6292.0

Australian Bureau of Statistics

Information Paper

# Forthcoming Changes to Labour Force Statistics

## Australia

## 2007

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AUSTRALIAN BUREAU OF STATISTICS

EMBARGO: 11.30AM (CANBERRA TIME) MON 21 MAY 2007

ABS Catalogue No. 6292.0

ISBN 0 642 47946 1



Produced by the Australian Bureau of Statistics

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# CONTENTS

# INTRODUCTION

## THE LABOUR FORCE SURVEY

The Australian Bureau of Statistics (ABS) publishes a range of data on the labour market. Labour statistics are important economic and social indicators. They are used in economic and labour market analysis, evaluation of government policies, and monitoring population groups of concern.

One of the most important ABS labour collections is the Labour Force Survey (LFS). The ABS has conducted the LFS since 1960, first as a quarterly collection and then monthly from February 1978. The LFS collects information from the occupants of a sample of dwellings to estimate the labour market activity of Australia's resident civilian population aged 15 years and over. The LFS is designed primarily to provide estimates of key labour force statistics for the whole of Australia and, secondarily, for each state and territory.

The LFS statistics of most interest are the monthly estimates of the number of people employed and unemployed, the unemployment rate and the labour force participation rate. Other data collected monthly or quarterly include hours worked, industry and occupation of employed persons, and duration of unemployment.

The LFS is a sample survey which collects information each month from a random sample of households across Australia (33,250 households in March 2007). Estimates of employment and unemployment are derived by weighting the sample data to represent the total civilian population aged 15 years and over.

## CHANGES TO THE LFS

In June 2007, the ABS will introduce an improved method of estimation for the LFS. The new method, known as composite estimation, is more efficient than the current estimation method. That is, the composite estimator achieves a given level of standard error at lower cost and respondent load than the current estimator.

The new estimation method will be introduced with the release of May 2007 labour force statistics on 7 June 2007 in *Labour Force, Australia* (cat. no. 6202.0). At the same time, the ABS will release revised historical LFS statistics based on the new estimation method, back to April 2001. The resulting discontinuity in labour force series at April 2001 will not be statistically significant.

For the LFS, the ABS provides standard error models which provide an indication of the standard error for any estimate without the need to access unit record data. The models can provide standard errors on level estimates, monthly movement estimates, averages, and movements other than monthly. To assist users, the models have been incorporated into a spreadsheet and released as *Labour Force Survey Standard Errors, Data Cube*, 2005 (cat. no. 6298.0.55.001) which is available free of charge from the ABS web site. This product will be updated with new standard error models with the introduction of the composite estimation method.

PURPOSE OF THIS PAPER

This paper provides users of LFS statistics with information about ABS investigations into alternative estimation methods, the new estimation method to be implemented, and the effect of the new method on LFS statistics. The three main sections of the paper are summarised below.

- *Investigations into Alternative Estimation Methods:* This section explains the current estimation method and the investigatory work which led to the change, including alternative methods considered.
- *New Estimation Method:* This section describes the new estimation method, and outlines the benefits of the change. It also explains those aspects of the method which may be adjusted over time.
- *Effect on the Labour Force Survey:* This section explains the impact of the new estimation method on LFS statistics. It also provides information on the new standard error model.

# INVESTIGATIONS INTO ALTERNATIVE ESTIMATION METHODS

## CURRENT ESTIMATION METHOD

The LFS collects information from the occupants of a sample of dwellings, currently in excess of 30,000 each month. Selected dwellings remain in the survey for eight months, with one-eighth of the sample being replaced each month. Each one-eighth of the sample which remains in survey for the same eight-month period is referred to as a rotation group, and this procedure of replacing rotation groups is known as sample rotation. Each month, the incoming rotation group is selected from the same geographic areas as the outgoing rotation group. The resulting seven-eighths sample overlap between consecutive months enables the ABS to produce estimates of month-to-month change in the characteristics of the labour force with relatively low sampling error.

The current LFS estimation method produces estimates based on the sample data collected for the reference month only. The estimator, known as the 'Generalised Regression' (GREG) estimator, produces population estimates of labour force characteristics by applying expansion factors (or weights) to the sample responses for the reference month.

The weights are calculated so that they sum to independent estimates of the civilian population aged 15 years and over (referred to as population benchmarks). The benchmarks are classified by geographic area, age and sex. In this way, the weight assigned to a sample respondent will depend on their chance of selection in the survey and the degree of sample representation of their geographic area, age and sex. Ensuring consistency with benchmarks reduces sampling variability and compensates for any under-enumeration or non-response in the survey.

Labour force estimates for each characteristic of interest are then obtained by summing the weights of the people in the sample with that characteristic.

## ALTERNATIVE METHODS

For several years, the ABS has been investigating alternative estimation methods to find ways of minimising LFS costs while maximising data quality. Early on, composite estimation techniques were identified as a means of reducing the sampling error of estimates. Composite estimation uses sample responses from nearby months as well as from the reference month to derive estimates for the reference month. This approach achieves gains in efficiency by exploiting the high similarity between the responses provided by the same respondent in previous months.

Investigations were carried out to determine the most appropriate form of composite estimator for use in the LFS. There are a number of different forms of composite estimator in use, since the most appropriate form of composite estimator depends on a variety of factors including the sample design. The ABS assessed three broad classes of composite estimators for the Australian LFS: the 'AK Composite' (AK) estimator, the 'Modified Regression' (MR) estimator and the 'Best Linear Unbiased' (BLUE) estimator.

ALTERNATIVE METHODS
*continued*

The ABS used four criteria to compare the various estimators against the current estimator:

- the complexity of the weighting process;
- the sampling error associated with level estimates and monthly movement estimates;
- the potential for bias and the associated likelihood for estimates to 'drift' away from the true value over a period; and
- any other properties of the estimates that would make them more or less acceptable, such as revisions to estimates.

The ABS's findings, in the context of the Australian LFS, were as follows.

*'Generalised Regression' (GREG) estimator*

This is the current estimator for the LFS. It is relatively simple, requiring only simple calibration from a single month's data to obtain estimates. It is simple in that it only uses current month data, and the weighting of sample responses depends only on the respondents' demographic characteristics, and not other factors such as survey responses from previous months. It has larger sampling error than the other methods, but is unbiased.

*'AK Composite Weighting' (AK) estimator*

The 'AK Composite Weighting' estimator has been used in the U.S. Bureau of Labor Statistics' Current Population Survey since December 1997. This estimator has two main components, the 'AK composite' estimator and the extension, composite weighting.

