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## Implications of differences in employment estimates by industry between ABS Labour Force Survey and ABS Business-survey data

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# Abstract

**Department of Jobs and Small Business Staff Discussion Paper Series: Implications of differences in employment estimates by industry between ABS Labour Force Survey and ABS Business-survey data**

In Australia, since around the year 2000 (and possibly beforehand), there have been large differences in the data which the Australian Bureau of Statistics (ABS) has published on employment for many industries, and noticeable differences in aggregate, between estimates based on the key household survey and estimates from business surveys. The household survey is the Labour Force Survey (LFS). The business-survey estimates are based on a combination of two business surveys, the Economic Activity Survey (EAS) which overwhelmingly covers the private sector and the release, Employees and Earnings in the Public Sector (EEPS), for the public sector.

In this paper, we present the key differences in employment estimates between these two sources and provide some possible reasons for the differences. Some of the key reasons for the differences are a variation in collection methods (the activity a person performs at work versus the industry to which his or her firm is coded), and different ways of including or excluding multiple jobholders, short-term temporary entrants working in Australia and child workers. We then attempt to reconcile this difference in aggregate. Finally, we discuss possible implications for economic research and analysis.

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# Background and introduction

This paper is the latest update (with data to 2015-16) of an earlier paper by Connolly, Medina and O'Regan[1] which was presented in a seminar in the former Department of Education, Employment and Workplace Relations (DEEWR) in November 2012. The topic of the earlier paper was attempting to reconcile differences in estimates of employment, in aggregate and by industry, between the ABS's Economic Activity Survey (EAS), which is released in *Australian Industry* (Cat. No. 8155.0) and the Labour Force Survey (LFS), which is released in *Labour Force, Australia, Detailed, Quarterly* (Cat. No. 6291.0.55.003) and what the ABS could possibly do to reconcile the differences. These options have been discussed separately with the ABS and so are not included in the current paper. One of the suggestions from the ABS during and after this seminar was to use a combination of EAS data (which basically covers the private sector) and public-sector data from the ABS publication, *Employment and Earnings, Public Sector, Australia* (Cat. No. 6248.0.55.001, hereafter abbreviated as EEPS) to get a better coverage of the entire economy than using EAS data alone. This suggestion has been adopted in the current analysis. In addition, the ABS is developing a set of Labour Accounts, with one of the aims of this development being to reconcile these differences. The first experimental annual labour account was released in the ABS publication, *Labour Account Australia, Experimental Estimates, July 2017* (Cat. No. 6150.0.55.001) on 25 July 2017. The thrust of the current paper is to alert analysts of Australian economic data to these discrepancies, discuss their implications and offer some suggestions for how analysts might be able to handle them in their research and analysis.

There are large differences in published employment data for many industries, and noticeable differences in aggregate, between estimates based on a household survey, the LFS, and estimates based on business surveys, the EAS and the EEPS. As shown later in this paper, there are also other reasons for the differences in estimates beyond the source of the survey.

In this paper, we present the key differences in employment estimates between these two sources, provide some possible reasons for the differences, attempt to reconcile this difference in aggregate and discuss possible implications for economic research and analysis.

# Differences in employment data

## Definition of employment

The employment definitions from both ABS publications (*Australian Industry*, which is based on the EAS and Labour Force Australia, which is based on the LFS) are listed in Table 1 below. In addition, in different parts of *Australian Industry*, the estimates are variously described as "Employment" and "employees", raising questions in the minds of the readers as to which LFS measures of employment are comparable.

[1] Connolly, G., Medina, J. and O'Regan, C. (2012), *Attempting to Reconcile Differences in Employment Estimates by Industry between ABS Economic Activity Survey and Labour Force Survey Data*, Paper presented to a Seminar in the former DEEWR, 26 November 2012, 50 Marcus Clarke Street, Canberra City.

*Table 1 – Employment definitions.*

| ABS Australian Industry publication (Cat.No.8155.0) | ABS Labour Force, Australia, Detailed, Quarterly publication (Cat.No.6291.0.55.003 |
|---|---|
| Number of persons working for businesses during the last pay period ending in June of the given year. Includes working proprietors and partners, employees absent on paid or prepaid leave, employees on workers' compensation who continue to be paid through the payroll, and contract workers paid through the payroll. Excludes persons paid by commission only, non-salaried directors and volunteers.<br><br>In addition, information provided to survey participants[2] further stipulates groups to be excluded from that firm's survey return:<br><br>▪ [Employment in the EAS survey] excludes casual or seasonal employees who are on the payroll, but did not work during this pay period.<br>▪ Contractors and subcontractors who are other businesses, (i.e. have their own ABN and are paid on a fee for service or commission only basis), should not be counted in Employment.<br>▪ If the business paid another business for contract staff, and those persons were on the payroll of the other business, they should not be counted in Employment. | All persons aged 15 years and over who, during the reference week, either:<br>▪ worked for one hour or more for pay, profit, commission or payment in kind in a job or business, or on a farm (comprising employees, employers and own account workers); or<br>▪ worked for one hour or more without pay in a family business or on a farm (i.e. contributing family workers); or<br>▪ were employees who had a job but were not at work and were:<br>○ away from work for fewer than four weeks up to the end of the reference week; or<br>○ away from work for more than four weeks up to the end of the reference week and received pay for some or all of the four week period to the end of the reference week; or<br>○ away from work as a standard work or shift arrangement; or<br>○ on strike or locked out; or<br>○ on workers' compensation and expected to return to their job; or<br>▪ were employers or own account workers, who had a job, business or farm, but were not at work. |

As shown in, the EAS definition of employment is not as comprehensive as the LFS definition. This was reiterated by ABS representatives at a meeting at the former DEEWR on 28 August 2012. However, even though the LFS definition is stated as relating to "all persons", it actually relates to "all Australian residents" as will be explained later in this paper.

In the data analysis presented later in this paper two separate definitions are used to compare the EAS and EEPS data against a comparable data set from the LFS. In all the definitions explored, contributing family workers and volunteers are excluded (people in both of these categories are not paid in cash). The alternative assumptions for these definitions are as follows:

- Employees – the intention in this category is to count only employees and exclude employers, own-account workers and people in other employment situations (note that all of the figures used in the EEPS data are assumed to relate to employees)[3]; and

[2] ABS, *Survey Participant Information - Economic Activity Survey* - AIC12C, 2012 http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Survey+Participant+Information+-+Economic+Activity+Survey+-+AIC12C

[3] There are some grey areas around this definition, particularly regarding owner-managers of incorporated enterprises, who are counted for the purposes of this analysis as being employees (of their own business; this is also the old ABS definition, but the ABS has in 2015 moved to reporting "employees only" separately from

- Total Employment – In addition to employees, employers and own-account workers are counted. However, in an effort to make the two sources of data more comparable, contributing family workers and volunteer workers are excluded from the LFS data (and it is unlikely that many people in this category would be included in the business-survey data)[4].

Another distinction is that the LFS data relate to the number of people employed, whereas the business-survey data, even where they are stated as relating to "employment" or "employees", could more properly be considered to relate to the number of jobs filled by employees or people in other employment categories (i.e., multiple job holders will be counted more than once in the business surveys but only once in the LFS).

## Data comparison

In this section, we compare the employment data in the EAS and the EEPS with the alternative from the LFS. As the EAS and EEPS data are only published in original terms, we have also used original data from the LFS. There are a few limitations when comparing these data including:

- Employment data in the EAS and the EEPS are only available annually and are for the end of June (EAS) and the month of June (EEPS), while data by industry in the LFS are published quarterly. The nearest published month (in the LFS) to June is May. Therefore May data (from the LFS) are compared with June data (from the EAS and the EEPS).
- In the publication, *Australian Industry*, the ABS does not publish data for the Financial and Insurance Services industry (except for issues from 2010-11 onwards where experimental estimates for a part of the industry called Auxiliary Finance and Insurance Services are included). Accordingly, the Financial and Insurance Services industry is excluded from this analysis.
- In the publication, *Australian Industry*, the ABS generally excludes the general government sector[5]. Accordingly, we have added data on the number of public-sector employees from EEPS so that our calculations apply to the whole industry and not just the private sector within each industry. This is likely to mean that there is some double-counting of the number of employees working for public corporations outside the Finance and Insurance industry.
- Employment data in the EAS are only available from 2004-05 onwards and for 2004-05 and 2005-06, are only available in the publications for the ANZSIC 1993 classification of industries, while the EEPS data are only available for the latest (ANZSIC 2006) classification of industries back to 2007-08. In comparison, the LFS data are available by industry for the latest (ANZSIC 2006) classification of industries back to November 1984. For some industries, including Agriculture, Forestry and Fishing; Mining; and Manufacturing; the change of industry classification does not make a major difference to the employment estimates. However, to make

owner-managers of incorporated enterprises). Many of the owner-managers of incorporated enterprises are also employers of other people.

[4] The exclusion of people in these two categories from the LFS employment statistics does not make much difference to the comparison. In August 2013, contributing family workers only constituted 0.3 per cent of total employment in the LFS, and the percentage has been around or below this level for the last decade. Even though being a voluntary worker theoretically gives a person an employment status, in the LFS the ABS does not currently count any people who are purely voluntary workers as being employed.

[5] At the one-digit ANZSIC 2006 industry classification. For the Water Supply, Sewerage and Drainage Services subdivision within the Electricity, Gas, Water and Waste industry, the ABS also includes data from relevant local government organisations.

the comparison tractable and comparable, only data from 2007-08 through 2015-16 is used for this analysis.

