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Who Cares and Does it Matter for the Labour Market?: A Longitudinal Analysis of the Labour Force Status of Indigenous and Non-Indigenous Carers

Boyd Hunter, Matthew Gray and Heather Crawford, Australian National University

Abstract

Indigenous Australians experience higher rates of severe or profound disability than other Australians and the gap in rates of disability between Indigenous and non-Indigenous Australians increases with age. The relatively high rates of disability amongst the Indigenous population lead to relatively heavy caring burdens. Relatively little is known about the impact of caring on the employment rates of Indigenous carers and virtually nothing about the impact of caring on changes in labour force status. This paper uses the recently released Australian Census Longitudinal Dataset to analyse the labour market dynamics of Indigenous and non-Indigenous carers and the extent to which these differ from the dynamics of those who are not carers. We also examine how labour force status changes, in association with commencement as a carer and exiting from caring. The analysis raises questions about how caring decisions are made within households and the extent to which the costs of caring may differ between Indigenous and non-Indigenous households.

JEL Codes: J13, J15, J22

Keywords: Carer, disability, labour force dynamics, Indigenous Australians

1. Introduction

Around 12 per cent of the Australian working age population, at any point in time, is providing unpaid informal care for a person who requires care because of a disability, long-term illness or old age. Unpaid carers are typically family members or friends and provide much of the care for people with a disability. The percentage of the population who will be unpaid carers at some point in their lifetime is considerably higher.

While there has been some Australian research into the impacts on carers of providing unpaid care, including on labour market outcomes, the existing research on carers is relatively limited, and for some groups such as Indigenous Australians there is very little research indeed.

This paper uses longitudinal data to estimate the impact of providing unpaid care for a person with a disability, long-term health condition or older age, on rates of paid employment of Indigenous and non-Indigenous Australians. Understanding the impact of caring on the paid employment of Indigenous Australians is important for several reasons. First, the proportion of the Indigenous population who require care is larger than for the Australian population as a whole and is projected to increase at a faster rate due to the impacts of the structural ageing of the Indigenous population. Because the Indigenous population is much younger, on average, than the non-Indigenous population, a larger proportion of Indigenous carers are of working age than are non-Indigenous carers. This means that understanding the impact of caring on the employment rate of Indigenous working age carers is important, particularly in the context of substantial policy attempts to increase the employment rate of the Indigenous population.

The provision of informal care has been found to have a negative impact on paid employment in a number of countries (e.g., Bittman, Hill and Thomson, 2007; Carmichael and Charles, 2003; Ettner, 1996, Gray and Edwards, 2009; Gray, Edwards and Zmijewski, 2008; Jenson and Jacobzone, 2000; and Leigh, 2010). The most convincing Australian estimates of the impact of informal care on paid employment are those of Leigh (2010), who finds that the provision of informal care reduces the probability of being in paid employment by 4-6 percentage points. An important point made by Leigh is that estimates of the impact of informal care on paid employment made using cross-sectional data substantially overstate the negative impact of caring on paid employment, primarily because carers had on average, lower rates of paid employment prior to commencing caring.[1] Such results can thus be very misleading.

There is very little research on the impact of informal care on the employment rates of Indigenous people and whether the impacts on employment for Indigenous and non-Indigenous carers are different, and virtually no longitudinal analysis. The one exception that we are aware of is Biddle and Crawford (2015) who found, using Australian longitudinal census data, that the provision of informal disability care was positively associated with acquiring a certificate-level qualification, with a larger effect among the Indigenous rather than the non-Indigenous population (after controlling for a small set of observable characteristics). Another relevant finding in the context of this paper is that Biddle and Crawford (2015) found there was a larger drop in the probability of becoming employed in 2011 (following a period outside the workforce) for Indigenous people who were carers in 2006 than for carers in the total population.

The linking of data from the 2011 Australian Census to a 5 per cent sample of the 2006 Census to create the Australian Census Longitudinal Dataset (ACLD) provides the opportunity to conduct the first ever longitudinal analysis of the labour market outcomes for Indigenous informal carers and the extent to which the impact of informal care on the Indigenous population differs from the impact on the non-Indigenous population. Census data also includes information on the provision of

1 Using data from the Household, Income and Labour Dynamics in Australia (HILDA) survey, Leigh (2010) finds that cross-sectional estimates indicate that being an informal carer reduces employment rates by between 20-28 percentage points.

childcare, which is important to distinguish from care for a person with a disability, long-term illness or who requires care because of old age (PWD for short). For the remainder of this paper we will refer to Childcare and Carer of PWD.

The remainder of this paper is structured as follows. The second section provides an overview of the ACLD data and the statistical methods used to estimate the impact of informal care on paid employment. The third section describes the labour force status of Indigenous carers and how this compares to non-Indigenous carers. The fourth section presents the results of the multivariate analysis of the impact of caring on labour force status. The final section concludes.

2. Data and empirical approach

2.1 Australian Census Longitudinal Dataset (ACLD)

The ACLD links a 5 per cent random sample of the 2006 Census with the 2011 Census using data linkage techniques.[2] The ACLD includes linked census data for 800,759 individuals of whom 14,802 identified as being Indigenous in 2006.[3] This number represents substantially less than 5 per cent of the Indigenous population, but nonetheless forms the largest longitudinal dataset of Indigenous Australians (ABS, 2013). There were substantial changes in Indigenous identification between 2006 and 2011 among the linked sample. Of those who were identified as being Indigenous in 2006, 9.2 per cent were identified as being non-Indigenous in 2011 and 1.1 per cent had not-stated Indigenous status in 2011. Of those identified as being non-Indigenous in 2006, 0.2 per cent were identified as Indigenous in 2011 and 0.9 per cent did not state a response (ABS, 2013). The instability in the identification of Indigenous status presents a challenge for analysis and interpretation of the data, particularly when trying to compare changes over time from two cross-sectional datasets. One advantage of the ACLD is that the group of individuals (however defined) whose characteristics and outcomes are being compared over time can be held constant. In this paper we have defined Indigenous status as measured by the 2006 Census.

