within a capital city to be clustered together;
- include long-term median price and socio-economic characteristics of suburbs as stratification variables;
- simplify the stratification methodology; and
- utilise updated datasets from the most recent Census (2006) to form the basis of stratification.

11.8 Analyses of various clustering options were undertaken (refer to above MAC paper). An optimal stratification was defined as one which maximised the homogeneity of the suburbs in a cluster, while also maximising the number of price observations each quarter. That is, reducing the number of clusters in a city would be expected to increase the number of price observations in most clusters, producing more robust cluster medians from which to derive price relatives, however, it could also have the effect of creating less homogenous clusters.

11.9 The recommendations of the methodological analyses were implemented in the December quarter 2008 publication of the HPI. The series were linked in the 'benchmark' quarter, March quarter 2008. The time series period of the HPI which is calculated using the new clusters is referred to as Series 2.

11.10 The resultant stratification was simplified to cluster suburbs according to long-term median price (mean-adjusted median) and SEIFA. Suburbs in a cluster therefore share common characteristics regardless of whether they fall within the same SSD. The number of clusters in each city were reduced (apart from Darwin), which has also contributed to improvements in analysis and editing processes.

11.11 The following table shows the number of clusters currently used for each city (Series 2), compared to the previous series (Series 1):

1 NUMBER OF CLUSTERS

	Series 1 (from March quarter 2002)	*Series 2 (from March quarter 2008)*
Sydney	55	22
Melbourne	39	20
Brisbane	51	20
Adelaide	27	11
Perth	14	10
Hobart	8	5
Darwin	5	6
Canberra	14	7

Improvements to the stratification continued

11.12 Data from the 2006 Census were used to update the coverage of the capital cities. This meant that transactions which had previously been excluded from cluster median calculations now contribute to index compilation if the suburb in which they are located was recorded in the 2006 Census. The opportunity was also taken to review the various permutations of locality nomenclature to ensure all in-scope transactions are included.

11.13 The 2006 Census data also contributed to the updated weighting of the HPIs, as described in Chapter 7.

CALCULATING WEIGHTS

11.14 When calculating new weights after a review, the link period is usually different from the period for which the new value weights have been calculated (for more information on the weight reference period refer to chapters 7 and 10). Therefore it is necessary to price update (revalue) the values from the weight reference period to the price levels of the link period.

11.15 As described in chapter 10, the methodology for price updating the value data for each cluster in the HPI differs to that of other ABS price indexes. In other indexes a measure of price change between the link period and the weight reference period is derived for the index component, and this is multiplied by the values from the weight reference period.

11.16 In the HPI, the updated value of the housing stock is determined by multiplying quantities from the weight reference period by prices from the link period for each cluster. Cluster quantities are house counts obtained from 2006 Census data. Cluster prices are derived as the 'mean-adjusted median' for the link period (March quarter 2008). This measure is calculated by finding the ratio of the mean and median for the four consecutive quarters up to and including the link period, and then averaging these ratios. This average ratio is applied to the link period median with the intention of deriving a more robust 'mean' price for the cluster than is possible by calculating a mean price for one quarter (which is influenced by any unusual transactions).

11.17 The resulting link period value aggregate is then expressed in terms of prices from the link period and quantities from the weight reference period.

CALCULATING INDEX NUMBERS

11.18 Chapter 7 also referred to the HPI methodology of deriving price relatives. Other ABS indexes derive price relatives by comparing the prices of items in the current period with the prices in the base period (or price reference period), and then calculating an average of these price relatives for the product grouping. A percentage change for the group (or 'elementary aggregate') is then determined from current and previous average price relatives.

11.19 In the HPI, the median price of a cluster in the current period is compared with the median price of the cluster in the previous period. As described in Chapter 7, the clusters are the lowest level, or elementary aggregate of the HPI index structure. The price relative derived then is used to revalue the value of housing stock in the previous period to produce a current period value for the cluster. The updated value provides an estimate of the value of the base period stock of houses in the current period.

