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Well-being losses due to care-giving☆,☆☆

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ABSTRACT

This paper estimates the impact of informal caregiving on self-reported well-being. It uses a sample of 23,285 respondents of the first eleven waves of the Household, Income and Labour Dynamics in Australia (HILDA).

We apply a relatively new analytical method that enables us to estimate fixed effects ordered logit to analyse subjective well-being. The econometric estimates show that providing informal care has a negative effect on subjective well-being.

The empirical evidence of our paper could be helpful to inform policy makers to better understand the impact of caregiving and design the appropriate long term care policies and support services.

1. Introduction

Informal care describes the care provided by family and friends, who are unpaid other than possibly receiving some form of carers' benefit (Van den Berg et al., 2004). While informal care has always been part of the care provided to the sick and disabled, it is becoming increasingly significant with the growing burden of chronic disease, the pressures to reduce acute hospital stays, and the emphasis on dying at home or at least remaining there as long as possible. Informal caregivers are responsible for the major amount of care provided, mostly at home, for people with chronic diseases, the elderly and the terminally ill (Norton, 2000).

Informal care has been largely ignored by economists on the basis that, if carers provided care, the benefits to them must outweigh the costs. This meant that informal carers were seen as a free resource, by economists and policy makers, and providing care at home as cost saving rather than as a redistribution of the costs. However, care-giving often involves considerable time (Van den Berg and Spauwen, 2006), limits the extent to which caregivers can take paid employment (Ettner, 1996; Carmichael and Charles, 1998, 2003; Heitmueller, 2007), or involves lower wages for those carers who are employed (Heitmueller and Inglis, 2007). The existing health economics literature on informal care has mainly focused on valuing this time input (Smith and Wright, 1994; Posnett and Jan, 1996). Most of the discussion has been around the appropriate method of valuation; see McDaid (2001) and Van den Berg et al. (2004) for overviews. Traditionally, economists have suggested valuing informal care using opportunity cost or proxy good (also called replacement cost) methods (Van den Berg et al., 2006). The first uses the foregone earnings of the caregivers as the value of care,

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and it ignores the (dis)utility that a caregiver might derive from providing the care. In the proxy good method, the value of informal care is the price of a market substitute, e.g. professional home care. It assumes that informal care and professional care are perfect substitutes, and that professional care is available. This assumption is not realistic. Professional care, however skilled, is not the same as the care provided by someone in the context of an ongoing relationship; and in many circumstances, professional care is not high quality or is simply not available. Carers may also feel a sense of obligation or duty to provide care. Neither method reflects the preferences of the informal caregiver or those of the care recipient. For this reason, Van den Berg et al. (2005a,b,c, 2008) suggest contingent valuation and choice experiments as a more adequate approach to valuing informal care as these methods are preference based and give a total valuation of informal care.

Beyond the economics literature, the impact of care giving on the carer has been well documented. Caregivers have reported negative effects on their physical and mental health, finances, social life and leisure, as well as labour market participation (Pearlin et al., 1990; Kramer, 1997; Hughes et al., 1999; Schulz and Beach, 1999; Dunn and Strain, 2001; Savage and Bailey, 2004; Hirst, 2005; Yamazaki et al., 2005; Kenny et al., 2010). This has lead to another stream of literature which tries to incorporate the so-called quality of life impacts of informal caregiving. Mohide et al. (1988) introduced the term caregiver quality of life in the literature by applying the time trade-off technique to caregiving. In fact the literature that followed simply applied health-related quality of life measures to informal caregiving (see for references Dixon et al., 2006) or valued informal care using best worst scaling (Al-Janabi et al., 2011) or subjective well-being (Brouwer et al., 2006). There is however little conceptual clarity about caregiver quality of life. For instance, it is not clear what aspects of caregiving should be included (Kramer, 1997; Chappell and Ried, 2002). Moreover, the obvious interdependency in utility functions between caregivers and their care recipients is neglected (Van den Berg et al., 2005b).

While caregiving can impose a considerable burden on caregivers, caregivers also report satisfaction with giving to a significant other, e.g. Jacobi et al. (2003), Andrén and Elmståhl (2005) and Zapart et al. (2007). This implies that the impact of caregiving is complex, involving both positive and negative effects. This suggests that a more sophisticated approach to understanding the caregiving role is required, and that the impact on overall well-being in addition to specific aspects should be assessed. Subjective well-being research measures respondents' own internal judgement of well-being as opposed to social indicators research that measures people's objective circumstances in a given cultural or geographic unit (Diener and Suh, 1997). It can measure people's judgement about their own life as a whole or be limited to specific domains of life, for instance, their job, house or family; for an overview see Myers and Diener (1995). Subjective well-being measures have been used in economics to understand and explore a large range of topics. They include: unemployment, inflation, health, job situation, and income (DiTella et al., 2001; Ferrer-i-Carbonell and Van Praag, 2002; Clark and Oswald, 1994; Easterlin, 2001; Long, 2005; Ferrer-i-Carbonell, 2005). Economists take the answers to well-being questions as a proxy measure of experienced utility; see, e.g., Kahneman et al. (1997), Frey and Stutzer (2002) and Luttmer (2005). On a few occasions, the economics literature goes one step further. It uses the general finding that household income increases self reported well-being to calculate a monetary compensation for cost-benefit analysis. This approach is called the well-being valuation method and has been applied, for instance, to airport noise (Van Praag and Baarsma, 2005) and chronic conditions (Ferrer-i-Carbonell and Van Praag, 2002; Powdthavee and van den Berg, 2011). There is only one paper which has applied this approach to informal care (Van den Berg and Ferrer-i-Carbonell, 2007)[1]; it demonstrated that the results obtained from the wellbeing valuation method were similar to contingent valuation estimates using two measures of wellbeing. It also showed that providing more informal care, as measured by hours of care, decreased care-giver self reported well-being. Moreover, the effect was stronger for family caregivers (i.e. living in the same household) compared with non-family caregivers. However, the study was limited to a cross sectional sample of caregivers recruited from carers' support centres likely involving self-selection bias. These respondents tended to be older, have an illness themselves, and provide more care than the national average hours of care provided.

