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Wages, Government Payments and Other Income of Indigenous and Non-Indigenous Australians

Monica Howlett, University of California Berkeley
Matthew Gray, The Australian National University
Boyd Hunter, The Australian National University

Abstract

This paper compares the level and source of income for Indigenous and non-Indigenous Australians using data from the 2011 wave of the Household Income and Labour Dynamics in Australia (HILDA). Three sources of income are considered: wages and salaries; government benefits; and income from businesses, investments and other private transfers. Consistent with many previous studies, Indigenous Australians have, on average, lower total income than non-Indigenous Australians, with this difference being largest for those who are full-time employed. The difference is also larger for males compared to females. In terms of non-wage income, Indigenous men and women receive a much smaller proportion of income from other sources than their non-Indigenous counterparts (primarily business and investment income). This is particularly the case for those who are not in the labour force (NILF). Correspondingly, government benefits constitute a higher proportion of income for the Indigenous population than for the non-Indigenous. This is true for both males and females, and for all labour force states, although the difference is largest for part-time employed and those who are NILF. Given Indigenous persons are also more likely to be unemployed than non-Indigenous persons, they are more likely to be dependent solely on government payments as a source of income at any one time. The implications of these findings are discussed, as well as directions for future research.

JEL Classification: J15, J21, J78

Keywords: Personal income, wages, government payments, Indigenous employment, labour market segmentation

Address for correspondence: Boyd Hunter, CAEPR, Australian National University, Canberra ACT 0200. Email: boyd.hunter@anu.edu.au
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1. Introduction

There is an extensive literature on the extent to which there are differences in the income of Indigenous and non-Indigenous Australians (e.g., Altman and Hawke 1993; Altman, Biddle and Hunter 2005; Biddle 2013; and Hunter and Gray 2008). This literature has consistently found that Indigenous Australians have a much lower average[1] income than non-Indigenous Australians. For example, according to the 2008 National Aboriginal and Torres Strait Islander Social Survey, the average disposable weekly income of Indigenous males was 63 per cent that of non-Indigenous males and, for Indigenous females, it was 79 per cent that of non-Indigenous females (Biddle 2013).

There however is very little research on source of income for the Indigenous population and whether this differs to that of the non-Indigenous population. This type of information can be used in a variety of ways. First, it can help understand the reasons for differences in income levels and where policy should best focus. Second, the ability to estimate hourly wage rates which is important for understanding differences in labour market productivity and the extent to which income differences are due to lower employment rates or lower labour market income if employed. From an economic perspective, the hourly wage is particularly important, because this variable is used in many economic models that involve choices about the amount of time spent in paid employment (see for example, Killingsworth 1983; Mincer 1974). Third, differences in lifetime individual and family labour market earnings and in inheritance are likely to mean that Indigenous Australians have smaller levels of income generating assets. Fourth, it is important information for understanding the economic incentives for a range of behaviours, including labour supply decisions, decisions about investments in education, geographic mobility and fertility decisions.

The limited research that is available on source of income for the Indigenous population is based on data from the 1994 National Aboriginal and Torres Strait Islander Survey which is now more than two decades old.[2] The availability of more recent data on income source for a useable sample of Indigenous Australians is now available from wave 11 of the Household Income and Labour Dynamics in Australia (HILDA) survey. The ability of HILDA to provide data on Indigenous Australians has been increased by the addition of a top-up sample in the 2011 wave, which boosted the number of Indigenous respondents to a sufficient number to allow statistically valid estimates.[3]

This gap in the evidence base is unfortunate because the effective design of policies aimed at reducing income disparities between Indigenous and non-Indigenous Australians would be assisted by having an accurate understanding of source of income for Indigenous Australians and differences between the Indigenous and non-Indigenous populations. Examples of source of income include wages and salaries, public transfers and investment and business income.

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[1] In this paper the terms average and mean are used interchangeably.
[2] Subsequent National Aboriginal and Torres Strait Islander Social Surveys have not collected information on income by source, nor does the census.
[3] One of the advantages of the Household Income and Labour Dynamics in Australia (HILDA) data compared to the publicly released data from the 1994 National Aboriginal and Torres Strait Islander Survey is that that HILDA releases continuous data on income.

In this paper the 2011 wave of HILDA is used to estimate income from wage and salaries, government benefits, and income from businesses, investments and other sources for the Indigenous and non-Indigenous populations. The extent to which there are differences in the source of income of Indigenous and non-Indigenous people according to labour force status is also examined.

The analysis is of personal income, rather than income at the family or household level. The focus on personal income is important for several reasons. First, it is at the individual level that many policies primarily operate (e.g. labour market and education policies). Second, the income received by an individual is often in recognition of their behaviour (e.g. productivity in the workplace), endowments (e.g. personal assets), or individual family and social circumstances. It is important to understand the various sources of personal income to understand Indigenous economic behaviour. Although there have been some analyses of personal (individual income) of Indigenous Australians,[4] much of the literature has focused on income measured at the household level, which considers questions of financial living standards, poverty and related concepts (e.g. Hunter 2012).

The next section of this paper provides an overview of the HILDA dataset and the measures of income and labour force status used. The third section focuses on personal income level and source and provides a decomposition of the income differential between Indigenous and non-Indigenous population that accounts for differences in labour force status. The fourth section considers wage and salary income and hours worked in order to allow hourly wage rates to be estimated, the fifth section presents data on non-wage income from private sources and the sixth income from government payments. The seventh section analyses source of income by proportion of year an individual was employed, while the eighth section reports findings for age-standardised estimates. The final section reflects on the implications of the findings for future research.

2. Data

2.1 The HILDA survey

The HILDA survey is a longitudinal survey of the Australian population that started in 2001, with interviews conducted each year. The survey covers a broad range of social and economic topics. The sample began with around 15,000 persons at wave 1, almost half of which have participated in each subsequent year. In 2011, a general top-up sample of 2,153 responding households was added to the sample. The top-up sample allowed for the inclusion of four groups of respondents who could not have been included in the wave 1 sample (i.e. immigrants arriving in Australia after 2001, long-term visitors arriving since 2001, Australians not in Australia in 2001 and the Australian-born children of these groups). The top-up sample also increased the number of respondents in other groups, including Indigenous respondents.

The analysis here is restricted to the working age population (15-64 years). In wave 11 of HILDA, there were 460 Indigenous respondents and 14,200 non-Indigenous

[4] For example, Daly (1995), Daly and Hunter (1999), Daly and Liu (1997), Nepal and Brown (2012), Biddle (2013), and Birch (2014).

respondents. Although this is a large enough sample to allow a broad analysis of the Indigenous population, the ability to use the HILDA data to look at subgroups (e.g. by location, education and occupation) is limited.

HILDA has three key strengths for estimating source of income for the Indigenous population. First, it has detailed income data. Second, the large non-Indigenous sample allows comparisons between Indigenous and non-Indigenous populations. Third, the survey is longitudinal, which will allow for the first longitudinal analysis of sources of income for the Indigenous population. While this paper does not use the longitudinal nature of the HILDA survey it is hoped that it will establish a benchmark which potentially inform future analyses of the data.[5]

2.2 Income measures

In this paper, income from the following sources are examined: wages and salaries; government benefits; and other income which includes business and investment income, and private transfers such as workers compensation, accident and sickness, child support, regular transfers from non-resident parents, regular transfers from non-household members and other regular private transfers.

The HILDA survey collects information on income for the most recent financial year (the 2010-11 financial year for wave 11). In this paper, the main overall income measure used is annual gross income. Missing income data have been imputed by the HILDA survey and the imputed income variable is used in this paper. Government benefits are also imputed. Summerfield *et al*. (2012) provides details of the imputation procedure and the construction of the measure of the value of government benefits received.[6] The use of a 12-month measure of income means that people who were not employed at the time of the interview, but who had any paid employment during the 12-month reference period will be recorded as having labour market income. For people who were employed at the time of the interview, hourly wages are derived from information on weekly wages and hours worked per week. However, for those persons who are not employed at the time of the interview, information on hours worked in previous jobs is limited and it is not possible to construct a valid measure of hourly wage.

Personal income tends to increase with age until around the age of 55 years, after which income starts to decrease (e.g. ABS 2013a). There are many reasons as to why this happens, including productivity in the labour market (age is a proxy for labour market experience) and capital accumulation that generates an income stream. In this paper, when comparing the income of Indigenous and non-Indigenous, differences in the age structure of the Indigenous and non-Indigenous populations are controlled for by age-standardising income.

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[5] If a sufficient number of these Indigenous respondents are reinterviewed in future waves of HILDA.

[6] Missing data is on indication of data quality that can vary between sub-populations. Melbourne Institute (2013) argues that while less than half of the Indigenous respondents have been re-interviewed in every wave of HILDA, 69 per cent were interviewed in wave 11 – this is slightly higher than the proportion of non-Indigenous sample interviewed in that wave. The overall data quality for the Indigenous sample of wave 11 does not appear to be a particular concern, at least in terms of interview rates.

The analysis is conducted separately for men and women. Studies have also found that gender is strongly associated with personal income. This partly reflects the potential impact of child bearing and rearing on female labour market participation. Studies of the Australian population have found substantial differences in the source of income for men and women (Headey, Marks & Wooden 2005; Jefferson & Ong 2010).

2.3 Labour force status

Two measures of labour force status are used in this paper. The main measure used is based on labour force status the week before the interview. A second measure used is the proportion of the previous 12-months which the individual was in paid employment.

The labour force states used in this paper are full-time employed (working 35 hours or more per week), part-time employed, unemployed and not-in-the labour force. Table 1 provides information on labour force status by gender and Indigenous status estimated from the HILDA data and for benchmarking purposes estimated from the 2011 Census. The 2011 Census data is restricted to non-remote areas in order to maximise comparability with the HILDA sample.

One of the reasons for distinguishing between full-time and part-time employment is that the Australian social security system is designed so that many people in part-time employment will continue to receive income-support payments (e.g. Parenting Payment, Newstart Allowance), and many people in part-time and full-time employment will receive payments such as the Family Tax Benefit, the Child Care Benefit and the Child Care Rebate (although the amount received decreases as income increases).

The distribution of labour force status estimated from HILDA is broadly comparable to the census, although the differences between HILDA and the census are larger for Indigenous than non-Indigenous Australians. This is not surprising given the relatively small Indigenous sample in HILDA. In general, the differences in the Indigenous and non-Indigenous employment rates is very similar when estimated using HILDA and the 2011 Census, but there is a bigger Indigenous / non-Indigenous gap for women when HILDA is used than when the 2011 Census is used. The proportion of Indigenous men and women in full-time employment is much lower than that of non-Indigenous men and women. The part-time employment proportion of Indigenous men is slightly lower than that of non-Indigenous men, but Indigenous women are much less likely to be employed part-time than are non-Indigenous women.

Indigenous unemployment rates are about 4.5 times higher than non-Indigenous rates, regardless of gender. A higher proportion of Indigenous persons are also not in the labour force (NILF). Indigenous employment is correspondingly lower than the non-Indigenous estimates for both workers employed part-time or full-time.

Table 1 - Labour force status, by gender and Indigenous status (%), 2011

	Male		*Female*	
Labour force status	*Non-Indigenous*	*Indigenous*	*Non-Indigenous*	*Indigenous*
HILDA data				
Employed full-time	68	45	35	19
Employed part-time	13	10	34	19
Unemployed	4	13	4	14
NILF	15	32	27	48
Total persons	6,836	191	7,428	269
2011 Census data				
Employed full-time	62	38	35	23
Employed part-time	14	11	31	20
Unemployed	5	12	4	9
NILF	19	40	31	49
Total persons	6,090,264	113,625	6,282,594	121,974

Notes: Data include people aged 15-64 years. Census figures refer to persons living in non-remote areas only. The HILDA estimates are weighted using the enumerated person weights supplied with the data.
Source: HILDA, wave 11; ABS (2011a).

3. Personal income

3.1 Income level

According to HILDA, the mean of total personal gross annual income for Indigenous males was $34,500, substantially lower than that for non-Indigenous males which was $62,600. For Indigenous women, the average income was $26,200 compared to $37,400 for non-Indigenous women. Figures 1 and 2 show total income by labour force status by Indigenous status for males and females, respectively.

Although the personal income for Indigenous males and females is lower than that of their non-Indigenous counterparts for all labour force states, the size of the gap differs according to labour force status. For full-time workers, the difference is substantial, with Indigenous incomes being around $23,700 and $9,900 lower for males and females, respectively. In addition, Indigenous males who are not in the labour force had an income that was around $10,000 lower than non-Indigenous males. However, for the remainder of the labour force categories, the income difference between Indigenous and non-Indigenous persons is much less substantial.

Figure 1 - Total personal gross income per year ($'000), by Indigenous status, males, 2011

Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant. For instance, employed full-time and NILF incomes are statistically significantly different, whereas employed part-time and unemployed are not. This figure does not control for differences between the Indigenous and non-Indigenous populations in the number of hours worked within the part-time and full-time employed groups. However, as demonstrated in Table 2 the differences are mostly very small with the largest difference being that part-time employed Indigenous men work, on average, an additional 2.8 hours per week.
Source: HILDA Wave 2011.

Figure 2 - Total personal gross income per year ($'000), by Indigenous status, females, 2011

Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant.
Source: HILDA Wave 11.

The information on income by labour force status can be used to answer the question of how much of the difference in incomes between Indigenous and non-Indigenous Australians is due to differences in labour force states and how much is due to differences in income given labour force status. This is achieved by reweighting Indigenous income in each labour force state (Figures 1 and 2) by the proportion of the non-Indigenous population in each labour force state estimated using HILDA (Table 1).

$$\bar{Y}_I^{non-IndLFS} = \sum_{i=1}^{4} Y_i^{Ind} LFS_i^{non-Ind} \quad (1)$$

where

$\bar{Y}_I^{non-IndLFS}$ = average income of Indigenous if have non-Indigenous labour force status but Indigenous income in each labour force state

Y_i^{Ind} = income of Indigenous if in labour force state i

$LFS_i^{non-Ind}$ = % of non-Indigenous population in labour force status i

The average income of Indigenous men $34,700 which increases to $44,500 under the hypothetical scenario of Indigenous men having the same labour force status as non-Indigenous men, but income within each labour force state is the actual estimated from the HILDA survey. This implies that 35 per cent of the gap in income between Indigenous and non-Indigenous men is due to differences in labour force status and 65 per cent is due to differences in income given labour force status.

The average income for Indigenous women is $26,200 which is increases to $34,400 under the hypothetical scenario of Indigenous women having the same labour force status as non-Indigenous women. 71 per cent of the difference in income between Indigenous and non-Indigenous women is explained by the differences in labour force status, and 29 per cent is due to differences in income given labour force status.

3.2 Source of income

This section provides estimates of income by source for the Indigenous and non-Indigenous population and how this differs by labour force status (Figure 3 for males and Figure 4 for females). Complete data are provided in Appendix Table A1.

Full-time employed non-Indigenous men, on average, obtain 86 per cent of their income from wages, 12 per cent from other sources and just 2 per cent from government benefits. Full-time employed Indigenous men have a substantially lower income than their non-Indigenous counterparts, but receive a higher proportion of their income from the labour market (95 per cent), a similar proportion from government benefits and a much smaller proportion from other sources (3 per cent). The differences in income for full-time employed men is in part due to higher hourly wages (see Table 2).

Part-time employed Indigenous and non-Indigenous men receive a smaller proportion of their income from wages and a higher proportion from government benefits compared to their full-time employed counterparts. The big difference in

source of income between part-time employed Indigenous and non-Indigenous men is that non-Indigenous men receive 25 per cent of their income from other sources, whereas for Indigenous men it was just 4 per cent. Part-time employed Indigenous men also receive a higher proportion of their income from government benefits than their non-Indigenous counterparts.

For those who were unemployed at the time of the interview, both Indigenous and non-Indigenous men receive 63 per cent of their income from wages (reflecting the fact that many of those who were unemployed at the time of the survey had been employed during the previous 12 months). The main difference in source of income between Indigenous and non-Indigenous men who are unemployed is that Indigenous men receive a higher proportion of their income from government benefits and a lower proportion from other sources.

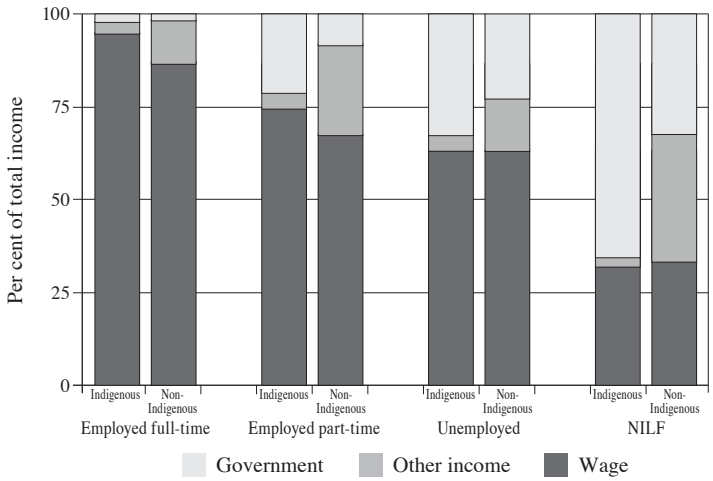
For both Indigenous and non-Indigenous men who are NILF, only around 32 per cent of their income is from wages and salaries. But, similar to other labour force categories, the main difference is that non-Indigenous men have a much higher proportion of their income from other sources compared to Indigenous men (34 per cent vs. 2 per cent) and a correspondingly lower proportion of their income from government benefits (32 per cent vs. 66 per cent).

For women, the overall pattern is generally similar to men, but there are differences in the proportion of income from different sources. Indigenous women who are not in paid employment (unemployed and NILF) obtain a much lower proportion of their income from paid work compared to non-Indigenous females. Correspondingly, Indigenous females who are unemployed and NILF obtain a much higher proportion of their income from government payments compared to non-Indigenous females.

Although the proportion of total income from other private sources is similar for both Indigenous males and females regardless of labour force status, the level of other income for non-Indigenous males is substantially higher than for females across all labour force statuses.

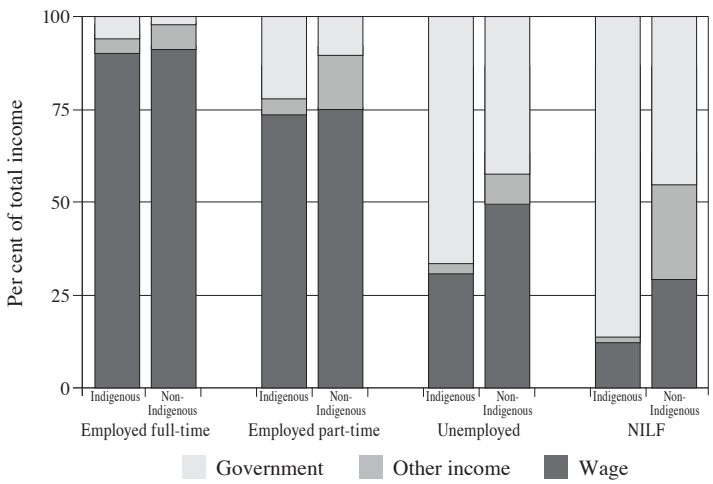
In summary, several main observations can be made. As one would expect, for both employed Indigenous and non-Indigenous Australians, the major contributor to income is wages, and the proportion of income from wages decreases as people spend less time in the labour force. In terms of non-wage income, government benefits constitute a higher proportion of income for the Indigenous population than for the non-Indigenous. This is true for males and females, and for all labour force states. However, the difference is largest for part-time employed and those NILF, and lowest for full-time employed and unemployed. Indigenous men and women receive a much smaller proportion of income from other sources (primarily business and investment income) than their non-Indigenous counterparts. This is particularly the case for those NILF. For non-Indigenous Australians, income from other sources is particularly important for part-time workers and those NILF, where it constitutes 15-35 per cent of all income. It is also worth noting that more than 50 per cent of income for unemployed males comes from wages, whereas for females it is lower, especially for Indigenous Australians.

Figure 3 - Source of personal income by labour force status and Indigenous status (%), males, 2011



Note: Population aged 15-64 years.
Source: HILDA Wave 11.

Figure 4 - Breakdown of total income by labour force status and Indigenous status (%), females, 2011



Note: Population aged 15-64 years.
Source: HILDA Wave 11.

4. Wage income

This section focuses on various aspects of wage income; hourly wage rates received, number of hours per week and per year and annual wage income. As in earlier sections the analysis is conducted by Indigenous status and gender.

4.1 Hourly wages

Average hourly wage rates are lower for Indigenous men and women than their non-Indigenous counterparts (Table 2). Overall, employed Indigenous men have an hourly wage of $23.3, around 18 per cent lower than the average hourly wage of employed non-Indigenous men of $28.3. Average hourly wages of women are slightly lower than for men, and are lower for Indigenous women ($22.6) than for non-Indigenous women ($26.1). Given the well-known disparities in level of education and other human capital between Indigenous and non-Indigenous persons, this difference in hourly wage rate at the aggregate level is not surprising.

For males, the differences in hourly wages (in percentage terms) between the Indigenous and non-Indigenous are similar for the part-time and full-time employed. For women, the hourly wage of full-time employed Indigenous and non-Indigenous women are very similar. However, part-time employed Indigenous women have a substantially lower hourly wage compared to part-time employed non-Indigenous women ($20.0 compared to $25.8). This may be because women are more likely than men to work part-time for all occupations, and so there are a high proportion of higher-income earning non-Indigenous women working part-time. One explanation for this observation is that, irrespective of occupational status, mothers might choose to work part-time immediately after the birth of their children as a means of combining the work and family aspects of their lives (ABS 2011b).

4.2 Working hours and number of weeks worked

The total income from wages earned during a year depends not only on the wage rate received, but also the number of hours worked per week and the number of weeks worked per year.

On average, Indigenous men worked 24 weeks during the past year, substantially less than the 33 weeks worked by non-Indigenous men (Table 2). Similarly, Indigenous women worked 17 weeks during the past year, compared to 28 weeks by non-Indigenous women. These averages are for the working age population and thus include those who were unemployed or not-in-the labour force for the entire past year.

For each labour force state, Indigenous men and women work between one and three weeks less per year than their non-Indigenous counterparts. This difference is much smaller than the total differences in weeks worked among the Indigenous and non-Indigenous populations. This is largely due to differences in labour force state rather than a lower number of weeks worked per year for each labour force state.

The number of weeks worked during the past year is higher among the full-time and part-time employed, but the unemployed and those NILF, on average, had spent a number of weeks employed during the past 52 weeks. For example, unemployed Indigenous people had spent 13 weeks during the past 52 weeks employed and unemployed non-Indigenous people had spent 15.5 weeks of the past 52 weeks employed.

Full-time employed Indigenous people work around the same amount of hours as full-time employed non-Indigenous persons. Similarly, for the part-time employed Indigenous work a similar number of hours as non-Indigenous. This is despite spending fewer weeks in paid employment than non-Indigenous people during the year. Note that among those currently employed part-time, Indigenous males work three hours more per week on average than non-Indigenous males.

4.3 Annual labour market earnings

Table 2 also shows the annual income from wages earned in 2011. Full-time employed Indigenous men have an average annual income from wages of $53,000 compared to full-time employed non-Indigenous men who have an annual income from wages of $69,000. Similarly, Indigenous women employed full-time have an annual income from wages of $45,800 compared to $55,300 for full-time employed non-Indigenous women. The higher annual incomes for full-time employed non-Indigenous people compared to full-time employed Indigenous people reflects higher hourly wages and numbers of weeks worked per year.

However, there is no significant difference between the annual wages of part-time workers. For men, this is a combination of the lower hourly wage, but longer average hours worked by part-time employed Indigenous men compared to non-Indigenous men. For part-time employed women, Indigenous women have a lower hourly wage rate compared to non-Indigenous women, but there is no significant difference in the number of weeks worked per year or hours worked per week.

For those not in paid employment at the time of the survey, non-Indigenous Australians generally had higher incomes from previous jobs. Non-Indigenous persons who were not in the labour force earned around twice as much during the year as Indigenous persons, which is probably a combination of higher wage rates and more time spent working.

