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Australian Bureau of Statistics

Information Paper

Wage Cost Index

Australia

2000

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Australian Statistician

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PREFACE

This edition of the Information Paper is an update of *Information Paper: Wage Cost Index, Australia, 1998* (Cat. no. 6346.0). It provides detailed information about the Wage Cost Index (WCI), published in *Wage Cost Index, Australia* (Cat. no. 6345.0). The purpose of this paper is to assist users to understand the conceptual framework, statistical design, collection and compilation methodologies of the WCI.

W. McLennan
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June 2000

LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AWE	Survey of Average Weekly Earnings
EA	Elementary aggregate
EEH	Survey of Employee Earnings and Hours
LPI	Labour Price Index
SEE	Survey of Employment and Earnings
SNA93	System of National Accounts 1993
WCI	Wage Cost Index

CONCEPTUAL FRAMEWORK

MEASURING CHANGES IN WAGE AND SALARY COSTS

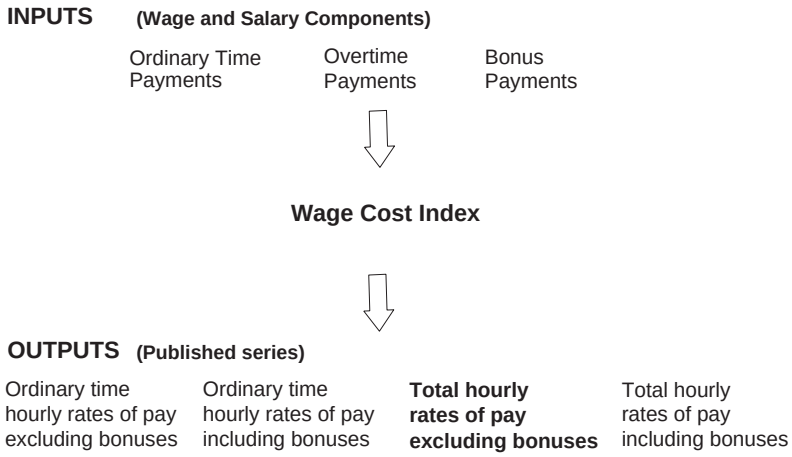
1 The Wage Cost Index (WCI) is one of the key quarterly economic indicators produced by the ABS. It provides a measure of changes in wage and salary costs in the Australian labour market, unaffected by changes in the quality and quantity of work performed. Wages and salaries account for the majority of expenditure on labour costs, and of the costs outlined by the System of National Accounts 1993 (SNA93) concept *Compensation of Employees*, defined as 'the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period' (source: SNA93, paragraph 7.21).

2 In the WCI, wages and salaries refer to cash payments to employees and include ordinary time earnings, overtime earnings, and bonus payments, together with the value of any salary sacrificed. Other forms of cash and non-cash remuneration that might be included in the value of a salary package — such as superannuation, private health cover, share options, travel allowances, penalty payments, etc. — are excluded. Appendix 1 lists components of wages and salaries and whether they are included in or excluded from the WCI.

3 The four quarterly WCI series published in *Wage Cost Index, Australia* (Cat. no. 6345.0) are produced by combining the following three different components of wages and salaries in various ways, as illustrated in diagram 1:

- ordinary time earnings;
- overtime earnings; and
- bonus payments made to employees.

DIAGRAM 1: COMPONENTS OF THE WCI



MEASURING CHANGES IN WAGE AND SALARY COSTS *continued*

4 Each of the four index series is compiled for various combinations of State/Territory, sector (private/public), broad industry group and broad occupation group. The index of total hourly rates of pay excluding bonuses can be viewed as the *headline* WCI measure, as it represents a pure price measure for the combined ordinary time and overtime hourly rates of pay, excluding bonus payments, which are not priced to constant quality (see paragraph 20).

5 The ABS conducts a number of sample surveys of businesses which provide measures of changes in wages and salaries over time, e.g. the Average Weekly Earnings (AWE) series which is designed to provide reliable estimates of average weekly earnings and the quarterly change in that average. However, these surveys can be affected by a number of factors including compositional shifts in the labour market and changes in the hours worked by employees, as well as changes in the survey sample selected each quarter from the ABS Business Register.

6 The WCI was developed to provide a quarterly measure of changes over time in wage and salary rates of pay for employee jobs which would not reflect changes in the composition of the labour force, numbers of jobs, hours worked or changes in characteristics of employees and their career paths.

7 In addition, the WCI does not reflect changes in the composition of remuneration between cash and non-cash benefits or in the composition of wage and salary payments. With the introduction of enterprise bargaining in Australia it has become quite common for benefits such as overtime payments, allowances, leave entitlements or fringe benefits, to be traded-off to obtain greater pay increases by rolling them into ordinary time or base pay. These trade-offs do not reflect changes in the price of the job in the labour market, and therefore do not affect the total hourly rates of pay indexes. For example:

- when there are trade-offs in remuneration between overtime and ordinary time payments, the total hourly rates of pay indexes show only any additional net increase;
- when a job occupant chooses to convert a portion of remuneration into non-wage items through salary sacrifice, the indexes do not show the impact of any resulting changes; and
- when there is a trade-off between the cash component and non-cash benefits (e.g. the roll-in of leave entitlements) the change is not reflected in the indexes.

8 While the ordinary time rates of pay indexes show the impact of the shift of payments from overtime to ordinary time, they exclude all other roll-ins which are not related to the value of the job in the labour market.