CALCULATING INDEX NUMBERS *continued*

11.20 The price updated values for the clusters are then summed to derive the current value of the total housing stock. Index numbers are calculated from the value aggregates at every level of the index.

11.21 When a price index has not been linked, indexes for any component can be calculated simply by dividing the current period value aggregate by its value aggregate in the index reference period and multiplying by 100 (when the index is set to 100.0). However, the HPI has been linked once since its reference period (2003–04) and the index numbers must be calculated from

$$I_{LP} \times V_{CP}/V_{LP}$$

where I_{LP} is the index number for the link period (March quarter 2008) for the HPI Series 2, and V_{CP} and V_{LP} are the value aggregates in the current periods and link periods respectively.

11.22 The process can be illustrated by the example in Tables 2 and 3 which show the index calculation for a city which is made up of five clusters. In this example, the first step is to calculate the price movement for each cluster via a price relative. The next step is to produce a current period value for each cluster by using the price relative to inflate or deflate the previous period value. The cluster values can be aggregated to produce values for the city. The final step is to produce a current period price index by dividing the current period value by the link period value and then multiplying this by the link period index number. This example demonstrates that the movement in the aggregate index is determined not just by the price movements, but also by the weights. Cluster 1 shows a very large price fall, however its impact on the overall index movement reflects its relatively low weight.

2 CALCULATING INDEX NUMBERS: PRICE RELATIVES

	Previous period (p_{t-1})	*Current period* (p_t)	*Price relative* (p_t/p_{t-1})
	$	$	no.
Cluster 1	1 500 000	1 260 000	0.840
Cluster 2	800 000	800 000	1.000
Cluster 3	500 000	505 000	1.010
Cluster 4	400 000	412 000	1.030
Cluster 5	300 000	315 000	1.050

CALCULATING INDEX NUMBERS *continued*

3 CALCULATING INDEX NUMBERS

	Link period	*Previous period*	*Current period*	*% change*
	no.	no.	no.	%
VALUE AGGREGATES ($'000)				
Cluster 1	600 000	650 000	546 000	–16.0
Cluster 2	8 000 000	7 500 000	7 500 000	—
Cluster 3	15 000 000	16 000 000	16 160 000	1.0
Cluster 4	15 000 000	17 500 000	18 025 000	3.0
Cluster 5	2 000 000	3 200 000	3 360 000	5.0
City A	40 600 000	44 850 000	45 591 000	1.7
INDEX NUMBERS				
Cluster 1	105.0	113.8	95.6	–16.0
Cluster 2	105.0	98.4	98.4	—
Cluster 3	94.0	100.3	101.3	1.0
Cluster 4	91.0	106.2	109.4	3.0
Cluster 5	96.0	153.6	161.3	5.0
City A	93.0	102.7	104.4	1.7

— nil or rounded to zero (including null cells)

THE TWO STAGE APPROACH

The benchmark series

11.23 Though a complete coverage of property sales data can eventually be obtained from the VGs, this data is not available on a timely basis for the most recent quarters. As a result, the ABS has adopted a two-stage approach to produce the HPI. The first stage is to compile a benchmark series based on the complete, or near complete, VGs dataset for each quarter. In practice, the data underlying the benchmark series for any quarter is not sufficiently complete until two more quarters of data has been received. For example, the benchmark HPI for March quarter each year will not be available until it is released with the September quarter issue of the HPI publication. Thus, in the March quarter issue, the index is preliminary; the index is subsequently revised in the June quarter issue, but it is still preliminary until it is revised for the final time in the September quarter issue. See below for a further explanation of revisions.

11.24 The benchmark series index numbers for a city are calculated, in the manner described above, using price relatives for each cluster which have been calculated from price observations sourced from the VGs. The weighted average index for eight capital cities is compiled in the same way as the benchmark series (i.e. aggregating the revalued value of housing stock in each city, dividing that aggregate by the link period aggregate value for the eight capital cities, and then multiplying this ratio by the link period index number for the eight capital cities).