Indigenous Australians, on average, receive a lower wage rate than non-Indigenous Australians. They are also more likely to be unemployed, more likely to be out of work for longer periods of time and are more likely to change jobs than non-Indigenous persons. In addition to Indigenous persons spending more time out of the labour force, those currently in work have been with their current employer for a shorter time than non-Indigenous persons. Indigenous persons are thus more exposed to financial stress in times where there is no regular wage income. We now investigate to what extent other sources of income play a role in helping to shield from potential spells of unemployment.

Table 2 - Average weeks of work, hours per week and labour force status in current job, by gender and Indigenous status, 2011

	Hourly wage ($)				*Hours of work per week*			
Labour force status	*Indigenous*		*Non-Indigenous*		*Indigenous*		*Non-Indigenous*	
Males								
Employed full-time	**24.5**	**(1.6)**	**29.5**	**(0.3)**	**46.5**	**(1.4)**	**46.2**	**(0.2)**
Employed part-time	18.2	(2.5)	22.0	(0.9)	21.1	(1.8)	18.3	(0.3)
Unemployed	–	–	–	–	–	–	–	–
NILF	–	–	–	–	–	–	–	–
Total	23.3	(1.4)	28.3	(0.3)	41.6	(1.5)	46.2	(0.2)
Females								
Employed full-time	25.3	(1.2)	26.3	(0.3)	42.3	(1.3)	42.3	(0.2)
Employed part-time	20.0	(2.0)	25.8	(0.7)	19.7	(1.0)	19.6	(0.2)
Unemployed	–	–	–	–	–	–	–	–
NILF	–	–	–	–	–	–	–	–
Total	22.6	(1.2)	26.1	(0.4)	30.9	(1.4)	31.2	(0.20)

	Weeks in work				*Annual wages ($'000)*			
Labour force status	*Indigenous*		*Non-Indigenous*		*Indigenous*		*Non-Indigenous*	
Males								
Employed full-time	38.4	(2.4)	39.3	(0.3)	53.4	(4.2)	69.2	(0.8)
Employed part-time	32.8	(4.7)	33.8	(0.8)	19.4	(4.3)	20.6	(1.2)
Unemployed	13.0	(3.5)	15.5	(1.1)	12.7	(4.2)	14.2	(1.6)
NILF	5.1	(1.6)	6.6	(0.5)	4.1	(1.6)	7.6	(1.0)
Total	24.0	(2.5)	33.0	(0.4)	28.7	(3.4)	51.3	(0.9)
Females								
Employed full-time	37.0	(3.1)	39.5	(0.4)	45.8	(4.0)	55.3	(0.7)
Employed part-time	34.1	(3.2)	36.1	(0.5)	24.8	(4.0)	24.2	(0.5)
Unemployed	9.1	(2.6)	11.9	(1.2)	4.7	(1.4)	8.5	(1.0)
NILF	3.8	(1.0)	5.8	(0.3)	2.0	(0.7)	5.2	(0.4)
Total	17.0	(2.0)	28.0	(0.4)	15.1	(2.1)	29.4	(0.6)

Note: Population aged 15-64 years. Standard errors are in parenthesis. – = not applicable
Source: HILDA Wave 11.

5. Non-wage income from private sources

Income from private sources other than wages includes rent, interest payments, dividends, royalties and regular private transfers such as child support payments and other intra-family transfers.[7] Availability of income from private non-wage sources can be important in alleviating financial stress while an individual is out of a job.[8] This type of income has been found to have an impact upon labour supply decisions (Cai 2010; Taylor & Gray 2010).

Figures 5 and 6 show non-wage private income by labour force status for males and females, respectively. Non-wage private income is substantially higher for the non-Indigenous population compared to the Indigenous population. For example, full-time and part-time employed non-Indigenous males had $9,600 and $7,500 in non-wage private income in 2011, respectively, which is more than five times that of employed Indigenous males.

The biggest difference is between those who are NILF. Although the level of privately sourced, non-wage income for non-Indigenous persons who are NILF is on par with the working non-Indigenous population ($7,800 for males and $4,600 for females), Indigenous persons who are NILF receive a negligible amount from this source.

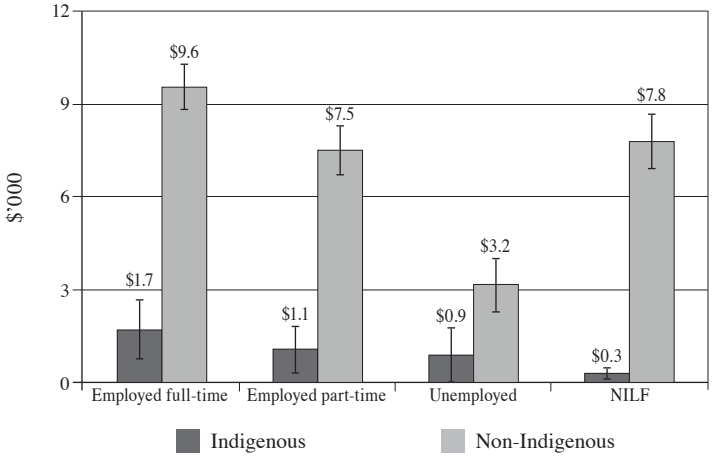
For non-Indigenous part-time workers, especially males, the amount of non-wage income is substantial in absolute value terms and also as a proportion of total income. Referring to Figure 5, non-wage income constitutes almost 25 per cent of income for non-Indigenous males who are working part-time, and around 15 per cent of the income of female part-time workers. It is possible that this access to reasonable amounts of non-wage private income is influencing non-Indigenous labour supply decisions.

The lower non-wage income of Indigenous Australians could also be linked to their historically lower income from wages. If Indigenous Australians are earning a lower salary, they have fewer resources and opportunities to invest in other ways of earning income, such as in real estate or the share market. As such, Indigenous persons may be more susceptible to financial stress in times of economic downturn, as they do not have as wide a range of income sources as non-Indigenous persons. Another avenue for the effect of such income on wage outcomes is that the additional resources associated with that income could be used for longer periods of job search and, hence, result in finding better jobs that are well matched to the skills of the individual (Hunter & Gray 2006).

[7] It is worth noting that royalties do not make up a significant part of private income for Indigenous persons surveyed in HILDA. Although royalties are an important source of income for Indigenous Australians living in remote areas, the HILDA survey covers only non-remote areas.

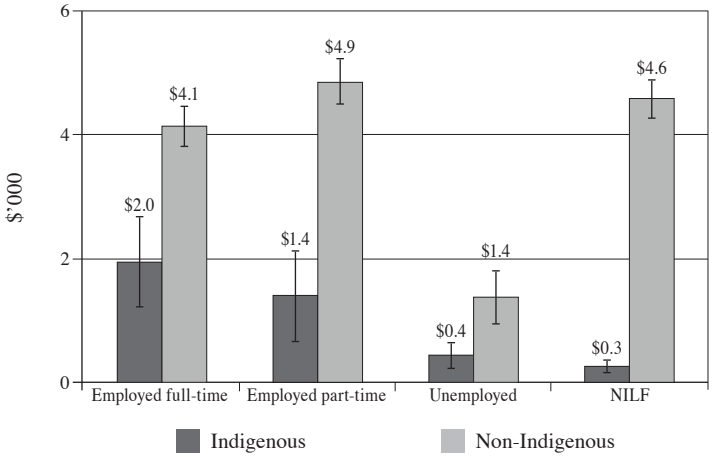
[8] Income flows from rent, interest payments and dividends will be related to the level of wealth held, but a given level of wealth can generate very different flows of income at a point in time depending upon the nature of the asset held and the way in which the wealth holdings are structured. Non-realised increases in wealth (capital gains) are not reflected in the income flows at a point in time. In other words, the size of these other non-wage private income provides an indirect indication of the size of holdings of wealth, but they are not measures of wealth itself. HILDA does collect information on net value of assets, but these data were not collected in wave 11 of HILDA.

Figure 5 - Average non-wage private income per year ($'000), males, 2011



Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant.
Source: HILDA Wave 11.

Figure 6 - Average non-wage private income per year ($'000), females, 2011



Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant.
Source: HILDA Wave 11.

6. Government benefits

The final source of income considered in this paper is government benefits (also termed public transfers). Government payments include income support payments (e.g. unemployment, parenting, carer and disability-related payments) and allowances such as Family Tax Benefit payments related to having dependent children, mobility and

carer allowances. When considering differences in income from government benefit it is important to bear in mind that the amount received depends upon family income (not just individual income) and the amount received for some benefits depends upon family structure including number of children (e.g., Family Tax Benefit and Child Care Benefit).[9]

Figures 7 and 8 show total government payments by labour force status. On average, government payments are higher for females compared to males, irrespective of Indigenous status. This reflects a combination of factors, including the fact that women are more likely to have dependent children and therefore receive the Family Tax Benefit and child care–related payments. Women are also more likely than men to receive a Carer Payment, which is paid at a higher rate than unemployment-related payments, and a Parenting Payment Single, which in 2011 was paid at a higher rate than the unemployment-related benefits.

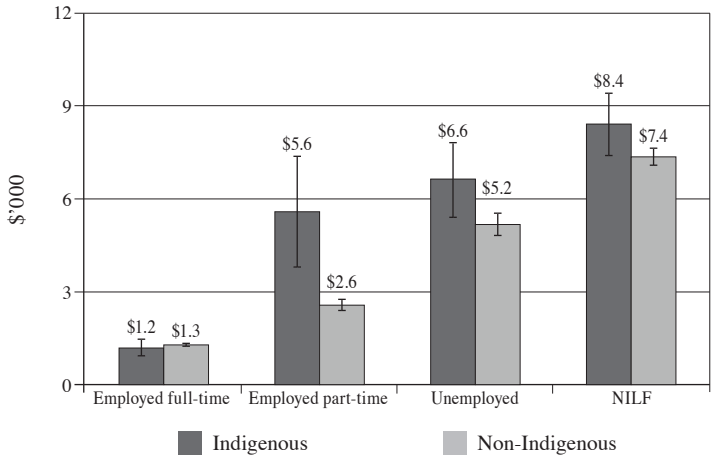
Government payments are generally higher for Indigenous persons, irrespective of gender and labour force status. The differences are most substantial for the female population; for example, Indigenous females who are NILF receive, on average, more than $6,000 more in government payments than their non-Indigenous counterparts. However, for the male population, differences by Indigenous status are smaller and not significant (except for those working part-time). The substantial difference in government payments for women could be due to the fact that, on average, Indigenous women are more likely to have more children than non-Indigenous women, and are also more likely to be a carer and hence receive higher benefits. On the other hand, the differences in the number of dependent children (dependent as defined by the social security system) between Indigenous and non-Indigenous men is not as large, so there is not such a difference in the amount of government benefits received.

Government payments are relatively high for Indigenous males and females who are employed part-time, at $5,600 and $7,500, respectively. These figures are more than twice that of the non-Indigenous part-time workers. As expected the payments are also substantially higher than those received by Indigenous persons working full-time given the means testing of the Australian system (discussed in the following paragraph), The government benefits received by the part-time employed Indigenous people are substantially below those not-in-the labour force, and are relatively close to the amount received by the unemployed It may be the case that the availability of government benefits is affecting worker's decision of how much labour to supply. If available benefits are relatively high, a person may choose to work less than they otherwise would in the absence of benefits (Doiron 2004; Hu 1999).

Australia's welfare system is one of the most targeted systems in the Organisation for Economic Co-operation and Development, and these transfer payments tend to provide support to those most in need – recipients who are out of work temporarily, or permanently in the case of those with a disability or long-term illness (Whiteford 2005). Government payments are particularly important as a source of income for Indigenous persons, because they are more likely to be unemployed and more likely to be out of work for longer, and have very little non-wage income to support them.

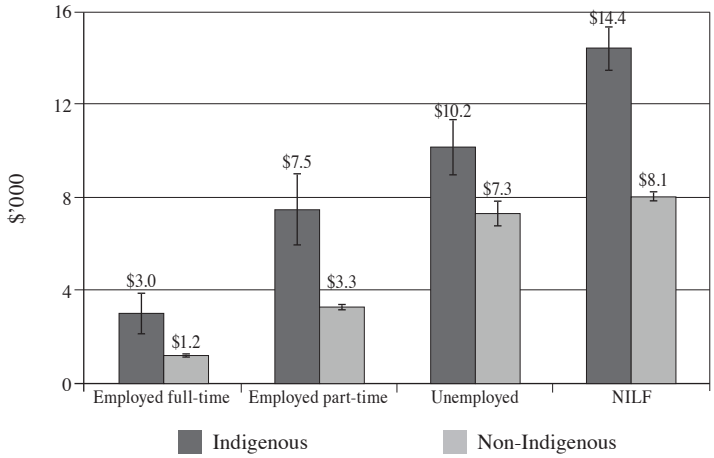
[9] A wider variety of public transfers are available to the Indigenous population. For example, ABSTUDY provides help for Indigenous Australians who are studying or undertaking an apprenticeship. There is also an income supplement available to those participating in the Community Development Employment Projects scheme. Expenditure on the Indigenous specific benefits comprise only a small proportion of government benefits paid to the Indigenous population.

Figure 7 - Average income per year from government payments ($'000) by Indigenous status, males, 2011



Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant.
Source: HILDA Wave11.

Figure 8 - Average income per year from government payments ($'000) by Indigenous status, females, 2011



Notes: Population aged 15-64 years. Bars indicate 95% confidence intervals. If the endpoints of these bars overlap, the difference between the Indigenous and non-Indigenous groups is not significant.
Source: HILDA Wave 11.

7. Source of income by the proportion of the year employed

The analysis of income by labour forces has to this point has compared annual income by labour force status at a point in time. However, many people are not in a single labour force state for the entire year. As noted above, this is the reason as to why people who are not employed at the time of the interview may have positive labour market income. The higher levels of average government payments received by Indigenous people will, at least in part, relate to the longer time of unemployment in the period over which the income accrued.

This section complements the earlier analysis by presenting information on source of income according to a measure of employment status over the annual period for which income is reported. Table 3 provides source of income by proportion of year employed. The groups are 0-25 per cent of the year employed, 25-75 per cent of the year employed and 75-100 per cent of the year employed.[10] The pattern of results is as expected, with wages comprising a higher proportion of income as the proportion of the year employed increases and government benefits decrease. An interesting feature of the results is that Indigenous people receive a lower proportion of income from wages and a higher proportion from government payments for all three groups categorised by per cent of the year employed. A final point to highlight from the

Table 3 - Source of income by proportion of year employed by Indigenous status and gender, 2011

	Indigenous % year employed			Non-Indigenous % year employed		
	0-25	25-75	75-100	0-25	25-75	75-100
Females						
Wages	23.0	43.3	77.6	61.1	61.9	85.3
Government payments	75.3	52.9	16.0	22.8	25.9	4.5
non-wage private income	1.7	3.7	6.4	16.1	12.2	10.2
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0
Total (Number)	138	29	102	2,916	589	3,923
Males						
Wages	70.3	75.8	89.1	73.6	67.9	85.3
Government payments	27.9	22.4	6.8	8.6	14.1	2.1
non-wage private income	1.7	1.8	4.1	17.8	18.0	12.6
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0
Total (Number)	83	22	96	2,155	395	4,286

Note: Population aged 15-64 years.
Source: HILDA Wave 11.

[10] The relatively small Indigenous sample means that it is not possible to analyse the proportion of the year that respondents are unemployed. analysis in Table 3 is that for the non-Indigenous population the proportion of income derived from non-wage private income is lower the higher the proportion of the year employed, whereas for the non-Indigenous population the reverse pattern is found with the proportion coming from this source increasing as the proportion of the year employed increases.

8. What is the role of age-related factors?

Income and wages are related to basic demographic factors such as age and gender, reflecting factors such as differences in employment rates and hours worked associated with participation in education, child bearing and the decline in employment rates as retirement age approaches. Hourly wage rates increase with years of labour market experience typically into the forties and fifties and then start to decline. The differences in the average age of the Indigenous and non-Indigenous population mean that it is of interest to consider how much of the difference in income remains after age standardising income.

Age differentials may have been particularly important for the NILF comparisons, especially to the extent that a particular group has access to superannuation as they approach retirement age. However, a similar point can be made for any Indigenous to non-Indigenous comparisons, given the substantial age differences between the two populations irrespective of labour force status (see Table 4). Note that the largest age differential between non-Indigenous and Indigenous people is for males who are NILF, with an average age difference of 12.4 years. These observations are consistent with the substantially lower life expectancy of Indigenous Australians, especially Indigenous males, relatively few of whom are expected to reach retirement age (ABS 2013b). Table 4 shows that not only are the overall age distributions very different for Indigenous and non-Indigenous populations, but age distributions are different even when disaggregated by labour force status.

To standardise the non-Indigenous estimates, we used the Indigenous age distribution in the 2011 Census, disaggregated by labour force status and gender, and for non-remote areas only. For each labour force status and gender, the proportion of Indigenous persons in each five-year age group between ages 15 and 64 years was used to weight the HILDA estimates of average non-Indigenous income estimated separately for each five-year age group. The resulting age-standardised estimates can be interpreted as the average amount of income non-Indigenous people of a particular labour force status would have received if they had the same age distribution as the Indigenous population. To make direct comparisons between the Indigenous and non-Indigenous results, we also age-standardised Indigenous estimates using the appropriate census distribution.

In general, the age-standardised results show very similar patterns to the non-standardised estimates discussed in earlier sections (see Table A2 in the appendix). The main effect of the age-standardisation was to lower the average income received by non-Indigenous Australians, as more weight is given to the younger age groups, who often earn lower wages and do not have potential income from superannuation. However, total income, wages and other private sources still remain substantially higher for non-Indigenous Australians compared to Indigenous Australians.

Table 4 - Average age by labour force status, gender and Indigenous status, non-remote Australia, 2011

	Average age males (years)		*Average age females (years)*	
Labour force status	*Indigenous*	*Non-Indigenous*	*Indigenous*	*Non-Indigenous*
Employed full-time	34	40	35	39
Employed part-time	29	34	32	38
Unemployed	27	31	28	30
NILF	26	39	33	41

Note: Population aged 15-64 years.
Source: HILDA Wave 11.

9. Discussion

This paper presents estimates of the differences in source of income of Indigenous and non-Indigenous Australians, how source of income differs by labour force status and explores the implications of this data for where policy needs to focus to reduce the large income disparities between Indigenous and non-Indigenous Australians.

A key difference between Indigenous and non-Indigenous Australians of working age is that the Indigenous population receives significantly less income from non-wage private income. This is true for men and women and all employment states. The difference the Indigenous and non-Indigenous populations in non-wage private income are largest for those employed full-time and those not-in-the labour force. In addition, part-time employed non-Indigenous women have substantially higher non-wage private income than the part-time employed Indigenous women. There is little difference between Indigenous men and women in non-wage private income, but non-Indigenous men receive substantially more non-wage private income than do non-Indigenous women.

The lower non-wage private income of the Indigenous population has a range of explanations, but there is no doubt that a major difference is that Indigenous Australians have far lower levels of income generating assets and hence investment income than do non-Indigenous Australians. This reflects both current differences in earned income but also lower levels of assets being transferred intergenerationally, reflecting: the relatively poor employment prospects experienced by Indigenous people during a long period; and Indigenous Australians having received lower average wages since Australia was colonised and the first monetary-based labour market was established.

There is a widespread perception of labour market discrimination against Indigenous Australians (Biddle *et al*. 2013). Whatever the extent of contemporaneous discrimination in the labour market, it is almost inevitable that historical discrimination and disadvantage means that Indigenous persons have fewer resources and capital to invest in other private ventures to increase their overall wealth. This may limit the ability of Indigenous people to participate in the labour market as a worker, but it also places a constraint on the ability of Indigenous people to start their own businesses (Hunter 2013).

As a consequence of lower income from private sources and, on average, lower labour market income if employed, a greater proportion of Indigenous income comes from government payments. Given Indigenous persons are more likely to be out of work than non-Indigenous people, they are more likely to be dependent solely on government payments as a source of income at any one time. Indigenous men and women who are full-time employed have substantially lower incomes than the non-Indigenous men and women who are employed full-time. The lower income of Indigenous men is explained both by non-Indigenous men receiving a higher wage rate and being more likely to be employed full-time.

A substantial proportion of the difference of income between Indigenous and non-Indigenous Australians is due to differences in labour force status for both men and women, although there are substantial differences between men and women in the extent to which differences in labour force status explain the income gap. For men, it is estimated that 35 per cent of the gap in income between Indigenous and non-Indigenous men is due to differences in labour force status and 65 percent is due to differences in income given labour force status. For women the proportion of the difference explained by differences in labour force status is much higher at 71 per cent. This reflects that the income disparities by labour force status are higher for Indigenous men than they are for Indigenous women.

One key findings about a third of the gap in income between Indigenous and non-Indigenous men is due to differences in labour force status and about two-thirds is due to differences in income given labour force status. In contrast for women, over two-thirds of the difference income between Indigenous and non-Indigenous is explained by the differences in labour force status, and just under one-third is due to differences in income given labour force status. This is important from a policy perspective because it demonstrates that attempts to narrow the employment gap will have a substantial impact in narrowing income gaps, but there also needs to be increases in income if employed, particularly for the full-time employed. For Indigenous men, policy will also need to focus the relatively low wages relative to non-Indigenous men by removing persistent barriers to education and training.

The main implication for future research is that analysis needs to distinguish adequately between wage and non-wage sources of income when we are trying to understand economic incentives in the Indigenous labour market (cf., Birch 2014). Of course, such analysis requires that disaggregated income data is available and it is important that data collections give some priority to acquiring this information.

Appendix A
Additional data

Table A1 - Breakdown of total income sources, by gender, labour force status and Indigenous status, 2011

	Wages (%)	*Other income (%)*	*Government benefit (%)*
Indigenous males			
Employed FT	94.8	3.1	2.1
Employed PT	74.3	4.2	21.5
Unemployed	62.8	4.5	32.8
NILF	31.9	2.4	65.7
Non-Indigenous females			
Employed FT	90.2	3.8	6.0
Employed PT	73.6	4.1	22.2
Unemployed	30.5	2.8	66.6
NILF	12.1	1.6	86.4
Non-Indigenous males			
Employed FT	86.4	11.9	1.6
Employed PT	67.1	24.5	8.4
Unemployed	63.0	14.0	23.0
NILF	33.3	34.3	32.4
Non-Indigenous females			
Employed full-time	91.2	6.8	2.0
Employed part-time	74.9	15.0	10.1
Unemployed	49.6	8.0	42.5
NILF	29.0	25.7	45.2

Notes: FT = full-time; NILF = not in the labour force; PT = part-time
Source: HILDA Wave 11; ABS (2011a).

Table A2 - Age-standardised wages, other private income and government payments, 2011

Income source and labour force status	*Males, $ per year*				*Females, $ per year*			
	Indigenous		*Non-Indigenous*		*Indigenous*		*Non-Indigenous*	
Wages								
Employed FT	57,000	(13,913)	65,238	(2,111)	48,798	(10,791)	54,222	(1,972)
Employed PT	20,550	(51,48)	21,608	(3,591)	27,575	(8,585)	22,931	(1,343)
Unemployed	13,627	(22,26)	14,919	(4,461)	4,012	(2,948)	8,236	(2,718)
NILF	3,815	(3,083)	9,141	(3,315)	1,887	(1,415)	5,330	(1,091)
Other income								
Employed FT	1,932	(3,041)	8,390	(1,697)	2,110	(1,662)	3,912	(886)
Employed PT	801	(364)	6,995	(2,126)	1,500	(1,806)	4,208	(911)
Unemployed	824	(824)	2,148	(1,592)	612	(452)	1,403	(1,140)
NILF	345	(345)	5,076	(2,022)	980	(883)	3,226	(796)
Government payments								
Employed FT	1,235	(625)	1,272	(117)	2,546	(1,646)	1,289	(195)
Employed PT	4,735	(1,454)	2,848	(544)	6,605	(3,224)	3,393	(345)
Unemployed	6,803	(1,524)	5,514	(1,035)	9,998	(2,421)	7,574	(1,417)
NILF	10,399	(1,800)	7,378	(827)	14,398	(2,785)	7,759	(595)

Notes: FT = full-time; NILF = not in the labour force; PT = part-time.
Standard errors are in parenthesis.
Source: HILDA Wave 11; ABS (2011a).