The AK composite estimator is not very complex but it does require weighted data for previous months in order to produce a current estimate, thereby making the current estimate dependent (to a small extent) on all previous months' data. The evaluation on the Australian LFS found that the AK composite estimator has larger sampling error than the other composite methods considered, but has a low bias.

The composite weighting extension is a process whereby only the current month's responses are required for tabulation purposes (although previous months' responses are still required for deriving weights). However, this increased simplicity is at the cost of increased standard errors for estimates other than a set of pre-defined key estimates.

*'Modified Regression' (MR) estimator*

A regression composite estimator has been used in Statistics Canada's Labour Force Survey since January 2000. The ABS assessed six variants of the 'Modified Regression' estimator. All variants are fairly complex and require weighted data for previous months in order to produce the current month's estimates. Some variants produce very good sampling errors for the set of estimates at which they are targeted. It was found that in the Australian context, there is a high potential for bias, and the series may drift away from the true series.

*'Best Linear Unbiased' (BLUE) estimator*

The ABS assessed two types of this estimator. The first type required previous months' weighted data in order to produce a current estimate; and the second type required only previous months' unweighted data. The investigation found that the second type was more acceptable because it produced a greater reduction in standard errors than the first type. The method is less complex than most others, with the desirable feature of

'*Best Linear Unbiased*' *(BLUE) estimator continued*

requiring only previous months' unweighted data. The evaluation also found that this estimator is unbiased (as is the current estimator). All variants may produce negative estimates for cells which contain no data for the current month. This problem can be overcome by use of an extension known as 'composite weighting' (similar to that used by the U.S. Bureau of Labor Statistics for the AK estimator).

## CONCLUSIONS

For the Australian LFS, the ABS found that the BLUE estimator provides moderate reductions in sampling error for employed and unemployed estimates without introducing any bias. The AK estimator was noticeably less desirable than the BLUE estimator in both standard errors and bias. The MR estimator achieved greater reductions in sampling error but at the risk of introducing a fairly large and seasonal bias. Based on this evaluation, the ABS decided that a variation of the BLUE estimator, known as the 'BLUE B1 Composite Weighting' estimator, was the most appropriate for the Australian LFS.

The BLUE B1 Composite Weighting estimator is explained in detail in the following section. Further details on the findings of the ABS's investigations can be found in the article 'Comparison of Alternative Labour Force Survey Estimators' by P. Bell which was published in the journal *Survey Methodology* (Vol. 27, No. 1, June 2001, pp. 53-64).

# NEW ESTIMATION METHOD

## OVERVIEW

The composite estimation method being implemented into the LFS is a modified version of a Best Linear Unbiased (BLUE) estimator. The ABS is implementing a variant of the BLUE estimator known as the BLUE B1 estimator, along with an extension known as 'composite weighting'. The complete new estimator is known as the BLUE B1 Composite Weighting estimator.

The key characteristic of the new method is that it combines data collected in the previous six months with the current month's data to produce the current month's estimates. This uses the correlation of LFS responses from month to month (which occurs because of the overlapping design of the LFS sample) to achieve lower standard errors than the current estimator.

The new BLUE B1 Composite Weighting estimator produces the LFS estimates in two steps:

1. BLUE B1 Composite Estimation: Produces composite estimates for a set of key LFS aggregates for the current month using the BLUE B1 estimator. The current month's and the previous six months' LFS data are used in this step.
2. Composite Weighting: Calibrates the *current* month's LFS data to both the population benchmarks and to the set of composite estimates produced in step 1, thereby producing the current month's weighted data.

This final weighted LFS data for the current month (from step 2) is then used to produce all estimates for the current month.

## BLUE B1 COMPOSITE ESTIMATION (STEP 1)

The BLUE B1 estimator exploits the way the LFS sample is designed. In the LFS, dwellings remain in the survey for eight consecutive months, with one-eighth of the sample (known as a rotation group) being replaced each month. This means there is a seven-eighth overlap in the dwelling samples in adjacent months, a six-eighth overlap in the samples two months apart, and so on. The BLUE B1 estimator exploits the high correlation between overlapping samples across the current and immediately preceding months to achieve lower standard errors than the current estimator.

This exploitation is achieved by applying weighting factors, known as BLUE B1 Multipliers, to the current and preceding six months' sample responses. The weighting factor to be applied to each sample response is dependent on how long ago the response was collected and the number of months the rotation group has been in the sample. The weighting factors determine the extent to which the LFS sample responses over the seven month 'window' contribute to the current month's LFS estimates.

### *The BLUE B1 Multipliers*

The ABS has derived the optimal BLUE B1 Multipliers from a model based on the correlation structure observed in historical LFS estimates produced from rotation groups. The model reflects high correlation between rotation group estimates arising from the same sample of selected dwellings and low correlation between rotation group estimates arising from different dwellings selected in the same geographic areas. Zero correlation is reflected between all other rotation group estimates.

Table 1 shows the resulting BLUE B1 Multipliers which the new estimator will use for the new and revised historical LFS estimates (back to April 2001). The multipliers are listed by rotation group, whereby rotation group 'A' is in sample for the first time in the current month, rotation group 'B' was in sample for the first time in the previous month, and so

*The BLUE B1 Multipliers continued*

on. Lag 0 refers to the current month's data, Lag 1 refers to the previous month's data, etc.

The following illustrates the application of the BLUE B1 Multipliers, using rotation group 'B' as an example:

- In the current month, rotation group 'B' consists of dwellings which are in sample for their second month.
- The rotation group 'B' responses in the current month (Lag 0) were collected from the same selection of dwellings as the previous month (Lag 1). The responses from rotation group 'B' would have their weights for the current month (Lag 0) multiplied by a factor of 0.98 and their weights for their previous month's responses (Lag 1) multiplied by a factor of -0.21.
- Two months ago the rotation group 'B' responses were collected from a different selection of dwellings from the same geographical area. These dwellings had been in sample for the prior four months as well. The responses from rotation group 'B' would have their weights for two months ago (Lag 2) multiplied by a factor of 0.43, for three months ago by a factor of 0.07, for four months ago by a factor of -0.02, for five months ago by a factor of -0.04, and for six months ago by a factor of -0.05.

A negative multiplier implies the responses would have a negative weight.

The important aspects to note in Table 1 are that responses from the incoming rotation group make a smaller contribution to estimates (the multiplier for the incoming rotation group 'A' in the current month is 0.79, compared to 1.04 for current month's responses from rotation groups 'E' to 'H' which have been in sample for more than four months); and the multipliers sum to zero for each previous month's data, ensuring the estimator is unbiased for current month estimates.