- Data on the number of employees are not published directly in the latest issues of Australian Industry[6] but instead have to be derived by dividing the total wage and salary bill for the financial year by the "Industry ratios" for wages and salaries per employee. This introduces complexity into the calculations, compared with the situation that would apply if the ABS were to release the statistics for employees directly in Australian Industry.
- Data in EEPS are not published for all industries, with the following industries being aggregated into a category called 'Other industries': Agriculture, Forestry and Fishing; Mining; Manufacturing; Wholesale Trade; Retail Trade; Accommodation and Food Services; Administrative and Support Services; and Other Services. Fortunately, the ABS has provided us with unpublished data on public-sector employment, averaged over several years to reduce the problem of high variability of the data for a particular year, from its Employee Earnings, Benefits and Trade Union Membership (EEBTUM) publication (ABS Cat. No. 6310.0). These data were used to calculate the average share of the eight industries named above, so that the data on the number of public-sector employees in 'Other industries' in EEPS could be allocated to each relevant industry according to its share of total employee numbers in 'Other industries'.

## Employment in all selected industries

There appear to be significant differences between the number of employed people estimated using the business surveys versus the LFS under both employment definitions. This is shown in Table 2.

[6] The ABS does state on page 5 of *Australian Industry*, *2011-12* that "PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES increased by 80,000 employees (or 8.7%)", but it is likely when looking at the data further in the publication that this change in employment refers to total employment (which rose by 80,000 from 918,000 at the end of 2010-11 to 998,000 at the end of 2011-12. However, our calculations are that the number of employees in this industry rose by around 81,000 over this time period, so it could also have been referring to an ABS internal estimate of the number of employees in this industry).

*Table 2 - Employment (000s) for all selected industries between 2007-08 and 2015-16[a]*

| Financial year | Employee – Business Surveys[b] | Employee – LFS data | Percentage difference from LFS | Total employment – Business Surveys[b] | Total employment – LFS data | Percentage difference from LFS |
|---|---|---|---|---|---|---|
| 2007-08 | 10,427 | 9,048 | 15.2 | 11,569 | 10,212 | 13.3 |
| 2008-09 | 10,381 | 9,151 | 13.5 | 11,605 | 10,309 | 12.6 |
| 2009-10 | 10,642 | 9,285 | 14.6 | 11,888 | 10,494 | 13.3 |
| 2010-11 | 11,212 | 9,499 | 18.0 | 12,416 | 10,699 | 16.1 |
| 2011-12 | 11,359 | 9,747 | 16.5 | 12,548 | 10,893 | 15.2 |
| 2012-13 | 11,377 | 9,866 | 15.3 | 12,441 | 10,997 | 13.1 |
| 2013-14 | 11,370 | 9,924 | 14.6 | 12,472 | 11,067 | 12.7 |
| 2014-15 | 11,411 | 10,165 | 12.3 | 12,499 | 11,343 | 10.2 |
| 2015-16 | 11,518 | 10,325 | 11.5 | 12,591 | 11,509 | 9.4 |

[a] The All Selected Industries estimates exclude the Financial and Insurance Services industry. All the estimates also exclude contributing family workers and volunteer workers. [b] "Business Surveys" refers to the sum of EAS (private sector) and EEPS (public sector) data.

Employment estimates for all selected industries from the combination of the two business surveys are consistently above those from the LFS for both employment measures. The differences are substantial (i.e., greater than 10 per cent for each year compared, except for total paid employment in 2015-16). These differences grew up to 2010-11, but have declined since then to a lower level in 2015-16 than in 2007-08. Over the nine years shown in Table 1, the average difference between the business-survey estimate and the ABS estimate was 14.6 per cent for Employees and 12.9 per cent for Total Employment.

These differences are statistically significant at a high level of precision, using the standard errors from the LFS as the yardstick. From the relevant ABS Labour Force Survey for May 2013[7], the standard error for the estimated level of total employment in Australia was 37,300 persons. This means that the 95 per cent confidence interval for this level is + or - 73,100 persons. This confidence interval does not change substantially from month to month and the figures compared here cover most of total employment. As can be calculated from Table 2, at the end of 2012-13, the difference between the levels of the LFS and Business-survey data was around 1,444,400 persons. This implies that these differences are indeed statistically significantly different from zero at a very high level of probability.

[7] ABS (2013), *Labour Force, Australia, May 2013*, Cat. No. 6202.0, page 40.

## Industry Differences

For many industries, the percentage differences in employment between the business survey and LFS data are much larger than the aggregate figures presented in Table 2. Table 3 summarises the average percentage differences, for the nine years to 2015-16, for both employment measures.

*Table 3 - Average (%) Difference between Business Survey and LFS Employment data by Industry[a]*

| 2007-08 to 2015-16 | Employees | Total Employment |
|---|---|---|
| Agriculture, Forestry and Fishing | 38.4 | 53.3 |
| Mining | -22.9 | -23.2 |
| Manufacturing | -0.8 | -2.7 |
| Electricity, Gas, Water and Waste Services | 19.8 | 18.7 |
| Construction | 10.9 | 3.0 |
| Wholesale Trade | 41.8 | 41.5 |
| Retail Trade | 7.6 | 7.4 |
| Accommodation and Food Services | 17.6 | 16.1 |
| Transport, Postal and Warehousing | 10.6 | 12.8 |
| Information Media and Telecommunications | -12.1 | -13.7 |
| Rental, Hiring and Real Estate Services | 45.7 | 94.3 |
| Professional, Scientific and Technical Services | 15.4 | 10.4 |
| Administrative and Support Services | 151.0 | 105.5 |
| Public Administration and Safety | -4.6 | -4.9 |
| Education and Training | 10.6 | 6.4 |
| Health Care and Social Assistance | 8.3 | 6.6 |
| Arts and Recreation Services | 14.7 | 4.1 |
| Other Services | 19.0 | 7.6 |

[a]Contributing family workers and volunteer workers are excluded from all the estimates.

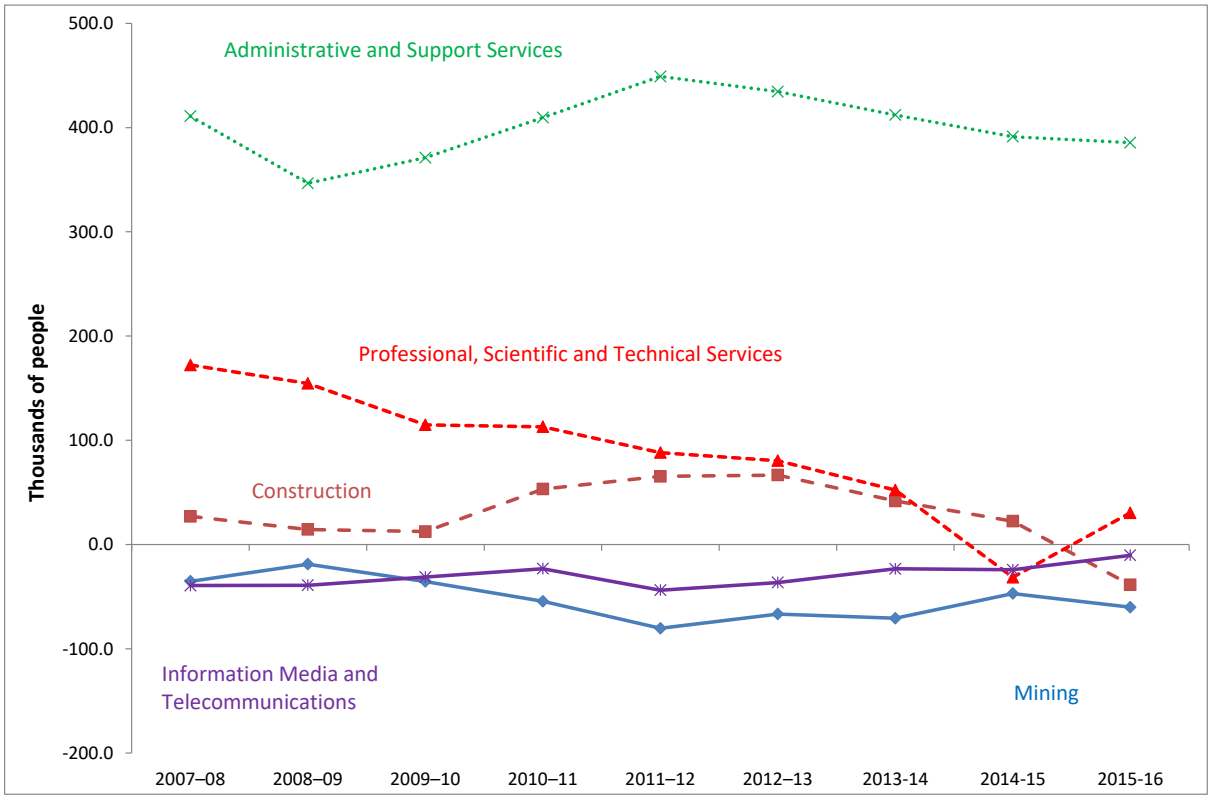
Some of these differences are very large for both employment measures. The prime instance of this is the Administrative and Support Services industry, where the business survey estimates were more than double the LFS estimates, on average between 2007-08 and 2015-16, for both employees and total employment. However, other differences are not so large. For example, for the Manufacturing industry over this time period, the business-survey measure was 0.8 per cent lower than the comparable LFS data in the Employees category and 2.7 per cent lower than the comparable LFS data in the Total Employment category.

The LFS employment estimates were noticeably larger than the business survey data in two industries, for both employment measures. These industries are Mining; and Information Media and Telecommunications.

For Total Employment, these differences are statistically significant for almost all industries, and usually at a very high level of precision, using the standard errors from the LFS as the yardstick. From the relevant ABS Spreadsheet of Standard Errors from the Labour Force Survey, the standard errors were calculated for the level of total employment in each of the selected industries for May 2013[8]. Comparing these with the difference (in thousands of persons) between business-survey and labour-force-survey data revealed that these differences were statistically different from zero at the 95 per cent confidence level (at least, and usually at much higher confidence levels), for all of the selected industries at the end of 2012-13, except: Manufacturing; and Arts and Recreation Services).

Further, for many industries, the differences have not been constant or even changing at a constant rate over time. This is shown for key industries in Figure 1.