References

Altman, J.C., Biddle, N. and Hunter, B.H. 2005. 'A Historical Perspective on Indigenous Socioeconomic Outcomes in Australia, 1971-2001', *Australian Economic History Review*, 45(3): 273-295.

Altman, J.C. and Hawke, A.E. 1993. 'Indigenous Australians and the Labour Market: Issues for the Union Movement in the 1990s', *Discussion Paper 45*, CAEPR, The Australian National University, Canberra.

Australian Bureau of Statistics (ABS) 2011a. *2011 Census of Population and Housing*, ABS, Canberra.

Australian Bureau of Statistics (ABS) 2011b. *Pregnancy and Employment Transitions, Australia, November 2011*, cat. no. 4913.0, ABS, Canberra.

Australian Bureau of Statistics (ABS) 2013a. *Household Income and Income Distribution, Australia, 2011-12*, cat.no. 6523.0. ABS, Canberra.

Australian Bureau of Statistics (ABS) 2013b. *Life Tables for Aboriginal and Torres Strait Islander Australians, 2010-12*, cat. no. 3302.0.55.003, ABS, Canberra.

Biddle, N. 2013. 'Income', *Indigenous Population Project 2011 Census Papers 11/2013*, CAEPR, ANU, Canberra.

Biddle, N., Howlett, M., Hunter, B. and Paradies, Y. 2013. 'Labour Market and Other Discrimination Facing Indigenous Australians', *Australian Journal of Labour Economics*, 16 (1): 91-113.

Birch, E. 2014. 'The Determinants of Eearnings for Indigenous Australian Workers', *Australian Journal of Labour Economics*, 17(3): 211-232.

Cai, L. 2010. 'Intertemporal Labour Supply of Married Australian Women', paper presented at the 39th Australian Conference of Economists, 27-29 September 2010, Sydney.

Daly, A. 1995. 'The Determinants of Income for Employed Indigenous Australians', *International Journal of Manpower*, 16 (4): 11-29.

Daly, A. and Hunter, B. 1999. 'Incentives to Work: Replacement Ratios and the Cost of Job Loss Among Unemployed Indigenous Australians', *Australian Economic Review*, 32 (3): 219-36.

Daly, A. and Liu, J. 1997. 'Estimating the Private Rate of Return to Education for Indigenous Australians', *Australian Economic Papers*, Special Issue: 100-12.

Doiron, D. 2004. 'Welfare Reform and Labor Supply of Lone Parents in Australia: A Natural Experiment Approach', *Economic Record*, 80(249): 157-176.

Headey, B., Marks, G. and Wooden, M. 2005. 'The Structure and Distribution of Household Wealth in Australia', *Australian Economic Review*, 38: 159-75.

Hu, W.Y. 1999. 'Child Support, Welfare Dependency and Women's Labor Supply', *Journal of Human Resources*, 34 (1): 71-103.

Hunter, B.H. 2012. 'Is Indigenous Poverty Different from Other Poverty?' in B. Hunter and N. Biddle (eds), *Survey Analysis for Indigenous Policy in Australia: Social Science Perspectives*, CAEPR Research Monograph No. 32, ANU E-Press, Canberra.

Hunter, B. 2013. 'Recent Growth in Indigenous Self-employed and Entrepreneurs', *Working Paper 91*, CAEPR, The ANU, Canberra.

Hunter, B.H. and Gray, M.C. 2006. 'The Effectiveness of Indigenous Job Search Strategies', *The Economic Record*, 82(256): 1-10.

Hunter, B.H. and Gray, M.C. 2008. 'Analysing Recent Changes in Indigenous and Non-Indigenous Australians' Income: A synthetic Panel Approach', *Australian Economic Review*, 34(2): 135-154.

Jefferson, T. and Ong, R. 2010. 'Profiling Gender Differentials in Asset and Debt Portfolios in Australia', Curtin University of Technology, Centre for Research in Applied Economics Working Paper Series No. 2010-04, Curtin University, Perth.

Killingsworth, M. 1983. *Labor Supply*, Cambridge University Press, New York.

Melbourne Institute 2013. *HILDA Survey Annual Report 2012*, The University of Melbourne, Melbourne.

Mincer, JU 1974. *Schooling, Experience, and Earnings*. Columbia University Press, New York.

Nepal, B. and Brown, L. 2012. 'Modelling Potential Impact of Improved Survival of Indigenous Australians on Work-Life Labour Income Gap Between Indigenous and Average Australians', *Journal of Population Research*, 29 (2): 157-71.

Summerfield, M., Freidin, S., Hahn, M., Ittak, P., Li, N., Macalalad, N., Watson, N., Wilkins, R. and Wooden, M. 2012. 'HILDA User Manual – Release 11', Melbourne Institute, University of Melbourne.

Taylor, M. and Gray, M. 2010. 'The Impact of Child Support Payments on the Labour Supply Decisions of Resident Mothers', Australian Institute of Family Studies Research Paper No. 47, AIFS, Melbourne.

Whiteford, P. 2005. *The Welfare Expenditure Debate: 'Economic Myths of the Left and the Right' Revisited*, OECD, Paris.

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Job Insecurity Within the Household: Are Australian Householders Caring When it Comes to Risk Sharing?*

Francesco Mariotti, University of Trento
Maria Dickson, University of Trento
Karen Mumford, University of York and IZA
Yolanda Pena-Boquete, University of Vigo

Abstract

We investigate perceived job security risk and the distribution of non-labour income between spouses in a household context. In the process, the restrictions implied by Beckerian-caring preferences in the Chiappori (2002) Collective model are considered, and estimates of the sharing rule are derived. The findings support the idea of household formation as a tool that caring partners use to share risk. Our results provide further insight as to how unemployment risk may affect interaction between Australian spouses.

JEL Classification: J01, J3, J6

Keywords: household, labour supply, job-insecurity, collective, bargaining.

1. Introduction

A major risk encountered by workers in the labour market is the possibility of losing their job; not least because becoming unemployed has serious consequences for an individual's consumption, savings and wealth (Berloffa and Simmons, 2003). The role played by unemployment risk on the decision making of the individual is, however,

* This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either DSS or the Melbourne Institute. We thank the HILDA data providers. We are also grateful to Martyn Andrews, Kit Baum, Sarah Brown, Fabrizio Iacone, Arthur Lewbel, Peter Simmons, and Peter Smith for much helpful advice. Research on this paper was carried out whilst Karen Mumford held Visiting Fellowships at the Melbourne Institute of Applied Economic and Social Research (MIAESR) and the Centre for Applied Macroeconomic Analysis (CAMA); their hospitality is gratefully acknowledged. Corresponding author, Karen Mumford (karen.mumford@york.ac.uk).
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substantially more complex when that person is placed within a household context. For example, couples may adjust their hours of employment to offset changes in their partner's employment (Altonji, 1986; Juhn and Potter, 2007; Lundberg, 1985; and Mumford and Smith, 1999), which could be viewed as behaviour consistent with the household insuring against the risk of income shocks (Blundell *et al*., 2012; Apps *et al*., 2014).

Intra-household interaction is a focus of the Collective models which appeared in the labour supply literature with the works of Chiappori (1988, 1992). In the Collective framework, the household is an environment where the respective spouses first interact and agree upon a sharing rule (e.g., the sharing of the household total non-labour income between the couple); and then maximize their own utility functions subject to their own budget constraints (for a recent survey see Browning *et al*., 2014).

Our contribution to this literature is to shed further light on how unemployment risk may affect interaction between spouses. We investigate the relationship between perceived unemployment risks and the relative power between the members of the couple in a particular type of household. This is achieved by first introducing job insecurity elements into the sharing rule and then estimating to what extent job insecurity affects the distribution of power between spouses in a household. In order to capture this effect, a specific version of the Collective model proposed by Chiappori *et al*., (2002) is estimated.

The paper is organized as follows: section 2 discusses the theoretical model developed by Chiappori *et al*., (2002); section 3 describes the data and the sample's characteristics; section 4 explains the econometric approach and presents the results; and section 5 concludes.

2. Model

In the Collective models the household's members' decision process is given by a two-step procedure. In the first phase the members of the couple agree on a sharing rule and they split the total household non-labour income. This sharing is affected by the individual's relative power (sometimes called bargaining strength). In the second phase the two individuals separately maximize their utility functions subject to their own budget constraints.

Following Chiappori *et al*., (2002), let h^i and C^i, for i=1,2 denote member i's labour supply (where $0 \leq h^i \leq 1$) and consumption of a private Hicksian composite good whose price is set equal to 1. In addition, $\mathbf{x}$ denotes a K-vector of preference factors such as age, gender, and education of the two agents. Also, let w_1, w_2, y represent the members' wage rates and the household non-labour income. Finally, let $\mathbf{s}$ be an L-dimension vector of distribution factors. Distribution factors affect the decision process but don't impact on the preferences or the budget constraint; for example, in our case exogenous changes in individual job insecurity.

In the most general framework member i's preferences are represented by some utility function of the form $U^i\left(1 - h^1, C^1, 1 - h^2, C^2, x\right)$ and the household is assumed to maximize a General Household Welfare Function (GHWF) that can be explicitly written as $H^C = \mu U^1 + (1 - \mu)U^2$. Formally, given $\left(w_1 w_2 y, s, x\right)$ there exists

a weighting factor $0 \leq \mu(w_1, w_2, y, \mathbf{s}, \mathbf{x}) \leq 1$ assumed continuously differentiable in its arguments such that (h^i, C^i) is a solution to the program:

$$\max_{\{h^1, h^2, C^1, C^1\}} \quad \mu U^1 + (1 - \mu) U^2 \tag{1}$$

subject to

$$w_1 h^1 + w_2 h^2 + y \geq C^1 + C^2,$$
$$0 \leq h^i \leq 1, \quad i = 1,2.$$

It is important to note that a change in **s** does not affect the Pareto frontier but only the final location of the optimal solution on it.

Note the form of the individual preferences used in program (1), $U^i(1 - h^1, C^1, 1 - h^2, C^2, x)$, imply that this general version of the Collective model cannot be uniquely identified from knowledge of just the labour supplies. There is a continuum of different structural models generating the same labour supply functions. Additional identifying assumptions are accordingly imposed on the model in order to estimate the Collective model. As shown by Chiappori (1992), the main identifying assumption for a Collective model to be estimated is given by the individual preferences being either egoistic, $U^i(1 - h^i, C^i, x)$ for i=1,2; or caring in a Beckerian sense, $u^i = F^i[U^i(1 - h^i, C^i, x)\ U^j(1 - h^j, C^j, x)]$ with i=1,2 and $i \neq j$. Note that in the Beckerian case household members care about each other's preferences as well their own.

Both types of preferences are discussed in Chiappori *et al*., (2002). The Beckerian Caring Preferences impose an additional restriction on the household members' labour supply functions (see equation (9)). The egoistic assumption plays a key role in the formulation of the maximization problem. Chiappori (1992) proved that whenever individual utilities are of the form $U^i(1 - h^i, C^i, x)$, then (1) can be reformulated as in Proposition 1, as a direct consequence of the Second Fundamental Welfare Theorem.

Proposition 1 – Whenever individual preferences are egoistic, then, there exists some function $\varphi(w_1 w_2 y, s, x)$ *such that* (h^1, h^2, C^1, C^2) *is the solution to the program:*

$$\max_{\{h^i, C^i\}} \quad U^i(1 - h^i, C^i, \mathbf{x}) \tag{2}$$

subject to

$$w^i h^i + \phi^i \geq C^i,$$
$$0 \leq h^i \leq 1,$$

where $\varphi^1 = \varphi$ *and* $\varphi^2 = y - \varphi$.

The two individuals have to first agree upon $\varphi(w_1 w_2 y, s, x)$. As shown by (2), the sharing rule φ^i, represents the link between the two individuals who would otherwise behave independently. Importantly, φ^i is not observable to the analyst if the data report total household non-labour income and not the shares.

In the Collective model it is possible to identify $\varphi(w_1 w_2 y, s, x)$ by considering the response of the labour supply function of the two individual spouses in the

household to variations in w_1, w_2, y and s. The labour supply functions are assumed to be continuously differentiable and can be written as:

$$h^1 = H^1\left(w_1, \varphi\left(w_1, w_2, y, \mathbf{s}, \mathbf{x}\right), \mathbf{x}\right); \tag{3}$$

$$h^2 = H^2\left(w_2, y - \phi\left(w_1, w_2, y, \mathbf{s}, \mathbf{x}\right), \mathbf{x}\right); \tag{4}$$

where $H^i(\cdot)$ represents member i's Marshallian labour supply function. The partial derivatives of the two labour supply equations with respect to w_1, w_2, y and s, generate a system of partial differential equations. The sharing rule $\varphi(w_1 w_2 y, s, x)$ is then obtained by integrating this system. Given the nature of the solution, $\varphi(w_1 w_2 y, s, x)$ is identifiable only up to an additive constant $\boldsymbol{\kappa}(\mathbf{x})$. This implies $\sum_i \hat{\varphi}^i \approx y$, the sum of the two estimated non-labour income shares is approximately equal to total non-labour income, and will differ by the additive constant $\boldsymbol{\kappa}(\mathbf{x})$ which depends on the household heterogeneity and cannot be empirically identified. The structure of the two labour supply functions makes it possible to impose testable restrictions on labour supply behaviour and recover the partial derivatives of the sharing rule (see Chiappori *et al*., (2002) for further detail, especially Proposition 2).

We explore the distribution of power within the household by assuming that this distribution can be fully captured by how income is allocated between the spouses. Browning and Gørtz (2012) argue that the concept of power is defined not only in terms of how money is allocated between the spouses but also in terms of leisure. Using data on the use of time within households (Danish Time Use Survey), Browning and Gørtz (2012) observe that in some households the spouse that spends more time in the labour market is also the one enjoying less leisure. There are many possible explanations. For example, there might be some heterogeneity in the tastes for leisure and consumption within the household. Wages or productivity in home production may also vary across the spouses, and that may lead to differences in the leisure taken. Ultimately, there may be an uneven distribution of power within the household such that the low-power individual may be required to work more. The intra-household allocation of time has also been the focus of other studies (see Apps and Rees, 1996; 1997). Unfortunately, we do not have access to complete information on time-use within the household in the HILDA data set[1] and so we focus on the within household allocation of non-labour income.

2.1 Labour supplies: Functional form and parametric specification

Before proceeding with the estimation of the Collective model, it is necessary to specify the functional form of the spouses' labour supply functions. In this work the two distribution factors, namely, the elements of the s vector that appears in $\varphi(w_1 w_2 y, s, x)$ are: the individual's own expected job insecurity; and the individual's own worries about his/her future employment. The unrestricted semi-log system of equations is given by

[1] The HILDA data set provides some information on time use within the household but does not contain complete information on the distribution of time in the period.

$$h^1 = \alpha_0 + \alpha_1 \log w_1 + \alpha_2 \log w_2 + \alpha_3 y + \alpha_4 \log w_1 \log w_2 + \alpha_5 s_1 + \alpha_6 s_2 + \boldsymbol{\alpha}_7' \mathbf{X_1}; \quad (5)$$

$$h^2 = \beta_0 + \beta_1 \log w_1 + \beta_2 \log w_2 + \beta_3 y + \beta_4 \log w_1 \log w_2 + \beta_5 s_1 + \beta_6 s_2 + \boldsymbol{\beta}_7' \mathbf{X_2}; \quad (6)$$

Equation (5) is the parameterized version of equation (3) and represents the labour supply function of the female spouse. The α_i's, for $i = 1,\cdots,6$, are scalars; $\boldsymbol{\alpha}_7'$ is a K-vector of parameters; variables $\mathbf{s}_1$ (i.e. expected job insecurity) and $\mathbf{s}_2$ (i.e. future employment worry) represent the distribution factors; and $\mathbf{X_1}$ is a matrix consisting of a set of socio-demographic variables describing the wife. Analogously, equation (6) is the parameterized version of equation (4) and represents the labour supply function of the male spouse.

Using a semi-log functional form is standard in the estimation of labour supply.[2] Adopting this functional form allows equations (5) and (6) to be expressed in their *unrestricted* form; the restrictions of Proposition 1 and 2 are not imposed on the system and can instead be empirically tested. If the parameters (the α_i's and β_i's and) meet the collective restrictions, then the sharing rule can be derived up to the additive constant $\boldsymbol{\kappa}(\mathbf{x})$, and for a given $\boldsymbol{\kappa}(\mathbf{x})$ the individual indirect utility functions can be recovered. This specification can also be readily extended to allow for interactions between distribution factors and preferences factors. The generalized log-system constitutes a good basis if one wanted to make the whole system more flexible by, for example, introducing higher order polynomial in $\log w_1$, $\log w_2$ and y. The log form for wages allows the effect of w_i on h^i to decrease as h^i increases.

2.2 Sharing rule

Assuming the Collective restrictions are satisfied, and given the spouses' labour supply equations (3) and (4) and their empirical counterparts (5) and (6), the partial derivatives of φ are:

$$\phi_{w_1} = \frac{1}{\Delta} \frac{(\alpha_4 \beta_1 + \alpha_4 \beta_4 \log w_2)}{w_1}$$

$$\phi_{w_2} = \frac{1}{\Delta} \frac{(\beta_4 \alpha_2 + \beta_4 \alpha_4 \log w_1)}{w_2}$$

$$\phi_y = \frac{\alpha_3 \beta_4}{\Delta}$$

$$\phi_{s_1} = \frac{\beta_4}{\Delta} \alpha_5$$

$$\phi_{s_2} = \frac{\beta_4}{\Delta} \alpha_6$$

[2] Semi-log estimation of equations (5) and (6) implies the labour supply curves should be either upward sloping or backward bending everywhere. Empirical evidence, however, shows that the sign of the slope may change with the level of the wages. This is especially true in a household contest (i.e. in a two-individual economy where the two subjects strictly interact). What happens in such an environment is that the sign of $\partial h^i / \partial w_i$ changes both with the level of and with the level of $w_j (j \neq i)$.

where $\Delta(\alpha_3\beta_4 - \alpha_4\beta_3)$.

Solving this system of five differential equations system, the sharing rule equation is obtained as

$$\phi = \frac{1}{\Delta}\begin{pmatrix}\beta_1\alpha_4 \log w_1 + \alpha_2\beta_4 \log w_2 + \alpha_4\beta_4 \log w_1 \log w_2 \\ + \alpha_3\beta_4 y + \beta_4\alpha_5 s_1 + \beta_4\alpha_6 s_2\end{pmatrix} + \kappa(x). \tag{7}$$

Following the approach used by in Chiappori *et al*., (2002) the model restrictions are:

$$\frac{\beta_5}{\alpha_5} = \frac{\beta_6}{\alpha_6}, \tag{8}$$

in the case of pure Egoistic Preferences, and:

$$\frac{\beta_4}{\alpha_4} = \frac{\beta_5}{\alpha_5} = \frac{\beta_6}{\alpha_6}, \tag{9}$$

in the Beckerian Caring Preference case.

3. Data

We use data collected by the Household, Income and Labour Dynamics in Australia (HILDA) survey2. The HILDA survey started in 2001 and is an annual nation-wide longitudinal survey of Australian households occupying private dwellings. For greater detail on the response rates, structure, and changes over time in the HILDA design see Summerfield *et al*., (2013).

HILDA collects information on a range of topics including economic and subjective well-being, labour market dynamics and family dynamics. A potential weakness of annual surveys, such as HILDA, is the failure to capture intra-year dynamics. To address this problem, HILDA respondents are asked to recall information, especially with respect to labour market and social security histories, over the course of the previous year.

A particularly attractive characteristic of the HILDA survey is the presence of subjective job insecurity information. This inclusion is rare amongst economics surveys. Indeed, to the best of our knowledge, the only other relevant surveys containing similar information on employment prospects are: the Health and Retirement Survey (HRS), conducted at the University of Michigan since 1992; the Survey of Economic Expectations (SEE), conducted at the University of Wisconsin-Madison since 1994; and the Survey on Household Income and Wealth (SHIW) conducted at the Bank of Italy during the years 1995 and 1998. The problem with these latter three surveys, for the purposes of this study, is that they either collect information only at an individual level or they collect information only for a random sample of members within each household. This leaves HILDA as the preferred data source for this study.

[3] This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either DSS or the Melbourne Institute.

3.1 Sample selection and descriptive statistics

The Collective models are a class of generally non-nested models: each Collective model, while sharing some common features with the others, is unique in terms of the model restrictions and population of interest. The reference population analysed in this work is given by the Collective model developed by Chiappori *et al*., (2002). The selection criteria are: being an employee[4]; and being one of the two members of a couple family (with or without children) who are married (legally or de-facto). The sample is also restricted to households whose members are younger than 55.

We pool waves 2 to 9 of the HILDA survey data to estimate the Collective model. The first wave of data is excluded due to lack information on pertinent variables; and waves post 2009 have been excluded due to the impact of the recent global recession.[5] The years 2002 to 2009 (inclusive) are associated with a period of stable economic growth in Australia. These sampling restrictions and those associated with the explanatory variables leads to the identification of 6,613 couples.

Summary statistics for the sample of interest are reported in Table 1. On average the males are slightly older than the females, and the women are slightly better educated. The men are typically working almost 45 hours per week; unsurprisingly this is some four hours more than they would like to work. In contrast, the women are averaging almost 33 hours a week. The men also have considerably higher average hourly wages than the women. The difference of 17 log wage points between men's and women's wages is consistent with the empirical literature on the labour market in Australia (Chzhen *et al*., 2013). The men tend to work in the managerial and technical occupations whilst the women are more likely to work as professionals, clerical-administrators or personal service providers. Table 1 also shows that a relatively large proportion of women are employed on casual contracts, while men are more commonly employed on a permanent basis. Women tend to be employed in the education, health and retail services sectors whilst men are more typically found in manufacturing, public administration and construction.

We use two measures of job-insecurity. The first measure captures the individual household member's own expected job-insecurity. The respondent is asked the following question: "What do you think is the per cent chance that you will lose your job during the next 12 months? (That is, get retrenched or fired or not have your contract renewed)." A value of 0 indicates the individual is certain of retaining their job, whereas a value of 100 suggests the individual is certain of losing his/her job in the next 12 months. The second measure is of future employment worry: the respondent is asked to agree on a scale from 1 (totally disagree) to 7 (totally agree) with the following statement: "I have a secure future in my job". A binary variable was created and coded as 1 if the response is less than the midpoint 4 and 0 otherwise. Men perceive their employment prospects to be (slightly) but significantly more uncertain than women in our sample (see Table 1). The correlation between the spouses' job insecurity is low, however, averaging around 0.07 across the four possible combinations of the two job insecurity measures.

[4] The estimation of this particular version of the Collective model requires both members of the household to supply a positive number of hours of work. This means that any issue related to non-participation is ruled out.

[5] 2010 saw the impact of the global recession in Australia with a substantial growth in unemployment (Junankar, 2014).