The analysis is restricted to the population aged 20-59 years in 2006 to ensure that all respondents were in the working aged population in both 2006 and 2011. The majority of the analysis is for the population 20-59 years in order to focus on the post-secondary school population. A separate analysis is reported for the population aged 15-19 years in 2006 according to whether they were full-time students in 2006.

The 2006 and 2011 censuses both include a question about whether each person in the household aged 15 and over provided unpaid care or assistance to family members or others because of disability, a long-term illness or problems related to old age. The question includes the instruction that recipients of Carer Allowance or Carer

[2] The two census datasets were linked drawing on information about personal characteristics only (i.e., not using name, address, or numerical record identifiers). Deterministic linkage (assigning record pairs across two datasets that match exactly or closely on common variables) and probabilistic linkage (overall agreement on a common set of variables, allowing linkage despite inconsistent or missing information) were used. For more information, see ABS (2013).

[3] While the ACLD is a 5 per cent sample of the Australian population, the Indigenous sample is less than 5 per cent of the Indigenous population. The under-representation of the Indigenous sample in the ACLD is due to a lower rate of successful linkage for the Indigenous sample.

Payment should state that they provided unpaid care, and that unpaid help provided through a voluntary organisation or group should not be included. The question on the provision of unpaid care was the same in both censuses.

The strength of the ACLD for estimating the impact of informal care on the employment of Indigenous carers is that it includes a relatively large longitudinal sample of carers (with 68,300 carers in 2006, 78,000 in 2011, and 25,200 caring in both 2006 and 2011) and thus allows the impact of changes in carer status on paid employment to be estimated. The data source does however have several limitations. First, there is information for only two time points and this, combined with the fact that no information is provided on the start or end point of caring, means that it is not possible to analyse how labour force status of carers changes with duration of providing informal care. Second, it does not provide information on the intensity of care provided (e.g., number of hours), or the predictability of the caring requirements, which can be an important factor in determining the impact of caring on paid employment. The notion of a carer, according to the 2006 and 2011 censuses, covers people in a wide range of different circumstances, from those providing relatively few hours of assistance to someone with a mild disability living elsewhere, to those providing intensive, full-time care to a co-resident child or partner. Clearly, such variation in carers' circumstances is likely to have differential effects on labour force participation. However, beyond identifying carers, the censuses contain little information that can be used to distinguish between those with differing caring loads. Third, information is available five years apart and so the analysis of changes in labour force status relative to the timing of commencing or finishing caring is a little crude.

2.2. Empirical approach and statistical methods

The basic empirical approach is to estimate the probability of moving into or out of employment or not changing employment status between 2006 and 2011 according to carer status in 2006 and 2011. We first analyse differences in employment rates and changes in employment rates for various population groups identified in the ACLD data. The paper then provides some multivariate analysis of the probability of employment taking into account observable characteristics of the population.

This multivariate approach is operationalised by estimating regression models of the probability of being employed in 2011 for eight sub-populations defined according to caring status in 2006 and 2011 and employment status in 2006. Specifically, for those who were not employed in 2006, the key outcome variable is 'whether moved into employment by 2011'. For those who were employed in 2006, the key outcome variable is 'whether remained employed in 2011'. The basic empirical strategy is summarised in Table 1. The probability of being employed in 2011 is estimated using a logit model.

An alternative modelling strategy is to use the longitudinal nature of the ACLD data to take into account unobserved differences between individuals that may impact upon both their employment status and their likelihood of being an informal carer (i.e., unobserved heterogeneity). Two options are to estimate either a random effects or a fixed effects model. However, there is potential for bias in non-linear discrete choice

models when the number of time points is small.[4] For this reason we chose to estimate the probability of employment using a cross-sectional logit model, but to use the longitudinal nature of the data to condition on caring and employment status in 2006.

The explanatory variables included in the regression modelling are gender, age (and age squared), educational attainment, whether the respondent has a disability, region of residence and provision of unpaid child care. These variables are consistent with the basic set of human capital, demographic and geographic controls used in previous census analyses of employment (Gray and Hunter, 2002).[5] While the earlier census analyses controlled for education, age, gender, remoteness and some other socioeconomic characteristics, they did not control for carer and disability status, because such information was not collected at the time. The following analysis contributes to literature by focusing on such factors. Note that we consistently distinguish between the effect of childcare and providing care for a PWD.

The logistic regression models are estimated using maximum likelihood estimation techniques. When the explanatory variables are also categorical, the coefficients in a logistic model must be interpreted as relative to a reference person defined by the omitted categories of the respective groups of explanatory variables. The reference person, or base case in the following binary logistic regression analysis, is a non-Indigenous male without a disability who does not care for any children, has not completed education to year 12 and resides in a major urban area.

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[4] Since the regression models considered here are nonlinear, the least squares and feasible generalized least squares methods are not appropriate. This is more than an inconvenience in this setting, as it means that we need to consider some tricky specification issues when contemplating the extensions of the fixed and random effects models in the discrete choice modelling context.

