

# The Impact of Drought on Carers

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## Abstract

*Carers have, on average, a more tenuous and weaker attachment to the labour market than non-carers because they face a complex set of demands on their time and must balance the needs of other people. Accordingly, it is plausible that regional shocks from droughts may adversely affect carers compared to other residents. This paper combines meteorological data with recent census data to illustrate that drought in agricultural labour markets has a greater impact on employment outcomes for carers than other residents. Furthermore, the employment differential is not manifest for part-time employment outcomes. Implications for policy makers are considered in some detail.*

JEL Classification: J10; J4; R00

## 1. Introduction

Australia frequently experiences severe and prolonged drought. Despite the historical prevalence and severity of drought in Australia and the negative impact this has on the Australian economy, there have been few studies that examine the impact of drought on employment and which groups are most vulnerable to job loss. Much of the existing research has focused on the impacts of drought on farmers (e.g., Australian Bureau of Agricultural and Resource Economics [ABARE], 2008) with few studies having examined the flow-on effects to people working in other industries. Edwards, Gray and Hunter (2009) find that the labour market effects of drought can flow on to those living in drought-affected areas who are not employed in agriculture.

To our knowledge there has not been large-scale quantitative research into the impact of drought on vulnerable or disadvantaged sub-populations within society.<sup>1</sup> Most of the existing studies have focused on a small number of communities in specific locations, with relatively small sample sizes. Moreover, most of these studies

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<sup>1</sup> Alston (2005) provides a discussion of the potential for drought to widen existing social inequalities and increase social exclusion.

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have been cross-sectional or have not collected information from similar communities that are not in drought, which makes identifying the effects of drought difficult (Alston and Kent, 2004; Stehlik, Gray and Lawrence, 1999).

This paper provides estimates of the effects of drought on the employment of unpaid carers of a person with a disability or of the frail-aged and how the effect compares to that of those without caring responsibilities.<sup>2</sup> One motivation for the focus on carers is that they are a group that are likely to be particularly responsive to regional shocks associated with drought because of the competing demands on their time.

Carers are a group who have relatively high rates of involuntary joblessness and are often more tenuously connected to the labour market than other Australians (Bittman, Hill and Thomson, 2007; Gray and Edwards, 2009). The international literature emphasises the low rates of paid employment especially among those with relatively intense caring responsibilities (e.g., those providing 50 or more hours of care are less than half as likely to be employed or self-employed, see Arksey, Kemp *et al.* 2005: 20). Arber and Ginn (1995) found that care among females was associated with lower full-time employment and higher part-time employment relative to non-carers – they argue that this probably reflects both the selection of such women into the carer role and the adverse effects of caring on participation in full-time work (also see Joshi, 1995).

Clearly carers' family circumstances affect labour supply decisions, but this paper focuses on the effect of local drought on carer's employment status largely through the implied effect on the regional labour market or labour demand. We are not aware of any other studies that have examined the impact of drought on the employment of carers. Understanding the effects of drought on carers may also provide insights into the extent to which the labour market impacts of drought are likely to differ for other groups that are vulnerable to economic shocks.

The economic impact of drought can be conceptualised as a prolonged negative economic shock to the economy of a geographic area. Drought has a negative effect on farmers' incomes and can also result in job losses among those employed to work on farms, but there are also other effects of drought on agriculture-dependent businesses that provide farming inputs (Wilhite and Glantz, 1985). The most direct effect of drought is to reduce or even eliminate agricultural production, but it is likely to have a multiplying indirect effect on the regional economy that will depress labour demand (at least for the duration of the drought).

Regional economic shocks, such as the downsizing or closure of a local industry, are likely to disproportionately increase joblessness amongst those with lower levels of human capital (Eggert *et al.* 2010). Overall, people with relatively low levels of human capital are more likely to be not employed at any given time and the negative economic shock generated by a drought may make it more difficult for them to find employment, thus reducing the employment rate for that group. That is, residents with low levels of human capital are more likely to lose their job and, if they lose their job, are less likely to find another job. Mauro and Spilimbergo (1999) argue that high education groups are also in a better position to respond to regional shocks by moving to areas where employment prospects are better. The lower migration

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<sup>2</sup> Carers can be either paid or unpaid for the services they provide. The focus in this article is on unpaid carers, since there is a substantial existing literature that examines paid carers (predominantly through analysis of industry data on nursing and related professionals).

response of carers to regional shocks associated with droughts may be particularly important as carers are likely to consider the circumstances of the person they are caring for as well as their immediate individual economic circumstances.

This paper begins to fill the gap in our understanding by examining the impact of drought on the employment rates of carers and whether this differs to the impacts on those without caring responsibilities. Data from the 2006 Census of Population and Housing combined with information on rainfall in the local area is used to estimate the impacts of drought on employment. While the focus of the paper is on labour market effects of drought on a vulnerable group, the findings are potentially useful for understanding the impacts of other natural disasters such as floods or bushfires. It is projected that the frequency and severity of drought in Australia will increase as a result of climate change (e.g., Hennessy *et al.*, 2008).