Table 1 - Selected individual and household characteristics

	Men		*Women*	
Individual Variables	*Mean*	*Sd*	*Mean*	*Sd*
Age	40.34	8.86	38.37	8.69
Hours of Work	44.66	9.51	32.58	12.31
Desired Hours of Work	41.35	8.68	30.30	10.30
Ave Hourly Wage	26.87	12.02	22.48	9.84
Log Ave Hourly Wage Rate	3.20	0.41	3.03	0.39
Expected Job Insecurity	8.96	18.69	7.68	17.70
Overall Market Insecurity	10.34	3.08	9.33	2.92
Future Employment Worry	0.15	0.35	0.13	0.34
Schooling (Years of)	13.08	2.85	13.20	2.62
Household Variables		**Mean**	**Sd**	
Household Size		3.34	1.17	
Total Dependent Children		0.83	0.99	
Household Non-labour Income		7705.69	27609.76	
Regions		**Freq**	**Percent**	
New South Wales		1891	28.6	
Victoria		1701	25.7	
Queensland		1486	22.5	
South Australia		573	8.7	
Western Australia		477	7.2	
Tasmania		208	3.1	
Northern Territory		64	1.0	
Australian Capital Territory		213	3.2	
Section of State				
Major Urban		4178	63.2	
Other Urban		1598	24.2	
Rural		837	12.7	
Employment Contract	**Freq**	**Percent**	**Freq**	**Percent**
Employed on a Permanent basis	5592	84.6	4807	72.7
Employment on a Casual Basis	415	6.3	1130	17.1
Other (e.g. Fixed-term Contract)	606	9.2	676	10.2
Occupation				
Managers	1123	17.0	516	7.8
Professionals	1645	24.9	2282	34.5
Technicians and Trades	1239	18.7	231	3.5
Community-Personal Service	501	7.6	917	13.9
Clerical-Administrative	673	10.2	1654	25.0
Sales	327	4.9	535	8.1
Machinery Operators and Drivers	672	10.2	55	0.8
Labourers	430	6.5	421	6.4
Industry				
Agriculture-Fishing-Forestry	132	2.0	66	1.0
Mining	205	3.1	30	0.5
Manufacturing	996	15.1	297	4.5
Electricity-Gas Supply	150	2.3	20	0.3
Construction	533	8.1	84	1.3
Wholesale Trade	300	4.5	150	2.3
Retail Trade	382	5.8	632	9.6
Accommodation-Restaurants	166	2.5	296	4.5
Transport	465	7.0	122	1.8
Communication	201	3.0	187	2.8

Table 1 - Selected individual and household characteristics (continued)

	Men		*Women*	
	Freq	**Percent**	**Freq**	**Percent**
Finance	259	3.9	351	5.3
Rental-Hiring-Real Estate	80	1.2	82	1.2
Profess Scientific Technical	398	6.0	432	6.5
Administrative-Support	80	1.2	168	2.5
Public Administration	938	14.2	491	7.4
Education-Training	613	9.3	1387	21.0
Health Care	342	5.2	1572	23.8
Recreation Services	110	1.7	77	1.2
Other	263	4.0	169	2.6

Source: HILDA Dataset – Pooled Sample (Wave 2 to Wave 9).

The measure of overall market job insecurity makes some allowance for gender based employment differences in occupation and industries; it is constructed by taking the average of the individuals' "expected job insecurity" variable across all possible 151 combinations between occupations and industries. The individual hypothetical market is identified by a specific combination represented by his/her own occupation and his/her own industry. For example, an individual who is a technician and working in health care may operate in a different market from a technician working in the finance sector. Men are again found to have higher perceived job insecurity than women using the market based measure, although the gap between the genders is a little lower.

On average the households have slighter less than one dependent child (a resident child aged under 15), with total household size averaging 3.34 people suggesting that many households have another adult living with them. Finally household non-labour income[6] is relatively high in Australia as a wealthy OECD country, however, there is also considerable variance in this measure indicating high levels of inequality (Mariotti *et al*, 2015).

4. Estimation

As discussed above, the sharing rule plays a crucial role in Collective Labour Supply models. This rule is recovered if the Collective restrictions (either (8) or (9)) are satisfied. In the following, individual utilities are modelled as caring in a Beckerian sense and equations (5) and (6) are estimated subject to the restrictions reported in equation (9). The non-linear constraints, as specified in equation (9), can be dealt

[6] Household financial year non-labour disposable income calculated as the difference between household financial year gross incomes (including windfall and other income but excluding wages) less all household financial year taxes, measured in 2005 Australian dollars. To calculate net values, the tax rates indicated in the HILDA Usermanual (in accordance with Wilkins, 2009) are applied to relevant taxable income after deductions. The components which the Australian Tax Office (ATO) treats as taxable income are: wages and salaries, business income, investment income, private pensions and taxable Australian public transfers. Taxable public transfers are obtained by subtracting from public transfer income Family Tax Benefit Parts A and B, including Child Benefit and Child Tax Relief; Maternity Allowance, Maternity Payment, the Disability Support Pension and estimated Rent Assistance, none of which are taxable.

with in the usual manner by algebraic substitution. Thus rather than estimating the parameters β_4 and β_5 the following quantities are estimated:

$$\gamma_1 = \frac{\beta_6 \alpha_4}{\alpha_6} \; ; \quad \gamma_2 = \frac{\beta_6 \alpha_5}{\alpha_6}. \tag{10}$$

This reduces the dimensionality of the parameter vector by two (as two constraints are imposed on the problem). The two labour supply equations are reformulated:

$$h^1 = \alpha_0 + \alpha_1 \log w_1 + \alpha_2 \log w_2 + \alpha_3 y + \alpha_4 \log w_1 \log w_2 + \alpha_5 s_1 + \alpha_6 s_2 + \boldsymbol{\alpha}_7' \mathbf{X_1} + \varepsilon_1; \tag{11}$$

$$h^2 = \beta_0 + \beta_1 \log w_1 + \beta_2 \log w_2 + \beta_3 y + \gamma_1 \log w_1 \log w_2 + \gamma_2 s_1 + \beta_6 s_2 + \boldsymbol{\beta}_7' \mathbf{X_2} + \varepsilon_2; \tag{12}$$

where γ_1 and γ_2 as given by (10) are estimated in place of β_4 and β_5. Equations (11) and (12) are estimated simultaneously and the restrictions are imposed directly in the estimation process. The (asymptotic) standard errors $se(\hat{\gamma}_1)$ and $se(\hat{\gamma}_2)$ needed for constructing confidence intervals, conducting tests and making inference are computed using the Delta Method.

The two labour supply functions are estimated using the Generalized Method of Moments (GMM). This approach is preferred since it is able to consistently estimate the standard errors even in the presence of heteroskedasticity of unknown form (unlike Maximum Likelihood). The GMM estimator exploits the assumption that the instruments are exogenous, and the estimator is robust to heteroskedasticity (of unknown form) and allows for possible correlation between ε_1 and ε_2.

5. Results

Selected results for the estimation of the labour supply functions are presented in Table 2. The models are well defined and the coefficients are consistent with the priors discussed above. If the focus of this paper was on labour supply, we would go on to present relevant elasticities and discuss the results more fulsomely. However, for our purposes, the emphasis is on the parameter estimates as a means to calculate the sharing rule.

We proceed by considering whether Australian households behave in an efficient manner according to the Collective assumptions. The Collective restrictions (equation 9) are accordingly tested on the estimated unrestricted model and the results are reported in Table 2, columns 1 (for the wife) and 2 (for the husband). These results provide support for the efficiency assumptions behind the Collective model in this case.

Subsequently, the Collective restrictions are imposed directly on the GMM objective function as discussed in Section 4 above. Table 2 provides the results for the Collective model with Caring which is represented as a system of non-linear equations and estimated with non-linear GMM. Columns 3 and 4 of Table 2 report the parameter estimates of (11) and (12). The final column (column 5) reports the implicit parameter estimates of the sharing rule (7). It is worth stressing that the implicit parameters of the sharing rule are obtained as non-linear combinations of the previously estimated (constrained) parameters derived from the estimation of (11) and (12). The (asymptotic) standard errors of the sharing rule parameters estimates are computed using the Delta Method.

Table 2 - Parameter estimates

	Unrestricted model		*Constrained model*		
	Wife	*Husband*	*Wife*	*Husband*	*Sharing Rule with Caring*
	(1)	(2)	(3)	(4)	(5)
log w_f	-0.874**	-1.129***	-1.076***	-0.909***	5400.741**
	(0.444)	(0.401)	(0.388)	(0.260)	(2474.172)
log w_m	-0.961**	-1.128***	-1.145***	-0.905***	5325.301**
	(0.403)	(0.408)	(0.350)	(0.267)	(2396.712)
log w_f × log w_m	0.299**	0.350***	0.360***	0.282***	-1674.494**
	(0.133)	(0.125)	(0.116)	(0.081)	(766.352)
Nonlabour income	-0.0002**	0.00003	-0.0002**	0.00001	0.955***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.311)
Distribution Factors					
Expected Job Insecurity	-0.0002**	-0.0001*	-0.0002**	-0.0002**	0.942*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.544)
Future Employment Worry	-0.025***	-0.019***	-0.025***	-0.020***	116.294**
	(0.006)	(0.005)	(0.005)	(0.004)	(51.694)
Over-identifying restrictions:	5.391 (p=0.980)		6.803 (p=0.977)		
Observations:	6613		6613		

HILDA Dataset – Pooled Sample (Wave 2 to Wave 9). Notes: Significance levels: 10% (*), 5%(**), 1%(***). Control variables in Xi are: age; number of dependent children; general health; industry; occupation; and urbanisation

When dealing with labour supply in a household context, possible endogeniety of wages should be considered. If unobserved individual characteristics are positively correlated with wages, spurious correlation between the regressors and the error term in the labour supply equations is an issue [7]. Our choice of instruments is influenced by Mroz (1987), the set of (excluded) instruments consists of time dummies, second order polynomials in education, and the interaction of age and education [8].

As shown in Table 2, the set of instruments passes the over-identifying restrictions test. An additional test was conducted to check for the weakness of instruments. As explained in Stock and Yogo (2001) and Stock *et al*., (2002), this test involves the construction of what they call the concentration parameter. Given the different set of instruments used for the two labour supply equations, the concentration parameter was computed for the two labour supplies. Their closeness to the critical values provided in Stock and Yogo (2001) support the validity of the chosen instruments and their strength. Moreover, given the weighting matrix used in equation

[7] The dataset provides information on gross weekly wage and weekly hours of work. Average hourly wage rates are the ratio of these two variables. Measurement error in the hours of work measure may lead to a spurious negative correlation between this average hourly wage measure and the dependent variable.

[8] As discussed in Pencavel (1986), there is a debate in the labour supply literature whether education variables should be used as instruments for the wage rates or as exogenous regressors in the labour supply equation. It is common practice to use schooling as an instrument for wage rates whenever other instruments are not available. This approach has been followed in this work, and education has been used as an instrument.

(14), the GMM estimator used for the estimation is the efficient one among the class of GMM estimators, and is also robust to heteroskedasticity (of unknown form) and to any possible correlation between the two errors in the labour supply equations and across observations (in order to exploit the panel structure of the data).

The dependent variable and non-labour income are rescaled (they were divided by 100 and 1,000, respectively). This rescaling is necessary so the scale of the sharing rule and the scale of household non-labour income match each other. As explained in Section 2 and as represented in (2) the sharing rule function $\varphi(\cdot)$ gives the household non-labour income share that goes to the individual and adds to his/her own individual labour income before the spouses maximize their utilities. While household non-labour income is information that is usually available, the share φ^i that goes to the individual (as represented in (2)) is not available and is computed according to the sharing rule $\varphi(\cdot)$. This implies the scale of the household non-labour income share φ^i must match the scale of the household non-labour income y.

As discussed above, the distribution factors (i.e. the elements of the s vector) are: the individual's own "Expected job insecurity"; and the individual's own "Future employment worry". The control variables included in the analysis are: age; number of dependent children; industry; occupation; urbanisation; and an indicator of general health.

The estimates of the structural components of the two labour supply equations can be compared with those obtained by Chiappori *et al*., (2002). The estimates for the wife's labour supply equation obtained in this work are similar to those obtained in Chiappori *et al*., (2002). In contrast, the results related to the husband's labour supply equation are quite different. In particular, the estimates related to the wage rates are negative, as opposed to Chiappori's estimates that are positive. The negativity of the wage rates also contrasts with the empirical literature on male labour supply according to which the response of labour supply to increase in wages is positive. To check the robustness of the estimates for the male equation, different specifications of the male labour supply equation have been estimated (both individually and jointly with the wife's labour supply). In all the specifications the labour supply response to increase in wages is negative (for them). This result may be explained by the specific features of the selected sample. Table 1 indicates that these Australian men would rather supply less hours of work if allowed to do so. This might suggest that their position on the labour supply curve is on the backwards sloping section.

What is of particular note is the effect of the two self-assessed job insecurity variables on the sharing rule. Here the interpretation is carried out from the wife's perspective, but the same interpretation can be conducted from the husbands' perspective. The implicit parameters of the sharing rule suggest that when the perceived employment prospects of the wife change, and she becomes concerned about the future security of her job, she gets an additional portion of non-labour income from the husband. This is compatible with the type of utility function chosen for this work, namely "caring in a Beckerian sense". Since the members of the couple operate in a "caring" context it is plausible to think that the economic risks are shared between the members of the couple.

6. Conclusion

The study exploits a Collective model of labour supply to consider the household as a risk sharing tool that individuals use to cover against potential economic risks. The focus is the household as an environment and not as an economic agent. An application is made addressing (perceived) individual job insecurity. The job insecurity measures are incorporated into the model under the form of distribution factors. The restrictions implied by Beckerian-caring preferences in the Chiappori (2002) Collective model are considered, and estimates of the sharing rule are derived.

The results support the idea of household formation as a tool that (caring) individuals have in order to share possible risks they could encounter throughout their lives. Moreover, the collective behaviour of the Australian households under analysis has been tested and confirms their efficient behaviour. A negative shock, thought of in terms of an increase in individual job insecurity, is found to be related to the (re) distribution of power between the members of the couple. The results are consistent with the idea of caring individuals and show how the spouse affected by the negative shock is supported by the relatively more job-secure partner, supporting the idea of household formation as a tool that caring partners use to share risk. Our findings provide further insight as to how unemployment risk may affect interaction between Australian spouses.

References

Altonji, J. (1986), 'Intertemporal Substitution in Labor Supply: Evidence from Micro Data', *Journal of Political Economy*, 94(3 Part 2), S176-S215.

Apps, P., Andrienko, Y. and Rees, R. (2014), 'Risk And Precautionary Saving in Two-Person Households', *American Economic Review*, 104(3), 1040-46.

Apps, P. F., and Rees, R., (1996), 'Labour Supply, Household Production and Intra-Family Welfare Distribution', *Journal of Public Economics*, 60, 199-219.

Apps, P. F., and Rees, R., (1997), 'Collective Labor Supply and Household Production', *Journal of Political Economy*, 105, 178-190.

Berloffa G. and Simmons, Peter, J., (2003), 'Unemployment Risk, Labour Force Participation and Savings', *Review of Economic Studies*, 70, 521-539.

Blundell, R., Pistaferri, L. and Saporta-Eksten, I. (2012), 'Consumption Inequality and Family Labor Supply', *NBER Working Paper* No. 18445, November.

Browning, M., Chiappori. P.A. and Weiss, Y. 2014. Economics of the Family CUP, Cambridge.

Browning, M., & Gørtz, M. (2012). 'Spending Time and Money Within The Household', *Scandinavian Journal of Economics*, 114(3), 681-704

Browning, M. and Meghir, C., (1991), 'The Effects of Male and Female Labor Supply on Commodity Demands', *Econometrica*, 59, 925-51.

Chiappori, P.A., (1988), 'Rational Household Labor Supply,' *Econometrica*, 56, 63-89.

Chiappori, P.A., (1992), 'Collective Labor Supply and Welfare', *Journal of Political Economy*, 100, 437-467.

Chiappori, P.A., Fortin, B. and Lacroix, G., (2002), 'Marriage Market, Divorce Legislation and Household Labor Supply', *Journal of Political Economy*, 110, 37-72.

Chzhen, Y., Mumford, K.A., and Nicodema, C. (2013), 'The Gender Pay Gap in The Australian Private Sector: Is Selection Relevant Across the Wage Distribution', *Economic Record*, 89(286), 367-381.

Juhn, C. and Potter, S. (2007), 'Is There Still an Added Worker Effect?" *Federal Reserve Bank of New York*. Staff Report No. 310

Junankar, P.N. (2014), 'The Impact of the Global Financial Crisis on Youth Labour Markets', *IZA DP* No. 8400.

Lundberg, S. (1985), 'The Added Worker Effect', *Journal of Labor Economics*, 3(1), 11-37.

Lundberg, S., Pollak, R., and Wales, T., (1997), 'Do Husbands and Wives Pool Their Resources? Evidence from the U.K Child Benefit', *Journal of Human Resources*, 32, 463-480.

Mariotti, F., Mumford, K.A., and Pena-Boquete, Y. (2015) 'Household Asset Holding Diversification in Australia', *Australian Economic Review*, 48(1), 43-64.

Mumford, K.A. and Smith, P.N. (1999), 'The Hiring Function Reconsidered: On Closing the Circle', *Oxford Bulletin of Economics and Statistics*, 61(3), 343-364.

Pencavel, J., (1986), 'Labor Supply of Men: A Survey', in Orley Ashenfelter and Richard Layard (ed.), *Handbook of Labour Economics Volume 1*, Amsterdam: North-Holland, 3-102.

Stock, J. H., Wright, J., and Yogo, M., (2002), 'A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments', *Journal of Business & Economic Statistics*, 20, 518-529.

Stock, J. H., and Yogo, M., (2001), 'Testing for Weak Instruments in Linear Iv Regression', unpublished manuscript, Harvard University.

Summerfield, M., Freidin, S., Hahn, M., Ittak, P., Li, N., Macalalad, N., Watson, N., Wilkins, R. and Wooden, M. (2013) HILDA User Manual – Release 12. Melbourne Institute of Applied Economic and Social Research, University of Melbourne, Australia.

Wilkins, R. (2009) 'Updates and Revisions to Estimates of Income Tax and Government Benefits', *HILDA Project Technical Paper Series*, No. 1/09, February 2009.

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The Association Between Indigenous Australians' Labour Force Participation Rates and Access to Transport

Elisa Birch and David Marshall,* University of Western Australia

Abstract

This paper examines the factors associated with the labour force participation rates of Indigenous Australians. Emphasis is placed on the role that vehicle ownership, holding a valid driver's licence and having access to public transport has on Indigenous Australians' labour force participation decisions. Access to transportation has been widely regarded as a key barrier to employment for many minority groups, including the Indigenous population. The paper finds that Indigenous Australians who own a car or have a driver's licence have a higher probability of participating in the labour market. Indigenous Australians with cars or driver's licences also have a higher probability of being an active job seeker relative to those not in the labour force. The findings suggest that improved access to transportation for the Indigenous population should have a positive impact on their employment outcomes.

JEL Classification: C21, J00, J15

Keywords: Economics of minorities, Labour force participation, Transport access

1. Introduction

Indigenous Australians are widely established as being one of the most socioeconomically disadvantaged groups in Australia. A key aspect of this disadvantage is their limited engagement in the Australian labour market (Savvas *et al*., 2011; and Kalb *et al*., 2011). As shown in Figure 1, only two-thirds of Indigenous men and just over one-half of Indigenous women participate in the labour force. These rates are approximately 20 percentage points lower than the rates for non-Indigenous

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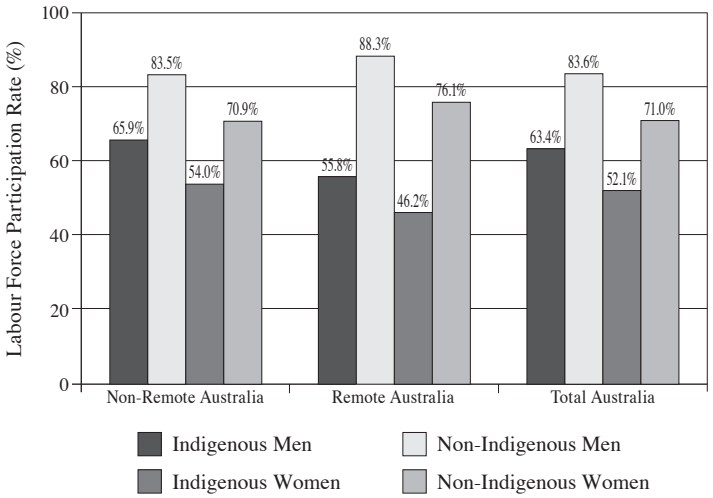
For Correspondence: Dr Elisa Rose Birch, Mail Bag M251, UWA Business School, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Ph: +61 8 6488 1444, Email: elisa.birch@uwa.edu.au

Australians. Figure 1 also shows that Indigenous men and women living in remote areas of Australia have considerably lower labour force participation rates than those living in non-remote areas.

Figure 1 Labour Force Participation Rates, 2011



Source: Australian Bureau of Statistics (ABS)(2011).

Improving the labour force participation rates of Indigenous Australians is essential to meet the Council of Australian Governments targets in 'Closing the Gap in Indigenous Disadvantage' which aims to half the gap in employment outcomes by 2018. Since 2008, this gap has actually widened, with mainstream Indigenous employment falling from 53.8 per cent to 47.5 per cent in 2012-13 (Commonwealth of Australia, 2016). The gap is even greater in very remote areas where only 30.4 per cent of Indigenous adults are employed. There are large social and financial benefits for closing the gap in employment outcomes. It has been estimated that if Indigenous Australians' employment rates matched those of the non-Indigenous population, the government would receive an additional $762 million per year in tax revenue and save $780 million per year on social security. Moreover, Indigenous Australians' earnings would increase by $4,821 million per year (Gray *et al*., 2014).

There have been a number of studies that have examined the factors associated with the labour force participation decisions of Indigenous Australians (see Savvas *et al*., 2011; and Kalb *et al*., 2011 for reviews). These studies have found that Indigenous Australians' participation in the labour force is associated with their education levels, health, geographic location and number of demographic, family and cultural characteristics. A limitation of this research is that there are few studies which have focussed on how access to transportation impacts on Indigenous Australians' labour force participation. Access to transport has been suggested as an important resource for providing individuals with the opportunity to pursue employment activities (Australian Institute of Health and Welfare, AIHW, 2011; and Dockery and Hampton, 2015).

There is a small body of international literature which has examined the impact of access to transportation on labour market outcomes (Raphael and Rice, 2002; Ong, 2001; Cervero *et al*., 2002; Gurley and Bruce, 2005; Thompson, 2001; Avrillier *et al*., 2010; Sanchez, 1999; and Kawabata, 2002). Most studies are based on minority groups and disadvantaged individuals and consider the impact of owning a car, driver's licence or having access to public transport on labour market outcomes. It has been found that individuals with access to vehicles have higher rates of employment than those who do not (Raphael and Rice, 2002; Ong, 2001; and Cervero *et al*., 2002). It has also been reported that holding a driver's licence has a positive impact on employment (Avrillier *et al*., 2010). Indeed, studies on remote Australia have found that having a driver's licence is very important for the mobility and employment of Indigenous people (Dockery and Hampton, 2015).

The relationship between access to public transport and labour market outcomes is less clear. On one hand, it has been reported that individuals with better access to public transport have higher rates of employment than those who do not (Sanchez, 1999; and Kawabata, 2002). On the other hand, studies have found that there is no significant relationship between access to public transport and labour market outcomes (Cervero *et al*., 2002; and Thompson, 2001). The differences in findings across studies are potentially reflective of the measurement of access to public transport as well as the use of different data sets and samples analysed.

Access to transportation may be of importance to Indigenous Australians' labour market outcomes given the fact that the population faces relatively high levels of transport disadvantage in terms of accessing vehicles, public transport and obtaining driver's licences (Rosier and McDonald, 2011; and Skinner and Rumble, 2012). Only 51 per cent of Indigenous Australian households have access to a motor vehicle compared to 85 per cent of non-Indigenous households (AIHW, 2011). Likewise, less than half of eligible Indigenous Australians hold a driver's licence compared to 70 per cent of the non-Indigenous population (Audit Office of New South Wales, AONSW, 2013). Transport disadvantage is more apparent in remote areas of Australia, of which the Indigenous population is heavily represented (Rosier and McDonald, 2011). Only 43.7 per cent of Indigenous Australians living in remote communities have access to a working car compared to 58.7 per cent of Indigenous Australians living in non-remote communities (ABS, 2002). Almost three-quarters of Indigenous Australians living in remote Australia have no access to public transport as compared to only one-fifth of the Indigenous population living in non-remote Australia (ABS, 2010).

There are many reasons why Indigenous Australians may face transport disadvantage. Two key reasons relate to the costs of owning private vehicles and difficulties in obtaining a driver's licence. It has been suggested that transport disadvantage is a result of a lack of affordability in being able to maintain private transport, such as the purchase of a car and the costs of using a car (Currie and Senbergs, 2007). Individuals with lower incomes face greater difficulty in affording private transport (Rosier and McDonald, 2011). It has been widely established that Indigenous Australians have lower levels of income than their non-Indigenous counterparts (Hunter, 2012). Issues regarding the costs of maintaining private cars may be particularly relevant for Indigenous Australians in remote communities.

This is due to the fact that in remote areas cars have a shorter life span as they are highly used, often purchased second-hand and are driven on rough terrain (Currie and Senbergs, 2007). In addition, car maintenance is more expensive due to lack of resources and cars are often shared which can cause tensions over who has the rights to use shared vehicles.