THE WCI AS A PRICE INDEX

9 The WCI is a Laspeyres price index which measures changes over time in wage and salary rates of pay for employee jobs, unaffected by changes in the quality and quantity of work performed. A Laspeyres price index measures the change in the price between the current period and the price at a given base period, with the quantity and quality of goods and services (in the case of the WCI the quantity and quality of labour services) being held constant.

10 In compiling the WCI, price movements for different segments of the labour market (defined by State, sector, industry and occupation) are combined using weights

THE WCI AS A PRICE INDEX *continued*

which represent each segment's proportion of the total expenditure on wages and salaries in the weighting base period. These weights, referred to as *expenditure weights*, are kept constant between successive weighting base periods. This ensures that changes in wages and salaries resulting from changes in the composition of the labour market are excluded from the WCI movements.

11 To enable the WCI to measure price changes over time, data are collected for a sample of individual jobs common between consecutive quarters. Only those jobs that have a price derived in both the current and previous quarters (i.e. matched jobs) contribute to index calculations. In addition, the price changes that are reported for these jobs are *pure* price changes, i.e. the changes do not reflect any changes in wage and salary payments resulting from a change in the quality or quantity of work performed.

Transaction and specification pricing

12 In the WCI, data are collected from actual market transactions (i.e. wage and salary payments made to job occupants in the survey reference period), as opposed to nominal or list rates (e.g. awards or book rates) which do not reflect price changes caused by discounting or payment of premiums attributable to changing market conditions and remuneration practices. This practice is referred to as *transaction pricing*.

13 In addition, a *specification pricing* methodology is employed. This involves identifying all the price-influencing characteristics of each sampled job and incorporating them in fully-defined and fixed pricing specifications to ensure:

- pricing to constant *quality*, so that quality changes do not affect the price measure, which would result in an index bias; and
- pricing to constant *quantity*, so that compositional shifts do not affect the price measure.

Input price index

14 The WCI is an input price index designed to measure changes over time in the cost to businesses of purchasing a fixed quantity and quality of labour input, irrespective of the output produced. Consequently, when considering price movements for jobs, no adjustment is made for productivity changes within the production process that arise from factors such as capital investment, technological change, more efficient organisational arrangements, and entrepreneurial activities.

PRICING TO CONSTANT QUALITY IN THE WCI

15 As mentioned earlier, effective construction of price indexes requires the application of specification pricing, which involves the use of fixed pricing specifications. In the WCI, fixed pricing specifications enable the employer to uniquely identify the selected employee job, as well as detailing the complete set of price determining characteristics of the job. These pricing specifications include a job identifier as well as characteristics of the job being priced, such as job title, grade or level, location and tasks.

16 Pricing specifications outline the price determining characteristics of each selected job. Hence by considering any changes in relation to these characteristics, and by removing any changes in wage and salary payments which relate to these changes, *pricing to constant quality* is achieved. Essentially, pricing to constant quality in the WCI ensures that price changes from the following are not reflected in the index series:

- changes in the nature of work performed (e.g. different tasks or responsibilities);
- changes in the quantity of work performed (e.g. the number of hours worked);
- changes in the characteristics of the job occupant (e.g. age, apprenticeship year, successful completion of training or a qualification, grade or level, experience, fitness, etc.);
- changes in other price determining characteristics which may exist (e.g. the site where the work is performed, the presence of other components of pay or labour costs which have been rolled in, changes in work schedules).

17 Identifying and measuring quality changes for jobs can be difficult. However, in the WCI, a range of procedures has been developed to achieve this, and every effort is made to ensure only pure price changes are reflected in the indexes.

18 As mentioned earlier, only matched jobs contribute to index calculation each quarter. For a job to match in two consecutive quarters, all pricing specifications must be unchanged between those two quarters. However, if there is a change in the pricing specifications for a job, then the impact of the change in quality or quantity is removed from the price change for the job prior to index calculation. Once these impacts have been removed, the job will then match and will contribute to the indexes. Appendix 2 gives further examples of changes in pricing specifications where the price change requires adjustment in order to price to constant quality.

19 Although every effort is made to ensure that only pure price changes are reflected in the indexes, for a small proportion of jobs it is not possible to separate quality changes (usually resulting from individual performance of the occupant) from pure price changes. For these jobs, the entire increase is allowed to contribute to the WCI. Over time, when the occupant of the job changes, there would be a tendency for the rate to fall again as a result of the new occupant having less experience in the job than the previous occupant, and hence a lower rate of pay. Any such falls are also allowed to contribute to the index to partially offset earlier performance based rises. While there may be some upward bias in the price rise during the tenure of a given employee, this treatment will produce little bias in the longer term.

20 Only those WCI indexes which *exclude* bonuses are considered to be pure price indexes (see paragraphs 38 to 40 for details about bonus payments). This is because the

PRICING TO CONSTANT QUALITY IN THE WCI *continued*

bonus hourly price is a form of unit value (i.e. total value divided by quantity). Therefore, changes in the quality of work performed can affect the bonus component and hence those indexes including bonuses. The ABS plans to investigate the treatment of bonuses and review the methodology for deriving the price change for bonuses. The aim of these investigations will be to develop a more refined measure of bonuses with respect to pricing to constant quality.