The fixed effects model would be specified by the latent variable, emp_{it*}:

$emp_{it*} = \alpha_i + x_{it}'\beta + z_i'\gamma + \varepsilon_{it}$, t = 1,...,T, i = 1,...,n

where $emp_{it} = 1$ if $emp_{it*} > 0$, and $emp_{it} = 0$ otherwise.

We have made the distinction between time varying attributes and characteristics, x_{it}, and time invariant characteristics, z_i. The common effects, α_i, may be correlated with the included variables, x_{it}. Since the model is nonlinear, the least squares estimator is unusable. The full maximum likelihood estimator for this model is inconsistent, a consequence of the incidental parameters problem. [See Lancaster (2000).] The problem arises because the number of parameters in the model, αi, rises with n. With small T or T_i this produces a bias in the estimator of β that does not diminish with increase in n. The conditional log likelihood is the sum of the logs of the joint probabilities. Given the conditional log likelihood does not include fixed effects, the resulting estimator has the usual properties, including consistency (i.e., it bypasses the incidental parameter problem – see Willis 2006). However, it does have a major shortcoming in that by avoiding the estimation of the fixed effects we have precluded computation of the partial effects or estimates of the probabilities for the outcomes.

For the random effects model involving a binary choice, the underlying model is:

$Emp_{it*} = x_{it}'\beta + z_i'\gamma + \sigma_{uui} + \varepsilon_{it}$, t = 1,...,T, i = 1,...,n,

where $E[u_i|x_{it}] = 0$ and $Var[u_i|x_{it}] = 1$ and, again, empit = 1 if $emp_{it*} > 0$, and empit = 0 otherwise. That is, in random effects models the unobserved variables are assumed to be uncorrelated with (or, more strongly, statistically independent of) all the observed variables. In our opinion the observable random effects are likely to be correlated with the explanatory variables so the assumptions probably do not hold.

[5] There are numerous studies of Indigenous employment, but Gray and Hunter was chosen as the example, because it used synthetic cohort analysis to try to get some insight into the longitudinal aspects of Indigenous labour force status by tracking cohorts across censuses. That is, prior to the ACLD, researchers had to construct artificial data to draw indirect conclusions about changes in Indigenous employment outcomes. Tracking individuals across time should facilitate more nuanced insights, especially if information is collected across future censuses for these individuals.

Table 1: Empirical approach to estimate employment transitions of carers controlling for carer status and change in carer status

Model	*Carer status in 2006 and 2011*	*Labour force status in 2006*	
Model 1	Carer of PWD in both censuses	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 2		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 3	Became a carer of PWD	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 4		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 5	Ceased being a carer of PWD	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 6		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 7	Not a carer of PWD in both censuses	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 8		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011

The estimation of separate regression models for the various sub-populations has the advantage that carer status is taken as given for each model. However, policy-makers are interested in comparing the prospect of employment for carers and non-carers. Arguably separate regression models complicate such comparisons because each model includes a different 'scaling' parameter. In order to facilitate such comparisons, a summary regression of the whole ACLD population is provided in the penultimate section. The summary regression is based on a larger sample and has relatively small standard errors. More importantly, it provides an estimate of the employment differences between various groups of carers. Note that the summary regression does not include employment status in 2006 as an explanatory variable because this would necessitate the move to a formal dynamic regression model that is beyond the scope of this paper (and is probably not sustainable given existing data).

3. Cross-sectional analysis of caring for a PWD and labour force status

According to the 2011 Census, the rate of caring for a PWD is slightly higher amongst the Indigenous working age population than among the non-Indigenous working age population. It is estimated that 19 per cent of Indigenous females were carers compared to 15 per cent of non-Indigenous females and 13 per cent of Indigenous males were carers compared to 10 per cent of non-Indigenous males (Table 2). It is evident that for both the Indigenous and non-Indigenous populations, males are less likely to be a carer than are females.

Table 2: Proportion of population who are carers for a person of PWD, 2011

	Indigenous		*Non-Indigenous*	
	Female	*Male*	*Female*	*Male*
Proportion of population who are carers of PWD	19%	13%	15%	10%
Number of carers of PWD	24,514	14,051	913,511	547,606

Note: Population aged 20-64 years. These data exclude a small number of persons who did not state their labour force status.
Source: Tablebuilder 2011 Census.

Table 3 provides information on the labour force status in 2011 of carer status, gender and Indigenous status. Indigenous and non-Indigenous carers of PWD have a lower employment rate than those who are not carers. The employment rate of non-Indigenous female carers of PWD is 61 per cent and for those without caring responsibilities it is 71 per cent. For non-Indigenous male carers the employment rate is 75 per cent compared to 83 per cent for those without caring responsibilities.

Indigenous women with caring responsibilities have an employment rate of 41 per cent, lower than the employment rate of 48 per cent for those without caring responsibilities. Indigenous men with caring responsibilities have an employment rate of 51 per cent, compared to 60 per cent for those without caring responsibilities.

For all groups (Indigenous, non-Indigenous, male and female), the proportion of employment that is part-time is larger among carers than it is among those without caring responsibilities, although the differences are not dramatic. For all groups, carers are more likely to be not in the labour force compared to those without caring responsibilities.

