6290.0.55.001

Australian Bureau of Statistics

Information Paper

Information Paper: Expansion of Hours Worked Estimates from the Labour Force Survey

Australia

2009

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EMBARGO: 11.30AM (CANBERRA TIME) TUES 8 SEP 2009

ABS Catalogue No. 6290.0.55.001

Produced by the Australian Bureau of Statistics

INQUIRIES

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INTRODUCTION

INTRODUCTION OF A NEW KEY MEASURE OF HOURS WORKED

The recent economic downturn has resulted in an increased focus on Australia's labour market, and in particular on changes in unemployment, employment and the relationship to hours worked. While much of the recent interest has been on movements in the unemployment rate, there is considerable value in analysing other indicators, such as underemployment and hours worked, to better understand the impacts on the labour market.

The ABS produces seasonally adjusted and trend estimates for employment and unemployment from the monthly Labour Force Survey (LFS), which enhance the analysis of month-to-month movements. However, estimates of hours worked have only been produced as original estimates. This limits their usefulness in monitoring movements as hours worked are influenced by seasonality.

In response to the increasing demand for hours worked estimates on a seasonally adjusted and trend basis, the ABS recently introduced a new key monthly measure, namely *aggregate monthly hours worked*. This new measure of hours worked complements the existing information on employment and unemployment, assisting analysts in understanding how the labour market is responding to economic challenges, for example, whether employers are reducing employee hours rather than retrenching employees in an attempt to reduce costs.

The ABS introduced estimates of aggregate monthly hours worked in the July 2009 issue of *Labour Force, Australia* (cat. no. 6202.0), available as both seasonally adjusted and trend for the period July 1985 onwards. An article titled *Aggregate Monthly Hours Worked* appeared in that issue, as well as a time series spreadsheet titled *Article Data on Aggregate Monthly Hours Worked - Trend and Seasonally Adjusted*. From the August 2009 issue, to be released on 10 September 2009, seasonally adjusted and trend aggregate monthly hours worked estimates will appear in both Table 18 and in a corresponding time series spreadsheet in *Labour Force, Australia* (cat. no. 6202.0), including for males and females.

MEASURES OF HOURS WORKED

The LFS collects data on a monthly basis on both the actual and usual hours worked by employed persons. The ABS publishes estimates of actual and usual hours worked monthly in *Labour Force, Australia, Detailed – Electronic Delivery* (cat. no. 6291.0.55.001) and quarterly in *Labour Force, Australia, Detailed – Electronic Quarterly* (cat. no. 6291.0.55.003).

Estimates of actual and usual hours worked are produced as original estimates and relate to hours worked in the survey reference week, that is the week prior to the survey interview. These actual and usual hours worked estimates cannot be aggregated across time, e.g. to produce quarterly or annual estimates, as they relate to only a single week rather than the entire month.

Analysis of actual hours worked (in the reference week) estimates across time is currently limited as they may not be representative of all the weeks in the month, particularly where there are holidays in the reference week. In addition, they take no account of seasonality.

MEASURES OF HOURS WORKED *continued*

For more details on the hours worked concepts collected in the Labour Force Survey and other labour collections, refer to *Labour Statistics: Concepts, Sources and Methods* (cat. no. 6102.0.55.001).

AGGREGATE MONTHLY HOURS WORKED

In contrast, the new aggregate monthly hours worked estimates measure the total number of actual hours worked by employed persons in a calendar month. This means that the aggregate monthly hours worked estimates are a true monthly measure, rather than referring only to a single week in the month. As such, these estimates may be aggregated across time to produce both quarterly and annual estimates.

ABS investigations have determined that aggregate monthly hours worked provides the most accurate seasonally adjusted measure of hours worked. Aggregate monthly hours worked allows direct comparison of hours worked across time, adding considerably to its value in explaining the behaviour of the labour market.