*Figure 1 - Differences in Employment between the ABS Business Surveys and LFS for Selected Industries*




Source: Calculated by staff of Labour Economics Section in the Department of Jobs and Small Business from ABS (2017), *Labour Force, Detailed, Quarterly* (Cat. No. 6291.0.55.003); *Australian Industry* (Cat. No. 8155.0) and ABS (2016), *Employment and Earnings, Public Sector, Australia* (Cat. No. 6248.0.55.001). Differences are calculated as the level of employment in business-survey data minus the level of employment in Labour Force Survey data.

[8] ABS (2014), *Labour Force Survey Standard Errors, Data Cube, Feb 2014*, Cat. No. 6298.0.55.001. The standard errors for May 2013 were generated by typing into the spreadsheet the employment estimates from the Labour Force Survey for each relevant industry's level of total employment. The 95 per cent confidence interval was calculated in the usual way of + or – 1.96 standard errors around the level of employment.

A very interesting feature of Figure 1 is that the time series for Mining and Construction generally appear to be mirror-images of each other, with Business-survey statistics being higher for Construction, but lower for Mining, than LFS statistics. Both series moved further away from zero as the construction phase of the mining boom moved towards its peak, but now that this phase is ending, both are closer to zero. As discussed further in the next section, this set of patterns is not a coincidence but comes about due to the different nature of recording industry of employment in the two sets of surveys, with the industry recorded in the LFS based on the householder's perception of the kind of business or service carried out by that person's firm, but the industry recorded in the business surveys based on the industry to which that person's firm is coded. There would have been a significant number of people who would have been working on mining-related activities during the construction phase of the mining boom (such as building infrastructure for a mine), but whose employers would have been in the Construction industry.

This phenomenon did not only affect the Mining and Construction industries. Accordingly, other key industries affected by this phenomenon are included in Figure 1. Administrative and Support Services is included in Figure 1 mainly because people who work for labour hire firms are coded to this industry in the business surveys, but may report in the LFS that they are working in Mining or Information Media and Telecommunications (e.g., if they are working for a labour-hire firm laying fibre-optic cable for a telecommunications network).

Over the last four years, the time series for Administrative and Support Services and Information Media and Telecommunications have headed back towards zero from opposite directions. The series for Professional, Scientific and Technical Services has fallen from above zero (Business Survey employment above LFS employment) to below zero and back above zero again. There would be people working for firms in this industry who would be doing industrial activities for Mining (e.g., geologists) or Information Media and Telecommunications (e.g., electronic engineers).

# Reasons for discrepancies

There are a number of probable reasons for the differences between the business-survey and LFS employment estimates including:

## Differences in methods of collection and coding

In the EAS, the industry of employment is the industry assigned to the business unit on the ABS Business Register. The industry is assigned by the ATO or the ABS, depending on the type of business unit, and is based on a description provided by the business. A single industry class is assigned, irrespective of any diversity of activities undertaken[9].

[9] ABS, *Australian Industry*, Cat. No. 8155.0, explanatory notes, paragraph 18: http://www.abs.gov.au/ausstats/abs@.nsf/Products/8155.0~2010-11~Explanatory+Notes~Explanatory+Notes?OpenDocument#223023122210994954

By contrast, in the LFS, industry of employment is based on the respondent's description of 'what kind of business or service was carried out by [name]'s employer or business at the place where [name] worked [last week]' as well as the name of the person's employer.[10]

A description of business activity provided by the business is likely to differ considerably from a description provided by a worker in that business (or by the member of the household reporting on their behalf). A description provided by the business may be a better reflection of the activities of the business unit as a whole; however, a description provided by a worker may be a better reflection of activities carried out at the workplace site (which is the concept being measured in the LFS).

Scope for misclassification exists in both surveys. Descriptions of business activity provided by businesses or householders can at times be insufficiently detailed to enable accurate industry coding. Each survey also has its own particular potential sources of classification error. In the EAS, the assignment of a single industry class to each business unit, irrespective of any diversity of activities undertaken, provides some scope for secondary and subsequent activities to be misclassified to the primary activity. In addition, in some cases where a business unit operates across industries, reported data are split between the industries involved.[11] Depending on how this splitting is performed, it may result in some degree of misallocation of employment to industries. Indeed, some of those industries in which complex business units (known as type of activity units) make a large contribution to sales and service income[12] are the same industries in which employment estimates from the business-survey data are lower than in the LFS, although why this should be the case is unclear.

In the LFS, there is considerable scope for misclassification, because the respondent may describe the employer with reference to the main customer of the business, rather than the employer's main activity. Indeed, this appears to explain, at least partially, for the business-survey data being substantially below the LFS data for Mining; and Information Media and Telecommunications. It is likely that there has been an increase in employment by contractors and sub-contractors to these industries and some of these workers (or a person responding on their behalf) would describe their employment as relating to Mining or Information Media and Telecommunications, when in fact their industry would be more accurately described as Construction; Professional, Scientific and Technical Services; Rental, Hiring and Real Estate Services; Administrative and Support Services or other industries which supply services to mining and media/telecommunications firms (evidence for this is shown in Figure 1).

The Administrative and Support Services industry is especially noteworthy in this regard because people hired by labour-hire firms are classified as being in this industry, but householders

[10] ABS, *Information Paper: Questionnaires Used in the Labour Force Survey*, 2004, Cat. No. 6232.0: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6232.02004?OpenDocument. While there was a change in the questionnaire in mid-2014, this question has remained unchanged.
[11] ABS, *Australian Industry*, Cat. No. 8155.0, explanatory notes, paragraph 19.
[12] ABS, *Australian Industry*, Cat. No. 8155.0, explanatory notes, paragraph 17. Industries which have a TAU contribution to sales and service income of greater than 50 per cent are Mining (93 per cent); Manufacturing (67 per cent); Electricity, Gas, Water and Waste Services (92 per cent); Transport, Postal and Warehousing (58 per cent); Information Media and Telecommunications (83 per cent); and Arts and Recreation Services (56 per cent).

responding to the ABS LFS may report the industry for which they're working, instead of the industry to which the labour-hire firm belongs. This is probably a substantial part of the explanation of why the business-survey data on employment for this industry are more than double the LFS data.

In the LFS data, the Department of Jobs and Small Business has observed a substantial increase in the number of records categorised to 'Not Further Defined' (NFD) categories since February 2000, which indicates a deterioration in data quality over this period. 'Not Further Defined' categories are used by the ABS to process survey responses which are too incomplete, non-specific or imprecise to be coded to the most detailed level of a classification, but which nevertheless, contain enough information to allow them to be coded to a higher level of the classification structure. Prior to February 2000, industry coding was a clerical process, performed by looking up the name and address of the person's employer on the ABS Business Register. The number of records categorised to NFD categories was negligible (resulting in a combined estimate of less than 3,000 persons at the two-digit ANZSIC level in November 1999[13]). In February 2000, ABS introduced computer-assisted coding for industry and occupation data, in place of manual coding and reference to the ABS Business Register. This change resulted in an increase in NFDs (resulting in a combined estimate of over 50,000 by February 2001), which increased considerably again with the introduction of computer-assisted interviewing in 2003-04 (resulting in a combined estimate of over 220,000 in August 2004). The introduction of computer assisted interviewing may have affected the quality of industry coding because interviewers (especially when the technology was new to them) were not skilled typists and it was therefore a lot of effort to record a detailed description of the activities of the person's employer. The collection of less detailed descriptions from respondents would result in less accurate industry coding. However, the number of people recorded to NFD categories for many industries has fallen in the last three years or so, perhaps because the introduction of the facility to complete Labour Force Surveys on the internet has allowed respondents to describe the industry in which they work more accurately, perhaps because ABS LFS interviewers have improved their recording of the industries in which the respondents work and more likely as a result of these two and other factors.

The large number of NFDs in the LFS data demonstrates the wide divergence between the employment estimates derived from the EAS and the employment data collected in the LFS since the coding process stopped referring to the ABS Business Register. This divergence is likely to be a major reason for the differences in industry employment estimates between the two surveys.

## Business versus household surveys

Both survey types (business and household) serve different purposes. The purpose of household surveys (such as LFS) is to provide information on the labour market activity of the usual resident civilian population of Australia, while business surveys (such as EAS) provide key measures on the income and expenditure of Australian industries. Employment levels are not a primary data item for the EAS, whereas they are for the LFS.

[13] ABS *Labour Force Survey* original data. NFD categories at the two-digit ANZSIC level have been summed here to give an indication of the impact of NFD categories on the data. The scale of the problem is even larger at the three-digit ANZSIC level.

Reflecting their different purposes, the surveys employ very different sample selection and estimation methods. The EAS is designed to provide estimates that reflect Australian businesses, while the LFS is designed to provide estimates that reflect the Australian usual resident population.

The different coverage of both types of surveys may explain a small proportion of the aggregate discrepancies. For example, there is a small amount of double-counting in the business-survey data for employment in the Electricity, Gas, Water and Waste Services industry because local government employment in the Water Supply, Sewerage and Drainage Services subdivision within this industry may be counted in both EAS and EEPS. More broadly, people working in public corporations outside this sub-industry and the Finance and Insurance industry (for which employment estimates are not provided in EAS) are likely to be counted in both EAS and EEPS[14]. Also, only employees are counted in EEPS, but in the LFS, some people might report themselves (or other adults in the household for whom they're responding) to be employers or own-account workers who are working in the public sector. There would also be a small degree of double-counting through combining data from the EAS and EEPS to provide the business-survey estimate of employment, for another reason; namely, that there would be a relatively small number of multiple jobholders who are both public-sector employees (and so counted in EEPS) and working a second job in the private sector (and so counted in EAS).

## Multiple jobholders

The EAS counts employment in terms of jobs rather than employed persons, while the LFS counts the number of employed persons rather than job numbers. For people who are multiple jobholders, they are likely to be counted more than once in the employment data in EAS (since there do not appear to be any checks in this survey to ensure that multiple jobholders are only counted once), but only counted once according to the industry of their main job in the LFS data. It is also possible that people could be counted more than once in EEPS (e.g., if they have two part-time jobs in different parts of the public sector) or counted in both EEPS and EAS (e.g., if their main job is in the public sector, but they have a part-time job in the private sector).