Table 3: Labour force status by carer (PWD) status, gender and Indigenous status, 2011

	Indigenous		*Non-Indigenous*	
	Carer for PWD	*Not providing care for a PWD*	*Carer for a PWD*	*Not providing care for a PWD*
Female				
Total employed	41%	48%	61%	71%
Employed, worked full-time	21%	28%	29%	40%
Employed, worked part-time	20%	20%	32%	31%
Unemployed	9%	8%	4%	4%
Not in the labour force	50%	44%	35%	25%
Total	24,514	104,329	913,511	5,042,315
Male				
Total employed	41%	60%	75%	83%
Employed, worked full-time	37%	47%	61%	70%
Employed, worked part-time	14%	13%	14%	13%
Unemployed	14%	11%	5%	4%
Not in the labour force	35%	29%	20%	13%
Total	14,051	98,239	547,606	5,177,424

Notes: Population aged 20-64 years.
Source: Tablebuilder 2011 Census.

4. Longitudinal analysis of the relationship between caring for a PWD and employment

One way of estimating the impact of caring on rates of paid employment is to calculate the changes in employment rates that are associated with changes in caring status and how these compare to the employment changes for people who do not change their caring status.

Information is provided on employment rates in 2006 and 2011 for each of the four carer of PWD transitions: (i) carer of PWD in both 2006 and 2011; (ii) not a carer of PWD in 2006, carer of PWD in 2011 (transitioned into caring/became carers); (iii) carer of PWD in 2006, not a carer of PWD in 2011 (transition out of caring/ceased providing care); (iv) not a carer of PWD in both 2006 or 2011. The data is presented by Indigenous status and gender.

Employment rates in 2006 and 2011 are reported in Table 4 and changes in employment rates between 2006 and 2011 for each carer transition are reported in Figures 1-4.

Table 4: Employment rates in 2006 and 2011 by carer of PWD status in 2006 and 2011, by Indigenous status and gender

	Indigenous		*Non-Indigenous*	
	Female	*Male*	*Female*	*Male*
	%	*%*	*%*	*%*
	Carer in 2006 and 2011			
Employment rate 2006	45.6	49.1	59.7	76.1
Employment rate 2011	50.7	44.3	58.4	70.6
	Not a carer 2006, carer 2011			
Employment rate 2006	48.4	66.7	68.8	84.1
Employment rate 2011	45.4	53.3	64.5	77.4
	Carer 2006, not a carer 2011			
Employment rate 2006	50.6	68.5	63.2	79.7
Employment rate 2011	50.6	62.9	65.9	79.1
	Not a carer in 2006 or 2011			
Employment rate 2006	50.9	68.4	72.4	86.4
Employment rate 2011	52.4	65.9	73.0	85.2

Notes: Population aged 20-59 years in 2006 and 25-64 years in 2011. Age range chosen to ensure that population of working age in both 2006 and 2011. Indigenous status according to what was reported on 2006 Census.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory

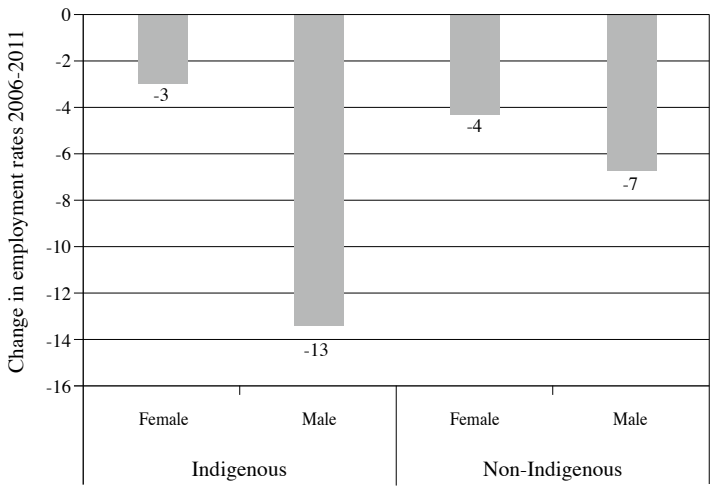
For those who were a carer in both 2006 and 2011 there was an increase in employment of 5 percentage points for Indigenous women but a decrease of 5 percentage points for Indigenous men. There was a small decline for non-Indigenous women (1 percentage point) and a substantial decline for non-Indigenous men (5 percentage points).

Those who became carers of PWD in 2011 have on average a lower employment rate prior to becoming a carer of PWD than do people who were not a carer of PWD in either 2006 or 2011. This is the case for Indigenous women and non-Indigenous women and men, although Indigenous men who became carers had a very similar employment rate to those without caring responsibilities.

For all groups examined there is also a decrease in employment rate associated with the commencement of caring by 2011. The decrease in employment rates associated with commencing caring was larger for men than women (Figure 1). For Indigenous men, there was a 13 percentage point decrease in employment rate and for non-Indigenous men the employment rate decreased by 7 percentage points. For women, the decrease in the employment rate following the commencement of caring was 3 percentage points for Indigenous and 4 percentage points for non-Indigenous.

This data suggests that the lower employment rates of carers is due in part to a lower pre-caring employment rate and in part due to a decrease in employment following the commencement of caring. As Leigh (2010) notes, some people may be able to take on a caring role because they are not in paid employment. This may include, for example, people who have already retired, or those who have young children and may be available to take on a caring for a PWD especially if it is less intensive. That is, part of the correlation of caring for PWD on employment rates is a selection effect and part of it appears to be due to the 'impact' of caring. The extent to which caring has a negative causal impact on the likelihood of being in paid employment is more effectively tested statistically using fixed effects models and the results are reported in Section 4.