Indigenous Australians face difficulties in obtaining driver's licences due to the financial costs of getting and renewing a driver's licence, difficulties in proof of identity and the difficulties in accessing vehicles and driving instructors to accumulate the required number of supervised driving hours to obtain a licence (Skinner and Rumble, 2012). Indigenous Australians also face difficulties in obtaining driver's licences due to having lower levels of literacy for driving tests and a fear of police (Skinner and Rumble, 2012). These difficulties could be more apparent in remote Australia due to the lack of resources in remote communities.

The purpose of this paper is to examine the impact of transportation disadvantage on Indigenous Australians' labour force participation decisions. Specifically, the paper focusses on the links between having a driver's licence, access to public transport and vehicle ownership on Indigenous Australians' labour force participations rates. The paper is structured as follows. Section 2 examines the data and method. Section 3 presents the empirical results and a conclusion and policy discussion is given in Section 4.

2. Data and Method

Data for this study is from the 2008 National Aboriginal and Torres Strait Islander Social Survey (NATSISS) conducted by the ABS. The NATSISS contains detailed information on Indigenous Australians' socioeconomic characteristics for those living in remote and non-remote areas of Australia. The data sample is restricted to Indigenous Australians aged 18 to 64 years and excludes missing information on the transport variables considered in the analysis.[1] It also excludes approximately 1 per cent of the sample who reported that they have a vehicle provided by their employers. This is because having a vehicle provided by an employer perfectly predicts labour force status. The data sample is comprised of 6,444 individuals of which 2,183 live in remote areas and 4,261 live in non-remote areas.

The framework to examine the impact of access to transportation on labour force participation decisions is based on the standard labour supply theory outlined in Killingsworth (1983), whereby an individual's decision to participate in the labour market (*LFPN*) is a function of their potential earnings (*w*), the value they place on not working (reservation wage, *r*) and their non-wage income (*V*). Hence, the probability that the i^{th} person participates in the labour force can be written as:

$$\Pr(LFPN_i) = \Pr\left(\beta_{w_0} + \beta_{w_1} A_{w_i} + \varepsilon_{w_i} > \beta_{r_0} + \beta_{r_1} V_i + \beta_{r_2} A_{r_i} + \varepsilon_{r_i}\right).$$

[1] There were 141 individuals in the sample (roughly 2 per cent) who did not report information on transport characteristics. This sample had a very similar labour force participation rate as the full sample.

Where A_{w_i} is a vector of observable characteristics affecting potential earnings, A_{r_i} is a vector of observable characteristics affecting the reservation wage, A_i represents the individual's non-wage income and ε_{w_i} and ε_{r_i} are mean-zero random error terms.

When specified in their reduced-form, potential earnings, the reservation wage and non-wage income can be proxied by the individual's demographics (*Demo*), educational attainment (*Edu*), the characteristics of their household (*Household*), behavioural traits (*Behaviour*) and transportation characteristics (*Transport*).[2] Hence, Equation (1) can be specified as:

$$LFPN_i = f(Demo_i, Edu_i, Household_i, Behaviour_i, Transport_i), i = 1, \ldots n. \quad (2)$$

Equation (2) is estimated using a probit model. The analysis considers the impact of three transportation characteristics on Indigenous Australians' labour force participation rates. These are: (i) whether the individual has a valid driver's licence, (ii) the number of working vehicles owned by the household and (iii) whether the individual has access to public transport in the area which they live.

As shown in Table 1, over one-third of the sample does not hold a driver's licence or have access to public transport and approximately one-quarter of the sample live in households without a car. Table 1 also shows that there are significant differences in the proportion of Indigenous Australians with these characteristics across remote and non-remote communities, with those living in remote areas being less likely to own a car, hold a licence or have access to public transport. There is also a high correlation between the number of vehicles owned by the household and whether the individual has a driver's licence in the sample. Approximately 76.9 per cent of Indigenous Australians who do not have a car do not have a licence. In comparison, only 18.6 per cent of Indigenous Australians who have three or more cars in their household do not have a driver's licence.

[2] A full description of the variables used in the analysis is presented in Table A1 of the Appendix. Many of the variables included in the analysis are consistent with those used in previous studies on Indigenous labour supply (particularly Savvas *et al*., 2011) and the inclusion of variables relating to demographics, education and household characteristics are standard in labour supply models (see Killingsworth, 1983). Behavioural characteristics such as cultural factors (i.e. whether the individual recognises an area as their homelands, identifies with a clan or was removed from their family), physical and mental health (measured by self-assessed health status and being of psychological distress) and risky health behaviour (i.e. cigarette, alcohol and illicit drug use) are included in the analysis to capture the individual's ability to participate in the labour market and the potential impact on their reservation wage.

Table 1 - Proportion of Indigenous Australians by Selected Transportation Characteristics[a]

	Full Sample	Remote Communities	Non-Remote Communities
Driver's licence:			
No licence	35.74	49.52	28.68
Has a licence	64.26	50.48	71.32
	100.00	100.00	100.00
Vehicle Ownership:			
No cars	24.66	36.92	18.38
One car	38.69	40.68	37.68
Two cars	25.81	16.77	30.44
Three or more cars	10.85	5.63	13.52
	100.00	100.00	100.00
Public Transport:			
No access to public transport	33.77	72.79	13.78
Access to public transport	66.23	27.21	86.22
	100.00	100.00	100.00

Note: [a] There are statistically significant differences the proportion of Indigenous Australians with specific transport characteristics by remote and non-remote Australia.

Two specifications of the transportation characteristics are considered in the analyses. First, the model is estimated with controls for the number of cars in the household (*1 car, 2 cars, 3+ cars*), whether the individual holds a valid driver's licence (*Licence*) and whether they live in an area with public transport (*Public transport*) (and various other characteristics specified in Equation (2) (known as model (*i*)). The second specification accounts for the interaction between household vehicles and having a driver's licence. This is important because there is a strong correlation between having a licence and owning a car and the interaction between the two presents a stronger proxy for mobility since using a car requires both access and a licence. The model is also estimated with variables controlling for whether the individual has a licence and one car (*Licence & 1 car*), a licence and two cars (*Licence & 2 cars*), a licence and three or more cars (*Licence & 3+ cars*), a licence and no cars (*Licence & No Cars*), at least one car but no licence (*No Licence & 1 car*) as well as access to public transport and the other control variables described above (known as model (*ii*)). Under this specification, the reference group is those without a car or a driver's licence.

A limitation of the study is that it cannot fully account for the issue of reverse causality. There is potentially a high degree of reverse causality in estimating the impact of access to transportation on labour force participation. Labour force participants include individuals who are employed as well as those who are looking for work. Individuals who are employed are more likely to have the financial means to purchase a car or obtain a licence than those who are not working. In addition, those who are actively involved in the labour market may choose to live in areas closer to public transport.

There have only been a few studies on transportation access and employment outcomes which have addressed the issue of reverse causation (Gurley and Bruce, 2005; Cervero *et al*., 2002; and Avrillier *et al*., 2010). The studies by Gurley and Bruce (2005) and Cervero *et al*., (2002) are based on panel data and therefore are able to observe changes in employment outcomes before and after receiving access to transport. This cannot be achieved using the NATSISS as the data is cross-sectional. Panel data on Indigenous Australians is very limited. Whilst some Indigenous Australians are surveyed in the Household, Income and Labour Dynamics Australia survey (HILDA), they are heavily under-represented in the survey. Moreover, HILDA only has information on driver's licences for one wave of data which limits the ability to examine the impact of before and after obtaining a driver's licence on labour force participation decisions.

The study by Avrillier *et al*. (2010) used instrumental variable (IV) methods to address the issue of reverse causation, where the impact of access to transport on employment was instrumented with other variables so that access to transport could be treated as exogenous in the employment model. In this study, holding a driver's licence was instrumented by a variable controlling for policy reforms which impacted on the ability of the sample to obtain a licence for free. Avrillier *et al*. (2010) reports that the findings using the IV approach are limited, largely due to a lack of suitable instruments for access to transport. For IV methods to be effective, it requires the instrument for the variables associated with access to transport to be correlated with the transport characteristics but uncorrelated with factors which impact on labour force participation decisions. Hence, the instrument cannot directly determine labour force participation decisions. Potential instruments for holding a driver's licence may include whether the individual's parents had a licence or own a car. Access to transport could potentially be instrumented by detailed information about home location or the population of the home neighbourhood and car ownership could potentially instrumented by whether the individual has a garage or car park at their house. Unfortunately, the NATSISS does not have appropriate information on these potential instruments. Moreover, most IV approaches (such as two-stage least squares) are more suitable to when the independent variable and instrument are continuous variables rather than dichotomous (such as the decision to participate in the labour force). It would be possible to estimate the labour force participation decision using a predicted value of the instrument. However, as the NATSISS is only accessible from the ABS's Remote Access Data Library (RADL) and RADL only has early versions of econometric software. As such, testing the validity of the predicted instrument (which could be achieved using more recent versions of the software) is limited.

Given these complications, the issue of reverse causation has not been accounted for in the empirical results. As a result, this study, at best, seeks to establish the association between access to transportation and labour force participation decisions. There is a real need for future data sets on Indigenous Australians to be of a panel nature so the issues discussed above can be addressed. To reduce the potential of reverse causality this paper focusses on the impact of transportation on labour force participation decisions rather than just employment. In addition, the models

are estimated on samples of Indigenous men and women by various labour force participation categories. The study considers the impact of transport characteristics on being an active job seeker relative to those who are not in the labour force.[3] It also considers the impact of transportation characteristics on the amount of time that the individual has been looking for employment (i.e. length of time being an active job seeker) relative to those not in the labour force.

3. Empirical Results

The results from the estimation of the probability of participating in the labour market are consistent with previous research on the labour market outcomes of Indigenous Australians.[4] The probability of participating in the labour market is positively associated with Indigenous Australians' level of education and health. It is generally negatively associated with the number of children living in the household and having spent time in jail.[5] Indigenous women who are married have a lower probability of participating in the labour market whereas Indigenous men who are married have higher labour force participation rates than those who are not married. The probability of participating in the labour market increases with Indigenous Australians' age, albeit at a diminishing rate.

Of central importance to this study is the impact of access to transport on Indigenous Australian's labour force participation rates. These results are presented in Table 2.[6] The table presents results for the full sample of Indigenous men and women as well as for those living in remote and non-remote communities.

[3] Active job seekers are defined as labour force participants who are unemployed, hence looking for employment. Whilst there may be some conjecture as to whether all individuals who are unemployed actively look for employment, the NATSISS does not have other data which could capture active job seekers.

[4] The full-set of the results are available from the authors.

[5] It is noted that some of the independent variables included in the analysis could be highly correlated; such as being arrested and jailed. Models were estimated with the inclusion of just being arrested or incarcerated. The results from these models did not have a substantial impact on the findings associated with the transportation variables. The variable for being arrested (in models without controls for jailed) did not change. Hence it was still insignificant in most of the labour force participation models, with the exception of Indigenous females living in remote areas.

[6] The models were estimated with different groups of control variables to test the robustness of the links between transport access and labour force participation. For example, the model was estimated using 'cars per adult' in the household as an indicator of access to vehicles. These results were very comparable with those in the paper. The model was also estimated with the inclusion of household income to assess the potential reverse causality in examining the link between access to transport and labour force participation. Household income was significantly positively associated with labour force participation (as expected) and the inclusion this variable had minimal impact on the magnitude and statistical significance of the link between the transport characteristics and labour force participation. In other words, when holding household income constant, access to transport still has a significant impact on labour force participation. Whilst this cannot rule of the impact of reverse causality, it does suggest some degree of robustness in the results.

Table 2 - Results from Models to Estimate the Probability of Participating in the Labour Market: Estimated Impacts for Transport Characteristics[a]

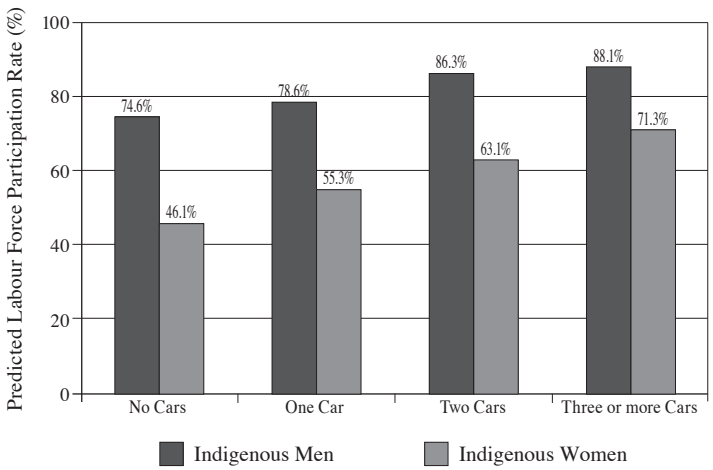
	Full Sample			*Remote*			*Non-Remote*		
	Coef.	*Std Error*	*Marginal Effect*	*Coef.*	*Std Error*	*Marginal Effect*	*Coef.*	*Std Error*	*Marginal Effect*
Indigenous Men									
Model (i)									
1 car	0.164	(0.083) **	0.040	0.284	(0.123) **	0.064	0.089	(0.119)	
2 cars	0.518	(0.106) ***	0.117	0.475	(0.183) ***	0.094	0.460	(0.141) ***	0.108
3+ cars	0.708	(0.138) ***	0.135	1.165	(0.343) ***	0.152	0.479	(0.172) ***	0.103
Licence	0.410	(0.080) ***	0.110	0.404	(0.129) ***	0.096	0.434	(0.106) ***	0.120
Public transport	-0.192	(0.081) **	-0.047	-0.146	(0.122)		-0.296	(0.115) ***	-0.068
Model (ii)									
Licence & 1 car	0.524	(0.098) ***	0.115	0.677	(0.159) ***	0.133	0.428	(0.133) ***	0.096
Licence & 2 cars	0.940	(0.114) ***	0.185	0.905	(0.219) ***	0.148	0.880	(0.146) ***	0.184
Licence & 3+ cars	1.175	(0.147) ***	0.181	1.421	(0.358) ***	0.162	0.975	(0.177) ***	0.168
Licence & No cars	0.309	(0.137) **	0.067	0.412	(0.193) **	0.081	0.108	(0.203)	
No Licence & 1+ car	0.222	(0.099) **	0.052	0.347	(0.146) **	0.073	0.070	(0.141)	
Public transport	-0.186	(0.081) **	-0.045	-0.146	(0.122)		-0.273	(0.116) **	-0.062
Indigenous Women									
Model (i)									
1 car	0.236	(0.064) ***	0.092	0.036	(0.097)		0.387	(0.089) ***	0.149
2 cars	0.447	(0.082) ***	0.170	0.410	(0.138) ***	0.157	0.549	(0.108) ***	0.206
3+ cars	0.713	(0.112) ***	0.252	0.121	(0.211)		0.965	(0.141) ***	0.320
Licence	0.462	(0.059) ***	0.181	0.520	(0.097) ***	0.203	0.446	(0.077) ***	0.178
Public transport	-0.022	(0.062)		-0.051	(0.089)		-0.046	(0.089)	
Model (ii)									
Licence & 1 car	0.660	(0.071) ***	0.246	0.527	(0.115) ***	0.201	0.787	(0.096) ***	0.288
Licence & 2 cars	0.924	(0.085) ***	0.325	0.977	(0.161) ***	0.333	1.003	(0.109) ***	0.350
Licence & 3+ cars	1.184	(0.118) ***	0.366	0.702	(0.247) ***	0.248	1.378	(0.144) ***	0.403
Licence & No cars	0.322	(0.107) ***	0.122	0.402	(0.164) **	0.152	0.303	(0.148) **	0.114
No licence & 1+ car	0.242	(0.077) ***	0.093	0.063	(0.111)		0.387	(0.111) ***	0.145
Public transport	-0.022	(0.062)		-0.048	(0.089)		-0.053	(0.088)	
Indigenous Men Sample Size:		2,751			948			1,803	
Indigenous Men Mean LFPN:		0.768			0.778			0.763	
Indigenous Women Sample Size:		3,693			1,235			2,458	
Indigenous Women Mean LFPN:		0.553			0.536			0.561	

Notes: [a] The model to estimate the impact of the transport characteristics on labour force participation controls for demographics, education, household characteristics and behavioural traits. The symbol * refers to statistically significant at the 10 per cent level, ** at the 5 per cent level and *** at the 1 per cent level.

The results from the model which directly controls for vehicles, driver's licences and access to public transport indicates that the number of cars owned by the household is positively associated with labour force participation. For example, Indigenous men and women with one car are 4.0 and 9.2 percentage points more likely to participate in the labour force than those without a car. Those with two cars are 11.7 and 17.0 percentage points more likely to participate in the labour market.

As shown in Figure 2, the predicted proportions of Indigenous men participating in the labour market varies by 13.5 percentage points for those with no cars to three or more cars (ranging from 74.6 per cent to 88.1 per cent).[7] The predicted labour force participation rates vary by 25.2 percentage points for Indigenous women ranging from 46.1 per cent for those without a car to 71.3 per cent for those with three cars.

Figure 2 - Indigenous Australians' Predicted Labour Force Participation Rates By Vehicle Ownership



The impact of vehicle ownership on labour force participation is significantly larger for Indigenous women compared to Indigenous men and is also significantly larger for Indigenous women living in non-remote areas than remote areas, suggesting that car ownership may be of particular importance to female labour force participation decisions. This may be associated with the fact that vehicles may assist women in combining work and with family commitments, such as grocery shopping or taking children to school.

Indigenous men and women with valid driver's licences are also more likely to participate in the labour force. The predicted proportion of Indigenous men with driver's licences participating in the labour market is 76.2 per cent, which is 11.0 percentage points higher than the rate for Indigenous men without a driver's licence, of 65.2 per cent. Indigenous women with a driver's licence have labour force participation rates that are 25.2 percentage points higher than the rates of those without a driver's

[7] The predicted labour force participation rates are derived from the marginal effects, holding all other variables at their means.

licence (predicted labour force participation rates of 70.7 per cent compared to 45.4 per cent). This finding may be a further indication that access to transport is more pertinent to the labour force participation of Indigenous women than Indigenous men. Whilst there are significant differences in the labour force participation rates of Indigenous Australians with and without driver's licences in remote and non-remote Australia, these differences are relatively small, suggesting that improving Indigenous Australian's ability to hold a driver's licence should have a positive impact on labour force participation in remote and non-remote Australia.

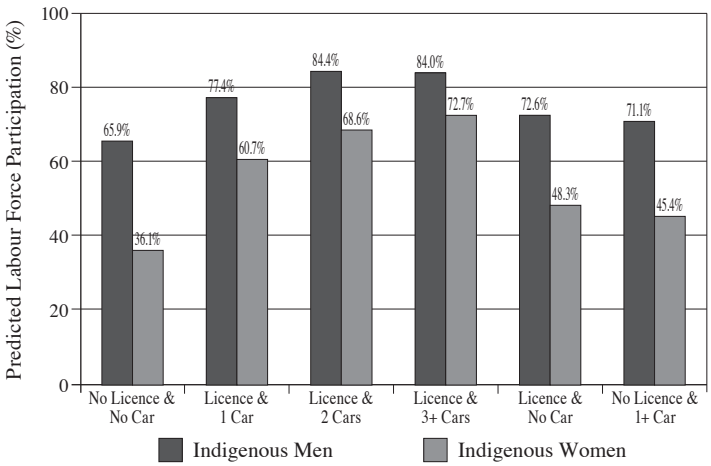
For most of the Indigenous population, there are no significant differences in the labour force participation rates for those who live in areas with public transport and those who do not. The exception to this is Indigenous men living in non-remote communities who are 7.1 percentage points less likely to participate in the labour force if they live in an area with access to public transport than their counterparts without access. The insignificance of the public transport variable for most of the sample could be a result of specification of the public transport variable, as access to public transport does not necessarily equate to public transport use. Indeed, only 35.1 per cent of Indigenous men and 38.8 per cent of Indigenous women who have access to public transport in the sample report that they used public transportation within the past two weeks. When the models were estimated with variables controlling for public transport use in place of public transport access, public transport use was still insignificant. In addition, models were estimated on samples of Indigenous Australians living in high socioeconomic status areas to capture those living in inner cities. The results from these models showed that access to public transport was statistically insignificant. As such the findings suggest that public transport does not have an impact on the labour force participation decisions of Indigenous Australians. This may be a result of public transport not providing adequate links to employment for Indigenous Australians. The significant negative impact of public transport on the labour force participation rates of Indigenous men living in non-remote areas could be due to reverse causation whereby, non-labour force participants live in areas with greater access to public transport. It may also be due to labour force participants being less likely to recognise that public transport is available in their area, reflective of problems in the collection of the information about public transport access in the dataset.

The results from the model estimated with vehicle ownership interacted with holding a driver's licence are consistent with those from model (i). Hence, Indigenous Australians who hold a valid driver's licence and live in households with cars are more likely to participate in the labour force than those who do not. The largest difference in these labour force participation rates are for those with a licence and three or more cars compared to those without car or licence. As shown in Figure 3, Indigenous Australian men and women with a driver's licence and three or more cars have predicted labour force participation rates that are 18.1 and 36.6 percentage points higher than the rates for their counterparts without a car or licence.

The results suggest that holding a driver's licence but not owning a car is positively associated with labour force participation. Indigenous men and women who hold a driver's licence but do not have a car have labour force participation rates that are 6.7 and 12.2 percentage points higher than the rates of those without a car and licence, respectively (predicted labour force participation rates for males and females of 76.2 and 48.3 per cent for compared to 65.9 and 36.1 per cent, see Figure 3). Living in a

household with at least one vehicle but not having a driver's licence is also positively associated with labour force participation. The predicted labour force participation rates of Indigenous men and women without a driver's licence but who live in households with a car are 71.1 and 45.4 per cent.

Figure 3 - Indigenous Australians' Predicted Labour Force Participation Rates by Vehicle Ownership Interacted with Holding a Driver's Licence



The impact of the variables associated with holding a driver's licence interacted with car ownership is again significantly larger for Indigenous women than Indigenous men. They are also significantly larger for Indigenous women living in non-remote areas than remote areas. This further suggests that transport characteristics are more important to labour force participation for Indigenous women than men, particularly for those in living in non-remote areas. Access to public transport is also generally insignificant, which may be a further indication that it is access to private transportation which affects labour force participation.

The model was also estimated on separate samples of different types of labour force participants. Specifically, the model was used to estimate the probability of being an active job seeker, a job seeker for less than 13 weeks, a job seeker for 13 weeks or more, and being employed relative to not participating in the labour market. These results are presented in Table 3.[8] As shown in the table, owning a car, holding a driver's licence or both has a very strong positive impact on the probability of being employed relative to not in the labour force for Indigenous Australians. The coefficients for the transport characteristics are relatively larger in the model estimating the probability of being employed compared to the coefficients from the models estimating the labour force participation decisions. This finding could be attributed to reverse causation. However, it may also suggest that holding a driver's licence or having a car improves the likelihood of finding employment for the Indigenous population as well as labour force participation.

[8] Due to small sample sizes, the models were only estimated on the full sample of Indigenous men and women, not separately for those in remote and non-remote areas.