The latest estimate of the ratio of jobs filled by multiple jobholders to employment that the authors have so far been able to calculate from freely available and readily interpretable ABS sources is 5.7 per cent in February 2013[15], which corresponds with an incidence of multiple job holding of 5.3 per cent. Further, in an earlier release (*Australian Social Trends, September 2009*, ABS Cat. No. 4102.0),

14 The authors were not able to obtain estimates of the number of people working in public corporations, either overall or by industry, in the freely available data released by the ABS in either EEPS or EAS, and so were not able to make an adjustment for this double-counting.

15 Source: calculated from statistics in "Estimating Jobs in the Australian Labour Market", Feature Article in ABS (2013), *Labour Force, Australia, February 2013*, ABS Cat. No. 6202.0. The ratio of jobs filled by multiple job holders to employment is around eight per cent higher than the incidence of multiple job holding, because some multiple job holders have three or more jobs. There are some more recent figures available from the ABS's Linked Employer-Employee Database (see for example, ABS (2015), *Information Paper: Construction of Experimental Statistics on Employee Earnings and Jobs from Administrative Data, Australia, 2011-12*, ABS. Cat. No. 6311.0), but the ABS describes these estimates as "experimental" and they can be difficult to interpret (there are two concepts of multiple job holding in these statistics, with one of them relating to the number of jobs held throughout a year).

the ABS also reported that the "incidence of multiple job holding has not changed much since the 1990s, hovering around 5% to 6%". It is likely then, that multiple job holding could explain as much as half of the discrepancy in total employment numbers in all selected industries shown in Table 2.

In the above-mentioned *Australian Social Trends* article on multiple job holding, the ABS also reports that:

> *The industries in which the majority of multiple job holders held their second job were retail trade (14% of all second jobs), health care and social assistance (12%), education and training (10%), accommodation and food services (9%) and agriculture, forestry and fishing (9%).*

As can be seen in Table 3, Accommodation and Food Services; and Agriculture, Forestry and Fishing; are both industries in which the EAS employment estimates are substantially higher than the LFS estimates. It is therefore likely that the uneven distribution of multiple job holding helps to explain the discrepancies among industries.

## Child workers

Children (persons aged 14 years and younger) are not included in the working-age (adult) population for the LFS. However children are able to work, provided they do not work full-time and satisfy other conditions (including school attendance and restrictions on particular work activities such as serving alcoholic drinks). It is not clear from the descriptions of employment in the *Australian Industry* publication that children aged 14 years and younger are excluded from the EAS and so this is a likely partial explanation of why the EAS statistics are larger than the LFS statistics.

Statistics on working children are limited, although the ABS publication *Child Employment, June 2006* (ABS Cat. No. 6211.0) reports that 95,100 children aged between 5 and 14 years were likely to have been paid employees[16] over the 12 months to June 2006. This is likely to explain some of the discrepancies between the business-survey data and the LFS. According to the publication, working children (aged between 5 and 14 years) were most likely to be employed as Farm, Forestry and Garden Workers; Leaflet or Newspaper Deliverer; Cleaners and Laundry Workers; and Community and Personal Service Workers. These four occupations accounted for 55 per cent of all children who were employed.

The children employed across these occupations may explain some of the discrepancies in employment between business-survey data and the LFS data at an industry level. For example a number of children working as Farm, Forestry and Garden Workers are likely to be employed in the Agriculture, Forestry and Fishing industry (where there are large differences in employment estimates between the business-survey data and the LFS data). Similarly child employees working as

[16]In the publication *Child Employment, June 2006* (ABS Cat. No. 6211.0), the term "worker" includes variations of unpaid work, therefore paid employees in this paper are assumed to be workers which worked under the sub-category of workers who worked for an employer. It is also worth noting that the although 95,100 children were estimated to be paid employees over the 12 months to June 2006, not all of them would have been working at the end of June 2006, and the end of June is the reference period for the EAS.

food preparation assistants are likely to be working in the Accommodation and Food Services industry, where there are also large discrepancies between the two data sets.

### Non-Australian-resident employees

It is probable that the EAS would count many employed people who are not Australian residents (i.e., foreign students, Working Holiday Makers and other temporary entrants who don't meet the 12-months-out-of-16-months residency rule for being counted as part of Net Overseas Migration) while the LFS would only include Australian residents by design. Tan et al (2009) found that Agriculture, Forestry and Fishing and Accommodation and Food Services were the industries which were most likely to employ Working Holiday Makers. This could likely explain some of the differences in employment estimated between these two industries.[17]

### Other

This is not an exhaustive list. There are other reasons for differences between the two sources but these appear to be small. For example, there are a small number of Australian residents working for non-resident entities, such as locally engaged staff working for foreign Embassies and High Commissions in Australia, who are likely to be counted in the LFS, but would be out of scope for being included in business surveys[18].

## Attempt to reconcile the difference in employment estimates

In this section of the paper, we will present the results of our attempt to reconcile the differences between the business-survey and LFS data in aggregate[19]. Unfortunately the authors have found it difficult to find reliable data to use in reconciling the difference for each individual industry. Therefore this section will be concentrated on reconciling the difference at an aggregate level.

This section will give an indication of the extent to which the reasons presented earlier can account for the difference between the two survey data sets. The two reasons for the discrepancies which will be explored in this section are **Multiple jobholders** and **Non-Australian-resident Employees**. In order to quantify these two groups, a number of assumptions of both these groups will be made. The employment definition which is used in this section is Total Employment, as it is more comprehensive than the definition of Employees.

### Multiple jobholders

While the number of multiple jobholders is not regularly published, the authors were able to find the proportion of multiple jobholders relative to employment for select periods between 1987 and

[17] Tan, Y. et al (2009), *Evaluation of Australia's Working Holiday Maker (WHM) Program*, National Institute of Labour Studies, Flinders University, Adelaide, Australia, page 2.
[18] The authors would like to thank Jennifer Humphrys and Ian Ewing of the ABS for providing information on this area of difference between the two ABS sources of employment statistics.
[19] Excluding the Financial and Insurance Services industry.

2013)[20]. During this period, the rate ranged between 3.7 and 6.3 per cent, with a slight upward trend. These rates were used for the periods when they were available. For the periods when they were not available, the closest equivalent rate was used. They were then converted to the ratio of jobs filled by multiple jobholders to the number of multiple jobholders by multiplying them by the constant ratio of 1.079[21], which adjusts for the fact that some multiple jobholders hold three or more jobs. This is the method used by the ABS in its Feature Article, "Estimating Jobs in the Australian Labour Market", in *Labour Force, Australia, February 2013* (ABS Cat. No. 6202.0). This conversion was done because the statistics on 'employment' and 'employees' in the business-survey data would appear to relate more closely to the number of jobs filled than the number of persons employed. Table 4 below shows the approximate number of jobs filled by multiple jobholders between 2007-08 and 2015-16.

*Table 4 - Estimated Numbers of Jobs Filled by Multiple Jobholders (000s)*

| 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|---|---|---|---|
| 628 | 634 | 714 | 615 | 711 | 705 | 707 | 708 | 713 |

## Non-Australian-resident employees

As discussed Non-Australian-resident Employees are likely to be counted in the EAS employment data and probably also the EEPS data, but not the LFS employment data.

Three groups which are identified as Non-Australian-resident Employees are employees who visit Australia to work for less than 12 months (which includes working holiday maker visa holders), working international students who stayed in Australia less than 12 months, and possibly visitors for business purposes (who can work in Australia under certain circumstances).

In the publication *Overseas Arrivals and Departures* (Cat. 3401.0), the ABS publishes the aggregate flow of entrants into Australia with the main reason of visit and intended length of visit. Short-term visitor arrivals (these are entrants with the intention of staying in Australia less than 12 months) with the main reason of employment, education and business are used by the authors to estimate the likely number of Non-Australian-resident Employees.

[20] Data for 1987, 1991, 1994 and 1997 were found in ABS *Multiple Jobholding,* August 1997 (Cat.No. 6216.0); data for the years 2000, 2005 and 2008 were found in ABS *Locations of* Work June 2000, November 2005 and November 2008 (Cat.No. 6275.0), data for the years 2006 and 2009 were found in ABS *Working Time Arrangements,* November 2006 and November 2009 (Cat.No. 6342.0). For 2011-12 and 2012-13, the percentage of multiple jobholders used was 5.3 per cent. This was calculated from statistics on the numbers of multiple jobholders and employed people as at February 2013, from "Estimating Jobs in the Australian Labour Market", Feature Article in ABS (2013), *Labour Force, Australia, February 2013*, ABS Cat. No. 6202.0. ABS *Multiple Jobholding* (Cat. No. 6216.0) is only available in electronic form from www.abs.gov.au for the 1997 publication.

[21] This ratio is obtained by dividing the number of jobs filled by multiple jobholders by the number of multiple jobholders, to take account of the fact that some multiple jobholders work three or more jobs. The ratio is constant, as was also assumed by the ABS in "Estimating Jobs in the Australian Labour Market", Feature Article in ABS (2013), *Labour Force, Australia, February 2013*, ABS Cat. No. 6202.0. This is because the only recent relevant ABS data on this ratio is from ABS (2009), *Employment Arrangements, Retirement and Superannuation, Australia, April to July 2007 (Re-issue)*, ABS Cat. No. 6361.0.