TABLE 1. BLUE B1 MULTIPLIERS, By rotation group

| *RG* | *Lag 0* | *Lag 1* | *Lag 2* | *Lag 3* | *Lag 4* | *Lag 5* | *Lag 6* |
|---|---|---|---|---|---|---|---|
| A | 0.79 | 0.54 | 0.08 | –0.02 | –0.04 | –0.05 | –0.05 |
| B | 0.98 | –0.21 | 0.43 | 0.07 | –0.02 | –0.04 | –0.05 |
| C | 1.02 | –0.08 | –0.19 | 0.34 | 0.05 | –0.02 | –0.04 |
| D | 1.03 | –0.06 | –0.09 | –0.15 | 0.27 | 0.04 | –0.02 |
| E | 1.04 | –0.05 | –0.07 | –0.07 | –0.11 | 0.22 | 0.03 |
| F | 1.04 | –0.05 | –0.06 | –0.06 | –0.06 | –0.08 | 0.21 |
| G | 1.04 | –0.05 | –0.06 | –0.05 | –0.05 | –0.04 | –0.04 |
| H | 1.04 | –0.05 | –0.06 | –0.05 | –0.05 | –0.04 | –0.04 |
| Total | 8 | 0 | 0 | 0 | 0 | 0 | 0 |

Note: In Lag 0 rotation group 'A' is in sample for the first time, in Lag 1 rotation group 'B' was in sample for the first time, and so on.

As explained above, this set of BLUE B1 Multipliers is based on the correlation structure observed in historical LFS data. It is possible that the correlations may change in the future. The ABS will periodically assess whether such a change has occurred and adopt a new set of BLUE B1 Multipliers accordingly. The ABS expects to re-evaluate the BLUE B1 Multipliers every five years using the most up-to-date data.

*Calibration to Population Benchmarks*

After the BLUE B1 Multipliers are applied to the seven months of data, the weights of the sample responses are adjusted to align with *current* month population benchmarks (this process of calibration is done using generalised regression). The benchmarks are classified by geographic area, age and sex, and are identical to those used by the current estimator. After this adjustment, the weight assigned to a sample response depends on the geographic area, age and sex of the respondent, as well as how long ago the response was collected and the number of months the rotation group had been in the sample at that time.

*Production of Key LFS Composite Estimate Benchmarks*

At this point, the BLUE B1 estimator could have been used to produce the LFS estimates for the current month but it may produce negative estimates where there is no current month's data contributing to the estimate. To ensure that negative estimates cannot be produced, the BLUE B1 estimator is used to produce composite estimates for key LFS aggregates which are then used as benchmarks in composite weighting (step 2).

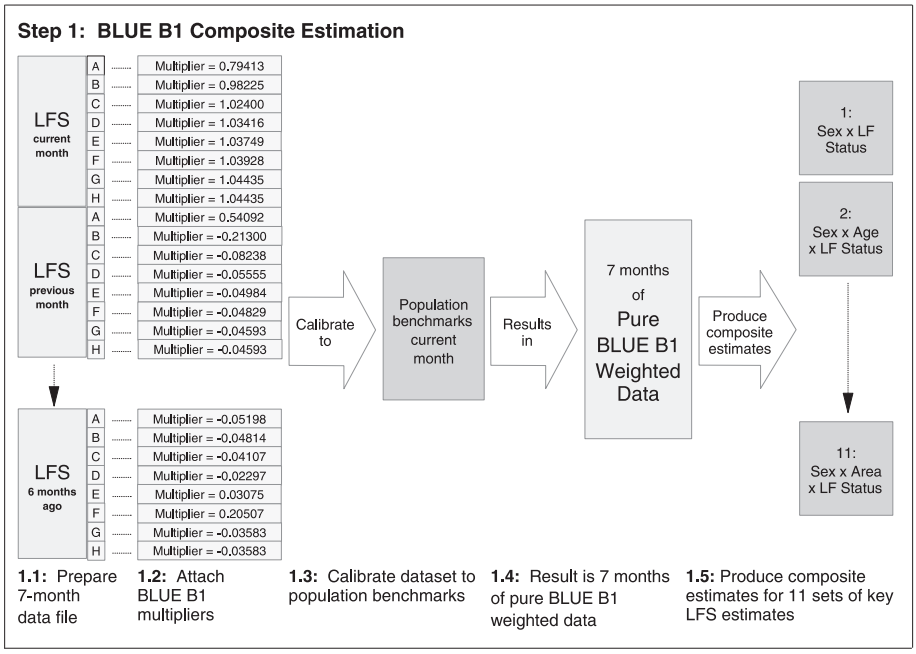
In determining the key LFS composite estimate benchmarks, the ABS had to achieve a balance between covering as many key aggregates as possible, and not disaggregating them too far which would cause higher standard errors. The ABS has chosen benchmarks which cover all the key monthly LFS aggregates, as follows:

- Labour force status (full-time employed, part-time employed, unemployed, not in the labour force) by sex.
- Labour force status by age and sex.
- Employed/not employed by age and sex.
- State of usual residence by area of usual residence (capital city/balance of state), labour force status and sex.
- Hours worked by sex.
- Duration of unemployment by sex.
- Persons aged 15-19 and attending school by age and sex.
- State of usual residence by hours worked and sex.
- State of usual residence by duration of unemployment and sex.
- Persons aged 15-17 by labour force status and sex.
- Geographic region by employed/not employed and sex.

These 11 sets of key LFS composite estimate benchmarks may be reviewed in the future and possibly altered if priorities change.

*Diagram of BLUE B1 Composite Estimation*

The following diagram illustrates the BLUE B1 Composite Estimation step described above. This step results in 11 sets of key LFS composite estimate benchmarks which are then used in composite weighting (step 2).




## COMPOSITE WEIGHTING (STEP 2)

Composite weighting is an adjustment to avoid the possibility of negative LFS estimates.