This paper is structured as follows. Section 2 discusses the theoretical reasons for carers being more vulnerable to drought. Section 3 provides an overview of the data sets used and the empirical approach taken. In section 4 demographic and human capital characteristics of carers and non-carers by drought status are described. Section 5 discusses the estimates of the impact of drought on the employment rates of carers and those without caring responsibilities. Section 6 concludes.

## 2. Some Theoretical Considerations

The family is a key institution that looms large in choices individuals make about labour supply, job search and the decision to take up work if offered (Ermisch, 2003). In order to understand the likely labour market impacts of drought on carers, it is necessary to briefly reflect on resource allocation within families.

While, the role of unpaid labour, including caring, is not explicitly considered in most analyses of market exchanges between waged workers and firms, there has been increasing attention paid to household decision making, including joint labour supply, fertility, child-raising, as well as other areas of what is generally referred to as home production. Caring for a family member is a form of home production of services and is an alternative use of time to paid employment (Becker, 1965).

There is evidence that the preference of many carers of work age is to combine caring with paid employment (Mooney *et al.* 2002). For many carers, the time and emotional demands of caring is more compatible with part-time employment than with full-time employment. Thus there is a trade-off between the hours available for caring and those available for work. The available literature indicates that the majority of non-employed carers gave up work because of their caring responsibilities (Arksey, Kemp *et al.* 2005: 23), for many carers the impact of caring on labour supply is to reduce the number of hours worked rather than lead to a total withdrawal from paid employment (although the latter occurs for some carers).

According to Becker's (1965) model of the allocation of time between paid and unpaid activities, the higher the value placed on the unpaid activities the less likely it is that a person will spend time in paid employment at a particular wage rate and the higher the elasticity of labour supply with respect to the wage the person can command in the labour market. To the extent to which drought reduces regional labour demand (shifts the labour demand curve to the left) and thus places downward pressure on regional wage rates, the higher elasticity of labour supply of carers is predicted to reduce the number of hours supplied to the market by carers compared

to the reduction in labour supply of those without caring responsibilities who have a lower elasticity of labour supply.

Because carers have the alternative of using their time to provide unpaid care (and thus to save the costs of paying for formal care) a decline in market wages reduces the opportunity cost of increasing the number of hours of unpaid care provided and hence reduces labour supply. It is particularly important to acknowledge that co-residential informal care competes with other time demanding activities such as childcare and employment (Mentzakis *et al.* 2009). The access to appropriate formal support will play a clear role in the ability of individuals to manage these trade-offs.

Another potential mechanism by which drought may differentially affect carers' employment outcomes vis-à-vis those without caring responsibilities is that carers may be more sensitive to flexible working environment conditions. Arksey *et al.* (2005: 31) identify workplace practices that are carer friendly, including: access to a telephone, flexible working hours, option of reducing working hours, availability of unpaid leave, ability to work at home occasionally, emergency care, availability of career breaks, supportive work colleagues. As labour demands contracts as a consequence of drought, firms may become less generous in working conditions that make employment a less attractive option. In other words, the excess labour supply in the local labour market enhances employers bargaining position and hence they will have less incentive to institute carer-friendly working conditions even if the direct cost implications are minor (e.g. provision of unpaid leave).

In summary, there are theoretical reasons to expect that carers will be more sensitive to regional shocks, but the empirical question of the importance of such issues can and should be tested and measured.

### 3. Data and Empirical Approach

#### *Census Data*

The only Australian data source with a large enough sample of carers in agricultural areas to allow an analysis of the differential effects of drought on employment of carers and non-carers is the 2006 Census of Population and Housing (2006 Census). The 2006 Census defines carers as those, who in the two weeks prior to the census night provided unpaid care, help or assistance to family members or others because of a disability, a long-term illness or problems related to old age.<sup>3</sup> By limiting the definition to a two week period, census data does not include care for people with episodic needs. The census question is clearly not optimal for addressing the research questions posed in this article, but provides a broad indication of incidence of caring.<sup>4</sup>

<sup>3</sup> The relevant 2006 Census question is (completed by a person 18 years or older):

*In the last two weeks, did the person spend time providing unpaid care, help or assistance to family members or others because of a disability, a long-term illness or problems related to old age?*

- *Recipients of Carer Allowance or Carer Payment should state that they provide unpaid care.*
- *Ad hoc help or assistance, such as shopping, should only be included if the person needs this sort of assistance because of his/her condition.*
- *Do not include work done through a voluntary organization or group.*

<sup>4</sup> For example, the 2006 Census question does not provide information on the intensity of care provided, which is likely to have a substantial impact of carers' employment. It also does not include information on caring work done through a voluntary organisation or group. Other salient limitations of the census data means that analysis cannot take account of a number of other factors that impact on carers' employment including: duration of care-giving, access to other forms of informal support, and service availability.

The Statistical Local Area (SLA) geographic level was chosen for the analysis because the areas were small enough to have substantial differentiation of rainfall while having a sufficient number of carers to allow a separate analysis of carers and non-carers. The sample is restricted to geographic areas that are 'agricultural' and hence likely to be significantly economically affected by drought. For the purposes of this paper, the data was drawn from SLAs where at least 10 per cent of the local workers were employed in agriculture at the time of the 2001 Census (which was prior to the last drought). The data excludes people aged less than 15 years of age because they are unlikely to be in paid employment for many hours in the average week. People aged over 64 years of age are included given that many farmers are working into later life. The median age of farmers is 52 years, with 18 per cent aged 65-years or older (Drought Policy Review Expert Social Panel, 2008; Productivity Commission, 2009).