PURPOSE OF THIS PAPER

This paper provides detailed information on:

1. The methodology used to produce seasonally adjusted and trend estimates for aggregate monthly hours worked.

2. Extending the methodology to produce seasonally adjusted and trend estimates for aggregate monthly hours worked for males and females.

METHODOLOGY

OVERVIEW

Seasonally adjusted estimates of aggregate monthly hours worked are constructed by creating the following two intermediate series:

1. Monthly seasonally adjusted actual hours worked in the reference week, which is used as the indicator series; and

2. Aggregate annual hours worked, which is used as the financial year benchmark series.

These two series are then combined in a benchmarking process to produce the final seasonally adjusted monthly hours worked estimates. The methodology ensures that:

- Month to month movements in the seasonally adjusted actual hours worked in the reference week series are maintained; and
- Seasonally adjusted aggregate monthly hours worked estimates for each financial year sum to the annual benchmark estimate.

The methodology for calculating each series, including benchmarking, is detailed below.

SERIES 1: SEASONALLY ADJUSTED ACTUAL HOURS WORKED IN THE REFERENCE WEEK

Currently original estimates of actual hours worked *in the reference week* are published each month in *Labour Force, Australia, Detailed - Electronic Delivery* (cat. no. 6291.0.55.001). These estimates are affected by holidays, and therefore may not be representative of the hours worked in other weeks of the month. This limits the ability to compare results against other months.

Series 1 is constructed by applying a seasonal adjustment to the original actual hours worked in the reference week series.

Seasonal adjustment is a process which estimates and removes systematic calendar effects. Seasonally adjusting the hours worked in the reference week series removes:

- the effects of holidays, referred to as holiday correction; and
- monthly seasonality.

This creates an estimate that is directly comparable with other months. Estimates of seasonally adjusted employed and unemployed are calculated in the same way, although the holiday effects for these estimates are negligible.

Holiday correction

Holiday correction removes the effects of regular non-random events, such as holidays in the reference week, and is performed prior to adjusting for monthly seasonality. The holiday corrected series therefore excludes known holiday impacts, and is considered to reflect a 'normal working week'. Each holiday has a different effect, for example the effect of Good Friday on hours worked is larger than the effect of the Queen's Birthday holiday.

Data are collected in the LFS over a two week period, with the reference weeks usually falling on the first two weeks of each calendar month. As a consequence, individual holidays do not affect the entire sample. For example, the Queen's Birthday holiday in 2009 only affected one third of the sample that were interviewed in the second week. Holiday corrections adjust for this by incorporating not only the holiday effect itself but also the proportion of the sample that was affected.

Seasonal adjustment

The holiday corrected series of actual hours worked in the reference week is then adjusted for monthly seasonality, such as for the strong decrease in hours worked in January each year. Adjusting for non-random events and seasonality allows for direct comparability between months.

While the seasonally adjusted series is much more representative of the hours worked during the month and is comparable with estimates from other months, it does result in an overcount of hours. This occurs because the seasonally adjusted series does not contain any holidays. This series is therefore not considered appropriate for publication. However, it is used an an indicator series for the movement in the seasonally adjusted aggregate monthly hours worked series.

For a more detailed description of the calculation of seasonally adjusted actual hours worked in the reference week, refer to *Technical Note: Issues with Seasonal Adjustment of Hours Worked*, published in the September 2005 issue of *Australian Economic Indicators* (cat. no. 1350.0).

SERIES 2: AGGREGATE ANNUAL HOURS WORKED

Aggregate annual hours worked data, i.e. the total hours worked in a financial year, is derived from actual hours worked estimates for each week in the financial year. Estimates for those weeks not covered in the LFS are imputed. Aggregate annual hours worked estimates are therefore synthetic, and consequently seasonally adjusted aggregate monthly hours worked are also synthetic estimates.

This financial year hours worked series is used to benchmark the seasonally adjusted aggregate monthly hours worked series. Financial year estimates of hours worked from the LFS are also used in the National Accounts for the calculation of gross domestic product.