*Calibration to Population Benchmarks and Key Estimates*

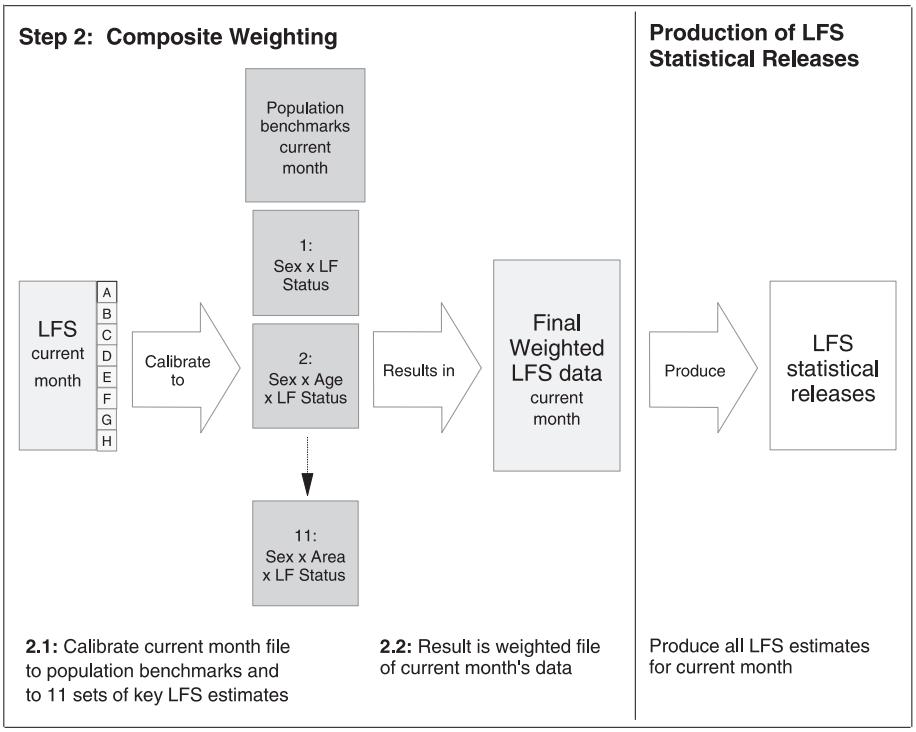
Composite weighting assigns a set of positive weights to the current month's data so that the weighted data aligns with the population benchmarks *and* reproduces the 11 sets of key LFS estimates produced by the BLUE B1 estimator. This calibration process again uses generalised regression (the existing estimation method) except in this step calibration is done to an expanded set of 'benchmarks'. The result is a single month of weighted data, where all weights are positive. This dataset of weighted current month's data is used to produce all estimates for the current month.

*Resulting LFS estimates*

The LFS estimates in this single month file for the pre-defined sets of key series are true composite estimates (and exactly the same as if produced using the BLUE B1 estimator alone). In other words, the composite weighting step has no effect on the key LFS estimates, but all other non-key series are affected, though typically only by a small amount. The standard errors of these non-key series are typically no larger than the standard errors produced by the current estimator.

*Diagram of Composite Weighting*

The following diagram illustrates the composite weighting step described above. This step results in the final weighted LFS data for the current month which is then used to produce all LFS estimates for the current month.



# EFFECT ON THE LABOUR FORCE SURVEY

## EFFECT ON ESTIMATES

The monthly LFS is designed primarily to provide estimates of the key labour force statistics for the whole of Australia and, secondarily, for each state and territory. The main estimates are the seasonally adjusted and trend series of employed persons, unemployed persons, unemployment rate and participation rate.

The ABS is introducing the new estimation method with the release of the May 2007 labour force statistics on 7 June 2007. At the same time, the ABS will release revised historical LFS statistics based on the new estimation method, back to April 2001. It was decided to revise back no further than April 2001 because there is already a small discontinuity in the unemployment series between March 2001 and April 2001. At that time, the ABS introduced a new questionnaire and changed the definition of unemployed to include those people waiting to start a new job in the next four weeks and who could have started in the reference week if the job had been available then.

### *Lower estimates of employment and unemployment*

The new estimator produces estimates of employment and unemployment which are slightly lower on average than those produced by the current estimator. This effect applies for original, seasonally adjusted and trend series. However, composite estimation does not have a systematic effect on movement estimates. The impact on level estimates can be seen in the graphs for Australia and each state/territory which are included in the section 'Graphs'.

Analysis of labour force data for the period April 2001 to January 2007 shows that, for seasonally adjusted series at the Australia level, employment estimates were 0.07% lower on average under the new estimator than under the current estimator. Unemployment estimates were 1.60% lower, whilst the unemployment rate was 0.08 percentage points lower (on average). The participation rate was 0.10 percentage point lower on average.

Table 2 shows equivalent results for the states and territories.

- Employment estimates in most states and territories were on average 0.06% to 0.13% lower under the new estimator. The exceptions are Western Australia, where employment estimates were on average the same, and the Northern Territory, where employment estimates were 0.24% higher under the new estimator.
- Unemployment estimates were 0.15% to 3.20% lower on average under the new estimator, with New South Wales and the Northern Territory showing the largest difference at 2.07% lower and 3.20% lower respectively.
- The unemployment rate was 0.04 to 0.18 percentage points lower, with the exception of Tasmania, where the unemployment rate was on average the same.
- The participation rate was 0.03 to 0.13 percentage points lower, with the exception of the Northern Territory, where the participation rate was 0.03 percentage points higher under the new estimator.

*Lower estimates of employment and unemployment continued*

TABLE 2. COMPARISON OF NEW AND CURRENT SEASONALLY ADJUSTED ESTIMATES, Average difference(a)—April 2001 to January 2007

| State/Territory | *Employed persons* % | *Unemployed persons* % | *Unemployment rate* % points | *Participation rate* % points |
|---|---|---|---|---|
| NSW | –0.07 | –2.07 | –0.11 | –0.12 |
| Vic. | –0.06 | –1.49 | –0.08 | –0.09 |
| Qld | –0.11 | –1.47 | –0.08 | –0.13 |
| SA | –0.06 | –1.27 | –0.07 | –0.08 |
| WA | 0.00 | –0.76 | –0.04 | –0.03 |
| Tas. | –0.10 | –0.15 | 0.00 | –0.06 |
| NT | 0.24 | –3.20 | –0.18 | 0.03 |
| ACT | –0.13 | –1.39 | –0.05 | –0.13 |
| Australia | –0.07 | –1.60 | –0.08 | –0.10 |

(a) Negative value indicates that the new estimate was on average lower than the current estimate.

*'Time in survey' effect*

The pattern of slightly changed levels of employment and unemployment using the new estimator is due to the 'time in survey' effect which has long been observed in the LFS. This effect refers to the tendency of each rotation group to contain a slightly lower proportion of employed and unemployed persons, and a slightly higher proportion of persons not in the labour force, the longer it has been in sample. The new estimator changes the impact of the 'time in survey' effect on survey estimates because it puts less weight on the dwellings that are new in the sample. In contrast, the weight given to respondents for the current estimator does not depend on how long their dwelling has been in the sample. For detailed information about the 'time in survey' effect see the April 1998 release of the publication *Working Papers in Econometrics and Applied Statistics*, No. 98/2 (cat. no. 1351.0).

The relationship between the weights and the time in survey is shown in Table 3, which presents the BLUE B1 Multipliers by the time in survey. For example, the responses from the rotation group which was 'first-time-in' two months before the reference month (i.e. Lag 2) have a BLUE B1 Multiplier of -0.19. The right-most column is the sum of the multipliers across all lags, and it shows how the estimator puts more weight on the rotation groups that have been in the survey longer.