### ***Defining and Measuring Drought***

One of the important issues that must be addressed when attempting to understand the impact of drought is how to define drought. This is not a straightforward issue, as illustrated by the following quote from the Productivity Commission (2008) in a major review of Australian drought policy:

What constitutes a drought may seem readily apparent. But in fact it is difficult to disentangle a confluence of factors – for example: the quantity, location and timing of rainfall and runoff; temperature, evaporation and soil moisture; water storages and allocations; commodity prices and input costs; land values and equity levels; off farm diversification and so on. (p. 1)

All droughts originate from deficiency of precipitation and hence the meteorological definition of drought is a useful basis for analysis (Wilhite and Glantz, 1985). In this paper we use a rainfall-based measure of whether each of the SLAs was in drought at the time of the 2006 Census.<sup>5</sup> This rainfall deficit definition of drought is based upon rainfall deficits in the area in the last three years compared to the last 100 years.<sup>6</sup>

The categories of rainfall used are:

- **drought** (0 to 10th percentile of rainfall over the last three years compared to rainfall over the last 100 years);
- **below-average** rainfall (11th to 49th percentile); and
- **above-average** rainfall (50th to 100th percentile).

The rainfall definition of drought is arguably limited by the fact that it does not take into account potentially important aspects of the quantum and timing of water availability. Other more sophisticated definitions also make use of information on the timing of rainfall relative to growing seasons, soil moisture and plant growth, but extant measures do not take into account the allocations of irrigated water and therefore it is still not clear that they provide a better operationalisation of the concept of drought (Raupach, *et al.* 2007). The basic rainfall definition of drought used in this paper has the considerable advantage that it covers the entire Australian continent.

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<sup>5</sup> Data is from the Bureau of Rural Sciences.

<sup>6</sup> A discussion of this and other definitions of drought is provided in Edwards, Gray and Hunter (2009).

### Estimation Method

Regression modelling is used to estimate the impact of drought on the probability of employment of those with caring responsibilities and those without these responsibilities. The analysis is based upon SLA level data, which is the geographic aggregation most commonly used to analyse local labour markets (DEEWR, 2010). While it would be preferable to use individual level data (as opposed to the area level data used in this article), the available unit record file is a five per cent census sample, which only provides geographic information for 64 Statistical Areas across Australia. While this level of disaggregation may be adequate for most analyses, it is not suitable for analysis of drought which is locally differentiated.

The dependent variable is the proportion of carers and non-carers in each SLA who are employed (i.e., calculated for each sub-population). Similarly the explanatory variables are the proportion of carers and non-carers in each SLA with a particular characteristic. The effects of drought are captured by a set of dummy variables that indicate whether the SLA was in drought, below average rainfall or above average rainfall. When considering the impact of drought, it is also important to control for any differences in rates of residential mobility stability between carers and non-carers. To the extent to which one group has a higher rate of out-migration from drought affected areas to areas with better employment prospects the estimated differential effect of drought on the employment of carers and non-carers will be biased. The variable used is the proportion of people living in the SLA who had not changed address in the last five years (i.e., a measure of residential stability). The other characteristics controlled for in the modelling are age, gender, relationship status, being of Aboriginal or Torres Strait Islander origin and educational attainment. Given that the dependent variable is regional employment rates that overwhelmingly takes a value between zero and one, an appropriate statistical technique is ordinary least squares.<sup>7</sup>

The SLA level nature of the data means that separate models need to be estimated for carers and non-carers. The regression models for carers and non-carers are shown in Equations (1) and (2) respectively.

$$\overline{Emp}_{c,j} = \alpha + \beta Dro_j + \delta \overline{X}_{c,j} + \lambda Mob_j + \varepsilon_{c,j} \quad (1)$$

where  $Dro_j$  is the set of indicators for drought experience of SLA  $j$

$\overline{EMP}_{c,j}$  is the proportion of carers (c) living in SLA  $j$  that are employed

$\overline{X}_{c,j}$  is a vector of control variables which measure the proportion of carers (c) living in SLA  $j$  with a particular characteristics

$Mob_j$  is residential mobility for SLA  $j$

$$\overline{Emp}_{nc,j} = \alpha + \beta Dro_j + \delta \overline{X}_{nc,j} + \lambda Mob_j + \varepsilon_{nc,j} \quad (2)$$

<sup>7</sup> For carers, two SLAs had 100 per cent employment rates however there were no zero employment rates in any SLA. The employment rate for non-carers ranged from 36 to 89 per cent.

Given that both the dependent variables and regressors are measured as regional averages the reliability of the estimates will increase with the size of the regional population of carers and non-carers. Heteroscedasticity is likely to be evident as estimates of SLA population exhibit substantial variation and hence robust standard errors are used when estimating statistical significance (Cook and Weisberg 1983). Descriptive statistics for the estimation samples are provided in Appendix A.