Assumptions surrounding short-term entrants entering for the purposes of employment, education and business are made to obtain the most accurate estimate of Non-Australian-resident Employees. These assumptions are:

- As the data sets for short-term entrants represents the flow of entrants coming into Australia, it is possible an entrant who enters Australia for either the purpose of employment, business or the purpose of studying will only stay for a short period and not the whole 12 months; using the whole data flow over the 12 months would imply everyone who came in one month stayed for the entire 12 months. This is unlikely and therefore an average length of time of visit is assumed.
- For visitors entering for the purpose of employment this average length of time is assumed to be eight months[22]. For education we have assumed that these entrants are likely to stay for 10 months; it was assumed that few international study programs would be shorter than 10 months[23]. For entrants entering for the purpose of business we have assumed that these entrants are likely to stay for one month on average (business visits include business-related meetings, informal training, business negotiations and exploratory visits).
- It is also likely that the entrants coming to Australia for the purpose of employment are not necessarily employed for their whole stay in the country. We assume 93 per cent of entrants entering for the purpose of employment are employed (93 per cent was estimated by subtracting the average rate of unemployment since February 1978 which is roughly 7 per cent). For entrants entering for the purpose of education a lower amount of only 60 per cent are assumed to be employed[24].For the purpose of business our central assumption is that none are employed (although in the sensitivity analysis there is one scenario where 30 per cent is assumed as the business visa types can allow short-term work in Australia under strictly limited circumstances; e.g., in highly specialised occupations).

[22] Tan, Y. et al (2009) found that Working Holiday Makers (which is likely to make up a proportion of this group) on average stay in Australia for eight months. While our group is not exclusively working holiday makers; for the purpose of this paper eight months is used as an average time of stay in Australia for all entrants entering for the purpose of employment. (Tan et al, 2009, Evaluation of Australia's Working Holiday Maker (WHM) Program, National Institute of Labour Studies, Flinders University, Adelaide, Australia).

[23] An article (titled *International students*) in the ABS publication: *Australian Social Trends, December 2011* (Cat. No. 4102.0) states "*International students study a range of different courses in Australia. While a small proportion study in schools and other post-secondary courses, most international students (80%) were engaged in Higher Education and VET courses in 2010, with some of these students having also studied English through an ELICOS provider"*. Higher Education (e.g university), VET courses and the longer English training courses can run up to and exceeding 10 months (http://www.studyinaustralia.gov.au/en/Courses/Academic-Year).

[24]Nyland, C. et al (2008), *International Student-Workers in Australia: A New Vulnerable Workforce,* University of Melbourne, conducted a survey of international students (about 200 students) in 2005. The students were not asked to indicate the years which they were employed; rather, just if they were employed while studying. Nyland et al (2008) found that about 57 per cent of the international students surveyed indicated they were employed at the time while in Australia. A further 13 per cent indicated they had worked at some time while studying in Australia, meaning 70 per cent (of international students) worked at some stage. From this finding we approximated 60 per cent of these international students were likely to be employed. We approximate 60 per cent instead of 70 per cent as the students in the survey by Nyland, C et al. (2008) included all international students and our study concentrates on students who are in Australia less than 12 months.

Once the assumptions mentioned above were taken into account, the likely number of measured working Non-Australian-resident Employees between 2007-08 and 2015-16 is shown in Table 5.

*Table 5 - Estimate of Non-Australian-resident Employed People (000s)*

| 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|---|---|---|---|
| 259 | 267 | 279 | 296 | 309 | 313 | 309 | 407 | 397 |

There were large increases in short-term arrivals for both employment and education/study purposes between 2013-14 and 2014-15 that have continued in 2015-16[25]. One of the probable explanations for the rise in short-term arrivals for education/study purposes is that the devaluation of the Australian dollar since 2013-14 would have made it more affordable for overseas students to be educated in Australia (for example, the value of the Australian dollar on the RBA's Trade Weighted Index fell 5.1 per cent between 2013-14 and 2014-15)[26].

## Total amount reconciled

Once both the estimated numbers of Non-Australian-resident Employees and Jobs Filled by Multiple Jobholders are added to the LFS Total Employment category (which includes employers, employees and own-account workers) the new difference between the two data sets is significantly reduced. This is shown in Table 6.

*Table 6 – Reconciliation of Estimates of Employed People[a] (000s)*

| Financial Year | Business Survey Data[b] | Adjusted LFS Employment | Remaining Difference (%) |
|---|---|---|---|
| **2007-08** | 11,569 | 11,099 | 4.2 |
| **2008-09** | 11,605 | 11,210 | 3.5 |
| **2009-10** | 11,888 | 11,486 | 3.5 |
| **2010-11** | 12,416 | 11,610 | 6.9 |
| **2011-12** | 12,548 | 11,913 | 5.3 |
| **2012-13** | 12,441 | 12,015 | 3.5 |
| **2013-14** | 12,472 | 12,083 | 3.2 |
| **2014-15** | 12,499 | 12,458 | 0.3 |
| **2015-16** | 12,591 | 12,619 | -0.2 |

[a] That is, total employment (i.e., not just employees) in all industries except Financial and Insurance Services.
[b] That is, the combination of EAS and EEPS data as explained earlier in this paper.

[25] This has been calculated by the authors from data in original terms from Spreadsheet 340106.xls from ABS (2016), *Overseas Arrivals and Departures, March 2017*, ABS Cat No. 3401.0, downloaded from www.abs.gov.au.
[26] This has been calculated by the authors from data in original terms from Spreadsheet f11hist.xls from the Statistics webpage on the RBA's website (www.rba.gov.au).

The average difference remaining after these adjustments are made, over the nine years to 2015-16, is 3.4 per cent. Another way of looking at these results is that the adjustments for multiple job holding and non-resident employment go around three quarters of the way to reconciling the differences between the two data sets[27].

A sensitivity analysis was conducted about the assumptions for short-term temporary entrants working in Australia, to explore the extent to which this affects the reconciliation of differences in total employment for all selected industries. The assumptions and a summary of results are shown in Table 7.

*Table 7 - Summary of Sensitivity Analysis of Employment of Short-term Temporary Residents in Australia*

| Scenario | High | Medium | Low |
|---|---|---|---|
| **Months in Australia by purpose** | | | |
| - Employment | 10 | 8 | 7 |
| - Education | 11 | 10 | 9 |
| - Business | 2 | 1 | 1 |
| **% Employed by purpose** | | | |
| - Employment | 95 | 93 | 90 |
| - Education | 70 | 60 | 50 |
| - Business | 30 | 0 | 0 |
| **Average % Difference between Business-survey and Adjusted LFS data between 2007-08 and 2015-16** | **2.4** | **3.4** | **3.9** |

As shown in Table 7, the results are not particularly sensitive to this range of assumptions about short-term temporary residents working in Australia. The aggregate discrepancies are not eliminated even with the high assumptions about length of stay in Australia and percentage employed by category.

# Implications

There are some wide-reaching implications of these differences in employment numbers between business-survey data and LFS data. Firstly there are the direct effects of large differences in reported levels and growth rates of employment by industry depending on which source is used. This means that the results are likely to vary substantially for many industries depending on which data source is used.

[27] This percentage is calculated in the following way. Averaged over the nine years to 2015-16, the initial difference between the two data sets for total employment is 12.9 per cent. The remaining difference after the adjustments is 3.4 per cent. Therefore the percentage removed by the adjustments is (12.9-3.4)/12.9 * 100 or around 74 per cent.

There could also arise a degree of confusion as to which data source to use when reporting employment. This is a larger problem than if the data on employment by industry were similar in each source.

Secondly, for many data items there is restricted choice as to which survey to use. As instances, data by industry on average hours worked is not available from EAS, while data on employment by industry for small, medium and large firms is not readily available from the LFS. This is likely to mean that the data obtainable for particular variables by industry (such as small business employment in the Administrative and Support Services industry) are likely to be inconsistent with other variables (such as average hours worked) for the same industry.

Thirdly, the implications can be particularly important for variables by industry, such as labour productivity, average compensation per hour worked and unit labour costs that are calculated using a combination of business-survey and LFS data.

Depending on the industry:

- current labour productivity estimates for industry are likely to be over- or under-estimated
- compensation of employees per hour worked is also likely to be over- or under- estimated.

Fourthly, there could be a problem with the estimation of the aggregate labour productivity level and growth rate as a result of the differences between the two sets of employment statistics for all selected industries.

There are likely to be implications for other areas of economic analysis, but these are four of the key areas. While it would be unfeasible to describe fully all implications of these findings in this paper, some illustrative examples and suggestions for dealing with the effects of these differences are described in the rest of this Section.

## Employment by business size by industry

Problems can arise if numbers of people employed by business size, from *Australian Industry*, are compared directly with the total number of people employed from the LFS, by industry. A prime example of this is Agriculture, Forestry and Fishing, where the number of people employed in small businesses at the end of June 2016 is estimated to be 385,000[28]. This number is around 51,000 higher than the **total** number of people employed in this industry, as recorded in the LFS, for May 2016 (the nearest equivalent date, with both figures being in original terms[29]). Some ways of circumventing or reducing these problems are: to avoid making direct comparisons between employment numbers in the two different surveys; to provide the total employment (across small, medium and large businesses) in the relevant industry as reported in *Australian Industry* at the same time as the statistics by business size are reported; to report the statistics by business size as