TABLE 3. BLUE B1 MULTIPLIERS, By time in survey

| *Time in* | *Lag 0* | *Lag 1* | *Lag 2* | *Lag 3* | *Lag 4* | *Lag 5* | *Lag 6* | *Total* |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.79 | –0.21 | –0.19 | –0.15 | –0.11 | –0.08 | –0.04 | 0.01 |
| 2 | 0.98 | –0.08 | –0.09 | –0.07 | –0.06 | –0.04 | –0.04 | 0.61 |
| 3 | 1.02 | –0.06 | –0.07 | –0.06 | –0.05 | –0.04 | –0.05 | 0.71 |
| 4 | 1.03 | –0.05 | –0.06 | –0.05 | –0.05 | –0.05 | –0.05 | 0.73 |
| 5 | 1.04 | –0.05 | –0.06 | –0.05 | –0.04 | –0.04 | –0.04 | 0.76 |
| 6 | 1.04 | –0.05 | –0.06 | –0.02 | –0.02 | –0.02 | –0.02 | 0.85 |
| 7 | 1.04 | –0.05 | 0.08 | 0.07 | 0.05 | 0.04 | 0.03 | 1.27 |
| 8 | 1.04 | 0.54 | 0.43 | 0.34 | 0.27 | 0.22 | 0.21 | 3.05 |

*'Time in survey' effect continued*

Since the 'time in survey' effect is very small, it is difficult to determine a precise cause or explanation. It is possible that the effect represents an improvement in data quality as time in survey increases (e.g. because respondent understanding of the survey questions may improve over time). Alternatively, the 'time in survey' effect may represent a slight deterioration in data quality as time in survey increases (e.g. due to respondent fatigue).

Table 4 shows the estimated average effect over the period April 2001 to January 2007.

For Australia, on average 59.94% of people in their first month in survey were employed, compared with 59.43% of people in their last month in survey. The proportion of people not in the labour force correspondingly increased on average from 36.24% of people in their first month in survey to 37.11% of people in their last month.

The impact of the 'time in survey' effect varies for the states and territories. In most states and territories, the proportion of employed persons and unemployed persons in a rotation group has been observed to decrease the longer the rotation group is in the survey. However, in the Northern Territory (over the period April 2001 to January 2007), the proportion of employed persons has been observed to increase as time in survey increases. This explains why the composite estimate for employment in the Northern Territory was slightly higher on average than the current estimate.

TABLE 4. PROPORTION OF PERSONS IN EACH LABOUR FORCE STATUS, by time in survey —April 2001 to January 2007

| | PROPORTION EMPLOYED | | | PROPORTION UNEMPLOYED | | | PROPORTION NOT IN LABOUR FORCE | | |
|---|---|---|---|---|---|---|---|---|---|
| | *First month in survey* | *Average of months 2-7 in survey* | *Last month in survey* | *First month in survey* | *Average of months 2-7 in survey* | *Last month in survey* | *First month in survey* | *Average of months 2-7 in survey* | *Last month in survey* |
| *State/Territory* | % | % | % | % | % | % | % | % | % |
| NSW | 58.60 | 58.36 | 58.12 | 3.69 | 3.45 | 3.28 | 37.72 | 38.19 | 38.61 |
| Vic. | 59.70 | 59.38 | 59.28 | 3.80 | 3.53 | 3.44 | 36.50 | 37.09 | 37.28 |
| Qld | 61.48 | 61.09 | 60.74 | 4.17 | 3.95 | 3.82 | 34.35 | 34.97 | 35.44 |
| SA | 57.72 | 57.17 | 57.32 | 3.70 | 3.67 | 3.50 | 38.51 | 39.16 | 39.19 |
| WA | 62.69 | 62.37 | 62.39 | 3.64 | 3.44 | 3.39 | 33.68 | 34.19 | 34.22 |
| Tas. | 55.00 | 54.51 | 54.36 | 4.38 | 4.23 | 4.18 | 40.63 | 41.26 | 41.46 |
| NT | 67.20 | 67.24 | 67.55 | 4.33 | 4.11 | 3.74 | 28.63 | 28.69 | 28.86 |
| ACT | 70.62 | 69.67 | 69.50 | 2.93 | 2.80 | 2.64 | 26.45 | 27.54 | 27.87 |
| Australia | 59.94 | 59.59 | 59.43 | 3.82 | 3.60 | 3.47 | 36.24 | 36.81 | 37.11 |

There is no adjustment implicit in the composite estimation method which would enable the change in level brought about by the 'time in survey' effect to be reduced and at the same time maintain the standard error reductions achieved by the estimator.

EFFECT ON STANDARD ERRORS

The estimates produced from the LFS, as from all surveys, are subject to sampling error. The most common way of quantifying sampling error is to calculate the standard error for the estimate. The standard error indicates the extent to which a survey estimate is likely to deviate from the true population value by chance. More precisely, it is a measure of the extent to which the LFS estimate from the selected sample is expected to deviate from the average result of all possible samples.

The new estimator achieves a given level of standard error at lower cost than the current estimator. That is, the new estimator can achieve lower standard errors for a given sample size than the current estimator. Alternatively, the new estimator can achieve a given level of standard error at lower sample size, and hence cost, than the current estimator.

Table 5 shows the average difference in standard errors (over the period April 2001 to January 2007) between the new and current estimators. Although the results are in terms of original (i.e. not seasonally adjusted) series, similar results were observed for seasonally adjusted series.

For estimates of employment for Australia, composite estimation reduced the standard errors for level estimates by around 10% and for monthly movements by around 12%. Employment estimates for the states and territories also showed similar reductions in standard errors, except for the Northern Territory which showed smaller reductions for level estimates and similar reductions for monthly movements.

For estimates of unemployment for Australia, composite estimation reduced the standard errors for both level estimates and monthly movements by around 5%. Unemployment estimates for the states and territories also showed similar reductions in standard errors, except for the Northern Territory which showed reductions of approximately double for both level estimates and monthly movements.