OVERVIEW OF INDEX CONSTRUCTION

21 There are three main stages of the index construction process in the WCI. These are:

- prices (i.e. quality adjusted hourly rates of pay) are derived for each matched job for both the current and previous quarters;
- prices for matched jobs (for both the current and previous quarters) are combined within elementary aggregates (EAs) to produce weighted average prices for each EA (see paragraph 46). A quarterly price ratio (the ratio of the average price in any two adjacent quarters) for the EA is calculated, which is combined with the previous quarter's cumulative price ratio (the ratio between the EA average price in the previous quarter and the EA average price in the weighting base quarter); and
- the cumulative EA price ratios (or EA indexes) are combined to form publication indexes.

22 Each of these is outlined in more detail below. In addition, a numerical example of this process is provided in Appendix 3.

DERIVING HOURLY PRICES

23 As discussed above, price changes in wages and salaries are derived from payments made to employees occupying the jobs selected in the WCI. These payments include ordinary time and overtime wage and salary payments, as well as bonus payments.

24 These payments are adjusted so that the derived change in hourly rates from one quarter to the next reflects only pure price changes, i.e. changes in wage and salary rates once the impact of any quality changes has been removed.

25 Hourly prices are derived by dividing payments made to employees by the number of hours to which these payments relate. These are derived for each of the three components (ordinary time, overtime and bonuses) which are combined to produce the outputs of the WCI. Details regarding how the hourly price is calculated for each of these components follow later in this section.

26 The index of ordinary time hourly rates of pay excluding bonuses uses only an ordinary time hourly price, while the index of total hourly rates of pay excluding bonuses uses a weighted sum of the ordinary time hourly price and the overtime hourly price for the job. For each job, the weights are the standard weekly ordinary time hours and standard weekly overtime hours respectively. Standard weekly ordinary time hours are the ordinary time hours that the occupant of the job is normally paid for in a week. Standard weekly overtime hours are the overtime hours actually worked (converted to a weekly equivalent) in the first pay period in which the job is selected. The example below shows how the total hourly price for a job is calculated.

Ordinary time hourly price = $10.00
Ordinary time standard hours = 40
Overtime hourly price = $17.50
Overtime standard hours = 8
Total hourly price = $10.00 x 40/(40+8) + $17.50 x 8/(40+8) = $11.25

DERIVING HOURLY PRICES *continued*

27 The index of ordinary time rates of pay including bonuses uses the sum of the ordinary time hourly price and the bonus hourly price. The bonus hourly price is added to the ordinary time hourly price before calculating the total hourly price when constructing the index of total hourly rates of pay including bonuses.

Deriving the ordinary time hourly price from wage and salary payments

28 To derive the ordinary time hourly price for each job, each quarter ordinary time gross earnings and ordinary time hours paid for are collected for the pay period. Any ordinary time penalty payments and allowances are removed from total ordinary time gross earnings to produce *basic* ordinary time earnings. These basic ordinary time earnings are then divided by the number of ordinary time hours paid for in the period to produce an ordinary time hourly price.

29 For salaried workers who are paid to perform a job regardless of the number of hours worked, the reported salary payment is converted to an equivalent hourly basis using information provided by the business contact about the usual or standard weekly hours for the job.

30 When a job is paid by piece rates, i.e. paid a set amount per unit produced, an hourly rate is determined in the first quarter after consultation with the business contact based on the rate per piece and the average number of pieces per hour. This average becomes part of the pricing specifications for the job and is priced from quarter to quarter. In subsequent quarters, any changes to the piece rate are collected, so that the percentage change is calculated and applied to the previous quarter's hourly rate.

Deriving the overtime hourly price from overtime payments

31 In the WCI, overtime relates to payment for hours worked in excess of standard or usual hours. Often, but not always, overtime attracts a higher rate of pay, or penalty rate, than ordinary time. This penalty rate is generally defined as some multiple of the ordinary time hourly rate of pay (e.g. 1.5 times the ordinary time hourly rate).

32 Overtime tends not to be worked on a standard or regular basis. Different hours of overtime will be worked in different jobs each week. Not all job occupants will be eligible to work overtime and not all occupants who are eligible will have been paid overtime in any particular period. For those who do, there is a broad range of scenarios and arrangements under which overtime might be paid. These arrangements are usually based on peaks and troughs in the operations of a business. Therefore overtime is often worked irregularly and may be infrequent.

33 Furthermore, different overtime rates may apply depending on the time and the length of overtime worked (e.g. 1.5 times the ordinary rate for the first three hours of overtime worked Monday to Friday, and 2.0 times the ordinary rate for hours in excess of three hours or for overtime worked on weekends). The details of these rates applying to different hours of overtime worked are referred to as *overtime provisions*.

34 To overcome the problem of irregular or fluctuating overtime hours and to enable overtime to be priced to a constant quantity and quality, standard overtime hours for a job are defined as the number of overtime hours actually paid for in the reference week of the first quarter the job is included in the survey. Therefore not all jobs where the occupant is eligible for overtime will have overtime priced in the WCI. This reflects the fact that overtime is not worked by all job occupants who are eligible to work overtime in a given week.

Deriving the overtime hourly price from overtime payments continued

35 In addition to deriving the standard overtime hours for the job, an *overtime provision factor* is derived from data collected in the first quarter. This factor is used to derive an average penalty rate for overtime hours worked and it represents the relationship between the hourly rates for overtime and ordinary time worked. For jobs where the occupant is not eligible to work overtime or where overtime is not being priced in the WCI (i.e. overtime was not worked in the first quarter the job was included in the survey), the standard overtime hours and overtime provision factor are both set to zero. The following example illustrates how the overtime provision factor is derived.