The aggregate annual hours worked estimates are produced using the steps detailed below. For additional details on the methodology, see *Research Paper: Estimating Average Annual Hours Worked* (cat. no. 1352.0.55.077).

STEP 1: ALLOCATE ACTUAL HOURS WORKED IN THE REFERENCE WEEK TO THE CORRESPONDING WEEKS OF THE FINANCIAL YEAR

For each month of the financial year, the original estimates of hours worked in the reference week are allocated to their appropriate week. As described above, the reference weeks are not the same for the entire sample for any given month. It is also not possible to calculate the hours worked in each of the two reference weeks separately. The hours worked for each month are therefore allocated in full to the reference week corresponding to the first week of interviews, as the majority of the sample is taken at that time.

STEP 2: APPLY HOLIDAY CORRECTIONS TO THE ACTUAL HOURS WORKED IN THE REFERENCE WEEK SERIES

As described previously, estimates are holiday corrected to remove the effects of national public holidays and school holidays. This creates an estimate of a 'normal working week' with no holidays. The holiday corrections compensate for all non-random events which have affected the sample, including holidays that occurred during the second reference week.

SERIES 2: AGGREGATE ANNUAL HOURS WORKED *continued*

STEP 3: LINEAR INTERPOLATION

Once the holiday corrected estimates for actual hours worked in the reference week have been allocated to their appropriate weeks, estimates for the remaining 40 weeks of the financial year are imputed. This is done by linearly interpolating between each holiday corrected estimate. For example, the imputed estimates for the weeks beginning 8 June, 15 June and 22 June are calculated by linearly interpolating between the (holiday corrected) estimates for the reference weeks beginning 1 June (June 2009 estimate) and 29 June (July 2009 estimate). As a result of using this method, July data is required to calculate estimates for the previous financial year. For example, July 2009 data is required to calculate 2008-09 aggregate annual hours worked estimates.

STEP 4: APPLY THE EFFECTS OF HOLIDAYS FOR ALL WEEKS

After calculating the holiday corrected actual hours worked estimates for each week of the financial year, the effects of the non-random holiday events are then reapplied to the data.

All public and school holidays have a predetermined holiday factor. These factors reduce the holiday corrected hours worked weekly estimates, by taking into account holidays that occured in each week. Unlike the holiday corrections applied in Step 2, no adjustment is required for the proportion of the sample affected by the holiday.

In this process, adjustments are made for holidays that are rarely or never observed in the LFS due to the timing of the reference weeks. These include Australia Day, ANZAC Day, Christmas Day and Boxing Day. The magnitude of the effects applied for these holidays are based on the observed effects of similar holidays. For example, it is assumed that Christmas Day has the same effect on hours worked as Good Friday (although different adjustments are made depending on whether Christmas Day falls on a weekend or weekday).

STEP 5: ESTIMATE THE PARTIAL WEEKS

No financial year contains only whole weeks, as there will always be at least one week that is only partially in the financial year. To create estimates for part of the week, estimates of hours worked in each day of the week are calculated. This is based on the days of the week that people work in their main jobs as recorded by the LFS, as hours worked per day are not collected.