Figure 1: Changes in employment rates between 2006 and 2011, people who became a carer of PWD between 2006 and 2011 (per cent)

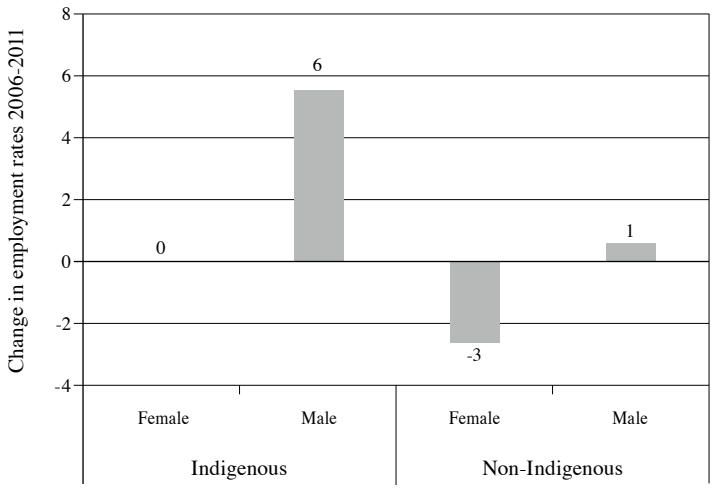


Notes: Population aged 20-59 years in 2006. Indigenous status according to what was reported on 2006 Census.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory. See Table 4.

The pattern in changes in employment rates between 2006 and 2011 for those who ceased providing care between 2006 and 2011 are less clear. For Indigenous women there was no change in average employment rates whereas for Indigenous men employment rates increased by 6 percentage points. For the non-Indigenous population there was a decline in employment rates for women of 3 percentage points and an increase for men of 1 percentage point (Figure 2).

For the majority of the population who were not a carer in either 2006 or 2011, there were small increases in employment rates for Indigenous and non-Indigenous women and a small decrease for non-Indigenous men. For Indigenous men there was a larger decline in employment rates of 3 percentage points.

Figure 2: Changes in employment rates between 2006 and 2011, people who ceased providing care for PWD between 2006 and 2011



Notes: Population aged 20-59 years in 2006. Indigenous status according to what was reported on 2006 Census.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory. See Table 4.

An alternative way of analysing the employment effect associated with caring for a PWD is to compare the employment transitions of those with and without caring responsibilities. Table 5 reports employment rates in the 2011 Census according to carer status in 2006 and 2011 and whether a person was employed in 2006. Irrespective of carer status, Indigeneity or gender, those who were employed in 2006 were more likely to be employed in 2011. Given that we condition on employment status in 2006, the employment probability can be read as a transition rate. For example if you were employed in 2006, the entry in the table provides an indication of the probability that you remained employed (measured in per cent). If you subtract this probability from 100, then the table entry provides information on the transition out of employment.

Similarly if you were not employed in 2006, then the employment probability for 2011 indicates the transition into employment between the last two censuses.

The first thing that is evident from Table 5 is that the probability of remaining in employment is lower for most Indigenous estimates compared to the analogous non-Indigenous estimates. The exception to this rule is Indigenous females who provided care at the last two censuses. They are not that different, in terms of transition probabilities, from the non-Indigenous females providing care in both 2006 and 2011 – indeed the probability of staying employed is actually slightly higher for Indigenous women (83 per cent, compared with 81 per cent of non-Indigenous women). Further evidence that this group of Indigenous female carers is not different from non-Indigenous female carers can be found in the fact that among those who are not employed in 2006, 24 per cent made the transition into employment by 2011 for both groups of female carers.

Table 5. Employment rates in 2011 by Indigenous status, gender, carer (PWD) status and employment status in 2006

	Female		*Male*	
	Carer of PWD 2011	*Not a carer of PWD 2011*	*Carer of PWD 2011*	*Not a carer of PWD 2011*
		Indigenous		
Carer of PWD 2006				
Employed 2006	83	66	69	75
Not-employed 2006	24	35	21	36
Not a carer of PWD 2006				
Employed 2006	62	74	62	80
Not-employed 2006	29	30	36	36
		Non-Indigenous		
Carer PWD 2006				
Employed 2006	81	83	86	88
Not-employed 2006	24	36	22	43
Not a carer of PWD 2006				
Employed 2006	79	85	85	91
Not-employed 2006	33	42	36	48

Notes: The population for this table is people aged 20-59 years in 2006.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory

For Indigenous males who provided care to PWD in both 2006 and 2011 the probability of remaining employed is 17 percentage points less than the analogous group of non-Indigenous male carers (69 per cent and 86 per cent respectively), but the transition into employment is only one percentage point less. To the extent that there is an employment impact from caring over the long run it appears to be associated with Indigenous males' capacity to remain employed while providing unpaid care

In order to discern the effect of providing care to a PWD on employment status, we need to compare the group who was not a carer in either census with the various categories of carers.

With one exception, the group who provide care over time tend to have a lower probability of remaining employed and a lower probability of entering employment between 2006 and 2011 than those who did not provide care at either point in time. For those who were employed in 2006, the differential between the 2011 employment rates for carers and non-carers tends to be less for the non-Indigenous population than the Indigenous population. Again the estimates for Indigenous female carers in both 2006 and 2011 are particularly noteworthy. The probability of remaining employed for Indigenous female carers is nine percentage points higher than for Indigenous females who did not provide care (83 per cent and 74 per cent respectively). However the probability of entering employment is substantially lower for this group of Indigenous female carers compared to non-carers (24 per cent and 30 per cent respectively). In our opinion, the relatively higher probability of remaining employed among this group of female Indigenous carers is probably due to better educational endowments and higher age.