4 hours @ $15 (time and a half) = $60
4 hours @ $20 (double time) = $80
Total overtime paid = $60 + $80 = $140
Total overtime hours = 4 + 4 = 8
Overtime hourly price = $140/8 = $17.50
Ordinary time hourly rate of pay = $10
Overtime provision factor = $17.50 / $10.00 = 1.75

36 Generally, the overtime provision factor is only derived in the first quarter a job is included in the survey. In subsequent quarters, if there has been no change in the eligibility of the occupant to work overtime and there has been no change to the overtime provisions, there is no change to the standard overtime hours or the overtime provision factor. Hence any change in the overtime hourly price would be due to a change in the ordinary time hourly price, as the overtime hourly price is derived from the ordinary time hourly price and the overtime provision factor, as illustrated in the example below.

EXAMPLE

	Quarter 1	*Quarter 2*	% *increase*
Ordinary time hourly price	$10.00	$10.50	5.0
Overtime provision factor	1.75	1.75	. .
Overtime hourly price	$10.00 x 1.75 = $17.50	$10.50 x 1.75 = $18.38	5.0

. . not applicable

37 Overtime provisions or eligibility may change when pay is reviewed for a job, for example when new individual contracts or collective agreements are struck. In such cases, the overtime provision factor and the overtime weekly standard hours are updated to reflect this change, which flows into the calculation of total hourly rates of pay.

Deriving the hourly price for bonuses from bonus payments

38 Bonuses are payments made to employees that are in addition to regular wage or salary payments. They may relate to the performance of the employee or the organisation, and may be paid on a regular basis i.e. weekly, fortnightly, monthly, quarterly, six monthly or annually, or on an ad hoc basis (e.g. staff suggestion bonuses).

39 Bonus payments fluctuate from quarter to quarter, as they generally relate to the productivity of either the individual in the job or the organisation as a whole. In the WCI, the hourly price for bonuses is derived from total bonus payments, without separating quality changes from pure price changes. Therefore, the indexes which include bonuses comprise a combination of a pure price index and a form of unit value (i.e. total value divided by quantity) with changes in quality or quantity affecting the bonus component and hence the indexes that include bonuses.

40 Hourly prices for bonuses are derived from the bonus payment, the frequency of the bonus payment and standard ordinary time hours, unless the frequency of the bonus is the same as the wage and salary payments in which case ordinary time hours for the period are used. For bonuses paid less frequently than quarterly, e.g. annual bonuses, the hourly price is carried forward to subsequent quarters until the next such payment is due.

LASPEYRES INDEX METHODOLOGY

41 The hourly prices derived from wage and salary payments are used to construct the WCI using the Laspeyres price index formula. As described in the section on pricing to constant quality, only matched jobs, i.e. those with a price derived for both the current and previous quarters, contribute to the indexes.

42 In theory, when calculating a Laspeyres price index the price should be compared between the current period and the given base period. This would be done by calculating the current to base period price relative, P_t/P_0, where P_t is the price in the current period and P_0 is the price in the base period. In constructing the WCI, a quarterly price ratio (P_t/P_{t-1}) is calculated for each EA which compares the average EA price in the current quarter with the average EA price in the previous quarter, for the set of matched jobs. The product of all successive quarterly price ratios, or the cumulative price ratio, is mathematically equivalent to the price relative, as illustrated below.

$$\frac{P_1}{P_0} \times \frac{P_2}{P_1} \times \frac{P_3}{P_2} \times \ldots\ldots \times \frac{P_{t-1}}{P_{t-2}} \times \frac{P_t}{P_{t-1}} = \frac{P_t}{P_0}$$

ANNUAL REWEIGHT

43 The Laspeyres index methodology requires that prices always be compared to the given base period. However, to ensure the index remains relevant and does not become out of date, the sample of jobs and the expenditure weights need to be regularly updated to reflect changes in the population and expenditure patterns. Once updated, the sample and weights are fixed again, and a new *weighting base* is created. In the following quarters, prices will be compared using this new weighting base. This process is referred to as *reweighting*. The WCI is reweighted annually each September. The first movement derived after reweighting has occurred is in respect of the December quarter of each year.

ANNUAL REWEIGHT *continued*

44 When the expenditure weights and sample in the WCI are updated, it does not follow that the published index numbers will recommence at 100.0, as the reference base (as opposed to the weighting base), which is currently September quarter 1997, may not be updated. Instead, the series based on the old expenditure weights and that based on the new weights are linked to form a continuous series via an arithmetic calculation, which is referred to as *chaining*. This was the case with the reweight which occurred in the September quarter 1999. The example in Appendix 4 illustrates the chaining process.

45 The period between one weighting base and the next is referred to as the *link*, and each link in the WCI lasts for four consecutive quarters (December quarter to September quarter). The last quarter of the previous link is also the base quarter of the current link. This overlap of one quarter allows the series to be linked through the chaining process.

ELEMENTARY AGGREGATE INDEXES

46 Elementary aggregates (EAs) are the finest aggregations of jobs in terms of State/Territory, sector (private/public), industry and occupation for which expenditure weights are available (see paragraphs 53 to 55). Each selected job in the sample is assigned to specific EAs based on the occupation code of the job and the characteristics of the employing organisation (State/Territory, sector and industry).

47 For each EA the quarterly price ratio is calculated. This is the ratio of the weighted average price per hour of the jobs in the EA between the current and previous quarters. These weighted average hourly prices are based only on the sampled jobs in that EA common to both the current and previous quarters. The individual job weights used to construct the quarterly price ratio are the product of the weekly standard hours and the sampling weight for each selected job.