#### **4. The Demographic Characteristics of Carers and Non-carers in Drought-Affected Areas**

In order to understand the extent to which drought has a differential impact on the employment of carers and those without caring responsibilities, it is important to understand the extent to which the demographic characteristics which are related to the likelihood of being in paid employment of these groups vary with rainfall outcomes in order to identify the impact of drought per se on employment rates. It is possible that drought may affect the average demographic characteristics of areas by affecting long-term migration patterns (particularly if people believe that the drought is a reflection of permanent changes to the climate). The demographic and human capital characteristics examined are: gender; presence of a partner; educational attainment (completed Year 12 education); being of Indigenous origin; and geographic mobility (having not changed address during the last five years). This information is shown in table 1.

There are several points to take from table 1. First, the demographic and human capital characteristics of carers are quite different to those of non-carers. Carers are more likely to be female, partnered, Indigenous and to have not changed address during the last five years than those without caring responsibilities. There is little difference in the level of educational attainment between carers and those without caring responsibilities. This pattern is consistent with the 2006 Census of Population and Housing and the 2006 General Social Survey (Edwards, Gray, Baxter and Hunter, 2009).

Second, there are relatively few differences in demographic characteristics of carers and non-carers according to rainfall. The main difference is that a higher proportion of carers and non-carers are Indigenous in the above average rainfall area than areas that had experienced below average rainfall or drought. This is a reflection of the above average rainfall areas tending to be in the north of Australia, areas which have a higher proportion of the population that is Indigenous. The rate of geographic mobility is slightly higher in drought affected areas than in above average rainfall areas and slightly lower in below average rainfall areas than in above average rainfall areas.

The age distribution of carers and non-carers by rainfall in the area is shown in figure 1. The proportion of carers who were of retirement age (65 years or older) was lower than for those without caring responsibilities. Older people are more likely to be infirm, and hence cared for, rather than caring. The converse of this is that people aged 45–64 years are more likely to have caring responsibilities. Youth aged under 25 years tend to have a substantially smaller percentage of carers presumably because most of their interactions are predominantly with peers and younger family members from the same generation who are likely to suffer from ill-health or disability. These observations probably indicate something about the stage of the life cycle as parents of youth may not be old enough to require caring services yet.

In summary, while there are differences between the characteristics of those with caring responsibilities and those without these responsibilities, within the carer and non-carer populations, there is little difference in demographic and human capital characteristics according to drought status. These patterns suggest that any differences in employment rate between areas in drought and other areas will not be explained by differences in the demographic and human capital characteristics of the population according to the experience of drought.

The relatively small differences in demographic and human capital characteristics across areas categorised according to rainfall suggests that drought is exogenous to the demographic and human capital characteristics of an area and that particular groups do not have higher out-migration from drought affected areas. This is consistent with the findings of Hunter and Biddle (2010) that the net effect of drought on migration is either small or insignificant in the short-run. This observation is important for this paper because it gives us some confidence that reverse causation is not driving our findings.

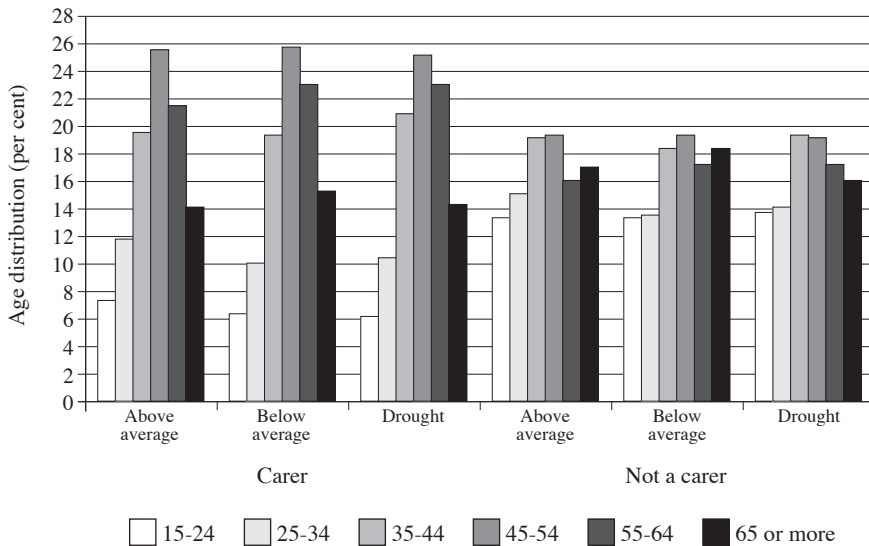
Table 1 - Demographic Characteristics, by Carer Status and Drought Category, 2006 (%)