TABLE 5. EMPLOYED AND UNEMPLOYED PERSONS, Average difference in standard errors—April 2001 to January 2007

| | EMPLOYED PERSONS | | UNEMPLOYED PERSONS | |
|---|---|---|---|---|
| | *Level* | *Movement* | *Level* | *Movement* |
| *State/Territory* | % | % | % | % |
| NSW | –9.9 | –13.6 | –4.7 | –4.2 |
| Vic. | –7.4 | –12.7 | –3.6 | –4.2 |
| Qld | –8.6 | –11.9 | –3.6 | –3.9 |
| SA | –8.8 | –11.6 | –5.1 | –4.8 |
| WA | –10.2 | –11.0 | –3.4 | –4.9 |
| Tas. | –9.6 | –12.8 | –5.3 | –5.1 |
| NT | –4.3 | –13.0 | –11.0 | –10.7 |
| ACT | –7.0 | –11.0 | –2.2 | –3.1 |
| Australia | –10.3 | –11.7 | –5.3 | –4.6 |

EFFECT ON STANDARD ERRORS *continued*

The table above shows that the improvement in standard errors was lower in the Australian Capital Territory (employment and unemployment) and the Northern Territory (employment) than for the other states. However, it should be noted that the observed gains from composite estimation for a given sample size could be expected to fluctuate across states and territories and over time, because the correlation between rotation groups naturally varies. For example, if the reductions in standard errors for the Australian Capital Territory for a different time period (1993 to 1999) are examined, the improvements are 11.5% for employed and 5.3% for unemployed. Since the Northern Territory and the Australian Capital Territory have the smallest sample size, they will have greatest volatility in the observed correlations.

NEW STANDARD ERROR MODEL

Standard errors that are published each month for selected estimates in *Labour Force, Australia* (cat. no. 6202.0) have been statistically modelled as a function of the estimate itself. The ABS makes these models available to allow the estimation of the standard error of any LFS statistic. The ABS will modify these models to reflect the change in estimation method.

The revised models will be incorporated into the May 2007 issue of *Labour Force, Australia* (cat. no. 6202.0), which will be released on 7 June 2007. The revised models will also be made available through the product *Labour Force Survey Standard Errors, Data Cube*, 2005 (cat. no. 6298.0.55.001), which will be released at the same time as the May 2007 LFS estimates. Although the ABS is not revising the information paper *Labour Force Survey Standard Errors*, 2005 (cat. no. 6298.0), it will still contain relevant information on how to use the revised models.

The modelled standard errors will differ from those shown in Table 5, which are calculated directly from the data. Standard errors derived from a statistical model are only ever an approximation of the standard errors calculated directly from the data. The standard errors themselves are also quite volatile, which adds to the discrepancy between the standard errors calculated directly from the data and those approximated from the model.

Both the old and new standard error models are only an approximation of the true standard errors. Therefore the new standard error models will show higher standard errors for some estimates than the current standard error models, despite the new estimation method having reduced the standard error. This is because the 'line of best fit' applied in the modelling process is inevitably a compromise between the higher and lower standard errors observed and is also affected by the period used to establish the model. The relevant estimates are:

- employment in Victoria (new model shows standard errors 6.2% higher than current model),
- employment in the Northern Territory (9.4% higher),
- unemployment in South Australia (2.9% higher),
- persons not in the labour force in Victoria (13.8% higher), and
- persons not in the labour force in the Northern Territory (4.3% higher).

LFS PRODUCTS

The new LFS statistics (beginning with the May 2007 statistics) and the revised historical LFS statistics (from April 2007 back to April 2001), will be incorporated in all LFS statistical releases. These are listed below.

- *Labour Force, Australia* (cat. no. 6202.0), monthly.
- *Labour Force, Australia, Spreadsheets* (cat. no. 6202.0.55.001), monthly.
- *Labour Force, Australia, Detailed - Electronic Delivery* (cat. no. 6291.0.55.001), monthly.
- *Labour Force, Australia, Detailed, Quarterly* (cat. no. 6291.0.55.003), quarterly.
- *Labour Force, Australia: Labour Force Status and Other Characteristics of Families* (cat. no. 6224.0.55.001), annual.

More information on these LFS products is available on the ABS website (Themes - Labour - Labour Releases).

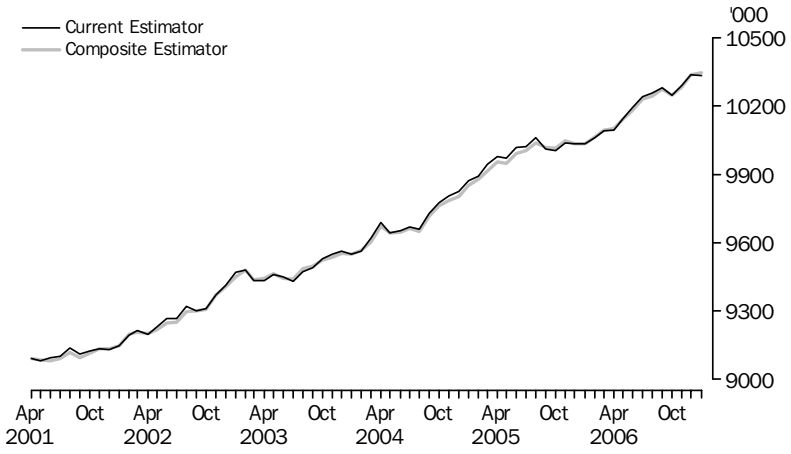
FUTURE CHANGES

In line with standard ABS practice, a new LFS sample design will be introduced progressively between November 2007 and June 2008, based on results from the 2006 Census of Population and Housing. Standard errors expected to be achieved under the new sample design will depend on a number of factors including available budget, cost of enumeration, and the variability of labour market characteristics in the population. Therefore the expected improvement in standard errors presented in this paper as a result of introducing composite estimation may not be achieved under the new sample design.