48 An EA index estimates the change in the average hourly price between the base quarter of the link and the current quarter for the population of jobs in the EA. The EA index is formed by multiplying together the successive quarterly price ratios from within the current link, which gives a cumulative ratio of average hourly price, as illustrated in paragraph 42.

PUBLICATION INDEXES

49 Each publication index (e.g. total Australia, or New South Wales private sector) represents the amalgamation of a number of component EA indexes combined using the expenditure weights. For example, the index at the Australian level is comprised of in excess of 250 component EAs, each corresponding to a particular combination of State/Territory, sector, industry and occupation.

50 Each publication index estimates the percentage change in the price of wages and salaries between the reference base and the current quarter. This is constructed in two parts.

51 Firstly, the publication index is calculated as the change in the price of wages and salaries between the current quarter and the base quarter of the link, as a weighted average of the component EA indexes, with the weight for each EA being its expenditure weight. See Appendix 3 for a numerical example of how an index is compiled.

PUBLICATION INDEXES *continued*

52 Secondly, this index is linked or *chained* to the series from the previous link, which currently has a reference base of September quarter 1997 equal to 100.0. The chaining of the index is a simple arithmetic operation, which does not affect the previously published WCI percentage change between any two quarters. The example in Appendix 4 illustrates the chaining process.

EXPENDITURE WEIGHTS

53 The EA expenditure weights, which are used to combine EA indexes into publication indexes, are derived from independent estimates of total weekly wages and salaries. They are a measure of the relative importance of each elementary aggregate, based on employers' total expenditure on wages and salaries. These weights are derived as the product of EA average weekly earnings estimates and EA employee counts. Average weekly earnings estimates are derived from employment and earnings data at the State by sector by industry level from the quarterly Survey of Employment and Earnings (SEE), and employment and earnings data at the sector by industry by occupation level from the biennial Employee Earnings and Hours (EEH) survey. Employee counts by State by sector by industry by occupation are obtained from the Census of Population and Housing.

54 The expenditure weights in the WCI were updated for the first time in the September quarter 1999 and will be updated annually thereafter each September quarter. However, each annual update is only a partial update due to the differing frequency that data used to construct the weights are available. As SEE is conducted quarterly, each year the updated weights incorporate the most recent average earnings data at the State by sector by industry level. The weights incorporate more up to date information on the occupation distribution of wages and salaries every second year due to the biennial availability of EEH data. Every fifth year the distribution of employees across EAs will be updated in the weights when data from the five-yearly Population Census are available.

55 In deriving EA expenditure weights, the following assumptions are made:

- the distribution of employees across State/Territory, sector, industry and occupation group has not changed significantly between the most recent Population Census and the most recent weighting base;
- average earnings relativities across occupation groups within sector by industry were the same for all States and Territories; and
- these relativities have not changed significantly between the most recent EEH survey and the most recent weighting base.

SCOPE AND COVERAGE

56 The target population of businesses for the WCI is all employing organisations in Australia (private and public sectors) except:

- enterprises primarily engaged in agriculture, forestry or fishing;
- private households employing staff; and
- foreign embassies, consulates etc.

57 The first group above is excluded primarily because a very high proportion of agricultural enterprises have no employees. It would be disproportionately costly to survey a sufficient number of these enterprises to obtain a sample of jobs that is large enough to adequately represent this industry. In addition, the highly seasonal nature of activities in this industry would make it difficult to track jobs over time. The other groups cannot be included because they are out of scope of the ABS Business Register from which the WCI sample of businesses is selected.

58 All *employee* jobs in the target population of businesses are in scope of the WCI, with the exception of the following:

- Australian permanent defence force jobs;
- *non-maintainable* jobs (i.e. jobs that are expected to be occupied for less than six months of a year); and
- jobs for which wages and salaries are not determined by the Australian labour market (e.g. working proprietors of small incorporated enterprises, most employees of Community Development Employment Programs, and jobs where the remuneration is set in a foreign country).

59 As such, full-time, part-time, permanent, casual, managerial and non-managerial jobs are in scope of the WCI. Costs incurred by businesses for work undertaken by *self-employed* persons such as consultants and subcontractors are out of scope of the WCI, as they do not relate to employee jobs. Workers paid commission without a retainer are also excluded, as a large number of such workers operate in a similar fashion to self-employed persons.

DATA COLLECTION

60 Information for the WCI is collected each quarter by mail questionnaires from businesses in the sample. The questionnaires used in the first quarter in which a business is included in the survey are different from those used in subsequent quarters.

61 A business is *initialised* to the survey in the first quarter that it is selected. Initialisation involves the business randomly selecting a sample of jobs and providing detailed pricing specifications for the selected jobs. The payments made to the employees in those jobs are also collected. Other qualitative information about the business relevant to the WCI is also collected through telephone contact with the business. This information includes details about pay change mechanisms for jobs, details of any awards or agreements that are relevant to selected jobs, details of overtime provisions, and any additional information about jobs that have unusual pay or working arrangements. This additional information assists survey staff to understand the nature of pay changes as they occur and to ensure that only pure price changes are reflected in the index.

DATA COLLECTION *continued*

62 Although payments made to employees are collected at initialisation, these newly selected jobs do not contribute to the index until the following quarter. This ensures that only jobs that have pay details for both the current and previous quarters, and hence pay movement data, contribute to index compilation in the current quarter.

63 In subsequent quarters businesses provide details of payments made to the job occupants in the reference period of that quarter. They also indicate whether there have been any pay changes for each job in the previous three months, and the reason for the pay change.