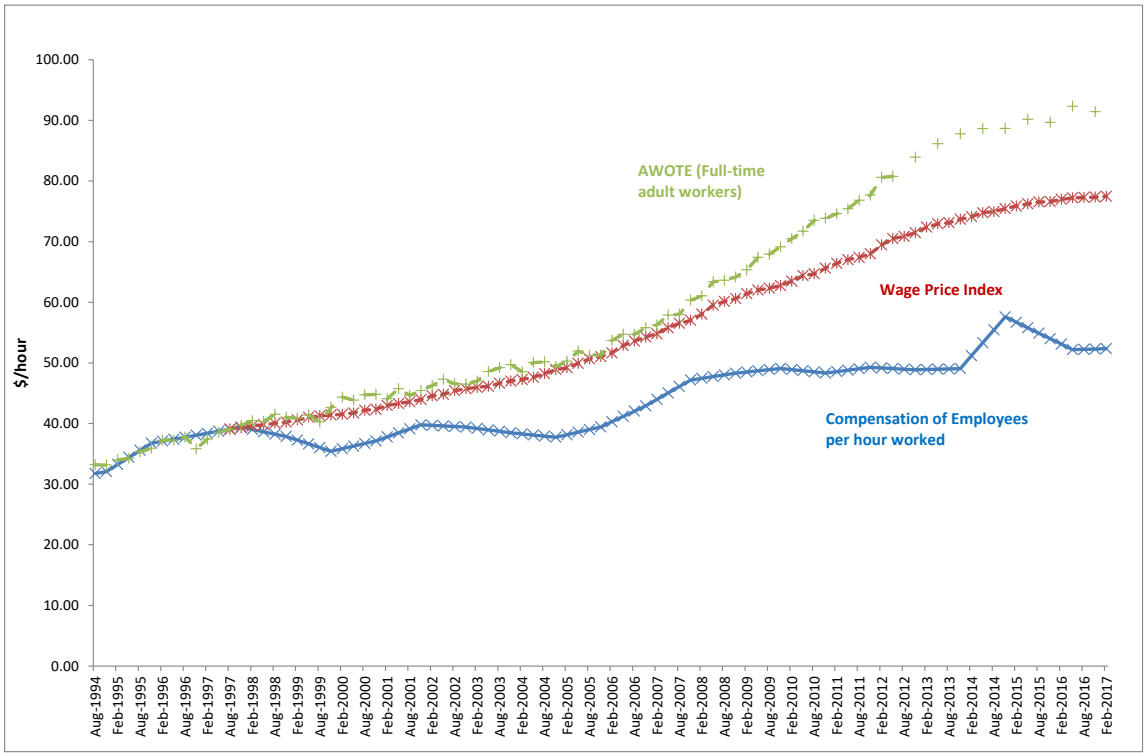
[28] ABS (2016), *Australian Industry, 2015-16*, Cat. No. 8155.0, spreadsheet 1 (81550do001_201516.xls), Table 5.
[29] This is calculated using the reported LFS figure for total employment, which includes Contributing Family Workers, from Spreadsheet 4 in ABS Cat. No. 6291.0.55.003.

percentages of total employment and not as raw numbers; and/or to provide caveats about the statistics on employment by business size being on a different basis to the LFS statistics.

## Wage and average compensation measures by industry

The findings about the differences in employment by industry between business-survey and LFS data have implications for the use of average compensation per hour worked (and possibly also per employee) as a measure of wages for some industries. If one calculates average compensation per hour worked for an industry using business-survey data for total compensation of employees (or wages and salaries) on the numerator, but uses LFS data on total hours worked (or the number of employees) on the denominator, then the results can be adversely affected by the difference in employment estimates by source of data. ABS statistics for wages, whether from the *Average Weekly Earnings* (Cat. No. 6302.0) or the *Wage Price Index* (Cat. No. 6345.0), are unaffected by this influence, because they are calculated within the one survey. A prime example of the divergence that can arise in measures of wages and average compensation per hour worked is in the Mining industry, as shown in Figure 2.

*Figure 2: Alternative Measures of Wages and Average Compensation in Mining*




Sources: Average compensation per hour worked in Mining was calculated using the following steps. Annual average compensation per hour worked was calculated first by dividing total compensation of employees (from Spreadsheet 46 in the ABS's *Annual System of National Accounts*, Cat. No. 5204.0) by the level of hours worked by employees for the four quarters of the same financial year (calculated from ABS Labour Force Statistics in Cat. No. 6291.0.55.003). These were then linearly interpolated to provide quarterly estimates. Quarterly or biannual statistics on Average Weekly Ordinary Time Earnings for Adults working Full-time (AWOTE) wages from *Average Weekly Earnings* (Cat. No. 6302.0) and the wage price index from *Wage Price Index* (Cat. No. 6345.0) were then indexed to the calculated level of average compensation per hour worked for the September quarter 1997 (the start of the Wage Price Index).

A key reason why this divergence arises in Mining is that the number of employees in the LFS was growing at a faster rate than the number of employees calculated from business-survey data during the mining construction boom. However, with the ending of this phase in 2014-15, there has been a diminution in the discrepancy between the Wage Price Index and average compensation per employee since 2013-14.

As shown in Figure 2, the calculated series for average compensation of employees per hour worked has been growing at a slower rate than the two directly reported wage series[30] since mid-1998. A likely key reason for this slower growth rate is that numerator is based basically on business-survey data, while the denominator is based on LFS data (where the number of employees has been growing at a faster rate than in the business-survey data during the mining construction boom).

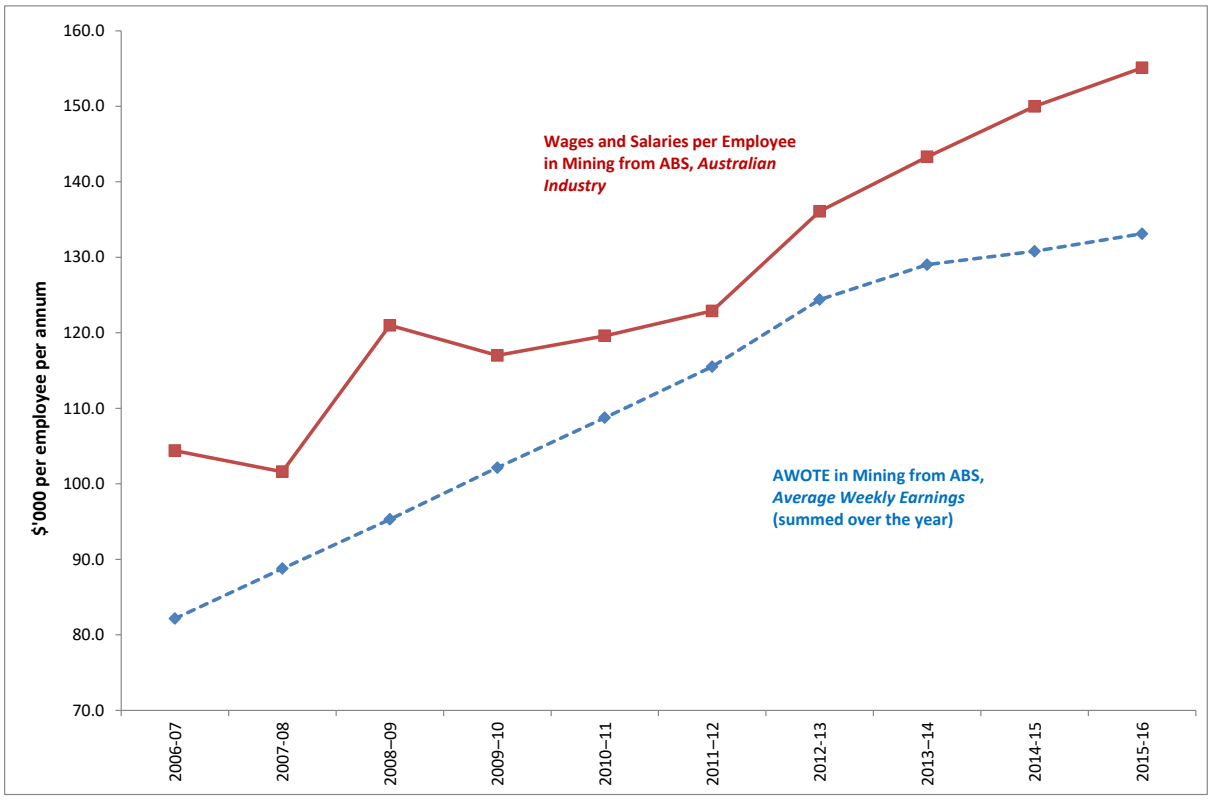
There are other potential reasons for the divergence among these three series. One is that the wage series from the *Wage Price Index* (WPI) would relate to the hours for which people are paid, but the average hours series used as the denominator for the calculation of average compensation in Figure 2 is for the hours actually worked. Hence, if there are changes in unpaid overtime in the Mining industry, this might cause a divergence between the WPI series and the average compensation series. This potential reason is probably not a major contributor to the divergence between these two series, although it is hard to ascertain this.

There are a number of possible ways of handling this divergence. One is to use wage data directly from the relevant ABS surveys (such as *Average Weekly Earnings* or the *Wage Price Index*) instead of calculating average compensation per hour worked from separate sources, where feasible[31]. Another is to calculate average compensation using estimates of the number of employees from business-survey data instead of LFS data. Better still, data on wages and salaries per employee can be used directly from the business-survey data. A comparison where this was done is shown in Figure 3.

[30] A separate issue that can be noticed from Figure 2 is that the AWOTE series has been rising at a faster rate than the Wage Price Index series between mid-2005 and the end of 2016. This seems to be unconnected with the data-comparison issues raised in this paper and probably mainly reflects the situation that AWOTE wages are more affected by compositional change than the Wage Price Index series.

[31] This is not always feasible. For example, the ABS does not publish statistics on wages in Agriculture, Forestry and Fishing in either of these two publications.

*Figure 3 - Alternative measures of annual wages in mining*




Sources: Wages and Salaries per Employee in Mining from ABS (2017 and previous issues), *Australian Industry* (ABS Cat. No. 8155.0); Average Weekly Ordinary Time Earnings for adults working full-time (AWOTE) in Mining from ABS (2017 and previous issues), *Average Weekly Earnings* (ABS Cat. No. 6302.0), with weekly figures converted firstly to quarterly (my multiplying by 13), then summed over the four quarters of the year (up to mid-2012) or bi-annual figures summed and multiplied by 26 (for 2012-13 onwards), when the ABS only published Average Weekly Earnings bi-annually.

As can be seen from Figure 3, this method leads to less divergence in the direction of movement over time (both series move upward, although over short periods of time, each series moves at different rates of growth). However, for some of the years shown in Figure 3, there is a substantial divergence between the levels of the two series. Also, the average compensation series from *Australian Industry* are only available annually and for a short span of years with the current survey, whereas data on average compensation per employee by industry can be calculated on a quarterly basis for a much longer period.