Compiling the 'leading indicator' series

11.25 The second stage, referred to as the 'leading indicator' series, involves compiling price indexes for the two most recent quarters (e.g. in the September quarter issue, the June and September quarters) based on a combination of mortgage lenders' data and the VGs data available at that point in time. The weighting of the leading indicator series are determined by the weights as they are inflated or deflated each quarter in the benchmark series. That is, when the benchmark quarter is compiled, the resultant value aggregates of each cluster are used in the subsequent leading indicator series, to be revalued by the price relatives produced in that series.

Compiling the 'leading indicator' series continued

11.26 The process of compiling the leading indicator series is presented algebraically below.

11.27 In merging the VGs and mortgage lenders' datasets for the leading indicator series, any property transactions appearing in both are removed from the mortgage lenders' data.

11.28 Chapter 8 describes the method of calculating price relatives which is used to address the changing composition of VGs and mortgage lenders' data in the sets of prices collected for each quarter.

REVISIONS

11.29 As the VGs based benchmark indexes become available, they are used to progressively replace the leading indicator series. As a result, the most recent two quarters' estimates of the HPI are preliminary, and subject to revision. The expectation is that the second preliminary estimate published for a quarter will be closer to the final estimate than was the first preliminary estimate published.

11.30 The latest quarterly observation (labelled with a 'p') in the HPI tables is the first preliminary estimate based on a combination of the available VGs data and mortgage lenders' data. The second latest observation (also labelled with a 'p') will be the revised estimate from the previous quarter's publication. It will be the second preliminary estimate based on available VGs data (more than were available for the first estimate) and mortgage lenders' data. The third latest observation (labelled with an 'r' if it has been revised since the previous quarter's estimate) is the first publication of the benchmark series compiled from a comprehensive set of VGs data only.

11.31 The ABS' aim is to develop a single optimal model for producing a final price movement in a more timely manner than is currently possible. While continuing investigations and analysis are underway, the HPI publication also includes a table stating the size of the revisions applied to these series over time. The first, second and final estimates of the index numbers for any particular quarter are collated (with this information dating back to June quarter 2005, when the first leading indicators were available). The size of the revision between the final index number and the two preliminary estimates is also published. This information eliminates the need to reference previous publications to determine what index number was initially published for a quarter, and also provides an indication of the accuracy of the leading indicator series.

11.32 The revisions to the indexes for each of the eight capital cities and for the weighted average of the eight capital cities are published as a time series spreadsheet in Table 9 of 6416.0 on the ABS website.

11.33 A summary of the preliminary and final index numbers, quarterly and annual percentage change, and the magnitude of the revisions to the percentage change is also published in Table 9.

ROUNDING CONVENTIONS

11.34 To ensure consistency in the application of data produced from ABS price indexes, 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

ROUNDING CONVENTIONS *continued*

sense of the underlying precision of the estimates. These conventions need to be taken into account when using price index data for analytical or other special purposes.

11.35 Index numbers are always published to a 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. 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. Percentage changes between these periods are calculated from the rounded average index numbers.

FORMULAE

11.36 A summary of the concepts described above is described algebraically below. As discussed in Chapter 4, Laspeyres price index formula (where quantities in the base period (q_{i0}) are fixed) can be expressed as follows:

$$I^t = \frac{\Sigma p_{it} q_{i0}}{\Sigma p_{i0} q_{i0}} \times 100 \qquad (11.1)$$

$$= \Sigma \frac{p_{it}}{p_{i0}} \left(\frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} \right) \times 100 \qquad (11.2)$$

11.37 That is, the index in the current period, *t*, for the sum of *i* clusters, is calculated by dividing the sum of current values by the sum of base period values, or alternatively multiplying the ratio of the median price in the current period to the median price in the base period (the price relative as described in Chapter 4) by the value weight of the cluster in the base period, and then calculating the index by summing these component indexes.