Table 3 - Results from Models to Estimate the Probability a Particular Type of Labour Market Participant: Estimated Impacts for Transport Characteristic[s(a)]

	Total Unemployed		*Unemployed < 13 weeks*		*Unemployed 13+ weeks*		*Employed*	
	Coef.	*Std Error*	*Coef.*	*Std Error*	*Coef.*	*Std Error*	*Coef.*	*Std Error*
Indigenous Men								
Model (i)								
1 car	0.042	(0.121)	0.317	(0.170) *	-0.222	(0.138)	0.257	(0.091) ***
2 cars	0.248	(0.164)	0.442	(0.233) *	0.152	(0.184)	0.641	(0.113) ***
3+ cars	0.383	(0.225) *	0.791	(0.292) ***	0.132	(0.266)	0.822	(0.147) ***
Licence	-0.033	(0.118)	0.098	(0.160)	-0.054	(0.136)	0.556	(0.086) ***
Public transport	-0.357	(0.135) ***	-0.459	(0.198) **	-0.317	(0.149) **	-0.184	(0.086) **
Model (ii)								
Licence & 1 car	-0.106	(0.151)	0.378	(0.221) *	-0.291	(0.171) *	0.761	(0.108) ***
Licence & 2 cars	0.190	(0.186)	0.573	(0.279) **	0.055	(0.205)	1.201	(0.123) ***
Licence & 3+ cars	0.428	(0.254) *	0.981	(0.339) ***	0.176	(0.301)	1.430	(0.155) ***
Licence & No cars	-0.058	(0.203)	0.362	(0.286)	-0.194	(0.229)	0.457	(0.148) ***
No Licence & 1+ car	0.037	(0.138)	0.501	(0.197) **	-0.182	(0.157)	0.322	(0.110) ***
Public transport	-0.355	(0.135) ***	-0.472	(0.198) **	-0.301	(0.149) **	-0.177	(0.086) **
Indigenous Women								
Model (i)								
1 car	0.082	(0.095)	0.103	(0.131)	0.061	(0.110)	0.314	(0.070) ***
2 cars	-0.061	(0.136)	-0.026	(0.185)	-0.065	(0.160)	0.578	(0.088) ***
3+ cars	0.286	(0.192)	0.489	(0.241) **	0.086	(0.237)	0.836	(0.118) ***
Licence	0.220	(00091) **	0.299	(0.125)	0.137	(0.106)	0.507	(0.064) ***
Public transport	0.105	(0.104)	0.001	(0.141)	0.195	(0.124)	-0.048	(0.065)
Model (ii)								
Licence & 1 car	0.297	(0.108) ***	0.390	(0.145) ***	0.190	(0.126)	0.781	(0.078) ***
Licence & 2 cars	0.186	(0.146)	0.316	(0.190) *	0.056	(0.177)	1.088	(0.091) ***
Licence & 3+ cars	0.497	(0.214) **	0.537	(0.285) *	0.377	(0.252)	1.352	(0.124) ***
Licence & No cars	0.232	(0.156)	0.147	(0.218)	0.223	(0.180)	0.366	(0.117) ***
No licence & 1+ car	0.078	(0.112)	0.028	(0.160)	0.085	(0.129)	0.334	(0.086) ***
Public transport	0.106	(0.104)	-0.004	(0.140)	0.198	(0.124)	-0.048	(0.065)
Indigenous Men Sample Size:	947		754		832		2,443	
Indigenous Men Mean(b):	0.325		0.153		0.232		0.738	
Indigenous Women Sample Size:	1,940		1,763		1,829		3,405	
Indigenous Women Mean(b):	0.148		0.063		0.097		0.515	

Notes: [a] The model to estimate the impact of transport characteristics on being a particular type of labour force participant controls for demographics, education, household characteristics and behavioural traits. The symbol * refers to statistically significant at the 10 per cent level, ** at the 5 per cent level and *** at the 1 per cent level. [b] The means refer the proportion of the sample who are that particular type of labour force participant.

Finally, the results from the model estimating the probability of being an active job seeker (i.e. labour force participants looking for employment) reveal that transport characteristics generally have a positive impact on Indigenous Australians' decisions to look for work relative to not being in the labour force. For example, Indigenous men with three or more cars are 13.6 percentage points more likely to be looking for work rather than being a non-labour force participant compared to the population without a car. Indigenous women with a driver's licence are also 4.3 percentage points more likely to be looking for work (relative to those who are not in the labour force) compared to women without a driver's licence. The impact of transport characteristics on the probability of being an active job seeker relative to not working is much more pronounced for Indigenous Australians who have been looking for work for less than 13 weeks. Transport characteristics do not have a large impact on being a job seeker for Indigenous people who have been looking for work for 13 weeks or longer. Whilst this finding may be due to reverse causation where the short-term unemployed are more likely to have access to vehicles and a driver's licence than the long-term unemployed, it does demonstrate the link between transport and successful engagement with the labour market.

4. Summary and Policy Discussion

Indigenous Australians face high levels of transport disadvantage in terms of vehicle ownership, holding a valid driver's licence and access to public transport. The population also has considerably lower labour force participation rates than non-Indigenous Australians. To date, little is known on how transportation characteristics such as vehicle ownership, holding valid driver's licence and access to public transport impact on Indigenous Australians' labour force participation. The purpose of this paper was to examine this issue. The paper has found that when controlling for various other factors known to influence labour force participation such as education and health, Indigenous Australians' labour force participation rates are positively associated with the number of cars in their household. They are also positively associated with holding a valid driver's licence. The models which accounted for vehicle ownership combined with holding a driver's licence suggest that is it is the combination of having a valid driver's licence and access to a car which has the most pronounced impact on Indigenous Australians' labour force participation decisions. However, Indigenous Australians who hold a driver's licence but do not have a car as well as those who do not have a licence but live in households with a car were also found to have higher labour force participation rates than those without a car or licence. The paper also found that the impact of transport on labour force participation was much larger for Indigenous women than Indigenous men as well as for Indigenous women living in non-remote areas than those in remote areas. Transportation characteristics have a positive impact on not only on labour force participation but also employment. They generally had a positive impact on the probability of being an active job seeker relative to not in the labour force, particularly for Indigenous Australians who have been looking for work for shorter periods of time. Finally it appears that access to public transport does not impact on the labour force participation rates of Indigenous Australians.

The findings of this paper can be used to assist policymakers and researchers in improving the labour market outcomes of Indigenous Australians. It clear from the

paper that there is a strong positive association between vehicle ownership and holding a driver's licence with labour force participation rates. Cars and driver's licences also have a positive impact on Indigenous Australians being employed, compared to not being in the labour force as well as being an active job seeker opposed to not working. Therefore, policies aimed at reducing the transport disadvantage faced by Indigenous Australians should have a positive impact on their labour force participation, which is paramount to the 'Closing the Gap' targets. Such policies may be more beneficial to Indigenous women given that their labour force participation is more closely linked to private transportation characteristics than Indigenous men. They may also be more beneficial for Indigenous women living in non-remote areas compared to remote areas as their labour force participation is also more sensitive to transport characteristics.

The results from this paper have shown that Indigenous Australians with a driver's licence are more likely to participate in the labour force. Even Indigenous Australians who do not own a vehicle but who hold a driver's licence were found to have higher rates of labour force participation. As such, policy aimed at directly improving Indigenous Australians' access to obtaining driver's licences should have a positive impact on their labour market outcomes. Removing the barriers Indigenous Australians face to get a driver's licence, such as the fear of the police responsible for licencing, financial constraints, documentation issues and supervised driving requirements could have a positive impact on their labour force participation (AONSW, 2013). There are currently a number of programs to support Indigenous Australians in obtaining licences such as ones relating to proof of identity requirements, changes in the supervised driving requirements and driving education programs (see Department of Transport, 2012; and Health Info Net, 2015). However, many of these programs are state or even region specific. There may be merit in expanding such programs to a national scale, so that all Indigenous Australians benefit from such policies.

In addition, Indigenous Australians are much more likely to have their driver's licences revoked due to fine default and more likely to be imprisoned for driving offenses (AONSW, 2013; and Skinner and Rumble, 2012). As a means of improving the proportion of Indigenous Australians with driver's licences, it may be beneficial for policymakers to consider alternative punishment methods for not paying fines. For example, Dockery and Hampton (2015) support a system of provisional 'locked' licences for employment purposes so that driving offences do not negatively impact on employment.[9] It may also be beneficial for government and law enforcers to review cases for Indigenous Australians who have lost their licences for 'life' to see if there is scope for allow such persons to reapply for driver's licences, particularly if their potential employment requires a driver's licence.

The findings of this paper also indicate that Indigenous Australians who live in a household with more vehicles are more likely to participate in the labour force. This is even for the population who do not have a driver's licence. Given that Indigenous Australians have poorer access to vehicles than the rest of the Australian population, policies aimed at improving vehicle ownership among the Indigenous population could have a positive impact on their labour force participation rates. It may be of merit for the

[9] It should also be noted that given the negative impact of jail on labour force participation, alternate punishments which avoid sending Indigenous Australians to jail for driving offences should positively impact on their labour force participation.

government to subsidise the cost of purchasing a vehicle and running a vehicle (such as vehicle registration fees) for the Indigenous population. There may also be merit in programs to train Indigenous Australians in car mechanics to improve the longevity of vehicles. Whilst the programs would be expensive to implement, increasing labour force participation for Indigenous Australians is beneficial to the Government budget (Gray *et al*., 2014). The benefits of improved labour force participation may outweigh the costs of such programs.

The results in the paper show that it is a combination of having a driver's licence and owning a vehicle which has the largest impact on labour force participation. Policy aimed at improving Indigenous Australians' access to driver's licences and vehicle ownership need to take this into consideration. The current licencing requirements in Australia stipulate that an individual must complete a certain amount of driving time with a suitable instructor. As such, all individuals need access to a car to obtain a licence. Given that Indigenous Australians are less likely to own a car than other Australian population sub-groups, especially in remote areas, there may be some scope for the government to provide cars in Indigenous communities specifically for driving instruction.

Access to public transport did not have major impact on Indigenous Australian's labour force participation rates (and when it did, it had a negative impact on labour force participation). This result may suggest that public transport does not provide Indigenous Australians with enough mobility to travel to their places of employment. It may also be reflective of other factors, as access to public transport is not parallel to private transport use. Further research is required to examine the relationship (if any) between public transport and the labour market outcomes of Indigenous Australians.

On a final note whilst this paper has established a clear association between vehicle ownership and holding a driver's licence and the labour force participation rates of Indigenous Australians, this study is not without its limitations. This largely stems from the fact that it is based on cross-sectional data. The study has been unable to correct to the issue of reverse causation between access to transport and labour force participation decisions. It cannot be ruled out that the relationship between vehicle ownership and having drivers licence, and labour force participation is a result of participating the labour market providing Indigenous Australians with the means to obtain a licence or vehicle. Much more research is needed on the impact of transport characteristics on the labour supply of Indigenous Australians. The NATSISS is limited in the sense that it cannot provide a more detailed analysis how access to transport impacts labour market participation in certain regions which may be of further merit. For example, the NATSISS by remoteness only defines remote and non-remote areas but does not further define regional areas. It would also be of value to be able to compare how transportation characteristics impact on other minority groups and the Australian population as a whole. It would be of value for more data sets, such as the Australian Census to include variables relating to driver's licences. In addition, there is a real need for detailed panel data on Indigenous Australians to test for reverse causation and endogeneity issues when examining their labour market outcomes. This would be of particular value for policymakers and researchers to gain a more detailed understanding of the factors driving the labour force participation rates of Indigenous Australians.

Appendix

Table A1 - Description of Variables Used in the Analysis

Variable	*Description*	*Mean*	*Std. Dev.*
Dependent variables:			
LFPN	Equal to 1 for labour force participant, and 0 for non-labour force participant	0.644	0.479
Employed	Equal to 1 for employed and 0 for non-labour force participant	0.608	0.488
Unemployed	Equal to 1 for unemployed and 0 for non-labour force participant	0.206	0.405
Unemployed < 13 weeks	Equal to 1 for unemployed for less than 13 weeks and 0 for non-labour force participant	0.090	0.286
Unemployed 13+ weeks	Equal to 1 for unemployed for 13 or more weeks and 0 for non-labour force participant	0.139	0.346
Independent variables:			
Transport:			
1 car	1 car owned by household members	0.387	0.487
2 cars	2 cars owned by household members	0.108	0.311
3+ cars	3 or more cars owned by household members	0.108	0.311
No car	Omitted category: No cars owned by household members	0.247	0.431
Licence	Possesses a current driver's licence	0.643	0.479
No licence	Omitted category: does not possess a current driver's licence	0.357	0.479
Public transport	Public transport available in local area	0.662	0.473
No public transport	Omitted category: Public transport is not available in local area	0.338	0.473
Licence & 1 car	1 car owned by household members and possesses a current driver's licence	0.268	0.443
Licence & 2 cars	2 cars owned by household members and possesses a current driver's licence	0.222	0.416
Licence & 3+ cars	3 or more cars owned by household members and possesses a current driver's licence	0.095	0.293
Licence & No cars	Possesses a current driver's licence but has no cars owned by household members	0.057	0.231
No licence & 1+ car	Has at least 1 car but does not possess a current driver's licence	0.168	0.374
No licence & No car	Omitted Category: No cars owned by household members and does not possess a current driver's licence	0.190	0.392
Demographics:			
Remote	Lives in remote/very remote areas based on ASGC remote area classification	0.339	0.473
Non remote	Omitted category: lives in non-remote areas based on ASGC remote area classification	0.661	0.473
Age	Age	37.071	12.550
No English	Main language spoken at home is not English	0.150	0.357
English	Omitted category: main language spoken at home is English	0.850	0.357
Married	Married or de facto relationship	0.509	0.500
Not married	Omitted category: not married or de facto relationship	0.491	0.500
Education:			
Degree	Highest educational attainment is a tertiary qualification	0.289	0.454
High school	Highest educational attainment is the completion of year 10, 11 or 12	0.456	0.498
Unqualified	Omitted category: highest educational attainment is less than year 10	0.254	0.435
Households:			
3+ adult household	Three or more household members aged over 15 years	0.360	0.480
2 adult household	Omitted category: two or less members of the household aged over 15 years	0.640	0.480

Table A1 - Description of Variables Used in the Analysis (continued)

Variable	*Description*	*Mean*	*Std. Dev.*
1 child	One child aged under 15 years in the household	0.191	0.393
2 children	Two children aged under 15 years in the household	0.180	0.384
3+ children	Three children or more under aged under 15 years in the household	0.206	0.405
No children	Omitted category: no children aged under 15 years in the household	0.422	0.494
Non-Indigenous household	Some members of the household are non-Indigenous	0.359	0.480
Indigenous household	Omitted category: All members of the household are Indigenous	0.641	0.480
Behaviour:			
Homelands	Recognises an area as homelands/traditional country	0.262	0.440
No homelands	Omitted category: does not recognise an area as homelands/ traditional country	0.738	0.440
Cultural group	Identifies with a clan, tribal or language group	0.664	0.472
No cultural group	Omitted category: does not identify with a clan, tribal or language group	0.336	0.472
Removed	Forced removal from family by the government	0.093	0.291
Not removed	Omitted category: not forcedly removed from family by the government	0.907	0.291
Excellent health	Self-assessed health rated as excellent or very good	0.411	0.492
Good health	Self-assessed health rated as good	0.349	0.477
Fair health	Self-assessed health rated as fair	0.163	0.369
Poor health	Omitted category: self-assessed health rated as poor	0.077	0.266
High Psychological Distress	Is in a high or very high level of psychological distress measured by their score on the Kessler Psychological Distress Scale (K5) (see ABS, 2009 for more information)	0.333	0.471
Low Psychological Distress	Omitted category: not in a high or very high level of psychological distress	0.667	0.471
Smoker	Current smoker	0.526	0.499
Non-smoker	Omitted category: not a current smoker	0.474	0.499
Daily drinker	Drinks alcohol every day	0.064	0.245
Drinker	Drinks alcohol, but not every day	0.696	0.460
Non-drinker	Omitted category: does not drink alcohol	0.241	0.427
Illicit drug use	Has taken an illicit drug in the past 12 months	0.218	0.413
Non-illicit drug use	Omitted category: has not taken an illicit drug in the past 12 months	0.782	0.413
Arrested	Has been arrested in the last 5 years	0.164	0.370
Not arrested	Has not been arrested in the last 5 years	0.836	0.370
Jailed	Has been incarcerated	0.105	0.307
Not jailed	Has never been incarcerated	0.895	0.307

References

Audit Office of New South Wales (2013), 'Improving Legal and Safe Driving among Aboriginal People', New South Wales Auditory-General's Report, Sydney, Australia.

Australian Bureau of Statistics (2002), 'National Aboriginal and Torres Strait Islander Social Survey, Australia', Australian Bureau of Statistics Catalogue No. 4714.0.55.001, Canberra, Australia.

Australian Bureau of Statistics (2009), 'National Aboriginal and Torres Strait Islander Social Survey, 2008', Australian Bureau of Statistics Catalogue No. 4714.0, Canberra, Australia.

Australian Bureau of Statistics (2010), 'The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples, October', Australian Bureau of Statistics Catalogue No. 4704.0, Canberra, Australia.

Australian Bureau of Statistics (2011), 'Labour Force Characteristics of Aboriginal and Torres Strait Islander Australians, Estimates from the Labour Force Survey', Australian Bureau of Statistics Catalogue No. 6287.0, Canberra, Australia.

Australian Institute of Health and Welfare (2011), 'The Health and Welfare of Australia's Aboriginal and Torres Strait Islander People: An Overview 2011', Australian Institute of Health and Welfare Catalogue No. 42, Canberra, Australia.

Avrillier, P., Hivert, L. and Kramarz, F. (2010), 'Driven Out of Employment? The Impact of the Abolition of National Service on Driving Schools and Aspiring Drivers', *British Journal of Industrial Relations*, 48(4), 784-807.

Cervero, R., Sandoval, O. and Landis, J. (2002), 'Transportation as a Stimulus of Welfare-to-Work: Private Versus Public Mobility', *Journal of Planning Education and Research*, 22(1), 50-63.

Commonwealth of Australia (2016), *Closing the Gap: Prime Minister's Report: 2016*. Commonwealth of Australia, Canberra.

Currie, G. and Senbergs, Z. (2007), 'Indigenous Communities: Transport Disadvantage and Aboriginal Communities', in G. Currie, J. Stanley, and J. Stanley (Eds.), *No Way to Go: Transport and Social Disadvantage in Australian Communities*, Monash University Press, Melbourne, Australia, 9.1-9.12.

Department of Transport (2012), 'Aboriginal People and Ethnic Minority Groups Accessing our Driver Licensing Services: Substantive Equality Framework Assessment', Department of Transport, Perth, Australia.

Dockery, A.M. and Hampton, K. (2015), *The Dynamics of Services, Housing, Jobs and Mobility in Remote Australian and Torres Strait Islander Communities in Central Australia*. CRC-REP Working Paper CW023, Ninti One Ltd. Alice Springs, Australia.

Gray, M., Hunter, B. and Biddle, N. (2014), 'The Economic and Social Benefits of Increasing Indigenous Employment', CAEPR Topical Issue No. 1/2014, ANU, Canberra, Australia.

Gurley, T. and Bruce, D. (2005), 'The Effects of Car Access on Employment Outcomes for Welfare Recipients', *Journal of Urban Economics*, 58(2), 250-272.

Health Info Net (2015), 'Road Safety: Programs and Projects', Indigenous Australians Health Info Net, Perth, Australia.

Hunter, B. (2012), 'Selected Issues for Closing the Income Gaps Between Indigenous and Other Australians, 2001-11', CAEPR Topical Issue No. 1/2012, ANU, Canberra, Australia.

Kalb, G. Le, T., Hunter, B. and Leung, F. (2011), 'Identifying Important Factors for Closing the Gap in Labour Force Status Between Indigenous and Non-Indigenous Australians', *Economic Record*, 90(291), 536-550.

Kawabata, M. (2002), 'Job Access and Work among Autoless Adults in Welfare in Los Angeles', Annals of the Association of American Geographers, 104(6), 1156-1182.

Killingsworth, M.R. (1983), Labour Supply, Cambridge University Press, Cambridgeshire.

Ong, P. (2001), 'Car Ownership and Welfare-to-Work', *Journal of Policy Analysis and Management*, 21(2), 239-252.

Raphael, S. and Rice, L. (2002), 'Car Ownership, Employment, and Earnings', *Journal of Urban Economics*, 52(1), 109-130.

Rosier, K. and McDonald, M. (2001), 'The Relationship between Transport and Disadvantage in Australia', Child Family Community Australia Resource Sheet, Australian Institute of Family Studies, Melbourne, Australia.

Sanchez, T. (1999), 'The Connection Between Public Transit and Employment: The Cases of Portland and Atlanta', *Journal of the American Planning Association*, 65(3), 284-296.

Savvas, A., Boulton, C. and Jepsen, E. (2011), 'Influences on Indigenous Labour Market Outcomes', Productivity Commission Staff Working Paper, Melbourne, Australia.

Skinner, M. and Rumble, N. (2012), 'A New Approach to Addressing Driver Licensing Issues Within Indigenous Communities Across Australia', Paper presented at the 12th Australian College of Road Safety National Conference, Sydney, Australia.

Thompson, G.L. (2001), 'New Insights into the Value of Transit Modeling Inferences from Dade County', *Transportation Research Record*, 1753, 52-58.

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Socioeconomic Response by Age Group to the Australian Baby Bonus: A Multivariate Analysis of Birth Data from 2001-13

Louise Rawlings, Stephen J. Robson and Pauline Ding,
The Australian National University

Abstract

To deal with the demographic trends of declining fertility rates and ageing populations, many developed countries have implemented pronatalist policies designed to increase fertility rates. A key pronatalist policy introduced in Australia was the 'Baby Bonus' payment scheme announced in May 2004. Responding to a gap in the literature, this paper assesses changes in birth rates by age group and socioeconomic status after the introduction of the Baby Bonus, using national birth data for Australia from 2001-2013. Our results show that during the key years of the Baby Bonus policy, the overall birth rate for all socioeconomic groups in the 15-19 age group rose by 8.1%. Of particular note were the lowest two socioeconomic quintiles, for whom birth rates rose by 10% and 12% respectively.

1. Introduction

Many governments around the world have expressed concerns about declining fertility rates and ageing populations, because these changes are associated with future labour and revenue shortages, and can adversely affect long term economic prosperity. In an attempt to arrest these demographic trends many developed countries have implemented pronatalist policies intended to increase fertility rates. These attempts have been seen most recently in China, which has conditionally lifted its longstanding 'one-child' policy.

A key pronatalist policy introduced in Australia was the 'Baby Bonus' payment scheme announced in May 2004. The impact of the Baby Bonus on fertility in Australia deserves careful scrutiny and investigation. Using national birth data for Australia from 2001-2013, this paper aims to provide statistical evidence about the variability of this impact across different age groups and socioeconomic regions. In

Correspondence: Dr Louise Rawlings, Regulatory Institutions Network, Australian National University, Canberra, Australia. National Circuit, Barton, ACT 2600, Australia, Louise.rawlings@anu.edu.au
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this study we aim to examine variability in the way different population subgroups appear to have responded to the policy. The main difference of our study lies in the use of official statistics from the Australian Bureau of Statistics (ABS) by age group and socioeconomic status over 13 years, thus it gives a comprehensive overview of changes in fertility rates on the national level. To date, other studies have investigated individual-specific associations between birth-rate and other factors using social survey data for a selected population, such as the Household, Income and Labour Dynamics in Australia (HILDA) Survey (Parr and Guest (2011) and Drago *et al* (2009)[1] or the data has been confined to a particular State (Lain *et al* 2009; Langridge *et al*. 2012).

2. Background: Australian Baby Bonus policy

On Australian Budget night 2004, the introduction of the Australian Baby Bonus was announced with then-Treasurer Costello (2004) famously quipping that Australian parents should consider having "one for mum, one for dad and one for the country". The policy had been designed specifically to increase fertility levels and was structured as below.

- The introduction of the Australian Baby Bonus would be staged with increasing payments as follows:
    - o From 1 July 2004, a Baby Bonus of A$3,000 would be paid for each child born.
    - o From 1 July 2006, a Baby Bonus of A$4,000 would be paid for each child born.
    - o From 1 July 2008, a Baby Bonus of A$5,000 would be paid for each child born.
- In 2008, it was announced that from 1 January 2009, a means test would apply to families with a combined income of A$150,000 a year or more, making them ineligible to receive the Australian Baby Bonus.
- From 1 January 2011, families whose primary carer earnt less than A$150,000 became entitled to 18 weeks' parental leave at the national minimum wage.
    - o The Paid Parental Leave scheme was designed to replace the Baby Bonus, however due to differences in eligibility criteria and tax treatment, some parents would have been better off under the old scheme. To avoid this situation, the Baby Bonus was still available and if a parent was eligible for both, they could choose which one to receive.
- From 1 March 2014, the Baby Bonus was abolished, instead giving recipients of Family Tax Benefit (FTB) Part A a smaller additional loading with the birth of a baby. FTB Part A is targeted towards parents earning lower or middle incomes.