5. Regression analysis of probability of employment

The estimates reported in the previous section of the associations between caring for a PWD and paid employment and the extent to which the associations differ between the Indigenous and non-Indigenous population does not take into account differences in demographic and human capital characteristics.

This section presents the results of estimates of the extent to which the changes in employment rates between 2006 and 2011 according to caring status in 2006 and 2011 differs between the Indigenous and non-Indigenous populations. As outlined in Section 2, separate models are estimating according to caring status in 2006 and 2011 and whether the individual was in paid employment in 2006. This allows estimation of the extent to which changes in paid employment status between 2006 and 2011 differs for the Indigenous and non-Indigenous populations.

The regression results are presented as marginal effects which are calculated as the change in the probability of employment in 2011 associated with a unit change in an explanatory variable (holding all other variables at their mean value).

Of the eight logistic models estimated, all either have an adequate ability to correctly predict outcomes within the sample or have a reasonably high concordance statistic.[6] The coefficients estimated are consistent with the expectation from economic theory (see Hunter, Gray, and Crawford 2016: Appendix A2).

In order to illustrate the magnitude of the differences, Table 6 reports the marginal effect of explanatory variables on the probability of employment holding other variables at their average value. We now discuss in detail the findings for females to illustrate the interpretation of the marginal effects. The first row indicates that being female was associated with a significantly lower probability of employment in 2011 for most sub-populations (compared with males in the corresponding sub-populations), except for those who were carers for a PWD in both censuses and not employed in

[6] Concordance statistics (i.e., C-stats) were estimated to provide an indication of the adequacy of the logistic models for prediction. The concordance statistic gives the percent of all possible pairs of cases in which the model assigns a higher probability to a correct case than to an incorrect case. Hosmer and Lemeshow (2000: 162) provide guidelines for interpreting the concordance statistic, which indicate that any statistic over the value of 0.7 is evidence that the model is adequate.

2006 (for whom the marginal effect was not significant). That is, the probability of being employed in 2011, among females who were not employed in 2006 and were carers for a PWD in both censuses, was not significantly different from that of their male counterparts. However, being female was associated with lower prospects of becoming employed than males among those who had not been a carer in one or both of these censuses (i.e., a marginal effect of between -7 and -10 percentage points). The marginal effect of being female on the probability of remaining employed between 2006 and 2011 is significant for all sub-populations irrespective of carer status for PWD in those two censuses, although the marginal effects are smaller than for those who became employed (between -4 and -6 percentage points). Note that the marginal effects for females are holding other explanatory factors constant, and therefore excludes the additional effect of childcare that itself tends to be associated with a significantly lower probability of employment (i.e., where it is significant at all in the regressions).

Increases in age and educational attainment are estimated to be associated with a higher rate of paid employment in 2011 for all eight models. Having a disability is associated with significantly lower employment rates in 2011.

Being Indigenous is estimated to reduce the probability of being employed in 2011, for those who became a carer for a PWD, those who ceased being a carer of a PWD and those who were not a carer of a PWD in both censuses. The estimated negative effect of being Indigenous on the probability of being employed is substantial. For those who were a carer for a PWD in both censuses there was no difference found between Indigenous and non-Indigenous.

Table 6: Marginal effects of explanatory variables on the probability of employment in 2011 (per cent)

	Carer of PWD in both censuses		*Became a carer PWD*		*Ceased being a carer of PWD*		*Not a carer of PWD in both censuses*	
	Not-employed in 2006	*Employed in 2006*	*Not-employed in 2006*	*Employed in 2006*	*Not-employed in 2006*	*Employed in 2006*	*Not-employed in 2006*	*Employed in 2006*
	%							
Female	1*	-4	-7	-6	-10	-5	-10	-6
Age	4	5	3	5	5	3	4	3
Age squared	0	0	0	0	0	0	0	0
Degree	28	7	26	9	28	6	29	4
Diploma	18	4	21	6	21	5	21	3
Certificate	20	4	18	5	20	4	22	2
Year 12 completed	4	3	8	2	4	2	8	0*
Disability	-15	-31	-25	-36	-32	-51	-38	-50
Indigenous	-4*	-1*	-7	-13	-8	-11	-14	-8
Regional area	3	1*	3	-1	3	0*	2	0
Remote area	9*	1*	7*	0*	11	1*	12	1
Childcare	2*	-3	-1*	-3	-7	-4	-7	-5

Note: The marginal effects are the change of the probability of employment in 2011 associated with a unit change in the explanatory variable holding all other variables at their mean values. The marginal effects that are marked with an asterisk are not significant at the 5% level using robust standard errors.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory.

Having a core disability is one of the strongest predictors of low employment rates, as is being female. While education tends to be the second largest factor associated with employment probabilities in 2011 there is significant variation in the returns to education in the various sub-populations. That is, the benefits of education can vary significantly among various sub-population groups after conditioning on carer status and employment status in 2006. Being a carer takes time and reduces the ability to find and secure work, irrespective of the level of your educational attainment.