The HPI in practice

11.38 In practice, the counts of houses (quantity) in the base period are fixed, and the value of the housing stock is updated each quarter. Median prices in the current and previous periods are compared, rather than in the current and base period.

11.39 As the value weight of each cluster is inflated or deflated each quarter by the price relative of the current quarter median to the previous quarter median, the formula can be expressed in the form:

$$I^t = \Sigma \frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} \times \left(\frac{p_{i1}}{p_{i0}} \right) \times \left(\frac{p_{i2}}{p_{i1}} \right) \times \ldots\ldots \times \left(\frac{p_{it-1}}{p_{it-2}} \right) \times \left(\frac{p_{it}}{p_{it-1}} \right) \times 100 \qquad (11.3)$$

The leading indicator series

11.40 Further, value weights of the clusters in the most recent quarters, P1 and P2, are derived from the weights of the clusters in the benchmark (BM) quarter. Hence equation (11.3) becomes:

$$I^t = \Sigma \frac{p_{i0} q_{i0}}{\Sigma p_{i0} q_{i0}} \times \left(\frac{p_{i1,BM}}{p_{i0,BM}} \right) \times \left(\frac{p_{i2,BM}}{p_{i1,BM}} \right) \times \ldots\ldots \times \left(\frac{p_{it-2,BM}}{p_{it-3,BM}} \right) \times \left(\frac{p_{it-1,P2}}{p_{it-2,P2}} \right) \times \left(\frac{p_{it,P1}}{p_{it-1,P1}} \right) \times 100$$

INTRODUCTION

12.1 This chapter describes the house price index data released by the ABS and provides users with some guidance on interpretation.

PUBLICATION OF STATISTICS

12.2 The HPI is compiled and published quarterly in *House Price Indexes, Eight Capital Cities* (cat. no. 6416.0). The publication is currently released approximately 4–5 weeks after the end of the reference quarter. Each quarterly issue of this publication announces the release dates for the subsequent four quarterly issues; i.e. the publication dates for these statistics are finalised and announced about twelve months in advance.

12.3 The statistics released in *House Price Indexes, Eight Capital Cities* (cat. no. 6416.0) are disseminated via several different mechanisms. Available free of charge on the ABS website <www.abs.gov.au> are:

- the main findings from the publication in HTML format;
- a downloadable version of the full publication in PDF format;
- all tables in the publication, available as time series spreadsheets, downloadable in Microsoft Excel format; and
- an historical table of the HPI using previous methodology, downloadable in Microsoft Excel format.

INTERPRETING INDEX NUMBERS

12.4 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 HPI for Sydney between December quarter 2005 and December quarter 2008. This procedure is applicable for any two periods.

For example:

December quarter 2008 index number	97.2
less December quarter 2005 index number	93.5
equals change in index points	3.7
percentage change	3.7/93.5 x 100 = 4.0%

12.5 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 change of 1.7%, but if the index number were 80 a change of 2 index points would be equivalent to a change of 2.5% – a significantly different rate of price change. Only when measuring change from the index reference period will the points change be numerically identical to the percentage change.

12.6 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. In other words, the percentage change between, say, the June quarter one year and the June quarter of the following year will not necessarily equal the sum of the four quarterly percentage changes. The error becomes more noticeable the longer the period covered and the greater the rate of change in the index. This can readily be verified by starting with an index of 100 and increasing it by 10% (multiplying by 1.1) each period. After four periods, the index will equal 146.4 delivering

INTERPRETING INDEX NUMBERS *continued*

a through-the-year percentage change of 46.4%, not the 40.0% obtained by adding the four quarterly changes of 10.0 per cent.

ANNUAL INDEX NUMBERS

12.7 Price indexes produced by the ABS are published on both a quarterly and a financial year basis. The index number for a financial year is the simple arithmetic average (mean) of the index numbers for the 4 quarters of that year. Index numbers for calendar years are not calculated for the HPI but can be derived by calculating the simple arithmetic average of the quarterly index numbers for the year concerned.