	<i>Carer</i>	<i>Non-carer</i>
	%	%
<b>Female</b>		
Above average rainfall	58.0	46.4
Below average rainfall	60.6	47.3
Drought	61.3	47.4
<b>Partnered</b>		
Above average rainfall	66.6	57.9
Below average rainfall	68.3	59.4
Drought	70.8	61.2
<b>Completed Year 12</b>		
Above average rainfall	31.2	32.7
Below average rainfall	30.8	30.6
Drought	30.2	30.8
<b>Indigenous</b>		
Above average rainfall	7.1	5.6
Below average rainfall	3.9	3.2
Drought	2.3	1.7
<b>Have not changed address during last five years</b>		
Above average rainfall	55.7	50.9
Below average rainfall	58.0	53.3
Drought	53.0	47.5

*Source:* Customised data from the 2006 Census of Population and Housing and rainfall data from the Bureau of Rural Sciences



Figure 1 - Age by Carer Status and Rainfall, 2006



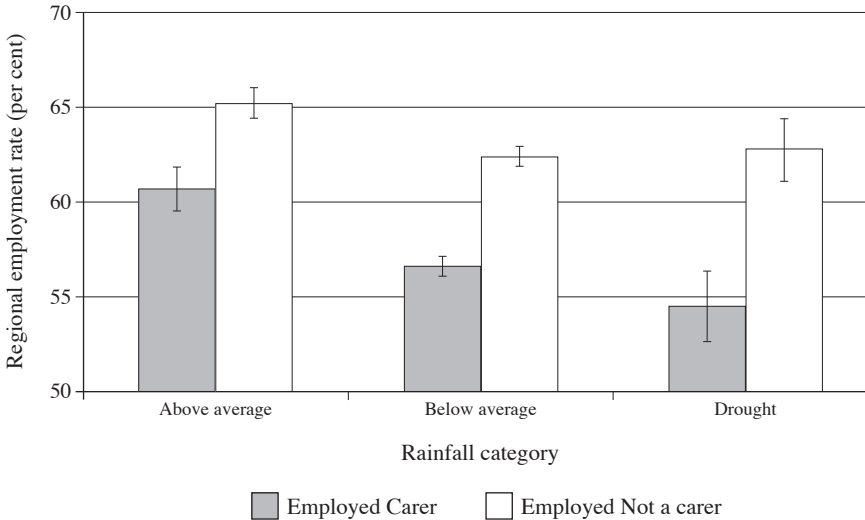
Source: Customised data from the 2006 Census of Population and Housing

## 5. Estimates of the Impact of Drought on the Employment Rates of Carers and Non-carers

### *Employment Rates by Drought Experience*

Figure 2 shows employment rates by drought experience for carers and non-carers. There are several points to take from this figure. First, employment rates are lower for carers than non-carers irrespective of drought experience. Second, for both carers and non-carers employment rates are lowest in currently drought affected areas, followed by areas which have experienced below average rainfall and highest in areas which have experienced above average rainfall. The differences are statistically significant for both carers and non-carers at the 95 per cent confidence level. The third and key point is that the differences in employment rates between carers and non-carers was larger in drought-affected and below average rainfall areas than in above average rainfall areas. In above average rainfall areas, the difference between carers' and non-carers' employment rates was 4.5 percentage points, in above average rainfall areas the difference was 5.8 percentage points and in drought-affected areas the difference was 8.2 percentage points. This pattern suggests that drought has a greater impact upon the employment rates of carers than those without caring responsibilities.

Figure 2 - Employment Rate by Carer Status and Rainfall



Notes: The bars on the columns indicated 95 per cent confidence intervals.

Source: Customised data from the 2006 Census of Population and Housing and rainfall data from the Bureau of Rural Sciences.

### **Regression Modelling of the Effects of Drought on Employment**

This section describes the estimated effects of drought on employment. The results of estimating equations (1) and (2) are shown in table 2.

For carers, there remains a statistically significant effect of drought on the employment rate of carers once demographic and human capital characteristics of carers are taken into account. Carers in SLAs which have experienced below average rainfall are estimated to have a 2.3 per cent lower employment rate than carers in SLAs which have experienced above average rainfall. Carers in drought affected areas are estimated to have a 3.7 per cent lower employment rate than carers in areas which have experienced above average rainfall.

For those without caring responsibilities, once demographic and human capital characteristics are taken into account there is no statistically significant relationship between drought and employment rates. This finding is consistent with Edwards *et al.* (2008) who only found differences in employment rates by drought as defined by rainfall deficits when farmers who are by definition employed, were excluded.

The extent to which the effects of drought on carers and non-carers employment differs is tested formally statistically using a z-test (Clogg, Petkova and Haritou, 1995):

$$Z = \frac{b_1 - b_2}{\sqrt{SEb_1^2 + SEb_2^2}} \quad (7)$$

Where  $b_1$  is the difference in the carer employment rate between those SLAs that are in drought compared to those with above average rainfall while  $b_2$  is the difference

in the employment rate of non-carers living in drought compared to above average SLAs.  $SEb_1^2$  is the squared standard error of  $b_1$  and  $SEb_2^2$  is the squared standard error of  $b_2$ . The z-test suggests that the effect of drought on carers' employment rates is significantly different from non-carers ( $z = -2.06, p = 0.02$ ) but not for below average rainfall ( $z = -1.11, p = 0.13$ ).