## Productivity by industry

The levels and growth rates of productivity by industry are an important issue in Australian economic analysis, such as in the analytical work conducted for the Review of the *Fair Work Act*[32]. There are likely to be substantial issues with reported or calculated statistics for productivity for

[32] Fair Work Act Review Panel (2012), *Towards more productive and equitable workplaces: An evaluation of the Fair Work legislation*, Australian Government, August.

some industries, as a result of the data-comparison issues described in the current paper. This is particularly pertinent for labour productivity[33], and so the likely effects on labour productivity are now discussed.

For calculations of the level of labour productivity, the problem arises because the numerator (real Gross Value Added or an alternative output measure such as Gross Output) for calculating labour productivity is generally based on business-survey data in the quarterly *National Accounts*, but the denominator (total hours worked) is based on LFS data.

However, quite different measures of the level of labour productivity are estimated[34] for particular industries if the business-survey data for total employment are used instead of the LFS data, as shown in Table 8. Because the employment data are used as the denominator for these calculations, the percentage differences are the reciprocal of those shown in Table 3. For example, the estimates of labour productivity levels for both Rental, Hiring and Real Estate Services; and Administrative and Support Services; are around half as high using the business-survey employment data, than using the LFS data. This is the consequence of the levels of total employment for both of these industries being around twice as high in the business-survey data as in the LFS data.

There are also implications for calculations of growth rates in labour productivity by industry. In terms of recent policy deliberations and debates, there has been substantial attention paid in Australia to estimates that labour productivity has declined substantially in Mining; and Electricity, Gas, Water and Waste; after the turn of the Century[35].

[33] These issues also apply, but to a lesser extent, to calculations of multifactor productivity. The effect is smaller because the denominator for multifactor productivity calculations is a weighted average of labour inputs (which are affected by the issues identified in this paper) and capital inputs (which are unaffected).
[34] Since the business-survey data don't contain information on average or total hours worked, this calculation can only be done in terms of output per person employed.
[35] The decline in measured labour productivity in both of these industries between the turn of the Century and around 2010 was described in Eslake, S. and Walsh, M (2011), *Australia's Productivity Challenge*, Grattan Institute, February. The decline in the mining industry up to 2013-14, and recovery in the year to 2014-15, was described in Davis, K., McCarthy, M. and Bridges, J. (2016), The Labour Market during and after the Terms of Trade Boom, *Bulletin – March Quarter 2016*, 1-10, Reserve Bank of Australia, downloaded from www.rba.gov.au on 31 January 2017.

*Table 8 - Estimates of labour productivity by industry using Business Survey and LFS Employment data[a]*

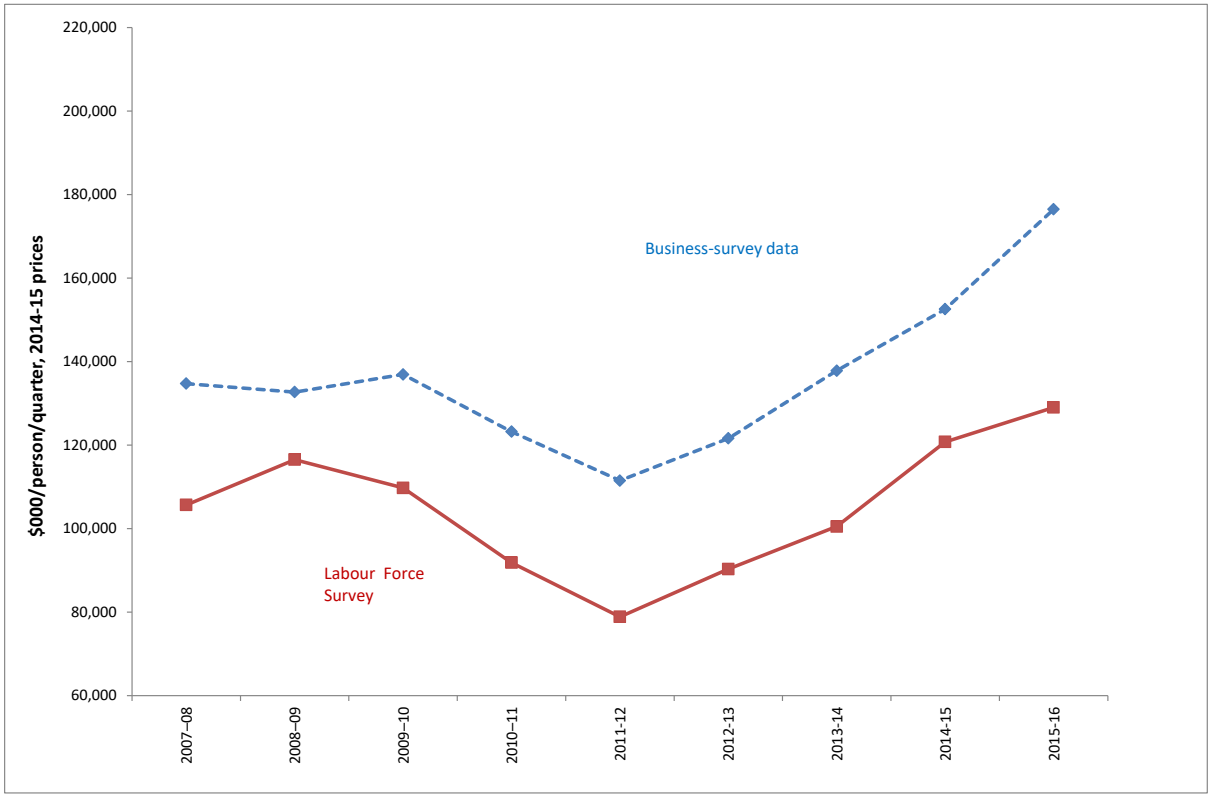
| Labour Productivity | Labour Productivity (business-survey data, $/person/quarter) | Labour Productivity (LFS data, $/person/quarter) | Difference from LFS data (%) |
|---|---|---|---|
| Agriculture, Forestry and Fishing | 18,939 | 29,059 | -34.8 |
| Mining | 136,402 | 104,822 | 30.1 |
| Manufacturing | 28,737 | 27,952 | 2.8 |
| Electricity, Gas, Water and Waste Services | 61,478 | 72,966 | -15.7 |
| Construction | 29,162 | 30,024 | -2.9 |
| Wholesale Trade | 27,706 | 39,207 | -29.3 |
| Retail Trade | 12,684 | 13,617 | -6.9 |
| Accommodation and Food Services | 10,277 | 11,915 | -13.7 |
| Transport, Postal and Warehousing | 28,358 | 31,986 | -11.3 |
| Information Media and Telecommunications | 55,801 | 48,272 | 15.6 |
| Rental, Hiring and Real Estate Services | 25,159 | 48,846 | -48.5 |
| Professional, Scientific and Technical Services | 24,551 | 26,986 | -9.0 |
| Administrative and Support Services | 14,169 | 29,131 | -51.4 |
| Public Administration and Safety | 30,007 | 28,475 | 5.4 |
| Education and Training | 19,495 | 20,728 | -6.0 |
| Health Care and Social Assistance | 17,185 | 18,315 | -6.2 |
| Arts and Recreation Services | 14,626 | 15,197 | -3.8 |
| Other Services | 14,971 | 16,078 | -6.9 |

[a]Labour productivity is calculated in terms of trend real Gross Value Added (GVA) $/employed person/quarter. The units are $/employed person/quarter in 2014-15 prices and the estimates are averaged between 2007-08 and 2015-16. The trend real GVA statistics are obtained from Spreadsheet 6 in the ABS quarterly *National Accounts* (Cat. No. 5206.0) and are for the June quarter of each year (so that they are aligned with the employment data, which are also for the June quarter). Contributing family workers and volunteer workers are excluded from all the estimates. Percentage differences are calculated on unrounded estimates.

However, it is very likely that some of the estimates of the rate of decline in these two industries, up until very recently, have been overstated. This is because these estimates are based on business-survey data on output in the numerator, while the denominator (aggregate hours worked) is based mainly on LFS data, and LFS estimates of employment in these two industries has been growing at a faster rate than business-survey estimates, until very recently. In Figure 4, the two alternative sets of estimates of labour productivity (output per person employed) in Mining are presented.

Using the business-survey data, labour productivity did not deteriorate as much as in the standard measure (based on the LFS) in the lead-up to the peak of the mining construction boom (i.e., between 2008-09 and 2011-12), but then did not rise as much as in the standard measure, between then and 2014-15.