12.8 For example, an index number for the year 2008 would be calculated as the arithmetic average of the index numbers for the March, June, September and December quarters of 2008. This characteristic of index numbers is particularly useful. It allows annual price movements to be calculated and compared with those of any other year. It also enables the index number in, say, the current quarter, to be compared with the average prevailing in some prior year.

HISTORICAL SERIES AVAILABLE

12.9 As noted above, the HPI series compiled under the previous methodology (prior to the 2004 review) is published on the ABS website for users to access. This series commences in June quarter 1986 and concludes in June quarter 2005.

12.10 Caution should be exercised when attempting to 'link' the original and current series. While the ABS can provide advice on re-basing (see Chapter 11) and splicing, due to the variety of outcomes determined by users' decisions, the ABS does not recommend a method for linking the two series.

PRACTICAL CONSIDERATIONS

12.11 The final decision for deciding the appropriateness or otherwise of the HPI for any particular application lies with the end user. While the ABS can provide technical and statistical guidance, it does not provide advice on indexation practices, nor can it tell users which index would best suit any particular use. See Appendix 2, Price Indexes and Contract Indexation, for further information.

INFORMATION PAPERS AND RELATED PUBLICATIONS

12.12 Users may also wish to refer to the following publications which are available from the ABS website:

- *Information Paper: Renovating the Established House Price Index, November 2005* (cat. no. 6417.0);
- *Research Paper: Refining the Stratification for the Established House Price Index (Methodology Advisory Comittee)* (cat. no. 1352.0.55.093) – published in June 2008;
- *Consumer Price Index, Australia* (cat. no. 6401.0) – issued quarterly;
- *A Guide to the Consumer Price Index: 15th Series, October 2005* (cat. no. 6440.0);
- *Consumer Price Index: Concepts, Sources and Methods, 2009* (cat. no. 6461.0);
- *Producer Price Indexes, Australia* (cat. no. 6427.0) – issued quarterly;
- *Producer and International Trade Price Indexes: Concepts, Sources and Methods, 2006* (cat. no. 6429.0);
- *Labour Price Index, Australia* (cat. no. 6345.0);
- *Labour Price Index: Concepts, Sources and Methods, 2004* (cat. no. 6351.0.55.001);
- *Australian National Accounts: National Income, Expenditure and Product* (cat. no. 5206.0) – issued quarterly;
- *Housing Finance, Australia* (cat. no. 5609.0) – issued monthly;

INFORMATION PAPERS AND RELATED PUBLICATIONS *continued*

- *Building Activity, Australia* (cat. no. 8752.0) – issued quarterly; and
- *Building Approvals, Australia* (cat. no. 8731.0) – issued monthly

12.13 Current publications and other products by the ABS are listed on the ABS web site <www.abs.gov.au>. The ABS also issues a daily Release Advice on the web site which details products to be released in the week ahead.

INTRODUCTION

13.1 Having determined that a price index is required for a particular application, it is important for price index users to carefully consider the range of available indexes and select the one that best meets the specific requirement. The ABS can provide statistical and technical guidance but it does not provide advice on indexation practices and it cannot advise users of which index they should use for particular indexation purposes.

PRINCIPAL PRICE INDEXES

13.2 The HPI is one of a range of price indexes published by the ABS. Other price indexes available include:

- the consumer price index (CPI);
- producer price indexes (PPI);
- international trade price indexes (ITPI); and
- labour price indexes (LPI).

OTHER HOUSE PRICE INDEXES

13.3 There are a number of other price indexes and other data related to housing that are produced by the ABS. A selection of these data are included in *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0), published in Table 5. Each of these are described below.

Project homes index

13.4 The index for project homes is compiled for use in calculating the house purchase expenditure class of the CPI where price information is obtained each month from a sample of project home builders in each capital city. For the purpose of the CPI, a project home is defined as a dwelling for construction on a client's block of land, and price changes therefore relate only to the price of the dwelling (i.e. excluding land).