The coefficients for the other explanatory variables are generally consistent with expectations. The higher the proportion of the population in a SLA that is Indigenous the lower the employment rate, the higher the proportion which is female the lower the employment rate and the higher the level of education the higher the employment rate of the SLA. The coefficients for the Indigenous variable may be related coincidentally to the fact that a disproportionate number of Indigenous people live in Northern Australia. That is, given that such areas are less likely to be in drought in the last decade, some of the effect of drought on carers labour force status outcomes may be taken up by the proportion of SLAs who are Indigenous. That is, the estimated effect of drought on employment may be a lower bound/conservative estimate.

One noteworthy result is that lower rates of mobility in an area are associated with significantly higher local employment rates – a result that is consistent that one important motivation for moving is to look for work and take up a new job. However, there is no significant difference in the association of mobility and employment for carers and non-carers and it would be a mistake to over-estimate the role of mobility on the differential role of drought on carers. Notwithstanding, we will return to this issue again in a later section.

Table 2 - The Effects of Drought on Employment by Carer Status, OLS Model

	Carers		Non-carers	
	Coef.	SE	Coef.	SE
Above average rainfall (omitted category)				
Below average	-2.31 **	0.84	0.28	0.43
Drought	-3.70 **	1.44	-0.32	0.80
Have not changed address during the last				
five years	0.20 ***	0.06	0.13 ***	0.04
Indigenous	-0.24 ***	0.06	-0.26 ***	0.07
15-17 years	0.54	0.36	-0.16	0.19
18-24 years	1.04 ***	0.22	0.92 ***	0.15
19-34 years	0.71 ***	0.11	0.83 ***	0.15
35-44 years	0.67 ***	0.14	0.69 ***	0.12
45-54 years	0.83 ***	0.12	0.58 ***	0.15
55-64 years	0.20	0.14	-0.03	0.16
Female	-0.31 ***	0.08	-0.58 ***	0.11
Partnered	-0.11	0.07	0.01	0.06
Completed Year 12	0.41 ***	0.07	0.40 ***	0.05
Intercept	11.00	10.61	28.80 ***	9.61
Number of observations	405		405	
R-squared	0.5022	0.7783		

Notes: Robust standard errors \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

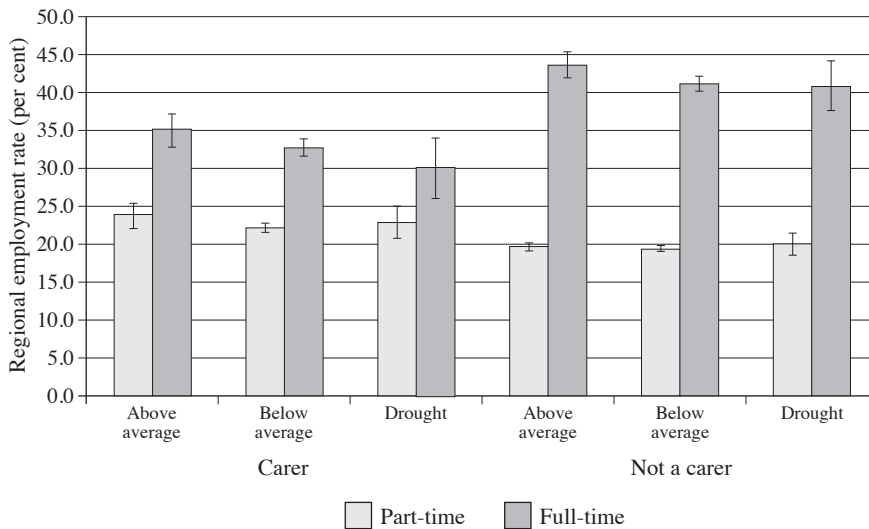
Source: Customised cross-tabulations from the Census 2006

### ***Drought and Full-time and Part-time Employment***

The relationship between drought and employment rates is disaggregated into full-time and part-time employment in figure 3. At the SLA level, the negative effects of drought on the employment rates of carers appears to be primarily the result of a fall in the full-time employment rates, with there being relatively little difference in the part-time employment rate of carers by drought experience. For example, the full-time employment rate of carers was 35 per cent in above average rainfall areas, 33 per cent in below average rainfall areas and 30 per cent in drought-affected areas. The part-time employment rates of carers were 24 per cent in above average rainfall areas and 23 per cent in drought-affected areas.

For those without caring responsibilities the full-time employment rates were 44 per cent in above average rainfall areas and 41 per cent in below average rainfall and drought-affected areas. The part-time employment rates of non-carers was basically 20 per cent irrespective of drought status. Overall there is not really any evidence that carers or non-carers are adjusting the number of hours they are willing to work in response to drought, but it may be possible to construct an argument that carers in drought affected areas have particularly low rates of employment in full-time work.