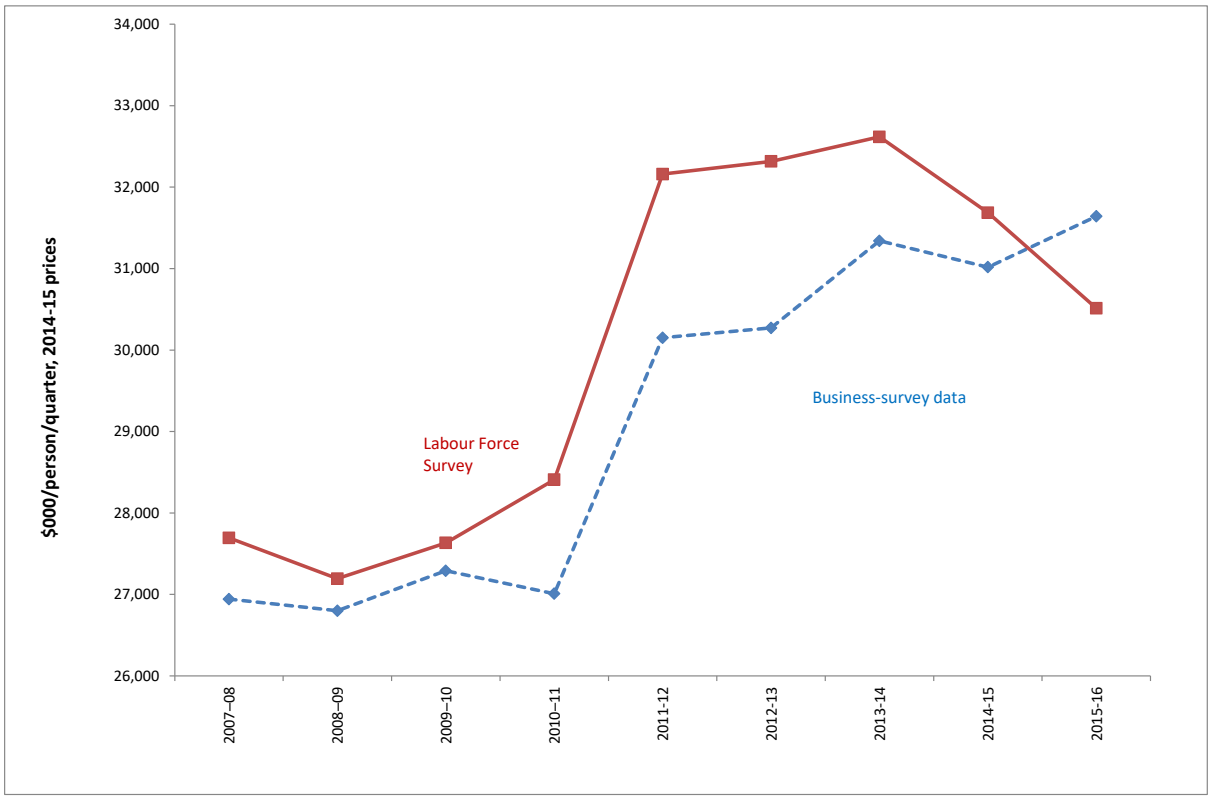
*Figure 4 - Labour Productivity (Output per Person Employed) in Mining*




Sources: Calculated by staff of Labour Economics Section in Department of Jobs and Small Business from ABS (2017), *Labour Force, Detailed, Quarterly* (Cat. No. 6291.0.55.003); *Australian Industry* (Cat. No. 8155.0); *Employment and Earnings, Public Sector, Australia* (Cat. No. 6248.0.55.001) and *Australian National Accounts: Income, Expenditure and Product, March quarter 2017* (ABS Cat. No. 5206.0).

This effect works in reverse for some other industries. Using the mirror-image pattern between the Mining and Construction of differences in employment measures shown in Figure 1 as a guide, the two measures of labour productivity in Construction are shown in Figure 5. Using the business-survey measure, labour productivity did not rise as much as in the standard measure at the peak of the mining construction boom (especially between 2008-09 and 2011-12), but then hasn't stagnated and then fallen since this peak as in the standard measure, but instead has continued to grow since 2011-12.

*Figure 5 - Labour Productivity (Output per Person Employed) in Construction*




Sources: Calculated by staff of Labour Economics Section in Department of Jobs and Small Business from ABS (2017), *Labour Force, Detailed, Quarterly* (Cat. No. 6291.0.55.003); *Australian Industry* (Cat. No. 8155.0); *Employment and Earnings, Public Sector, Australia* (Cat. No. 6248.0.55.001) and *Australian National Accounts: Income, Expenditure and Product, March quarter 2017* (ABS Cat. No. 5206.0).

This reverse pattern also applies to some other industries. For example, for Accommodation and Food Services, we calculate that labour productivity (per person employed) over the eight years to the June quarter 2016 has fallen by 6.2 per cent using LFS data, but by 10.2 per cent using business-survey data.

## Unit labour costs by industry

As a consequence of the implications for average compensation per hour worked and labour productivity by industry, as explained in the last two sub-sections, these findings will also have implications for the estimation of unit labour costs (in both real and nominal terms) by industry. However, these implications are fairly complex to determine, because unit labour costs depend on both average compensation and labour productivity.

As shown in the ABS documentation of its concepts, sources and methods for its National Accounts[36], the general formula it uses to calculate unit labour costs is:

[36] ABS (2012), *Australian System of National Accounts: Concepts, Sources and Methods, Australia, 2012, Edition 3*, ABS Cat. No. 6216.0, p. 461.

Unit Labour Costs = Average Labour Costs/Average Labour Productivity

The ABS[37] then states that average labour costs "are generally calculated as compensation of employees plus payroll tax minus employment subsidies divided by total hours worked by employees".

Since average compensation (which depends on the number of employees) is the largest component of the numerator (in Australia, payroll tax and employment subsidies are numerically small compared with compensation of employees) and labour productivity (which depends on total employment) appears on the denominator of the formula for unit labour costs, the effect of the findings of this paper on unit labour costs depends on whether there is a greater effect on employees or total employment. As shown in Table 3, there is a substantial variation for many industries between the estimates for employees and the estimates for total employment, in the gaps between business-survey and LFS data. For example, in Agriculture, Forestry and Fishing, the gap is 38.4 per cent for employees, but 53.3 per cent for total employment.

## Aggregate labour productivity

As can be calculated from the figures shown in Table 2, the level of total employment from business-survey data is 12.9 per cent higher, on average, than that from LFS data, over the nine years to 2015-16. This creates a potential problem for the direct calculation of aggregate labour productivity levels (i.e., in terms of dollars per hour worked in reference-year prices), because the numerator for the measurement of labour productivity is based on business-survey data, while the denominator is based on LFS data. This raises the possibility that the directly calculated level of labour productivity might be somewhat overstated, because a given level of output is divided by a smaller level of labour inputs than would be consistent with the business-survey data for employment. This potential problem should not arise with labour productivity indexes, because the rebasing to a reference year means that these indexes can’t be interpreted directly in terms of dollars per hour worked, in reference-year prices.

Another issue is that some of the growth in aggregate labour productivity over recent years may have come from unrecorded labour inputs (that is, labour inputs that are not recorded in the LFS). As shown in the previous section, there are two key quantifiable explanations for the difference in aggregate employment levels between business-survey data and LFS data: multiple jobholders and non-Australian-residents, which together appear to explain around three quarters of these differences. Multiple jobholders are unlikely to be a major issue in this regard: the proportion of them in total employment has remained fairly constant over the five years to the end of 2012-13 (and it seems to be a fair assumption that this proportion has remained largely unchanged between then and the end of 2015-16).

However, our estimate of the number of employed short-term temporary entrants has grown by 52.9 per cent over the eight years to 2015-16, compared with growth in LFS total employment in selected industries (as calculated from Table 2) of 12.7 per cent over the same period. Assuming that employed non-Australian residents work the same hours and have the same productivity level as

[37] ibid.

residents, we calculate that that adjusting labour inputs by adding in employed non-Australian residents would make a slight difference to the calculated total growth rate of labour productivity over the eight years, reducing it from 13.2 per cent to 12.2 per cent (and the compound annual average growth rate of labour productivity over these eight years would be reduced from 1.56 per cent to 1.45 per cent).

Another way of approaching this issue is to include an explanatory variable for the labour input of non-Australian residents in equations for the determinants of aggregate labour productivity, such as those estimated by Connolly, Trott and Li (2012)[38] and Veladkhani (2003)[39]. This was done with the long-run equation for aggregate labour productivity estimated by Connolly, Trott and Li (2012), through including a separate explanatory variable for the logarithm of employment of non-Australian residents (using the estimates calculated for this paper). However, this additional explanatory variable was not statistically significantly different from zero when the equation was respecified and re-estimated. This is not surprising, given that: the addition of this variable raised an already high level of multicollinearity among the explanatory variables in this equation; and the fact that the estimated number of employed short-term non-residents is very low at only around three per cent of the level of employment of people in the Estimated Resident Population. Further details of the re-estimated equation are available from the senior author.

# Conclusions

There are substantial variations in estimates of employment between those calculated from business-survey data (EAS and EEPS) and LFS data for many industries. This holds for both definitions of employment (Employees and Total Employment) that can be calculated from business-survey data. For some industries including Mining and Construction, these differences have been varied considerably since 2007-08. For these two industries, the differences appear to be linked to the phases of the recent mining construction boom, in opposite directions. There are also noticeable differences between these two sources of data for All Selected Industries (that is, all industries except Financial and Insurance Services).

There are numerous reasons for these differences, including the different employment definitions and collection methods in both data sources, ABS coding practices in its surveys, child workers, short-term temporary entrants who are working in Australia and multiple jobholders. The last two of these are quantifiable and we estimated that by adding estimates of the number of people in these two categories to the LFS data on total employment, we can substantially reduce the discrepancy with the business-survey data for All Selected Industries. While there is a degree of imprecision in our quantification of these two sources, especially of our estimates of short-term temporary

[38] Connolly, G., Trott, D. and Li, Y. (2012), *Workplace Agreements and Other Determinants of Labour Productivity*, paper presented to the Australian Labour Market Research Workshop, Perth, 29-30 November. This paper can be requested by sending an email to greg.connolly@jobs.gov.au.

[39] Valadkhani, A. (2003), "An Empirical Analysis of Australian Labour Productivity", *Australian Economic Papers*, vol. 42, No. 3, September, Blackwell Publishing.

entrants who are working in Australia, a sensitivity analysis around these assumptions showed that they did not make much difference to the aggregate results.

While we could quantify much of the aggregate difference, it would be very difficult to apply this method by industry and so it has not yet been feasible to attempt to reconcile the differences by industry.

We then drew out some of the key implications of our findings for aggregate productivity measurement, employment by business size by industry, wage and average compensation measures by industry, labour productivity by industry and unit labour costs by industry. In doing so, we made some suggestions for handling the issues raised by these findings. For many of these topics, issues arise because business-survey data are used in forming *National Accounts* aggregates of output and compensation of employees, but LFS data are used in forming data on employees or hours worked that are used in forming these measures.

These findings cast a different perspective on some of the recent economic debates and issues in Australia, including Australia's recent relatively slow growth rate of labour productivity and the role of the Mining; and Electricity, Gas, Water and Waste Services industries, in the slow-down in labour productivity growth.

The main conclusion from our analysis is that as a result of the large differences between business-survey and LFS employment data for some industries, economic analysts of industry data need to be aware of this issue and consider its implications for their analysis.