13.5 A price index series is produced for each capital city and for the weighted average of the eight capitals. The city weights are derived as the value of additions to the stock of houses in the city, calculated using average price data derived from the Building Activity survey and quantity data from house counts recorded in consecutive Censuses.

13.6 As extensions and renovations are conceptually part of the CPI expenditure class, their value is included in the calculation of the weights. No prices specifically relating to these activities are collected as their prices are assumed to move similarly to those of new houses.

13.7 Although the capital city price indexes for project homes are compiled for use in calculating the House purchase expenditure class of the CPI, price movements exhibited in the published CPI series are not comparable to those published with the established house price index because the CPI for house purchase is a broader aggregate which also covers fixed appliances and an adjustment for government subsidies directly related to house purchase.

13.8 Appendix 1 (eight capital city weighting pattern) shows each capital city's percentage contribution to the eight capital cities aggregate for the project homes index and the established house price index.

Materials used in house building

13.9 The index for materials used in house building is published for the weighted average of the six state capital cities in *Producer Price Indexes, Australia* (cat. no. 6427.0), re-referenced to 2003– 04 = 100.0. For more information on this index refer to *Producer and International Trade Price Indexes: Concepts, Sources and Methods, 2006* (cat. no. 6429.0).

Construction industry total hourly rates of pay

13.10 The index for the construction industry total hourly rates of pay excluding bonuses, private and public, is published in *Labour Price Indexes, Australia* (cat. no. 6345.0), referenced to 2003–04 = 100.0. For more information on this index refer to *Labour Price Index: Concepts, Sources and Methods, 2004* (cat. no. 6351.0.55.001).

Private housing investment

13.11 The private housing investment series is the annually-reweighted chain Laspeyres price index for private capital expenditure on new dwellings, as used (but not separately published) in *Australian National Accounts: National Income, Expenditure and Product* (cat. no. 5206.0), re-referenced to 2003–04 = 100.0. For more information on this index refer to *Australian National Accounts: Concepts, Sources and Methods, 2000* (cat. no. 5216.0).

OTHER HOUSE PRICE DATA

13.12 As well as the price indexes based on stratified weights for each city, the ABS publishes the median price of all established house transfers, and the number of established house transfers for each quarter since March quarter 2002. Both of these series are based on VGs house sales data and, are only available for those quarters for which the benchmark HPI is available. As the ABS receives more data, these figures are revised as necessary.

13.13 The median prices are calculated using all available VGs house sales data for each city each quarter, with no clustering (stratification) or weighting applied. These 'raw' medians will not correspond to the published HPI and will not show price movements that are consistent with the HPI.

13.14 The number of transfers of established houses recorded each quarter by the VG in each capital city are presented in the HPI publication to provide an indication of sales activity for the city each quarter.

DIRECT MEASURES OF PRICE CHANGE

13.15 The principal price indexes listed above in 13.2, and the other house price indexes (except the private housing investment series) are direct measures of price change, in that they are compiled through collecting and directly using price data. The CPI, ITPIs, PPIs, and LPIs are detailed in respective Concepts, Sources and Methods publications (see Chapter 12).

DERIVED MEASURES OF PRICE CHANGE

National accounts chain price indexes

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

National accounts chain price indexes continued

13.17 Chain price indexes are published in *Australian National Accounts: National Income, Expenditure and Product* (cat. no. 5206.0).

Implicit price deflators

13.18 In addition to the chain price indexes published for the major national accounts aggregates, the ABS publishes a range of implicit price deflators (IPDs). IPDs are obtained by dividing a current-price value by the chain volume measure expressed in dollar terms. Thus IPDs are derived measures (hence the term implicit) and are not normally the direct measures of price change by which current price estimates are converted to volume measures. They reflect both changes in the prices between the two periods and changes in the composition of the aggregate between those periods.