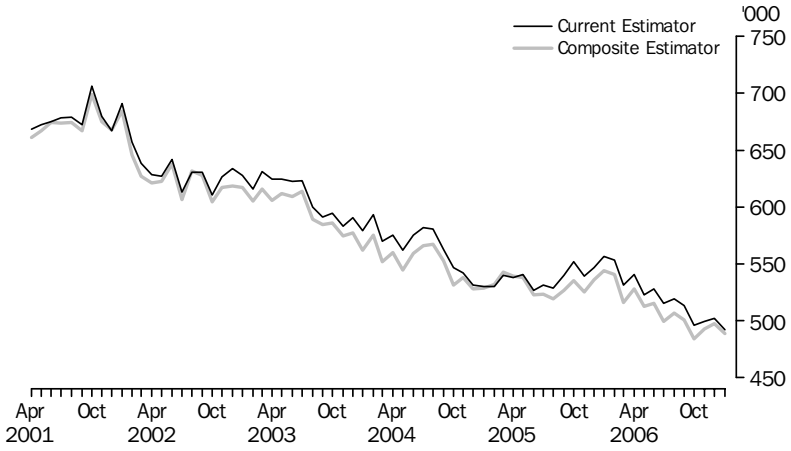
# GRAPHS

LEVEL ESTIMATES, AUSTRALIA: SEASONALLY ADJUSTED

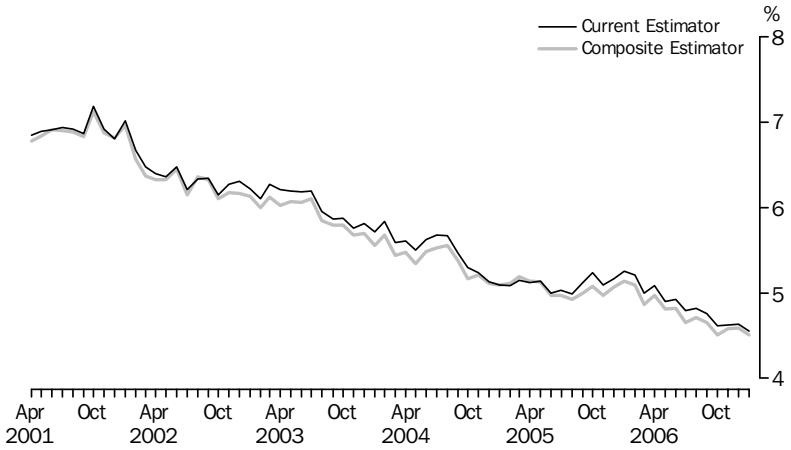
EMPLOYED PERSONS, Australia




UNEMPLOYED PERSONS, Australia

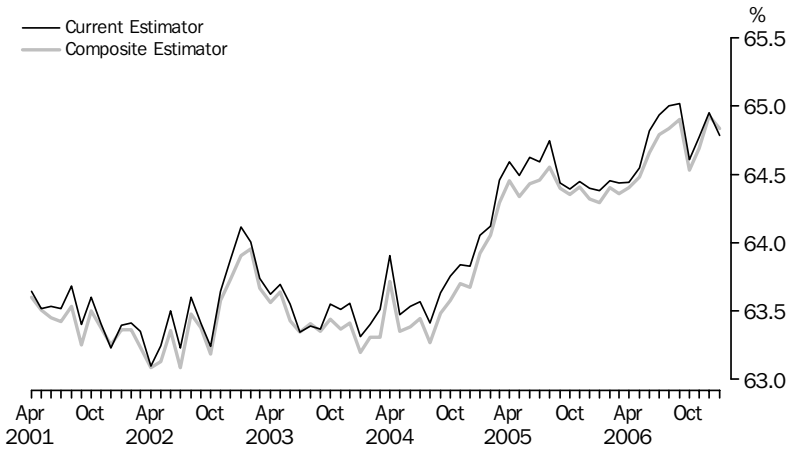



UNEMPLOYMENT RATE, Australia



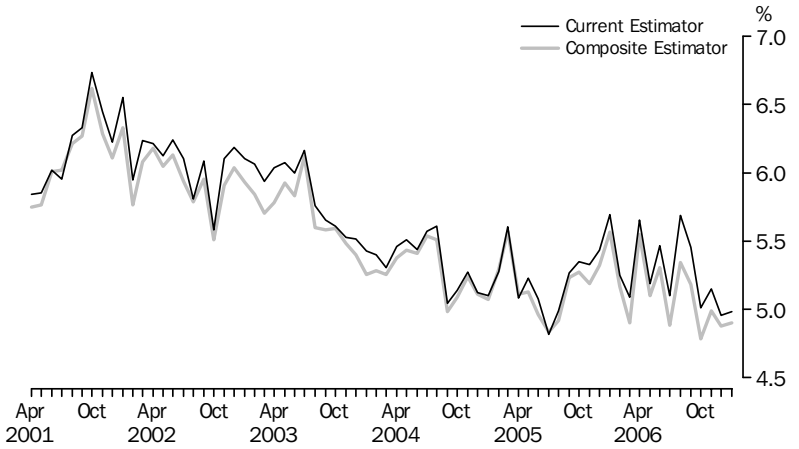
LEVEL ESTIMATES, AUSTRALIA: SEASONALLY ADJUSTED *continued*