We are confident that the results presented in Table 6 present a balanced and accurate estimates of the effect of explanatory variables on employment probabilities.[7] While the regression analysis above conditions on employment status and carer status in the last two censuses, it involves estimation in eight sub-populations which entails a loss of efficiency and makes it rather difficult to summarise the overall findings. Table 7 provides a summary cross-sectional model of employment in 2011 using a basic logistic model.[8]

In broad terms, the marginal effects reported in Table 7 are consistent with that of the other regression analysis in this paper. In contrast to Table 6, the marginal effects presented in Table 7 do not use the information on employment status in 2006, but nonetheless demonstrate a significant negative correlation between providing care to a person with a disability and employment. For example, providing this form of care in both the 2006 and 2011 censuses is associated with a 9 percentage point lower employment prospect for both the Indigenous and non-Indigenous population relative to those who did not provide care in either of those censuses. Perhaps one issue is that becoming a carer of a PWD is associated with a somewhat high level of employment disadvantage in the Indigenous population. However, we also note that ceasing being a carer is not associated with any significant employment effect for the Indigenous population. Therefore the higher incidence of caring in the Indigenous population does not, on balance, appear to be a major source of employment disadvantage.

[7] Section 2 discussed some of the limitations of standard panel data techniques in the context of discrete choice modelling when individuals are only observed at two points in time. Nonetheless, we estimated a fixed effects and random effects logistic model to use the more of the longitudinal information in the ACLD and in a tentative attempt to control for unobservable heterogeneity. These models also provide a robustness check for the logistic models reported above. Both the fixed effects and random effects estimates are statistically significant and consistent with the logistic estimates presented in this paper.

[8] Given the issues for using panel data techniques identified above, we have not attempted to estimate a dynamic model that would attempt to directly control for an individual's employment status in 2006.

Table 7: Marginal effects of explanatory variables from summary model of employment in 2011

	Indigenous		*Non-Indigenous*	
	Marginal Effect	*Z-Statistic*	*Marginal Effect*	*Z-Statistic*
Female	-15%	-10.7	-12%	-89.6
Age	5%	9.0	4%	91.8
Age squared	0%	-8.9	0%	-100.9
Degree	34%	23.5	14%	103.2
Diploma	25%	13.7	10%	65.5
Certificate	25%	16.9	9%	64.2
Year 12 completed	14%	7.3	4%	24.1
Disability	-51%	-22.2	-62%	-130.6
Regional area	-6%	-3.5	0%	1.8*
Remote area	-10%	-4.8	6%	13.8
Childcare	-4%	-2.3	-7%	-45.7
Carer PWD in both 2006-11	-9%	-2.7	-9%	-25.5
Became Carer PWD	-10%	-4.1	-6%	-24.7
Ceased as Carer PWD	-2%	-0.8*	-4%	-14.3
Number of observations	5,356		395,157	
C-statistic	0.74		0.75	

Note: All models estimated for the population aged between 20 and 59 in 2006. Almost all marginal effects are significant at the 5 per cent level. The exception to this rule are those estimates with z-statistics that are marked with an asterisk. The reference person, or base case in the following binary logistic regression analysis, is a non-Indigenous male without a disability who does not care for any children, has not completed education to year 12, resides in a major urban area and does not provide care to a person with a disability in either 2006 or 2011.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory.

6. Labour market endowments of carers of PWD and employment transitions

The effect of care giving on labour market outcomes (and vice versa) can be conceptualised as a time allocation problem in which an individual has to allocate time across work, leisure and care-giving activities (Wolf and Soldo, 1994). Economic theory suggests that the caring will be done by the family members with the lowest value of their alternative time use.[9] The argument is that the time cost of providing care may result in the potential for lost wages that diminishes family income and hence utility. This section considers this issue indirectly by considering the labour market endowments and employment transitions by carer (PWD) status.

Table 8 shows the means of a range of demographic and human capital variables according to Indigenous status and gender and whether a carer for a PWD in 2006 and 2011. The main pattern observed is that Indigenous people who provide care for a PWD in both 2006 and 2011 censuses tend to have a higher level of education than other groups classified by their carer (PWD) status. For example, over 13 per cent of Indigenous people who provided care for PWD in both censuses had a degree level

[9] Within this model the value of alternative time use is the wage rate the person could earn in the market if employed and their likelihood of being able to find employment.

qualification, which was almost twice the prevalence of degrees among those who did not provide care in 2011 (of whom just over 7 per cent had degrees). Even among those Indigenous people who became carers between the 2006 and 2011 censuses, fewer than 9 per cent had a degree in 2011. The pattern is also evident for other post-school qualifications (Diplomas and even Certificates) with the Indigenous carers of PWD at the time of the last two censuses tending to be more educated than other Indigenous people. However, this pattern was not evident for the non-Indigenous population; for that population people who provided care for PWD in the previous two censuses were less likely to have a degree or certificate than other non-Indigenous groups. Notwithstanding, it is important to remember that Indigenous education outcomes are substantially less than all non-Indigenous groups in Table 8.

Table 8: Population weighted summary statistics for 2011 information by carer status (PWD)