The Baby Bonus was introduced in the context of the FTB, Australia's primary form of assistance for families with children under the age of 16 years. The FTB was designed to compensate families for the costs of raising children, with higher rates of assistance to low income families. The FTB system comprises two parts: FTB Part A and FTB Part B. The amount of FTB-A that a family receives, depends on their annual income, and on the age and number of their children. FTB-B is more narrowly

[1] The HILDA survey is an annual household-based panel study which began in 2001.

targeted to families with only one income earner (including sole parents). As intended, the family assistance system in Australia has been important in reducing child poverty (Whiteford 2009; Whiteford & Adema 2007).

Australia has had a history of such payments: in 1912 the then-Prime Minister Andrew Fisher introduced the *Maternity Allowance Act* which was a one-off payment of £5 to all women who had given birth. In 1947, the Allowance was replaced by one-off payments that were means tested. In 1978, the payment scheme was replaced by other benefits (NMA 2016).

3. Theoretical context

The economic model predicts greater effects where pronatalist policies such as the Baby Bonus generate larger incentives (for example, for younger and lower income families). The demographic model predicts that the Baby Bonus would not have different effects among subgroups as the policy focused on short term, rather than longer term, arrangements such as enabling women to combine work and family.

The principal theoretical contributions in the economic model come from the rational choice school and in particular the work of micro-economist Gary Becker (Becker 1960; Becker 1981; Becker & Lewis 1973; Becker & Murphy 2003). Becker developed this framework seeking to explain why, in the nineteenth century, richer families had many children and poorer families fewer children – a trend that reversed in the twentieth century. Becker developed a rational way to reconcile these two facts in his theory of fertility. Becker saw a child as something that a family decides to have as a conscious decision, and in making such a decision families would trade off the costs of having a child against the benefits. Becker focused on the cost side, noting that children are very time-intensive and that it tends to be the mother's time involved in raising a child. Becker reasoned that the opportunity cost of a child was the price of the mother's time, or her wage rate. Becker theorised that women with high wages have very high values of time: as a result it is more costly for them to take time away from paid work to have children and therefore they tend to have fewer. In the nineteenth century women were not working and this mechanism of high-priced versus low-priced women was in reverse. Poorer women's time value was high in alternative activities, for example working on a farm, and they tended to have fewer children.

Becker theorised that as parents become wealthier they would want 'higher quality' children. As children are expensive to raise parents tend to have fewer, and family sizes fall with income independent of the woman's wage. Becker referred to this as the 'quantity-quality' trade-off. According to Becker, some families would rationally choose to have fewer children and spend more per child, rather than having many children and spending less (Becker & Lewis 1973).

There are additional theoretical insights from demography, including gender equity theory. Women's education levels and their capacity to compete with young men in the employment market have progressed rapidly since the 1970s across the developed world. Young women are able to compete almost equally with men in relation to education and employment for as long as they remain childless (McDonald 2006). From the 1970s, the Nordic-, French-, Dutch-, and English-speaking countries moved towards different models that supported the combination of work and family.

Social democratic countries did this mainly through the provision of services funded via the tax and transfer system. Liberal economies achieved the same aims through more market-oriented approaches including lower taxation, subsidised childcare, and income transfers. Reform has been much more difficult to achieve for women in the countries where complementarianism (where men and women are considered complementary to each other, having different and specialised roles) has remained strong, such as in Southern Europe and the German-speaking countries (McDonald 2006). This is also the case for women in the East Asian liberal economies, where an additional factor preventing reform has been the opposition of employers to allow reduced work hours. Further, in looking across the OECD, Castles (2003) found that the only aspects of family-friendly public policy associated with fertility outcomes are formal childcare provision, and the proportion of women reporting that they work flexible hours.

There also is an evolving body of literature suggesting that fertility may rebound at a certain level of socioeconomic development (Myrskylä *et al* 2009; Goldstein *et al* 2009; Furuoka 2009; Luci & Thvenon 2010; Day 2012). Myrskyla and colleagues (2009) suggested that as development continues, the demographic transition may go into reverse. They undertook a cross-country comparison of the Total Fertility Rate (TFR)[2] and the Human Development Index (HDI)[3] in the years 1975 and 2005. In the 1970s, Canada had the highest HDI score of 0.89 out of the 107 countries examined. By 2005, HDI ratings had improved markedly, with two dozen of 240 countries having HDIs above 0.9. In 1975, a graph plotting fertility rates against HDIs showed a fall as HDI rose. By 2005, though, the line had a kink in it: above an HDI of approximately 0.9 it trended up producing a mirror 'J-shaped' curve. In many countries with very high levels of development (indices of around 0.95) fertility rates are now approaching two children per woman. Subsequent studies that have examined various socioeconomic dimensions have demonstrated an emerging positive correlation between fertility and a threshold level of socioeconomic development (Goldstein *et al* 2009; Furuoka 2009; Luci & Thvenon 2010; Day 2012). Goldstein *et al* (2009) and Luci and Thevenon (2010) found that temporal-effect-adjusted fertility rates appeared to have risen alongside GDP per capita in many developed countries.

4. Literature review

International studies

There has been debate in the literature as to whether pronatalist policies have caused increases in 'cohort fertility' (the fertility of all women of the same age over their lifetimes) or whether observed increases are merely changes in 'period fertility' (measured year to year) (Heard 2010). Demographers have asserted that observed increases in birth rates have often occurred because women have more opportunities for work, and this promotes delays in childbearing while not necessarily increasing the

[2] The TFR for any given year is the sum of age-specific fertility rates for that year. It is a hypothetical measure which represents the average number of babies each woman would give birth to during her lifetime if she experienced the current age-specific fertility rates at each age of her reproductive life.
[3] The HDI, a measure used by the United Nations, has three components: life expectancy; average income per person; and level of education. Its maximum possible value is one.

total number of children they have. Any observed increases would thus be attributable to 'tempo effects' (increases in birth rate due to previously delayed childbearing, with that cohort of women responding to policy changes and ceasing the delay and causing the birth rate to spike). Such a response would likely lead to an observed increase in birth rates for women in their 30s and 40s.

Internationally, a considerable research effort has sought to evaluate the impact of attempts to stimulate fertility at a national level through fiscal policy. The results appear to be inconsistent, and this should not be surprising considering that the implications of financial incentives on fertility choices are complex and difficult to quantify. This is especially so when making cross-country comparisons, since policy, economic, and social contexts vary greatly (Gauthier 2007). In a literature review, Gauthier (2007) reported that although small positive effects on fertility attributable to policy initiatives had been found in a number of studies, no significant effect has been found in others. Moreover, Gauthier found that that the effect of policies tended to be on the timing of births rather than on completed fertility in some studies. A follow-up paper by Gauthier and Thevenon (2011), suggested that although financial incentive policies were clearly associated with an effect on the timing of births, their impact on cohort completed fertility was less clear, and often underestimated, due to the difficulty in assessing the long term effects. Earlier studies had suggested that pronatalist policies could have a positive effect on fertility. For example, Milligan (2005) found the effects of a policy implemented in Quebec, Canada, that paid families up to C$8000 for having a child, was associated with an increase in fertility of 25% for families entitled to the full benefit. There are studies that have shown that direct financial incentives can be effective, as they can assist with the direct costs of children, whereas policies that enable women to combine work with family reduce opportunity costs. Theory would suggest that opportunity costs of having children rise with a woman's wage, whereas the direct costs of children would be less responsive to rising wages. This means that as the wage rate rises, women will be more likely to favour the combination of work and childcare rather than direct financial incentives.

Australian studies

The Australian Baby Bonus scheme has received significant research attention. However, whether the policy led to a quantum increase in births remains contested. Some studies argue that the initial increase in births was a direct fertility response to the introduction of the policy. Sinclair *et al*. (2012) analysed 19 years of birth and macroeconomic data, beginning in 1990, and reported a significant increase in birth numbers ten months following the announcement of the Australian Baby Bonus. They further argued that this overall increase was sustained up to the end of the observed period (2009). A cumulative growth in birth numbers which commenced in January 2006, slowed in 2008 and 2009. Sinclair *et al*. suggested that the initial increase in births, identified in March 2005, was a direct fertility response to the introduction of the policy.

It has also been argued that the increase in births in the period following the 2004 introduction of the Australian Baby Bonus, at least until the 2008 peak, was more strongly influenced by other demographic and economic changes, with the

effect of the Australian Baby Bonus of minor importance. Parr and Guest (2011) analysed individual-level fertility using data from the HILDA survey focusing on the effects of changes to family benefits, macroeconomic variables, entitlements to family-friendly working conditions, and socioeconomic and demographic characteristics. They found that the effects of the Australian Baby Bonus and the Child Care Rebate were marginal, while the effects of education, income, occupation, marital status, age, and parity (the number of living children that a woman has had) were significant. Drago *et al*. (2009) also made use of the HILDA Survey to assess if the Australian Baby Bonus increased fertility intentions and thereby births, and whether the effects were temporary or sustained. They found that fertility intentions rose after the announcement of the Baby Bonus, and estimated that the birth rate rose modestly, between 0.7% and 3.2% as a result.

Research has also suggested that there may have been a heterogeneous response to the policy across sub-groups of the population. In a population-based study of NSW birth records from 1 January 1997 to 31 December 2006, Lain *et al*. (2009) reviewed changes in birth rates after the introduction of the Australian Baby Bonus in 2004, not only for the overall population, but for the sub-population within individual age, parity, socioeconomic and geographical groups. They found that in the first two years after the introduction of the Australian Baby Bonus, the greatest increase in birth rate was seen in teenagers. In another population-based study using NSW birth records Lain *et al*. (2010) assessed the impact of an increase in the number of births on maternity services in New South Wales following the 2004 introduction of the Australian Baby Bonus. They reported that compared with trends prior to the introduction of the Australian Baby Bonus, there were an estimated 11,283 extra singleton births each year in NSW hospitals by 2008, with significant increases in the number of deliveries performed in tertiary, urban and rural public hospitals. Langridge *et al*. (2012) examined Western Australian birth data from 2001-2008, and found that the greatest increase in births were among women residing in the highest socioeconomic areas who had the lowest general fertility rate in 2004 (21.5 births per 1000 women) but the highest in 2006 (38.1 births per 1000 women).

There was a need, prior to this study, to assess changes in birth rates by age group and socioeconomic status after the introduction of the Baby Bonus, using national birth data for Australia.

5. Data and methods

Responding to a gap in the literature, this paper assesses changes in birth rates by age group and socioeconomic status after the introduction of the Baby Bonus, using national birth data for Australia from 2001-2013. Women aged 15-49 years who gave birth in Australia from 1 January 2001 to 31 December 2013 were included in the study population. To assess changes in birth rates by age group and socioeconomic status, births were stratified by age group and socioeconomic status. Birth data (the numerator) and point estimates of population (used as the denominator for birth-rate calculations) were obtained from the ABS (2014).

The customised data set obtained from the ABS contained statistics on live births for Australia by state and territory, and sub-state region, based on calendar year of

registration. Registration of births is the responsibility of state and territory Registrars of Births, Deaths and Marriages, and is based on data provided on an information form completed by the parent(s) of the child. The customised dataset divided births by socioeconomic area as classified by the Socioeconomic Indexes for Areas (SEIFA). SEIFA is a product developed by the ABS that ranks areas in Australia according to relative socioeconomic advantage and disadvantage. SEIFA ranks and summarises aspects of the socioeconomic conditions of people living in certain areas. The four indices used to create SEIFA are the indices of Relative Socioeconomic Disadvantage, Relative Socioeconomic Advantage and Disadvantage, Economic Resources and Education and Occupation. Details can be found at the ABS website (www.abs.gov.au/websitedbs/censushome.nsf/home/seifa). SEIFA has a number of important policy and research purposes and has been used to help explain individual behaviour. For example, the *Longitudinal Study of Australian Children* used SEIFA to compare the academic skills of children in disadvantaged and advantaged neighbourhoods.

Although SEIFA has enabled the comparison of birth rates across advantage and disadvantaged regions, in this study there are a number of potential limitations in using SEIFA. It is not possible to look at the range of disadvantage for population subgroups included in the construction of the index. Further, within disadvantaged areas according to the SEIFA index there would likely be advantaged individuals, and vice versa in advantaged areas there would be disadvantaged individuals. These limitations notwithstanding, SEIFA represents an important tool for evidence-based policy making in Australia, and has supported research into some of Australia's major policy and social issues.

The births data is also limited by being unable to distinguish parity. Information on the number of previous children born to a mother is only collected in some Australian states, which means that development of a national dataset is not possible at this time.

Birth data were broken down according to local statistical areas (SA2s), which are medium-sized (an average population of 10,000 in each, but ranging from 3,000 to 25,000) communities that interact socially and economically. These are the smallest statistical areas for which ABS Census data for health and other vital statistics are available. Use of SA2 units allowed calculation of age band-specific birth rates per 1000 reproductive age (15 to 49 years) women, with individual five-year age band stratification. Each SA2 unit was classified according to SEIFA. In this paper we do not claim direct socioeconomic impact on birth rates; instead we use the SEIFA as a proxy to individuals' socioeconomic status and focus on investigating the change in birth rates in specific socioeconomic regions. For each SA2 region during the period 2001 to 2012 inclusive, the number of reproductive age women was determined and the number of births recorded to residents in the area extracted. Birth rates per 1000 population were calculated. In addition, a new variable period was defined as blocks of years of the various Baby Bonus schemes, as described in the 'Background: Australian Baby Bonus policy' section. We explored the association between age groups, socioeconomic status, and the various stages of the Baby Bonus scheme with birth rates using multivariate analysis (analysis of variance).

6. Results (including discussion)

We focused on examining whether or not the changes in the birth rates associated with changes in the Australian Baby Bonus schemes were consistent across the age groups and the socioeconomic regions. The analysis of variance (Table 1) shows statistically significant differences within age groups, within socioeconomic groups, and within the various stages of the Australian Baby Bonus scheme. Analysis also found statistically significant differences between age groups and socioeconomic status, between age groups and the various stages of the Australian Baby Bonus scheme, and between age groups, socioeconomic groups and the various stages of the Australian Baby Bonus scheme. Full reports of the analysis of variance, including the mean comparisons, standard errors and significance values, are available upon request from the authors.

Table 1 - Analysis of variance – Variate: log_birth

Source of variation	*d.f.*	*s.s.*	*m.s.*	*v.r.*	*F pr.*
Age	6	1.334E+03	2.223E+02	1.700E+05	<.001
SEIFA	4	4.192E+00	1.048E+00	801.51	<.001
period	6	2.822E+00	4.704E-01	359.73	<.001
Age.SEIFA	24	3.130E+01	1.304E+00	997.36	<.001
Age.period	36	4.205E+00	1.168E-01	89.32	<.001
SEIFA.period	24	9.804E-02	4.085E-03	3.12	<.001
Age.SEIFA.period	144	5.027E-01	3.491E-03	2.67	<.001

Figure 1 - Birth Rates from 2001 to 2013

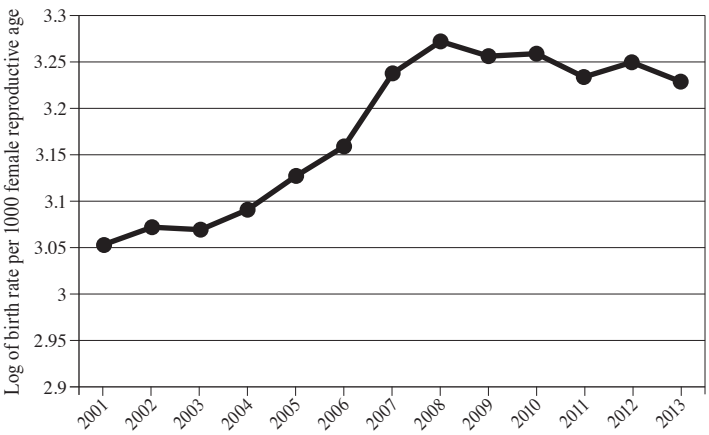

Figure 1 is a plot of the mean birth rates (on a logarithmic scale) from 2001 to 2013 and shows that the differences between the birth rates of the various Australian Baby Bonus schemes are statistically significant ($p<0.001$). The 2009 family income means test is associated with a stabilisation of birth rates from 2009 to 2010, with a decrease observed after the introduction of the 2011 paid parental leave scheme. Figures 2 to 9 show the changes in the Australian TFR, and birth rates across age and socioeconomic status during the pre-, during, and wind-down phases of the Australian Baby Bonus scheme. Detailed statistics can be found in these tables and the calculations in Table 9.

Figure 2 - Australia's total fertility rate

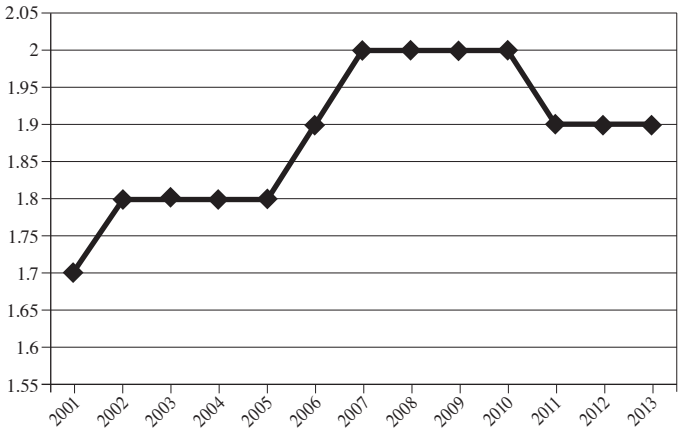

Figure 3 - Birth Rates 15-19 Age group, by SEIFA Quintile

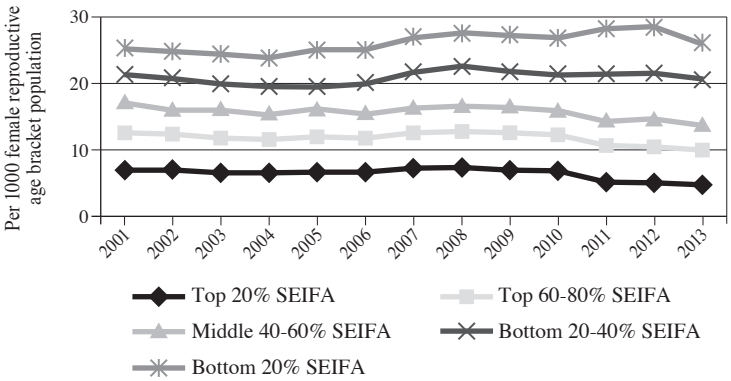

Figure 4 - Birth Rates 20-24 Age group, by SEIFA Quintile

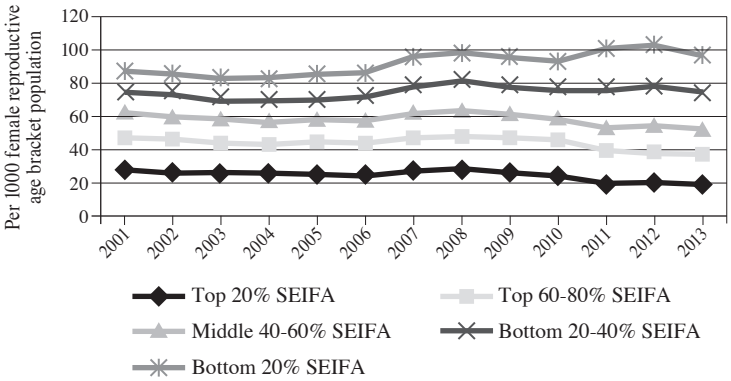

Figure 5 - Birth Rates 25-29 Age group, by SEIFA Quintile

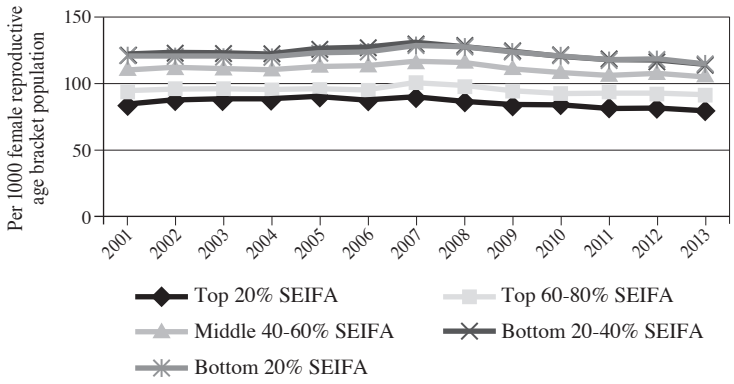

Figure 6 - Birth Rates 30-34 Age group, by SEIFA Quintile

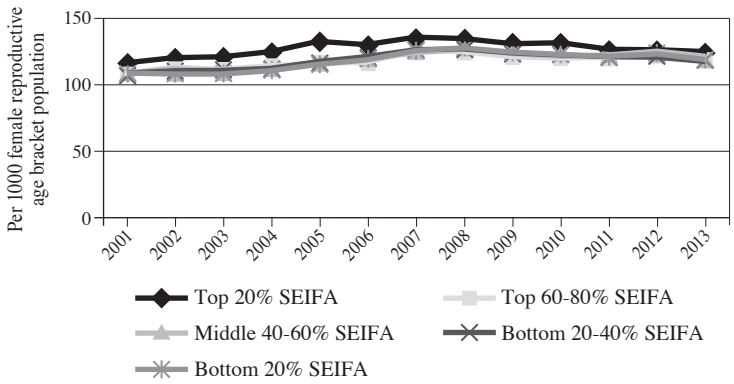

Figure 7 - Birth Rates 35-39 Age group, by SEIFA Quintile

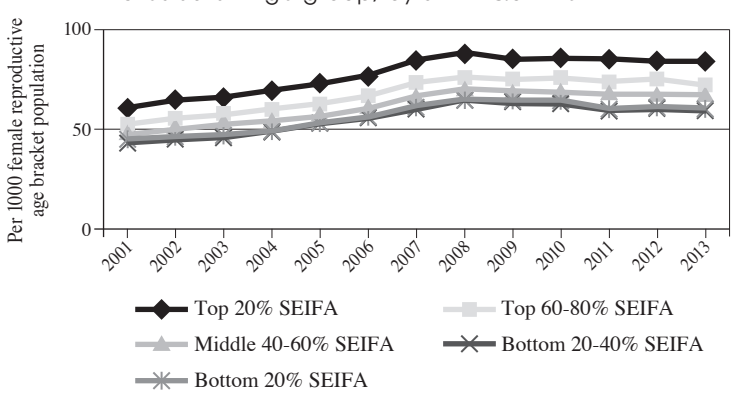

Figure 8 - Birth Rates 40-44 Age group, by SEIFA Quintile

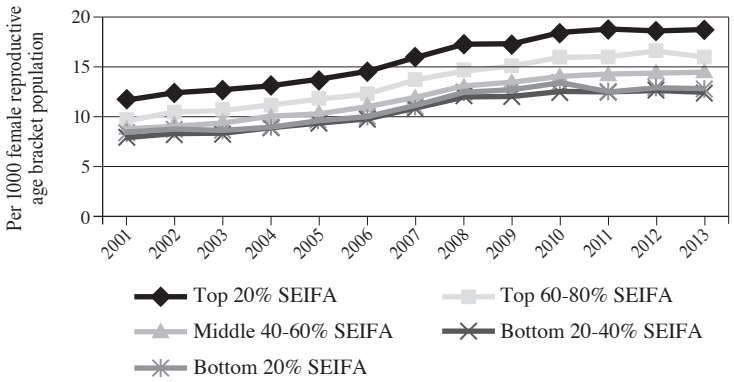

Figure 9 - Birth Rates 45-49 Agegroup, by SEIFA Quintile

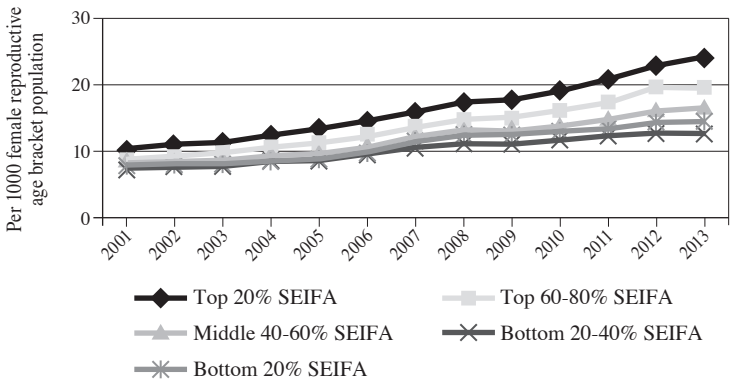

Table 2 - Birth Rates 15-19 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	7.03	7.01	6.56	6.57	6.54	6.53	7.12	7.37	6.96	6.69	5.18	5.03	4.73	-32.75
top 60-80% SEIFA	12.72	12.54	11.90	11.66	12.01	11.93	12.71	12.93	12.71	12.48	10.72	10.35	10.01	-21.30
middle 40-60% SEIFA	17.16	16.27	16.13	15.39	16.07	15.65	16.59	17.02	16.70	16.14	14.50	14.70	13.81	-19.51
bottom 20-40% SEIFA	21.45	20.96	19.90	19.55	19.72	20.38	21.79	22.71	22.12	21.74	21.60	21.82	20.63	-3.80
bottom 20% SEIFA	25.71	25.12	24.41	24.22	25.00	25.08	27.26	27.86	27.55	27.03	28.55	28.35	26.21	1.96
Total rate all SEIFA groups	16.65	16.20	15.60	15.28	15.64	15.64	16.80	17.28	16.90	16.51	15.72	15.64	14.66	-11.94