PARTICIPATION RATE, Australia

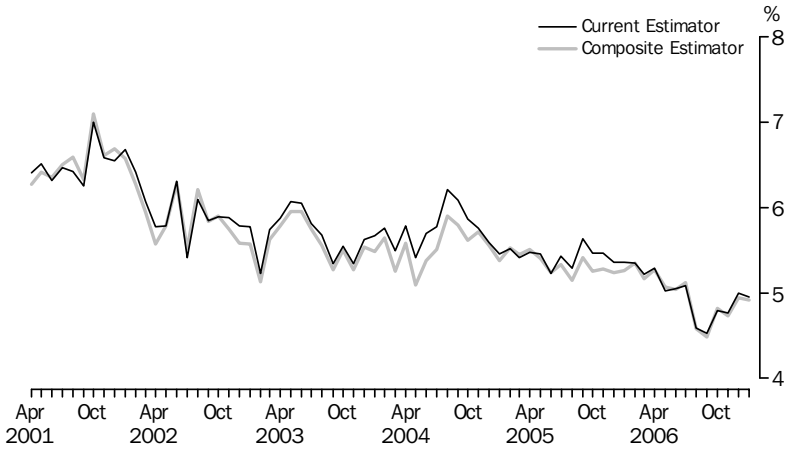



LEVEL ESTIMATES, STATES AND TERRITORIES: SEASONALLY ADJUSTED

UNEMPLOYMENT RATE, New South Wales

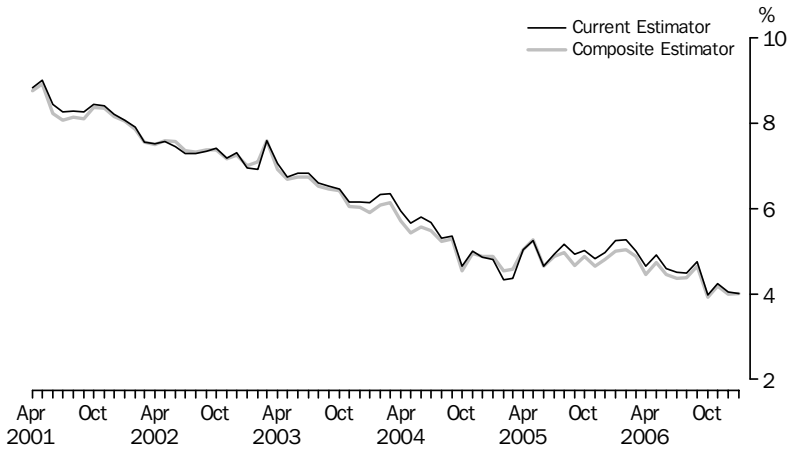



UNEMPLOYMENT RATE, Victoria

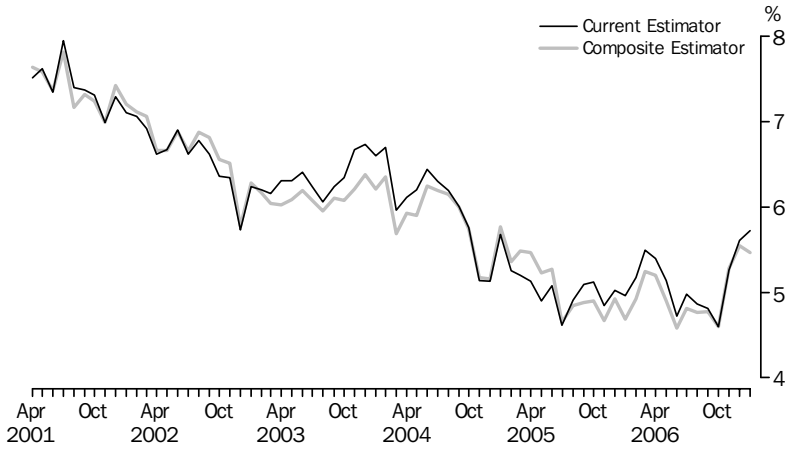


LEVEL ESTIMATES, STATES AND TERRITORIES: SEASONALLY ADJUSTED
*continued*

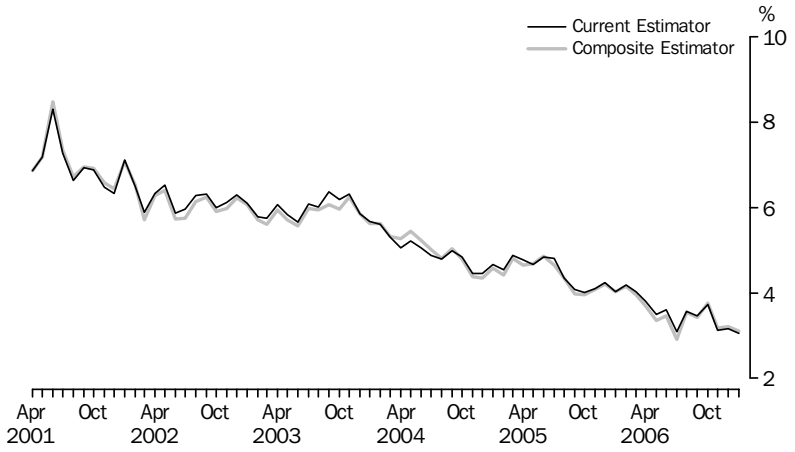
UNEMPLOYMENT RATE, Queensland




UNEMPLOYMENT RATE, South Australia

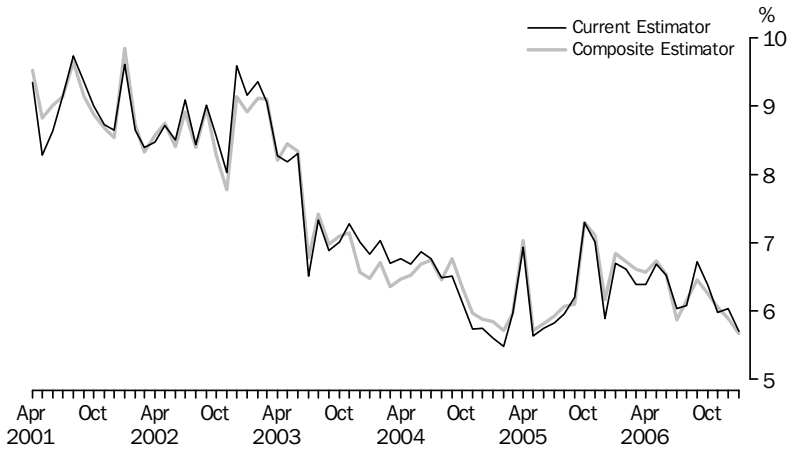



UNEMPLOYMENT RATE, Western Australia

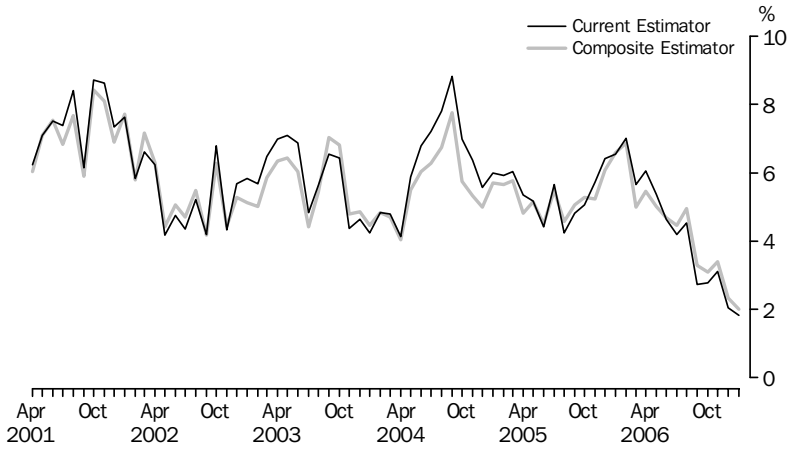


LEVEL ESTIMATES, STATES AND TERRITORIES: SEASONALLY ADJUSTED
*continued*

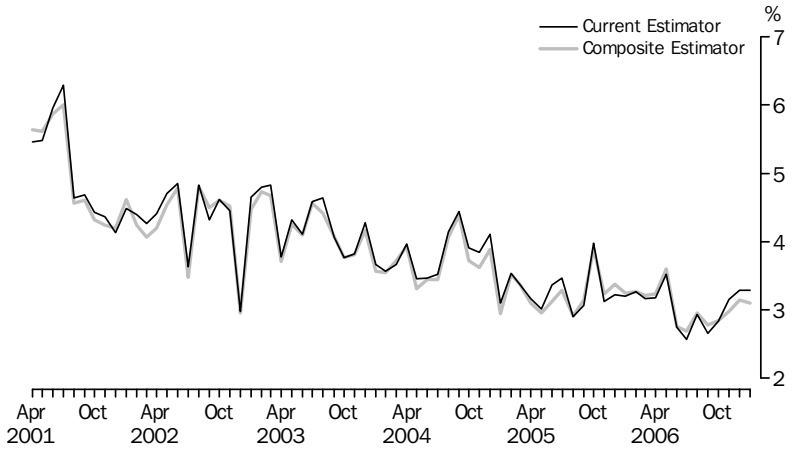
UNEMPLOYMENT RATE, Tasmania




UNEMPLOYMENT RATE, Northern Territory




UNEMPLOYMENT RATE, Australian Capital Territory



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