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

APPENDIX 1 EIGHT CAPITAL CITIES WEIGHTING PATTERN

WEIGHTS

Each capital city's percentage contribution to Eight Capital Cities for the established house and project home price indexes are presented in the following table:

A1 HOUSE PRICE INDEX: EIGHT CAPITAL CITIES WEIGHTING PATTERNS, percentage contribution to eight capital cities(a)

	Established houses(b)	*Project homes*(c)
8 Capital Cities	100.0	100.0
Sydney	33.5	31.3
Melbourne	27.3	28.1
Brisbane	13.2	14.4
Adelaide	7.6	7.0
Perth	14.2	13.1
Hobart	1.2	1.7
Darwin	0.6	1.3
Canberra	2.5	3.2

(a) Percentages may not add due to rounding.
(b) As at March quarter 2008.
(c) As at September quarter 2005.

APPENDIX 2 PRICE INDEXES AND CONTRACT PRICE INDEXATION

INTRODUCTION

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

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

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

THE ROLE OF THE ABS IN RESPECT OF INDEXATION CLAUSES

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

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

IMPORTANT DISCLAIMER

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

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

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

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?

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

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?
continued

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

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

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

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

WHAT PRICE INDEXES ARE PUBLISHED BY THE ABS?
continued

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

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

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

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

GENERAL MATTERS TO CONSIDER WHEN DEVELOPING INDEXATION CLAUSES USING A PRICE INDEX

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

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

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

GENERAL MATTERS TO CONSIDER WHEN DEVELOPING INDEXATION CLAUSES USING A PRICE INDEX *continued*

- Provide for potential revisions to the price index data. The quarterly and annual movements recorded by the ABS price indexes are not often revised (apart from the seasonally adjusted wage price index and trend wage price index, which can be revised as extra terms are added to the end of the series). Generally, situations in which revisions do occur include correcting an error that has arisen in the data first published. It could be useful for parties to set out agreed procedures to deal with the possibility of revisions occurring. For example, an Indexation Clause could state that a price is to be indexed by the percentage change first published in the relevant (indexation) series for each period covered by the contract, or it could be indexed by the latest available data at the point at which the indexation clause takes effect.
- Avoid locking indexes used for Indexation Clauses into any particular reference base period. Occasionally the reference base period of a price index (i.e. the period in which the index is set equal to 100.0) can be changed. This will result in a change in the index level from that which was previously available. Relative movements of any series over time, however, are not generally affected by a reference base change (except for rounding differences). Indexation Clauses should be drafted so that the parties to them are not adversely affected by a change to the reference base period of a price index.
- Define the formula for the price adjustment calculation. Often the change in payments or price is directly proportional to the percentage change in the selected index between two specified time periods. The following CPI example, which has a reference base year of 1989–90 = 100.0, illustrates the computation of percentage change:
- Index number for the All Groups CPI for Sydney in 2003–04 = 144.1
- less index number for the corresponding series in 2002–03 = 141.1
- Change in index points = 3.0
- Percentage change 3.0/141.1 x 100 = 2.1%
- Allow for negative price movements. Any potential variations from the recorded price movements should be explicitly set out. For example, in some Indexation Clauses, there is no change in the contract price in a period in which there is a fall in the price index being used for indexation. In some cases, there will be a catch up once the index rises again.