Figure 3 - Part-time and Full-time Employment Rates by Carer Status and Rainfall



*Notes:* The bars on the columns indicated 95 per cent confidence intervals

*Source:* Customised data from the 2006 Census of Population and Housing and rainfall data from the Bureau of Rural Sciences

## **6. Conclusion**

This paper provides the first large-scale estimates of the impact of drought on employment rates of carers – a group that has, on average, a more tenuous and weaker attachment to the labour market than many other groups. We find evidence

that employment rates were lower in drought-affected areas, but that drought had a greater impact on the employment rates of carers than non-carers. The difference in employment rates of carers and non-carers – already 4.5 percentage points lower for carers in above average rainfall areas – was 8.2 percentage points in drought-affected areas. The lower employment rates of carers in drought-affected areas were mainly due to a smaller proportion of carers being in full-time employment in these areas. These findings suggest that drought has a differential impact on carers' employment prospects and can be seen as a factor exacerbating the processes of social exclusion that affects many disadvantaged people.

There are a number of possible explanations for this result. One potential explanation would be if carers were less likely to move than non-carers in response to the regional shock associated with droughts in agricultural areas. However, while carers are less likely to have moved residences in the last five years than other Australians in both drought and other areas, we do not have information on the mobility of carers and non-carers by drought status.

Given that the proportion of carers in part-time employment does not appear to be related with the drought experience, the most likely explanation seems to be that when regional labour demand is depressed, the characteristics of carers make them more vulnerable to job loss and less likely to secure a new job than non-carers. One theoretical explanation suggested in section 2 is that firms are probably less likely to offer carer-friendly working environments when droughts or other regional shocks to the local labour market take place. The potential role of flexible employment conditions in helping insulate carers from the negative shocks to regional labour demand is an area for future research.

Clearly decisions made within households inform which family members will not be in paid employment or engaged in other activities such as caring. The relative and absolute capacities of various family members are obviously important and there may be some rationing of job search within families depending on the comparative advantage and opportunity costs of respective individuals. Notwithstanding that intra-household decisions about how care is provided to family members are largely a private matter, how to mitigate the effects of regional shocks to the labour market and disadvantaged members of society is a legitimate matter for policy debate. There are a number of possible policy approaches ranging from income or profit stabilisation schemes (analogous to existing income-contingent loans) for drought-affected businesses (Botterill and Chapman, 2009) in order to minimise the effects on regional labour demand. Another effective government policy response to a short-run shock would be a temporary boost to local spending to boost the regional economy. Like macroeconomic stabilisation policy, boosting local government spending would not be optimal if the shock was permanent.

The optimal policy response will depend, in large part, on the extent to which the regional economic shocks associated with drought are permanent or temporary. Irrespective of whether the economic shock associated with drought is temporary or permanent, it is important to acknowledge that drought and other regional economic shocks will have larger impacts on certain more vulnerable groups such as carers and their families.

## Appendix

Table A.1 - Descriptive Statistics from the OLS Regression of Carers' Employment Rates

<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Minimum</i>	<i>Maximum</i>
Employment rate	57.67	10.01	27.60	100.00
Rainfall deficits				
Drought	0.07	0.25	0.00	1.00
Below average	0.65	0.48	0.00	1.00
Have not changed address during the last five years	57.04	10.70	0.00	100.00
Indigenous	4.70	8.96	0.00	90.20
Age (omitted 65+ years)				
15-17 years	1.96	1.81	0.00	20.00
18-24 years	4.63	3.40	0.00	33.30
19-34 years	10.63	6.08	0.00	100.00
35-44 years	19.59	4.74	0.00	41.90
45-54 years	25.60	5.06	0.00	66.70
55-64 years	22.70	5.10	0.00	40.00
Female	59.90	5.86	0.00	73.30
Partnered	67.96	10.69	0.00	100.00
Completed Year 12	30.84	7.07	4.90	73.10

*Note:* Only 2 SLAs had an employment rate of 100 per cent. One SLA had an employment rate of more than 90 per cent

*Source:* Customised data from the 2006 Census of Population and Housing and rainfall data from the Bureau of Rural Sciences

Table A.2 - Descriptive Statistics from the OLS Regression of Non-carers' Employment Rates

<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Minimum</i>	<i>Maximum</i>
Employment rate	63.23	8.22	35.50	89.40
Rainfall deficits				
Drought	0.07	0.25	0.00	1.00
Below average	0.65	0.48	0.00	1.00
Have not changed address during the last five years	52.26	9.26	9.90	71.70
Indigenous	3.78	6.61	0.00	70.30
Age (omitted 65+ years)				
15-17 years	4.78	1.64	0.00	13.50
18-24 years	8.58	2.23	3.70	24.30
19-34 years	13.94	3.12	7.40	25.90
35-44 years	18.70	2.48	13.20	30.20
45-54 years	19.32	1.91	13.40	27.80
55-64 years	16.89	2.57	10.00	25.40
Female	47.05	3.51	25.60	52.00
Partnered	59.09	8.21	12.50	75.60
Completed Year 12	31.22	5.68	12.70	50.40

*Note:* There were no SLAs with employment rates above 90 per cent

*Source:* Customised data from the 2006 Census of Population and Housing and rainfall data from the Bureau of Rural Sciences