STEP 6: CALCULATE AGGREGATE ANNUAL HOURS WORKED

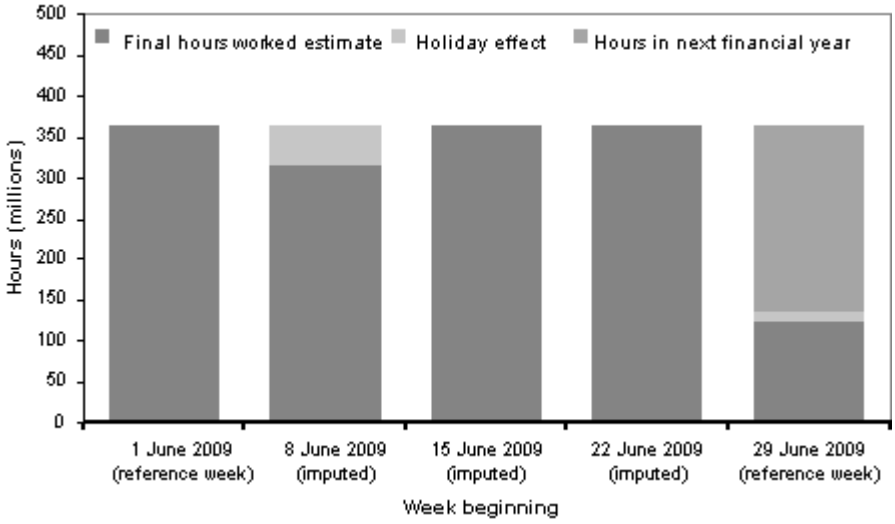
The aggregate annual hours worked estimate is finally calculated by adding all the results from each individual week of the financial year, including the adjustment(s) for partial weeks.

Figure 1 shows the hours worked estimates for the weeks in June 2009. The holiday corrected estimates for June and July 2009 are based on the reference weeks beginning 1 June and 29 June respectively. Hours worked for the weeks beginning 8 June, 15 June and 22 June are imputed based on linear interpolation between the reference weeks. The effect of the Queen's Birthday holiday is shown in the week beginning 8 June (reducing hours worked by 13.1%), and the July school holidays is shown in the week beginning 29 June (reducing hours worked by 2.5%). As only part of the week beginning

SERIES 2: AGGREGATE ANNUAL HOURS WORKED *continued*

29 June is in the 2008-09 financial year, the hours worked for that week is reduced by a further 62.5% (with the hours that were removed counting towards the 2009-10 financial year). The resulting hours worked estimates for each week contribute to the aggregate annual hours worked estimate for the 2008-09 financial year.

FIGURE 1: HOURS WORKED HOLIDAY ADJUSTMENT



BENCHMARKING OF SERIES 1 TO SERIES 2

The final step in producing the seasonally adjusted aggregate monthly hours worked estimates is to benchmark the seasonally adjusted actual hours worked in the reference week series (series 1) to the original aggregate annual hours worked series for financial years (series 2). The benchmarking methodology used by the ABS is that recommended by the OECD with a slight modification for use with monthly estimates. This methodology is also used by the ABS in the calculation of productivity measures.

Seasonally adjusted aggregate monthly hours worked is calculated by benchmarking under the following conditions:

- The monthly estimates must sum to the annual (financial year) benchmarks.
- The monthly percentage change must be as close as possible to that of the seasonally adjusted actual hours worked in the reference week series.
- The ratio of the aggregate series to the seasonally adjusted actual hours worked in the reference week series should not contain any discontinuities (to ensure a smooth monthly series at the boundaries of financial years).

Some months at the end of the time series will not be covered in the financial year benchmarks. For example, the latest monthly data currently available is for July 2009 although the latest available financial year benchmarks are for 2008-09 (ending in June 2009). For those months not covered by annual benchmarks, aggregate monthly hours worked is calculated by replicating the monthly percentage change of the seasonally adjusted actual hours worked in the reference week series. Therefore, for July 2009, both seasonally adjusted aggregate monthly hours worked and seasonally adjusted actual hours worked in the reference week decreased by 0.4% compared with June 2009.

BENCHMARKING OF SERIES 1 TO SERIES 2 *continued*

Over time, this means that up to 12 months of the aggregate monthly hours worked series are not included in the financial year benchmarks. For example, the most recent financial year benchmarks available when June 2010 data is released will be the 2008-09 financial year.

TREND AGGREGATE MONTHLY HOURS WORKED

The trend estimate of aggregate monthly hours worked is a moving average of the seasonally adjusted series.