FURTHER DETAILS

For more information about ABS price indexes, contact:

Assistant Director
Statistical Output and Enquiries
Prices Branch
Australian Bureau of Statistics
Locked Bag 10
Belconnen, ACT, 2616
Phone: (02) 6252 6251
Fax: (02) 6252 7060
E-mail: prices.statistics@abs.gov.au

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GLOSSARY

ABS	Australian Bureau of Statistics.
Aggregation	The process of combining lower level price indexes to produce higher level indexes.
ASGC	*Australian Standard Geographical Classification (ASGC)* (cat. no. 1216.0). This is the standard geographical classification used in the ABS.
CPI	Consumer Price Index - a general indicator of the rate of change in prices paid by households for consumer goods and services.
Cluster	A suburb or, more commonly, a group of suburbs that have similar characteristics and for which medians are estimated each quarter and aggregated to produce the HPI for each city (they are similar to an "elementary aggregate" in other ABS price indexes).
Component	A level of like items within a price index structure.
Elementary aggregate	The lowest level of commodity classification in ABS price indexes and the only level for which index numbers are constructed by direct reference to price data. In the case of the HPI, this relates to individual clusters.
Fixed-weight index	A price index in which the weighting pattern is fixed for the life of each index series.
HPI	The established house price index. The term is usually used in describing the price index of established houses but it should be noted that the ABS publication *House Price Indexes: Eight Capital Cities* (cat. no. 6416.0) contains series other than those relating to established houses.
Indexation	The periodic adjustment of a money value according to changes in a price index.
Index points change	The change in an index number series from one period to another expressed in terms of the difference in the number of index points in each of the index numbers.
Index points contribution	A quantitative expression of how much each component contributes to the magnitude of the upper level index number.
Index number series	A series of numbers measuring the change over time from a reference base period value, which is normally presented as an index value of 100.0.
Index reference period	The period in which an index series is given a value of 100.0. Also referred to as reference base. The index reference period should not be confused with the weighting base period - see "Weight reference period" below.
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.
Linking	The technique used to join a new index series (e.g. one having a changed composition and/or weighting pattern) to an old index series to form a continuous series. The technique ensures that the resultant linked index reflects only price variations and that introducing the new items and/or weights does not affect the level of the index.
Link factor	A ratio used to join a new index series to an old index series to form a continuous series.
Matched sample	In a matched sample, items that are priced from period to period are identical in all respects or sufficiently similar to be considered the same item.
Percentage change	The change in an index series from one period to another expressed as a percentage of its value in the first of the two periods.
PPI	Producer price index.
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 (or price changes)	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	The ratio of the price level in one period to the price level in an earlier period.

Price update	To revalue (inflate or deflate) a value using a measure of the price change between two periods.
Principal Component Analysis	A statistical method used in constructing the HPI stratification that determines which variables explain the variation in the price of houses (i.e. the principal components).
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.
RBA	Reserve Bank of Australia.
Sample	A representative selection of items to be priced, that acts to represent all items.
SD	Statistical Division, as determined in the Australian Standard Geographical Classification (see "ASGC"). In the HPI, each capital city is defined as those houses contained within the relevant statistical division.
SSD	Statistical Subdivision, as determined in the Australian Standard Geographical Classification (see "ASGC"). In the HPI, each cluster is geographically bounded within a statistical subdivision.
SEIFA	*Socio-economic Index for Areas* (cat. no. 2039.0). The SEIFA ranks geographic areas according to their social and economic conditions.
Splicing	A technique used to introduce new items into the index calculations so that the level of the index is not affected.
Transaction price	The price actually paid by a purchaser of a good or service - as opposed to a 'list' or 'quoted' price.
Value aggregate	The aggregate value in dollars of the housing stock (including land). In compiling the HPI, value aggregates serve as value weights which are updated each quarter using the price relatives for each cluster.
VGs	Valuers–General or equivalent government bodies in each state/territory responsible for the recording of property transfers.
Weight	The measure of the relative importance of an item in the index structure. Weights can be expressed in either quantity or value terms. Value weights are used by the ABS in compiling all official price indexes.
Weighted average	An average that is obtained by combining prices or price indexes according to the relative importance of each price index.
Weight reference period	The period to which the fixed quantity weights relate. (See also “Index reference period”.)

FOR MORE INFORMATION . . .

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PHONE 1300 135 070

EMAIL client.services@abs.gov.au

FAX 1300 135 211

POST Client Services, ABS, GPO Box 796, Sydney NSW 2001

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