## References

- Alston, M. (2005), 'Drought and Social Exclusion', in R. Eversole and J. Martin (eds.), *Participation and Governance in Regional Development: Global Trends in an Australian Context*, Ashgate Publishing, London.
- Alston, M. and Kent, J. (2004), *Social Impacts of Drought*, Centre for Rural Social Research, Charles Sturt University, Wagga Wagga.
- Arber, S. and Ginn, J. (1995), 'Gender Differences in the Relationship between Paid Employment and Informal Care', *Work, Employment and Society*, 9(3), 445-71.
- Arksey, H., Kemp, P., Glendinning, C., Kotchetkova, I. and Tozer, R. (2005), 'Carers' Aspirations and Decisions around Work and Retirement', Research Report No 290, Department for Work and Pensions, London.
- Australian Bureau of Agricultural and Resource Economics (2008), *Australian Farm Survey Results 2005-06 to 2006-07*, ABARE, Canberra.
- Becker, G.S. (1965), 'A Theory of the Allocation of Time', *The Economic Journal*, 75(299), 493-517.
- Bittman, M., Hill, T. and Thomson, C. (2007), 'The Impact of Caring on Informal Carers' Employment, Income and Earnings: A Longitudinal Approach', *Australian Journal of Social Issues*, 42(2), 255-77.
- Botterill, L.C. and Chapman, B. (2009), 'A Revenue Contingent Loan Instrument for Agricultural Credit with Particular Reference to Drought Relief', *Australian Journal of Labour Economics*, 12(2), 181-97.
- Clogg, C.C., Petkova, E. and Haritou, A. (1995), 'Statistical Methods for Comparing Regression Coefficients Between Models', *American Journal of Sociology*, 100, 1261-93.
- Cook, R.D. and Weisberg, S. (1983), 'Diagnostics for Heteroscedasticity in Regression' *Biometrika*, 70(1), 1-10.
- Department of Education, Employment and Workplace Relations (DEEWR) (2010), *Small Area Labour Markets*, Australia, DEEWR, Canberra.
- Edwards, B., Gray, M. and Hunter, B. (2009), 'A Sunburnt Country: The Economic and Financial Impact of Drought on Rural and Regional Families in Australia in an Era of Climate Change', *Australian Journal of Labour Economics*, 12, 109-31.
- Edwards, B., Gray, M., Baxter, J. and Hunter, B. (2009), 'The Tyranny of Distance?: Carers in Regional and Remote Areas of Australia', Report prepared for Carers Australia, Melbourne.
- Edwards, B., Higgins, D. J., Gray, M., Zmijewski, N. and Kingston, M. (2008), *The Nature and Impact of Caring for Family Members with a Disability in Australia* (AIFS Research Report No. 16), Australian Institute of Family Studies, Melbourne.
- Eggert, W., Krieger, T. and Meier, V. (2010), 'Education, Unemployment and Migration', *Journal of Public Economics*, 94(5-6), 354-62.
- Ermisch, J.F. (2003), *An Economic Analysis of the Family*, Princeton University Press, Princeton.
- Gray, M. and Edwards, B. (2009), 'Determinants of the Labour Force Status of Female Carers', *Australian Journal of Labour Economics*, 12, 5-21.

- Hennessy, K., Fawcett, R., Kironoa, D., Mpelasokaa, F., Jones, D. and Bathols, J. (2008), 'An Assessment of the Impact of Climate Change on the Nature and Frequency of Exceptional Climatic Events', A Consultancy Report by CSIRO and the Australian Bureau of Meteorology for the Australian Bureau of Rural Sciences, Department of Agriculture, Fisheries and Forestry, Canberra.
- Hunter, B.H. and Biddle, N. (2010), 'Migration, Labour Demand, Housing Markets and the Drought in Regional Australia', *Research Paper No. 47*, Australian Institute of Family Studies, Melbourne.
- Joshi, H. (1995), 'The Labour Market and Un-paid Caring: Conflict and Compromise', *The Future of Family Care*, E. Perkins (eds.) HMSO, London.
- Mauro, P. and Spilimbergo, A. (1999), 'How Do the Skilled and the Unskilled Respond to Regional Shocks?' *IMF Staff Papers*, 46(1), 1-17.
- Mentzakis, E., McNamee, P. and Ryan, M. (2009), 'Who Cares and How Much: Exploring the Determinants of Co-Residential Informal Care', *Review of Economics of the Household*, 7, 283-303.
- Mooney, A., Statham, J. and Simon, A. (2002), *The Pivot Generation: Informal Care and Work after Fifty*, The Policy Press, Bristol.
- Productivity Commission (2008), *Government Drought Support: Draft Inquiry Report*, Productivity Commission, Canberra.
- Raupach, M.R., Briggs, P.R., King, E.A., Paget, M. and Trudinger, C.M. (2007), Australian Water Availability Project (AWAP) CSIRO Marine and Atmospheric Research Component, CSIRO Earth Observation Centre, Canberra.
- Stehlik, D., Gray, I. and Lawrence, G. (1999), *Drought in the 1990s: Australian Farm Families Experiences*, Rural Industries Research and Development Corporation, Canberra.
- Taylor, J. (2009), 'Indigenous Demography and Public Policy in Australia: Population or Peoples?' *Journal of Population Research*, 26(2), 115-130.
- Wilhite, D.A. and Glantz, M.H. (1985), 'Understanding the Drought Phenomenon: The Role of Definitions', *Water International*, 10(3), 111-20.