Table 3 - Birth Rates 20-24 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	26.50	26.51	24.97	24.87	24.65	24.59	26.68	27.39	25.90	24.66	19.32	19.18	18.88	-28.76
top 60-80% SEIFA	45.69	45.23	42.61	41.70	42.80	42.67	46.02	46.43	45.52	44.30	38.34	37.42	37.25	-18.47
middle 40-60% SEIFA	62.32	59.36	58.69	55.94	58.69	57.15	61.43	63.12	61.19	58.57	53.29	54.76	52.47	-15.80
bottom 20-40% SEIFA	74.44	73.07	69.44	68.80	69.36	71.24	77.62	80.76	77.17	75.60	75.79	77.88	74.72	0.38
bottom 20% SEIFA	87.56	85.87	83.16	83.52	85.83	86.26	95.98	98.74	95.82	93.50	101.00	102.74	96.64	10.37
Total rate all SEIFA groups	58.76	57.43	55.16	54.31	55.50	55.46	60.55	62.24	60.09	58.29	56.21	56.95	54.53	-7.19

Table 4 - Birth Rates 25-29 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	84.07	87.88	88.69	88.47	90.36	87.70	90.41	87.16	84.20	84.24	81.71	81.30	79.40	-5.55
top 60-80% SEIFA	93.72	96.41	96.78	96.20	96.79	95.37	100.10	98.43	94.04	92.03	92.60	92.66	90.68	-3.25
middle 40-60% SEIFA	110.29	112.85	112.08	111.05	113.39	113.92	117.21	115.77	111.34	108.67	106.62	107.78	104.53	-5.22
bottom 20-40% SEIFA	121.89	122.85	123.09	121.42	125.73	126.27	130.33	126.93	124.50	120.06	118.00	117.33	113.65	-6.76
bottom 20% SEIFA	120.27	120.39	120.42	120.21	123.59	124.40	129.05	128.65	124.55	120.97	119.08	119.25	114.83	-4.52
Total rate all SEIFA groups	105.18	107.15	107.22	106.46	108.84	108.31	112.17	110.19	106.52	104.16	102.68	102.78	99.79	-5.13

Table 5 - Birth Rates 30-34 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	116.62	120.77	121.57	125.10	131.53	130.95	136.52	134.35	130.63	132.25	126.29	127.00	125.06	7.23
top 60-80% SEIFA	108.01	110.81	110.74	113.25	116.08	117.77	125.19	125.85	121.29	120.77	121.87	123.51	121.62	12.60
middle 40-60% SEIFA	109.13	111.82	111.01	112.64	117.26	120.82	127.24	128.00	124.19	122.96	122.25	124.88	121.43	11.27
bottom 20-40% SEIFA	109.66	110.62	110.70	112.05	117.99	120.95	127.09	125.99	124.70	121.86	120.74	121.47	118.57	8.13
bottom 20% SEIFA	108.30	108.49	108.60	110.65	115.61	119.17	125.78	127.90	124.96	123.19	121.88	123.40	119.66	10.48
Total rate all SEIFA groups	110.44	112.70	112.74	115.01	119.91	122.04	128.48	128.52	125.15	124.29	122.68	124.15	121.40	9.92

Table 6 - Birth Rates 35-39 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	61.09	65.01	66.77	69.63	73.16	77.56	85.12	88.67	84.65	86.40	85.83	84.17	84.22	37.87
top 60-80% SEIFA	51.52	55.02	56.38	59.45	62.44	66.05	73.21	75.67	74.29	75.29	74.24	75.61	72.39	40.50
middle 40-60% SEIFA	47.98	49.38	51.41	53.98	55.87	60.46	66.21	69.36	68.49	68.52	67.94	67.62	67.32	40.31
bottom 20-40% SEIFA	43.74	45.42	46.21	49.59	52.60	55.46	60.89	64.83	62.95	62.61	60.26	60.32	59.99	37.15
bottom 20% SEIFA	45.85	47.11	47.20	48.70	53.14	56.29	62.16	66.06	64.49	64.95	60.24	61.70	60.43	31.80
Total rate all SEIFA groups	50.44	52.87	54.15	56.89	60.09	63.91	70.38	73.78	71.82	72.50	70.82	70.96	69.94	38.67

Table 7 - Birth Rates 40-44 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	11.66	12.45	12.77	13.23	13.84	14.58	16.02	17.42	17.32	18.61	18.90	18.81	18.82	61.38
top 60-80% SEIFA	9.75	10.44	10.71	11.31	11.84	12.38	13.81	14.70	15.14	16.03	16.20	16.62	16.05	64.59
middle 40-60% SEIFA	8.95	9.20	9.60	10.05	10.28	10.99	12.10	13.12	13.59	14.13	14.35	14.42	14.57	62.75
bottom 20-40% SEIFA	8.00	8.31	8.45	9.00	9.38	9.82	10.84	11.99	12.26	12.72	12.60	12.62	12.69	58.70
bottom 20% SEIFA	8.60	8.87	8.84	9.10	9.68	10.13	11.23	12.57	12.82	13.44	12.63	13.07	12.96	50.67
Total rate all SEIFA groups	9.48	9.95	10.19	10.67	11.14	11.74	12.98	14.15	14.42	15.22	15.21	15.39	15.29	61.34

Table 8 - Birth Rates 45-49 Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*% change 01-13*
top 20% SEIFA	0.53	0.56	0.57	0.63	0.68	0.74	0.80	0.88	0.90	0.96	1.05	1.16	1.22	131.50
top 60-80% SEIFA	0.44	0.48	0.49	0.53	0.57	0.62	0.70	0.75	0.77	0.82	0.88	0.99	0.99	124.49
middle 40-60% SEIFA	0.41	0.42	0.44	0.47	0.48	0.53	0.61	0.66	0.67	0.69	0.74	0.81	0.84	102.91
bottom 20-40% SEIFA	0.38	0.39	0.40	0.44	0.45	0.49	0.53	0.55	0.56	0.59	0.61	0.64	0.64	71.28
bottom 20% SEIFA	0.41	0.42	0.42	0.43	0.46	0.51	0.59	0.62	0.63	0.65	0.67	0.72	0.73	79.12
Total rate all SEIFA groups	0.44	0.46	0.47	0.51	0.53	0.59	0.66	0.70	0.72	0.76	0.81	0.89	0.91	108.25

Table 9 - Birth Rates by Age Group (per 1000 female reproductive age group population), by SEIFA Quintile

	% change 01-04	*% change 05-09*	*% change 10-13*
15-19 Age Group			
top 20% SEIFA	-6.5	6.4	-29.4
top 60-80% SEIFA	-8.4	5.9	-19.8
middle 40-60% SEIFA	-10.3	3.9	-14.4
bottom 20-40% SEIFA	-8.8	12.1	-5.1
bottom 20% SEIFA	-5.8	10.2	-3.0
20-24 Age Group			
top 20% SEIFA	-6.1	5.1	-23.5
top 60-80% SEIFA	-8.7	6.3	-15.9
middle 40-60% SEIFA	-10.2	4.3	-10.4
bottom 20-40% SEIFA	-7.6	11.3	-1.2
bottom 20% SEIFA	-4.6	11.6	3.4
25-29 Age Group			
top 20% SEIFA	5.2	-6.8	-5.7
top 60-80% SEIFA	2.6	-2.8	-1.5
middle 40-60% SEIFA	0.7	-1.8	-3.8
bottom 20-40% SEIFA	-0.4	-1.0	-5.3
bottom 20% SEIFA	0.0	0.8	-5.1
30-34 Age Group			
top 20% SEIFA	7.3	-0.7	-5.4
top 60-80% SEIFA	4.8	4.5	0.7
middle 40-60% SEIFA	3.2	5.9	-1.2
bottom 20-40% SEIFA	2.2	5.7	-2.7
bottom 20% SEIFA	2.2	8.1	-2.9
35-39 Age Group			
top 20% SEIFA	14.0	15.7	-2.5
top 60-80% SEIFA	15.4	19.0	-3.9
middle 40-60% SEIFA	12.5	22.6	-1.7
bottom 20-40% SEIFA	13.4	19.7	-4.2
bottom 20% SEIFA	6.2	21.4	-7.0
40-44 Age Group			
top 20% SEIFA	13.5	25.2	1.1
top 60-80% SEIFA	16.0	27.8	0.1
middle 40-60% SEIFA	12.3	32.2	3.1
bottom 20-40% SEIFA	12.5	30.7	-0.2
bottom 20% SEIFA	5.8	32.4	-3.6
45-49 Age Group			
top 20% SEIFA	19.2	32.0	27.0
top 60-80% SEIFA	20.5	35.1	20.9
middle 40-60% SEIFA	13.3	40.0	21.9
bottom 20-40% SEIFA	17.3	24.4	9.0
bottom 20% SEIFA	6.8	35.9	11.5

These results show that birth rates in the different socioeconomic groups were not homogenous across different age groups ($p<0.001$). For the younger women (in the age bands from 15 to 29 years), birth rates were higher in the lower socioeconomic groups. This relationship was reversed in the older age groups. The observed differences in birth rates between the different socioeconomic groups were not uniform, and were greater in younger segments of the population than older segments of the population, suggesting that the socioeconomic factors had greater influence on the birth rates for younger women.

With respect to differences between socioeconomic groups for the various stages of the Australian Baby Bonus scheme of particular note are the 15-19 and 20-24 year age groups. In the three years preceding the announcement of the new Australian Baby Bonus scheme and in the year of announcement (allowing for time lags in responses to the policy) the overall birth rate for all socioeconomic groups in the 15-19 year (teenage) group dropped by 8.2%. During the key years of the Australian Baby Bonus policy (2005-2009 inclusive) the overall birth rate for all socioeconomic groups in teenaged women rose by 8.1%. Of particular note were the bottom two socioeconomic status quintiles in which birth rates in the years preceding the Australian Baby Bonus had dropped by 5.8% and 8.8% respectively and then during the key years of the policy rose by 10% and 12% respectively. Similar patterns were seen in the 20-24 year age groups.

For women in the 15-19 year age group in the lowest SEIFA quintile, the birth rates remained stable after the introduction of the first Australian Baby Bonus scheme in 2004 and showed significant increases ($p=0.012$) after the $5000 incentive policy in 2008. There were no significant changes in birth rates 2009 when the family income test ($p=0.643$) and paid parental leave scheme ($p=0.881$) were introduced.

The 25-29 and 30-34 year age groups are the most common demographic for pregnancy (accounting for 61.3% of all births in Australia in 2004 and 60.4% in 2012). From 2001-2004, the overall birth rate in all socioeconomic groups in the 25-29 and 30-34 year age groups rose by 1.2% and 4.2% respectively. During the key years of the Australian Baby Bonus policy, overall birth rates dropped by 2.1% for the 25-29 year age group, and rose by 4.4% for the 30-34 year age group. These patterns were broadly consistent between socioeconomic groups.

Among women aged 35-39 years, there were similar trends across socioeconomic groups. Birth rates in this age group increased across all SEIFA quintiles and remained higher, although the increases seen in the key Australian Baby Bonus years were highest in the middle and lower two quintiles. From 2001-2004, the birth rates for the middle 40-60% SEIFA, bottom 20-40% SEIFA, and bottom 20% SEIFA rose by 12.5%, 13.4% and 6.2% respectively, whereas during the key years of the Australian Baby Bonus policy the groups' birth rates rose by 22.6%, 19.7%, and 21.4% respectively. In the wind-down period of the Australian Baby Bonus, birth rates tapered off in all socioeconomic groups of the 34-39 year age bracket. Similar patterns were found in the 40-44 and 45-49 year age brackets (although in the 45-49 age group the absolute rates were small). Birth rates did, however, remain higher in the Australian Baby Bonus wind-down period across all SEIFA quintiles.

For women in the 45-49 year age group in the lowest 20% SEIFA, there were

significant increases in birth rates (p=0.001) from 2005, a year after the introduction of the first $3000 Australian Baby Bonus scheme. Increases in birth rates remained steady, even after 2009 when the family income test and paid parental leave scheme were introduced. This was in contrast to the other age groups, where introduction of the family income test and paid parental leave scheme appeared to have negative impacts on the birth rates.

7. Conclusion

Responding to a gap in the literature, this paper has assessed changes in birth rates by age group and socioeconomic status after the introduction of the Baby Bonus, using national birth data for Australia from 2001-2013. We find statistically significant differences within and between age groups, socioeconomic groups, and the various stages of the Australian Baby Bonus scheme. During the key years of the Baby Bonus policy, the overall birth rate for all socioeconomic groups in the 15-19 age group rose by 8.1%. Of particular note were the lowest two socioeconomic quintiles, for whom birth rates rose by 10% and 12% respectively.

The main strengths of our study lie in the use of a large national dataset which provides 13 years of birth data. Our results add weight to previous studies which show variability between subgroups in regions (Lain *et al*. 2009; 2010; Langridge 2012). Our results show this variability on a national scale.

In 2001 Australia's fertility reached a historic low of 1.73 babies per woman (ABS 3301.0). Since then, the TFR increased to a peak of 1.96 in 2008 before dropping back to 1.9 on the most recent data. We observed the strongest associations between the periods in which the policies were implemented and increased birth rates in the lowest socioeconomic quintiles of the 15-19 age group. This is a concern from a health policy outlook as pregnancy and birth outcomes in these groups are associated with a greater risk of adverse outcomes for both mothers and babies. This increase followed a decline in births in these groups in the years preceding the introduction of the policy.

That the policy appears to have had little association with birth rates in women aged 25 to 34 years – the age group to whom most babies are born - possibly adds weight to our findings of associations in the other age groups. There was also little variation between socioeconomic groups in this age group.

The impact of tempo effects on fertility in recent years is important to understanding the increases associated across all socioeconomic groups for the 35-39, 40-44 and 45-49 year age groups. These effects may have been underestimated by those concerned about low fertility rates seen around 2001, concerns that prompted the policy in the first place. Just as the postponement of childbearing contributed to long-term fertility decline, the end to this postponement may have boosted period fertility in the years of the study. Women in the older age groups may have been recuperating their delayed births. The increasing birth rates in all socioeconomic groups for older women may reflect a broader demographic trend towards women having babes at older ages in Australia.

In this article, we are not claiming a direct causation between the baby bonus policy and the variation in the birth rate, as we could not entirely account for other social and economic changes that occurred in Australia over the study period and that

may have affected birth rates. For example, there may have been an effect of prevailing rates of unemployment. Fertility decline slows over sustained periods of economic growth. The years following introduction of the Australian Baby Bonus and prior to the Global Financial Crisis was an environment characterised by high growth, low unemployment, and record terms of trade for Australia. Economic change may affect the tempo, rather than the quantum, of fertility. We also do not have data regarding the impact of the bonus on women's intentions, so we cannot draw conclusions as to whether the policy altered childbearing decisions, only that there is an association between the introduction of the policy and birth rates of the various maternal age and socioeconomic subgroups. We are unable to say whether these differences are causal or not but we can say that living in a disadvantaged area was associated with a spike in birth rates amongst younger age groups in the years after the introduction of the baby bonus in comparison to more advantaged areas. The impact of economic change over the period of the study warrants further investigation.

Over a similar period to this study, the National Centre for Social and Economic Modelling (NATSEM) looked at the costs of raising Australian children across all income groups. In 2002, NATSEM found that it cost a typical family A$448,000 to raise two children from birth until they left home (Percival and Harding 2002). In 2007, NATSEM found that the cost had increased to A$537,000 (Percival *et al* 2007). In 2013, NATSEM was reported that the cost of raising a family had increased to A$812,000 (Phillips 2013). Due to methodological and data differences these numbers are not strictly comparable, however the authors concluded that costs had risen significantly: costs as well as prevailing economic conditions would also require consideration.

The varying associations between age group, socioeconomic status and the Baby Bonus scheme were as the economic model would have predicted: stronger associations where pronatalist policies such as the Baby Bonus generate larger incentives (for example, for younger and lower incomes families).

In terms of stimulating fertility into the future, demographers such as McDonald (2006, 2013) have consistently argued that comprehensive change is necessary to avert conflict between family and career goals for women. Cross-national research suggests that the availability of formal child care and of flexible working hours are the most important institutional factors supporting fertility (Castles 2003, McDonald 2006). The aim is to keep women attached to the labour market while enabling them to have the desired number of children. Economic analyses have drawn similar conclusions. For example, Day's (2013) analysis predicts that as an economy grows, overall fertility initially declines with rising skill intensity of the workforce and then may recover with rising wages of a skilled workforce suggesting that policies to support child rearing inputs raise fertility. The issues at play are more complex than a crude lump sum payment would suggest.

References

Australian Bureau of Statistics (ABS), (2014), Births, Australia. ABS cat. no. 3301.0.

Becker, G. and Lewis, G. (1973), 'On the Interaction Between the Quantity and Quality of Children', *Journal of Political Economy*, 81.

Becker, G. (1960), An Economic Analysis of Fertility. Demographic and Economic Change in Developed Countries. Princeton University Press for the National Bureau of Economic Research, Princeton, NJ.

Becker, Gary. S. and Murphy, K.M. (2003), Social Economics: Market Behavior in a Social Environment.

Becker, G.S. (1981), A Treatise on the Family, Cambridge, MA: Harvard University Press.

Castles, F. (2003),'The World Turned Upside Down: Below Replacement Fertility, Changing Preferences and Family-Friendly Public Policy in 21 OECD Countries', *Journal of European Social Policy*, 13(3): 209-227.

Costello, P., 'Budget Speech 2004-05'. Available at: http://www.budget.gov.au/2004-05/speech/html/speech.htm

Day, C. (2013), 'Skill Composition, Fertility, and Economic Growth', *Review of Income and Wealth*, vol. 2013, pp. 1-15.

Day, C. (2012), 'Will Fertility Rebound in Japan?', *Asia Pacific Economic Papers*, vol. 395, p. 28.

Day, C. and Dowrick, S. (2004), 'Ageing Economics: Human Capital, Productivity and Fertility', *Agenda: A journal of Policy Analysis and Reform*, vol. 11, no. 1, pp. 3-20.

Day, C. and Dowrick, S. (2010), 'What Entices the Stork? Fertility, Education and Family Payments', *The Economic Record*, vol. 86, no. Special Issue, pp. 69-79.

Drago, R., Sawyer, K., Sheffler, K., Warren, D. and Wooden, M. (2009), 'Did Australia's Baby Bonus Increase Fertility Intentions and Births?', *Population Research and Policy Review*, 30, 381-97.

Furuoka, F. (2009), 'Looking for a J-Shaped Development-Fertility Relationship: Do Advances in Development Really Reverse Fertility Declines?', *Economics Bulletin*, 29(4), 3067-3074.

Galor, O. and Weil, D. (2000), 'Population Technology and Growth', *The American Economic Review*, 2000 90 (4). 806-28.

Gauthier, A. (2007), 'The Impact of Family Policies on Fertility in Industrialized Countries: A Review of the Literature', *Population Research and Policy Review*, 26(3): 323-346.

Gauthier, A. and Thévenon, O. (2011), 'Family Policies in Developed Countries: A 'Fertility-Booster' With Side-Effects', *Community, Work & Family*, 14(2): 197-216.

Guinnane, T. (2010), 'The Historical Fertility Transition: A Guide for Economists', *Journal of Economic Literature*, 49(3): 589-614.

Goldstein, J., Sobotka, T. and Jasilioniene, A. (2009), 'The End of "Lowest-Low" Fertility?', *Population and Development Review*, Volume 35, Issue 4, pages 663-699, December 2009.

Heard, G. (2010), 'Interpreting Australia's Fertility Increase', *People and Place*, 18(2): 10-18.

Kuziemko, I. (2006), 'Is Having Babies Contagious? Estimating Fertility Peer Effects Between Siblings', Mimeo, Harvard University.

Lain, S.J., Ford, J.B., Raynes-Greenow, C.H., Hadfield, R.M., Simpson, J.M., Morris, J.M. and Robert, C.L. (2009), 'The Impact of the Baby Bonus Payment in New South Wales: Who is Having ''One For The Country''?', *The Medical Journal of Australia*, 190, 238-41.

Lain, S.J., Roberts, C.L., Raynes-Greenow, C.H. and Morris, J. (2010), 'The Impact of the Baby Bonus on Maternity Services in New South Wales', *The Australian & New Zealand Journal of Obstetrics & Gynaecology*, 50, 25-9.

Langridge, A.T., Nassar, N., Li, J., Jacoby, P. and Stanley, F.J. (2012), 'The Impact of Monetary Incentives on General Fertility Rates in Western Australia', *Journal of Epidemiology and Community Health*, 66, 296-301.

Luci, A. and Thvenon, O. (2010), 'Does Economic Development Drive the Fertility Rebound in OECD Countries?', *Paper presented in the European Population Conference 2010 (EPC2010)*, Vienna, Austria, September 1-4, 2010.

McDonald, P. (2006), 'Low Fertility and the State: The Efficacy of Policy', *Population and Development Review*, 32(3), 485-510.

McDonald, P. (2013), 'Societal Foundations for Explaining Low Fertility: Gender Equity', Demographic Research 28 http://www.demographic-research.org 981.

Milligan, K. (2005), 'Subsidizing the Stork: New Evidence on Tax Incentives and Fertility', *Review of Economics and Statistics*, 87, 539-55.

Myrskylä, M., Kohler, H-P. and Billari, F. (2009), 'Advances in Development Reverse Fertility Declines', *Nature*, 460 741-743.

National Museum of Australia (NMA), (2016), '1912: Australian Government Introduces a Maternity Allowance', http://www.nma.gov.au/online_features/defining_moments/featured/maternity_allowance_introduced

Parr, N. and Guest, R. (2011), 'The Contribution of Increases in Family Benefits to Australia's Early 21st Century Fertility Increase: An Empirical Analysis', *Demographic Research*, vol. 25, pp. 215-244.

Percival, R. and Harding, A. (2002), 'All They Need is Love… and Around $450,000: The Costs of Children in Australia Today', AMP.NATSEM Income and Wealth Report Issue 3, October. http://www.amp.com.au/group/3column/0,2449,CH5268%255FNI74069%255FSI3,00.html

Percival, R., Payne, A., Harding, A. and Abello, A. (2007), 'Honey I Calculated the Kids… it's $537,000', AMP.NATSEM Income and Wealth Report Issue 18, December 2007. https://www.amp.com.au/wps/amp/au/FileProxy?vigurl=%2Fvgn-ext-templating%2FfileMetadataInterface%3Fids%3D42c7c158dd8c2210VgnVCM10000083d20d0aRCRD

Phillips, B. (2013), 'Cost of Kids: The Cost of Raising Children in Australia', AMP.NATSEM Income and Wealth Report Issue 33.

Sinclair, S., Boymal, J. and de Silva, A. (2012), 'A Re-appraisal of the Fertility Response to the Australian Baby Bonus', *Economic Record*, 80(1): 78-87.

Whiteford, P. and Adema, W. (2007), What Works Best in Reducing Child Poverty: A Benefit or Work Strategy? Paris: OECD.

Whiteford, P. (2009), Family Joblessness in Australia. Social Inclusion Unit: Canberra.

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