64 The ABS takes a number of steps to ensure that data from the same jobs are collected each quarter, and that any changes in price for the job between quarters relate to pure price change. During the data collection period survey staff contact businesses by telephone and question the business contact for clarification of information provided on the form. This contact with businesses enables survey staff to determine whether the price change for the job was a pure price change, or whether the change in the price was due to other factors, such as a change in the pricing specification, changes in the characteristics of the job occupant, or a new occupant being in the job.

65 The ABS also plans to introduce an ongoing program of personal visits to businesses, commencing in 2000. These visits will be prioritised, concentrating on businesses when they are first initialised into the survey or when the contact officer in the business changes, and businesses with complex remuneration arrangements. These visits will assist businesses to better understand the concepts of the survey and will help ensure the continuing effectiveness of pricing to constant quality in the WCI.

SAMPLE DESIGN AND MAINTENANCE

66 A two-stage sampling procedure is used to generate a sample of employee jobs for the WCI: a sample of businesses; and a sample of employee jobs from within those selected businesses.

67 Probability sampling is used in the selection of both businesses and jobs to ensure that the sample of jobs used in the compilation of the indexes is representative of all jobs in the labour market. The use of probability sampling also enables measures of statistical reliability to be derived.

68 In the first stage of sampling, approximately 4,100 private and public sector businesses are selected from the ABS Business Register. These businesses are selected by stratifying the target population of businesses by State/Territory, sector (private/public), industry group and business size and selecting a random sample from each stratum. For a number of large complex organisations, a subsample of locations is selected to simplify reporting arrangements.

SAMPLE DESIGN AND MAINTENANCE *continued*

69 In the second stage of sampling, providers selected in the first stage are asked to select a random sample of up to ten employees from their payrolls using instructions provided by the ABS. The provider then identifies the jobs occupied by these employees. A total of approximately 19,000 jobs are selected, for which wage and salary data are collected quarterly.

70 For effective and efficient ongoing index construction, it is important that a high proportion of the initial sample of businesses is retained in subsequent quarters, and that the same jobs within those businesses stay in the sample where possible. However, with annual reweighting of the index to ensure its continued relevance, it is also necessary to update or refresh the survey sample annually. The first sample refresh for the survey occurred in the September quarter 1999. Refreshing the sample also allows the ABS to control the length of time that small businesses in particular are included in the sample. By controlling the length of time businesses are included in the survey the ABS can ensure that burden placed on businesses is kept to a minimum.

71 The sample selection methodology used to refresh the sample of businesses in the survey is referred to as the *Rotating Panel Methodology*. In this methodology, the survey population is initially broken into five equal population panels. Sample refresh is performed from within only one population panel for each annual update. All new businesses commencing operation between each annual refresh are included in the next population panel to be refreshed, and therefore have a chance of being selected at the next annual update, ensuring the index reflects changes to the population of businesses.

72 When the sample of businesses is refreshed in the September quarter each year there are two components to the refresh: a number of businesses in the existing sample are identified to leave the sample; and a number of businesses from the ABS Business Register are selected in the sample for the first time. Businesses in the existing sample that are identified to leave the sample continue to provide data for the September quarter, as the businesses that are new to the sample need to be in the survey for two consecutive quarters before their data can contribute to index calculation. By having this sample overlap for one quarter when new businesses are first included in the survey, the number of jobs actually contributing to index calculation is maintained, along with the reliability of the resulting indexes.

73 Between each annual refresh of the business sample, a small number of employee jobs will be lost from the survey sample because of the closure of some businesses. In addition, some jobs in continuing businesses will be replaced in the sample because of restructuring and other job changes. These small sample losses do not affect the index as the jobs lost from the sample are represented by other similar jobs in the sample through adjustments to the sampling weights.

RELIABILITY OF THE INDEXES

Sampling error

74 Since the index numbers are based on information relating to a sample of employee jobs, they are subject to sampling error. That is, they may differ from figures that would have resulted had all relevant employee jobs in the labour market been included in the collection. To date, the ABS has not published any estimates of sampling error for the WCI quarterly index movements, as the series needs to be available for some time before reliable estimates of quarterly change can be published.

75 However, as the sample for the WCI has been selected using probability sampling, estimates of the sampling error, or standard errors, will be calculated using statistical techniques once data from a sufficient number of quarters are available. As this measure of sampling error will be an estimate itself, it too could be subject to some volatility. As a result the ABS plans to make available smoothed relative standard errors as a measure of sampling error from the September quarter 2001. The smoothing process will reduce the quarterly volatility in these estimates.

76 Currently, the method for assessing the reliability of indexes has been based on the number of matched jobs (i.e. jobs for which data for both the current and previous quarters are available) contributing to each specific index, with indexes for various combinations of State, sector, industry or occupation being made available for release on this basis. Early analysis suggests that the number of matched jobs contributing to an index is closely linked with the relative standard error of the quarterly movement of the index.

Non-sampling error

77 Inaccuracies in the data may also occur because of imperfections in reporting by businesses, forms design or in processing by the ABS. This kind of inaccuracy is referred to as non-sampling error. Every effort has been made to reduce non-sampling error, for example:

- by careful design and testing of questionnaires and processing systems;
- by providing instructions to businesses on how to select a sample of employee jobs;
- by detailed checking of completed survey forms; and
- by instituting a range of procedures for ensuring that jobs are priced to constant quality (see the section on pricing to constant quality for details).