AGGREGATE MONTHLY HOURS WORKED BY SEX

The ABS will release new seasonally adjusted and trend estimates of aggregate monthly hours worked for males and females on 10 September 2009 in *Labour Force, Australia* (cat. no. 6202.0). Users should refer to the Appendix in this Information Paper for details of the publication table and time series spreadsheets to be released.

Seasonally adjusted aggregate monthly hours worked by sex is calculated using a similar methodology to that described above. The seasonally adjusted actual hours worked in the reference week series for males and females (i.e. series 1) is calculated in the same way as for the total persons series, which includes holiday correction and seasonal adjustment. Holiday effects for males and females are calculated using the same methodology as for total persons, although the holiday correction factor for males and females may differ, for example, because the effects of school holidays are larger for females than males.

The estimates of males and females are benchmarked to the total seasonally adjusted aggregate *monthly* hours worked estimates. This differs from the total persons series, which are benchmarked to the financial year series (i.e. series 2). The final estimates are calculated by proportional distribution, so that the distribution of males and females in the hours worked in the reference week series is consistent with the aggregate monthly hours worked series. This ensures that the estimates for males and females add to person level seasonally adjusted aggregate monthly hours worked.

ORIGINAL AGGREGATE MONTHLY HOURS WORKED

The methodology outlined above details how seasonally adjusted and trend aggregate monthly hours worked estimates are calculated. An original series of aggregate monthly hours worked is not calculated as part of this process, and therefore original monthly estimates are not available.

MEASURE OF ERROR

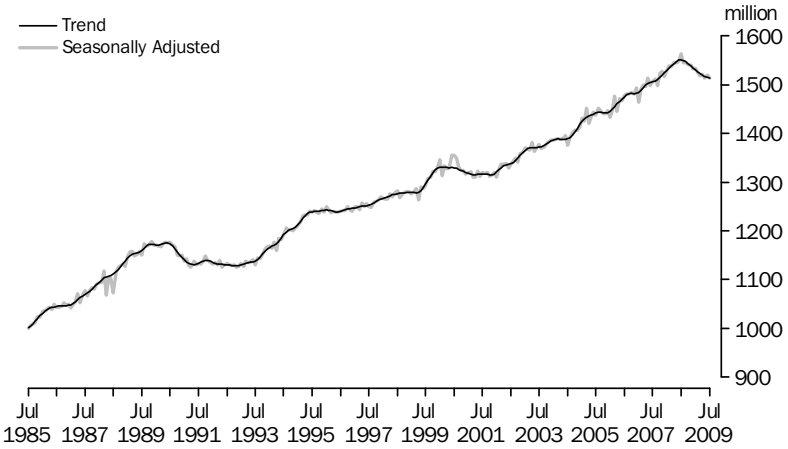
Seasonally adjusted aggregate monthly hours worked is a synthetic estimate because it is derived from both observed and imputed results. The estimates therefore do not have a standard error in the same manner as other estimates from the LFS. The standard error on an imputed estimate is unknown. The relative standard error of the original actual hours worked in the reference week estimate (currently approximately 0.5%) can be used as an indication of the error.

TIME SERIES

The ABS introduced estimates of aggregate monthly hours worked in the July 2009 issue of *Labour Force, Australia* (cat. no. 6202.0), available as both seasonally adjusted and trend for the period July 1985 onwards. An article titled *Aggregate Monthly Hours Worked* appeared in that issue, as well as a time series spreadsheet titled *Article Data on Aggregate Monthly Hours Worked - Trend and Seasonally Adjusted*.

The 24 year time series of trend aggregate monthly hours worked is shown in Figure 2.