	Indigenous 2006				*Non-Indigenous 2006*			
2011 characteristics	*Carer of PWD in both 2006-11*	*Became carer PWD*	*Ceased being a carer PWD*	*Not a carer of PWD in both censuses*	*Carer PWD in both 2006-11*	*Became carer PWD*	*Ceased being a carer PWD*	*Not a carer of PWD in both censuses*
Employed	0.472	0.462	0.491	0.542	0.518	0.601	0.580	0.671
Female	0.713	0.639	0.664	0.531	0.669	0.581	0.586	0.485
Age (years)	45	43	43	42	51	47	48	44
Age squared	2120	1917	1943	1857	2640	2306	2384	2047
Degree	0.133	0.085	0.073	0.071	0.221	0.236	0.225	0.232
Diploma	0.091	0.047	0.057	0.051	0.119	0.115	0.109	0.096
Certificate	0.196	0.191	0.184	0.185	0.169	0.195	0.182	0.200
Year 12 completed	0.090	0.140	0.144	0.154	0.133	0.153	0.149	0.178
Disability	0.065	0.053	0.081	0.069	0.048	0.044	0.060	0.053
Indigenous	0.964	0.953	0.956	0.953	0.003	0.003	0.002	0.002
Regional area	0.548	0.440	0.420	0.420	0.306	0.297	0.299	0.280
Remote area	0.140	0.255	0.256	0.230	0.011	0.012	0.016	0.019
Childcare	0.591	0.642	0.452	0.377	0.419	0.451	0.331	0.301
Estimated residential population	13,000	30,000	26,700	220,700	546,300	1,163,800	956,900	10,631,400

Note: The table population is people aged between 25 and 64 in 2011.Weights refer to the estimated residential population represented by the ACLD sample where all information was provided for both 2006 and 2011. This table presents means for variables measured at 2011 (except for Indigenous status that is held constant as that identified in 2006 and carer status which is allowed to vary between 2006 and 2011). Hence given that people may be identified as Indigenous at one census but not another, the average value for the indigenous variable does not necessarily equal zero or one. However, less than 5 per cent of Indigenous people have a different Indigenous status in 2006 and 2011.
Source: Author calculations based on ACLD 2006-2011 accessed through the ABS data laboratory.

These findings for the Indigenous are consistent with Biddle and Crawford (2015) who show that providing care to a PWD was associated with a higher probability of gaining an educational qualification. Biddle and Crawford speculate that the nature of care provided may be intermittent enough to allow for study (unlike child care, which may be more intensive).

The patterns in Indigenous educational outcomes by carer status appear to be inconsistent with the economic theories that suggest that care should be done by people with lowest value of their alternative time use. Within an Indigenous household, having a degree is relatively uncommon and those with a degree are more likely to be able to secure employment and be paid a high wage when employed. However the evidence for the non-Indigenous carers appears to be more consistent with the economic theory. We will return to this observation in the conclusion.

One reason for the high rates of education is that carers tend to be slightly older than non-carers. This may reflect the fact they are looking after an older partner or member of the household. Another salient observation in the context of this paper is that there is considerable correlation in the prevalence of care for a PWD and the provision of childcare.

7. Concluding remarks

There are several key findings that emerge from the analysis in this paper. First, over the short to medium term, providing unpaid care to a person with a disability is associated with substantially lower employment outcomes for Indigenous and non-Indigenous Australians and for men and women. Second, the impact of providing care on paid employment is greater for Indigenous men than it is for other groups (Indigenous women and non-Indigenous men and women). Third, Indigenous men who cease being a carer for a PWD experienced a substantial increase in employment, unlike other groups. Fourth, the impacts of caring on the probability of being in paid employment are negative but are relatively small for Indigenous women vis-à-vis non-Indigenous women. Fifth, the estimated effect of caring on the employment rates of non-Indigenous Australians is broadly consistent with the finding of Leigh (2010) who uses data from HILDA to estimate the impact of caring.

Indigenous Australians are more likely to be unpaid carers for a person with a disability than are non-Indigenous Australians and this caring has a particularly large negative impact upon the likelihood of being in paid employment of Indigenous men and is thus a significant factor underpinning the labour market disadvantage of Indigenous men.

There is evidence from the existing literature that for the Australian population as a whole, working age carers were less likely to be employed prior to commencing care than people who do not have caring responsibilities. There are likely to be a variety of reasons for this, including the economic argument that caring (where there is a choice) will be allocated to the family member with the lowest labour market opportunity cost and this will be strongly associated with educational attainment. However, for the Indigenous population, people who were either longer-term or recurrent carers (carers in both 2006 and 2011) had substantially higher levels of educational attainment than Indigenous people who were carers at one point in time only and those without caring responsibilities. For the non-Indigenous population there was no apparent relationship between educational attainment and caring. Elsewhere, analysis suggests that the rate of carer non-identification in the census may be higher among the Indigenous population than among the non-Indigenous populations, owing to culturally different perspectives on caring (Hill *et al*., 2012). It may be that Indigenous people with higher

levels of education are more likely to be familiar with what Hill *et al*. (2012, p. 7) describe as the 'formal Anglo-Australian connotations' associated with the notion of being a carer, and therefore more likely to identify as carers.

We must ask ourselves why people with relatively good economic prospects will be more likely to provide care. It may be something as simple as they are the only household members in a position, or with the resources, to provide care. Whatever the reason for substantial numbers of educated Indigenous people providing longer-term care, it is important to acknowledge the reality in that it may circumscribe the capacity to close the gap in Indigenous and non-Indigenous employment.

Given the high level of disability and need for caring in the Indigenous community, it is desirable to have a substantial number of Indigenous people engage in caring (which is by definition a socially worthwhile endeavour). The tricky question for policymakers and researchers is whether some of these Indigenous carers would otherwise choose to be actively engaged in the labour market had they not been engaged in to provide care to person with a disability. The answer to such questions require analysis which can provide further insights into causal processes. Longitudinal data may provide one avenue for such research, but mixed method analysis that interrogates individual circumstances over a longer time period is likely to be required (or at the very least more observations over time). One of the major limitations of census data used in this paper is that it is difficult to understand the structural relationship between caring and employment without adequate information on income or wages that allow a more formal analysis of reservation wages and labour supply.

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