ENHANCEMENTS TO THE WCI

78 During 1998–99 the ABS conducted a methodological review of the WCI. The review's findings in relation to current practices in the WCI were generally positive. However, because of the complex and highly specialised nature of price index work in the context of changing labour market conditions, more work will be undertaken to ensure the continued viability and effectiveness of the WCI in the future.

79 The main recommendations of the review included:

- the introduction of the Rotating Panel Methodology;
- the establishment of an ongoing program of personal visits to businesses; and
- an ongoing research program to allow analysis and review of salary setting practices, collection instruments and pricing treatments (particularly where quality and pure price change cannot be easily separated).

80 The first of these recommendations has been implemented and is described in this paper. The other recommendations from the review will be implemented progressively.

LABOUR PRICE INDEX

81 A large proportion of the change in the total price of labour services relates to wages and salaries paid to job occupants as measured by the WCI. However, to consider the total price paid for labour services, measures of non-wage items are required. These items include paid leave, employer funded superannuation, payroll tax, workers' compensation, fringe benefits and fringe benefits tax.

82 The Labour Price Index (LPI), formerly referred to as the Labour Cost Index (LCI), will measure changes in the price paid for labour services inclusive of wages and salaries as measured by the WCI and the non-wage items mentioned above. When developed, the LPI will produce movements covering the broader concept of the price of labour services. It is expected that collection of the LPI will commence from the September quarter 2001, with publication from 2003.

APPENDIX 1 COMPONENTS OF WAGES AND SALARIES

ORDINARY TIME PAYMENTS

Include

- Award, agreed or overaward payments
- Payments for leave taken during the pay period, e.g. sick leave, annual leave
- Casual loadings
- Value of any salary sacrificed
- Retainers
- Piecework payments
- Higher duties allowances which relate to the selected jobs

Exclude

- Shift allowances and shift penalty payments
- Taxable allowances
- Reimbursement and non-taxable allowances
- Leave loading
- Severance, termination and redundancy payments
- Employer contributions to superannuation funds (e.g. employer productivity contributions)
- Value of payments in kind that cannot be salary sacrificed
- Higher duties allowances which do not relate to the selected jobs

OVERTIME PAYMENTS

Include

- Payments for hours worked in excess of award, standard or agreed hours

Exclude

- Taxable and untaxable allowances which relate to overtime hours worked

BONUS PAYMENTS

Include

- Bonuses, commissions and other incentive payments

Exclude

- Retainers (included in ordinary time)
- Piece work payments (included in ordinary time)
- Leave loading

APPENDIX 2 EXAMPLES OF CHANGES IN PRICING SPECIFICATIONS

The following list includes examples of changes in pricing specifications where any change in the price of the job is adjusted, prior to index calculation, in order to price to constant quality.

- Age increments for junior employees
- Change in qualification level
- Change in apprenticeship year
- Successful completion of training
- Completion of a formal probationary period
- Salary increments due to length of service, provided there is no change in the underlying salary range
- Work performance of individual employees, provided there is no change in the underlying salary range
- The occupant of a job changes location, and different rates of pay apply for the different locations
- Salary maintenance, i.e. a new occupant of a job is paid at a higher level relating to their previous position
- Ordinary time penalty rates and allowances are rolled into base ordinary pay
- Bonuses are rolled into base ordinary pay
- A new occupant of a job is covered by a different remuneration arrangement at the discretion of the occupant
- An occupant of a job changes salary sacrificing arrangements
- An occupant of a job is on paid leave, and reduced payments apply during leave period
- There is a change in the tasks or responsibilities which apply to the job
- Non-wage benefits are rolled into or out of wages and salaries

APPENDIX 3 EXAMPLE OF INDEX CONSTRUCTION

The example below, using artificial data, illustrates the WCI index compilation method for an index comprising two Elementary Aggregates (EAs), one consisting of just two jobs, and the other consisting of just three jobs. In the example, the current quarter is assumed to be March quarter 2000, with expenditure weights as of September quarter 1999. The index numbers calculated in this example are then chained to the previous series with the reference base of September quarter 1997 = 100.0. This is illustrated in Appendix 4.

(i) Estimate the total weekly price for each EA population, for the current and previous quarters. This involves multiplying the hourly rate for each job by its usual weekly hours and its sampling weight to calculate a weekly price for the population represented by the job, and then summing the weekly prices over all jobs in the EA.

EXAMPLE

	PRICE PER HOUR ($)		STANDARD WEEKLY HOURS	SAMPLING WEIGHT	WEIGHTED WEEKLY PRICE FOR EACH JOB ($)(a)		WEIGHTED STANDARD WEEKLY HOURS(b)
	Dec 1999	*Mar 2000*			*Dec 1999*	*Mar 2000*	
Elementary aggregate 1							
Job 1	12.13	12.61	38	82	37 797.08	39 292.76	3 116
Job 2	14.11	14.52	38	52	27 881.36	28 691.52	1 976
Total	..	..	..	..	**65 678.44**	**67 984.28**	**5 092**
Elementary aggregate 2							
Job 3	18.00	18.20	35	60	37 800.00	38 220.00	2 100
Job 4	12.00	12.00	25	20	6 000.00	6 000.00	500
Job 5	13.80	14.00	40	60	33 120.00	33 600.00	2 400
Total	..	..	..	..	**76 920.00**	**77 820.00**	**5 000**

.. not applicable

(a) weighted weekly price = price per hour x standard weekly hours x sampling weight.

(b) weighted standard weekly hours = standard weekly hours x sampling weight.