FIGURE 2: AGGREGATE MONTHLY HOURS WORKED, July 1985 to July 2009



ADDITIONAL INFORMATION

FUTURE RELEASES

Seasonally adjusted and trend estimates of aggregate monthly hours worked for males and females will be released in the August 2009 issue of *Labour Force, Australia* (cat. no. 6202.0) on 10 September 2009. This data will be published in Table 18 of the publication and in a corresponding time series spreadsheet. The Appendix of this Information Paper shows the layouts of both the publication table and time series spreadsheet.

Over the coming months, the ABS will be:

- Extending the seasonally adjusted and trend time series from July 1985 back to February 1978, consistent with other Labour Force estimates.
- Investigating the feasibility of producing other detailed aggregate monthly hours worked series e.g. for states/territories and industry.

Any further developments in aggregate monthly hours worked, such as those above, will be detailed in *Labour Force, Australia* (cat. no. 6202.0).

The ABS welcomes comments about the proposed future development of the aggregate monthly hours worked estimates. Please forward any comments to michael.johnson@abs.gov.au.

APPENDIX

6202.0 TABLE LAYOUTS

Seasonally adjusted and trend estimates of aggregate monthly hours worked for males and females will be released in the August 2009 issue of *Labour Force, Australia* (cat. no. 6202.0) on 10 September 2009. This data will be published in Table 18 of the publication, with the layout shown below.

AGGREGATE MONTHLY HOURS WORKED

	MALES		FEMALES		PERSONS	
	TREND Hours worked	*SEASONALLY ADJUSTED* Hours worked	*TREND* Hours worked	*SEASONALLY ADJUSTED* Hours worked	*TREND* Hours worked	*SEASONALLY ADJUSTED* Hours worked
	millions	millions	millions	millions	millions	millions
August 2006	-	-	-	-	-	-
August 2007	-	-	-	-	-	-
2008						
August	-	-	-	-	-	-
September	-	-	-	-	-	-
October	-	-	-	-	-	-
November	-	-	-	-	-	-
December	-	-	-	-	-	-
2009						
January	-	-	-	-	-	-
February	-	-	-	-	-	-
March	-	-	-	-	-	-
April	-	-	-	-	-	-
May	-	-	-	-	-	-
June	-	-	-	-	-	-
July	-	-	-	-	-	-
August	-	-	-	-	-	-

The layout of the time series spreadsheet, released at the same time, is shown below.

AGGREGATE MONTHLY HOURS WORKED, Trend and seasonally adjusted

	Aggregate Monthly Hours Worked ; Males ;	*Aggregate Monthly Hours Worked ; Females ;*	*Aggregate Monthly Hours Worked ; Persons ;*	*Aggregate Monthly Hours Worked ; Males ;*	*Aggregate Monthly Hours Worked ; Females ;*	*Aggregate Monthly Hours Worked ; Persons ;*
	000 Hours	000 Hours	000 Hours	000 Hours	000 Hours	000 Hours
Series Type	Trend	Trend	Trend	Seasonally Adjusted	Seasonally Adjusted	Seasonally Adjusted
Data Type	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW
Frequency	Month	Month	Month	Month	Month	Month
Collection Month	1	1	1	1	1	1
Series Start	Jul-1985	Jul-1985	Jul-1985	Jul-1985	Jul-1985	Jul-1985
Series End	Aug-2009	Aug-2009	Aug-2009	Aug-2009	Aug-2009	Aug-2009
No. Obs	240	240	240	240	240	240
Series ID	A3346484T	A3346487X	A3346490L	A3346475R	A3346478W	A3346481K
Jul-1985	-	-	-	-	-	-
Aug-1985	-	-	-	-	-	-
Sep-1985	-	-	-	-	-	-
Oct-1985	-	-	-	-	-	-
Nov-1985	-	-	-	-	-	-
...	-	-	-	-	-	-
Apr-2009	-	-	-	-	-	-
May-2009	-	-	-	-	-	-
Jun-2009	-	-	-	-	-	-
Jul-2009	-	-	-	-	-	-
Aug-2009	-	-	-	-	-	-

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