(ii) Derive an average price for each EA, for the current and previous quarters, by dividing each EAs total weighted weekly price by its total weighted standard weekly hours. Calculate the latest quarterly ratio (current/previous) of average price for each EA as the ratio of current to previous quarter's average price, then calculate the cumulative ratio (current/base of the link) of average price for each EA by multiplying the current quarterly price ratio by the previous quarter's cumulative price ratio.

EXAMPLE

	AVERAGE PRICE PER HOUR ($)(a)		QUARTERLY PRICE RATIO(b)	CUMULATIVE PRICE RATIO(c)	
	Dec 1999	*Mar 2000*	*Mar 2000/ Dec 1999*	*Dec 1999/ Sep 1999*	*Mar 2000/ Sep 1999*
Elementary aggregate 1	12.898	13.351	1.035	1.020	1.056
Elementary aggregate 2	15.384	15.564	1.012	1.018	1.030

(a) average hourly price = sum of weighted average price/sum of weighted weekly average standard hours.
(b) quarterly price ratio = current quarter average hourly price/previous quarter average hourly price.
(c) cumulative price ratio = previous quarter cumulative price ratio x current quarterly price ratio.

(iii) For each EA, revalue the base period expenditure (see paragraphs 53 to 55 for details on expenditure weights) by the current quarter's cumulative price ratio to give the current quarter's estimated expenditure. Sum the estimated expenditures over all EAs.

EXAMPLE

	BASE PERIOD EXPENDITURE ($)	CUMULATIVE PRICE RATIO		ESTIMATED WAGE AND SALARY EXPENDITURE ($)(a)	
	Sep 1999	*Dec 1999*	*Mar 2000*	*Dec 1999*	*Mar 2000*
Elementary aggregate 1	62 000	1.020	1.056	63 240	65 472
Elementary aggregate 2	73 000	1.018	1.030	74 314	75 190
Total	**135 000**	..	..	**137 554**	**140 662**

.. not applicable
(a) estimated expenditure = base period expenditure x cumulative price ratio.

(iv) Calculate the current quarter's index number by dividing the current quarter's total estimated wage and salary expenditure by the base period expenditure, and expressing the result as a percentage.

$$\text{Index number for Dec 1999 (with Sep 1999 expenditure)} = \frac{137,554}{135,000} \text{x} 100 = 101.9$$

$$\text{Index number for Mar 2000 (with Sep 1999 expenditure)} = \frac{140,662}{135,000} \text{x} 100 = 104.2$$

These index numbers are then linked to the previous index numbers with the September quarter 1997 = 100.0 reference base, as illustrated in Appendix 4.

APPENDIX 4 EXAMPLE OF THE CHAINING PROCESS

Chaining refers to the process whereby one index series using one set of expenditure weights is 'linked' to another index series using another set of expenditure weights such that the change in weight does not, of itself, alter the level of the index. In the WCI, chaining is the process of multiplying the index numbers based on the 'new' weighting base by a linking factor to convert them to having the same reference base as the 'old' series, while maintaining quarterly percentage changes. The linking factor is the ratio of the index numbers (old/new) for the common quarter in each of the series being chained (i.e. the base quarter of the new link). This factor is applied to index numbers from the first quarter of the new link (i.e. from the quarter after the weighting base quarter). The example below follows on from the example in Appendix 3, and illustrates the chaining process.

EXAMPLE

Quarter	*WCI (Sep 1997 = 100.0)*(a)	*WCI (Sep 1999 = 100.0)*(b)	*Linking factor*(c)	*Published WCI (Sep 1997 = 100.0)*(d)
June 1999	106.2	. .	. .	106.2
September 1999	107.4	100.0	. .	107.4
December 1999	. .	101.9	1.074	109.4
March 2000	. .	104.2	1.074	111.9

. . not applicable

(a) Wage Cost Index calculated using September 1997 sample and expenditure weights. This index was published from December 1997 to September 1999 quarters inclusively.

(b) Wage Cost Index calculated using September 1999 sample and expenditure weights. This index is unpublished.

(c) Linking factor calculated in the common quarter (September 1999) as the ratio of the old series over the new series (107.4/100=1.074).

(d) Published WCI, calculated from December 1999 quarter as the product of the new series and the linking factor (e.g. in December quarter 1999 it was calculated as 101.9 x 1.074 = 109.4).

GLOSSARY

Bonus	Payment made to a job occupant that is in addition to regular wages and salaries and which generally relates to the job occupant's, or the organisation's performance.
Chaining	The technique used to join a new index series to a previous index series to form a continuous series. The WCI is chained after expenditure weights and survey sample are updated each year.
Elementary aggregate	The finest aggregation of jobs, in terms of State/Territory, sector, industry group and occupation group, for which expenditure weights are available.
Expenditure weight	A measure of the relative importance of each elementary aggregate, based on employers' total expenditure on wages and salaries. Expenditure weights are used to combine elementary aggregate indexes into publication indexes.
Laspeyres price index	A price index in which the weights used represent the relative importance of index components in the weighting base period.
Price relative	The ratio derived by dividing a price in one period by the corresponding price from the base period.
Pure price change	The change in the rate of pay of an employee job after removing any variation in the rate of pay attributable to a change in quality of work performed.
Quarterly price ratio	The ratio derived by dividing a price in one quarter by the corresponding price from the previous quarter.
Reference base	The period for which an index series is given the value of 100.0.
Salary sacrifice	A salary arrangement where an employee chooses to forego part of their salary to receive other benefits such as superannuation.
Weighting base	The period to which the expenditure weights relate.

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