This study also uses the wellbeing valuation method, following Van den Berg and Ferrer-i-Carbonell (2007), and extends it in various ways. We use panel data of a nationally representative population sample, the Household Income and Labour Dynamics in Australia (HILDA) data, which has repeatedly interviewed individuals. Thus we are able to examine the results of caregiving on a representative national sample. We compare the subjective well-being of caregivers and non-caregivers. The data set also provides income and health-related quality of life data, thus enabling us to compare the effect of care-giving with income and health-related quality of life on well-being. The panel nature of the data allows us to use analytical methods which control for the presence of unobserved individual effects. For example, altruism may be associated with both subjective wellbeing and informal care, and vary across individuals in our sample but is unobserved.

2. Data

2.1. Sample characteristics

We use the first eleven waves of HILDA, a nationally representative sample of the Australian population. The data were collected between 2001 and 2011, by interview and individually completed questionnaires. For more information, see Watson and Wooden (2002). The total household response rate in wave 1 was 66%. Out of 11,693 households, interviews were conducted within 7682 households, comprising 19,917 people, 4790 of whom were under 15 years of age on the preceding June 30 and hence ineligible for interview. This left 15,127 persons of whom 13,969 were successfully interviewed in the first wave (Heady et al., 2006). Subsequent waves include new individuals, due to existing household members turning 16, new household formation, and refreshment of the sample. We restricted our sample to individuals with complete data provided on the variables of interest in any wave. This consists of 23,285 individuals of whom 10,183 indicated that they would provide informal care (defined as any care) during a typical week in one or more waves.

2.2. Survey questions

The major variables of interest (see Table 1) are subjective well-being and the provision of informal care. Individual subjective well-being[2] was elicited by asking respondents to rate their own life satisfaction. We use the life satisfaction question as we believe

[1] Other papers apply subjective wellbeing measures to informal caregiving but they do not intend to measure caregiver's well-being according to the subjective wellbeing tradition but other concepts, for example process utility (Brouwer et al., 2005) and caregiver quality of life (Brouwer et al., 2006).

[2] The subjective well-being literature uses as interchangeable the terms subjective well-being, happiness, and satisfaction with life (Blanchflower and Oswald, 2004; DiTella et al., 2001; Frey and Stutzer, 1999). The term used is often chosen independently of the exact formulation used in the questionnaire itself. Here we

Table 1
Summary of data.

Variable	Description	Measure
LSAT	All things considered, how satisfied are you with your life?	0–10
INF	Caring for a disabled spouse or disabled adult relative, or caring for elderly parents or parents-in-law	0, 1
INFH	How many hours would you spend on caring for a disabled spouse or disabled adult relative, or caring for elderly parents or parents-in-law in a typical week?	Hours per week
INF1-20	Providing 1–20 h informal care per week	0, 1
INF > 20	Providing >20 h informal care per week	0, 1
INF0	Providing 0 h informal care per week	0, 1
HOU	Providing informal care to care recipients living in the same household	0, 1
NHOU	Providing informal care to care recipients living elsewhere	0, 1
INC	Gross monthly household income	Continuous
SF6D[a]	Health related quality of life measured with SF-6D	0.291–1
CHIN	No children	0, 1
CHIH	Children at home	0, 1
CHINH	Children not at home	0, 1
EDU	Years of school completed	5–12
NEV	Never married	0, 1
MAR	Living together/being married	0, 1
DIV	Divorced/widowed	0, 1
OUT	Out of labour	0, 1
PAID	Paid work	0, 1
UNE	Unemployed	0, 1
MALE	Being male	0, 1
AGE	Age	15–59

[a] Developed by Brazier et al. (2002) and consists of six health dimensions: physical functioning, role limitation, social functioning, pain, mental health, and vitality. Calculated using Brazier's (2002) preference data (results of model 10 in Table 6).

this is the best available proxy for utility according to the experienced utility tradition.[3] Time use was asked for seven activities, one of which was time spent in informal care-giving. The exact question was: "How many hours would you spend on each of the following activities in a typical week? Caring for a disabled spouse or disabled adult relative, or caring for elderly parents or parents-in-law." We also make a distinction between caregivers providing informal care to care recipients living in the same household versus living elsewhere.

In order to derive monetary or health-related quality of life equivalents of informal care we use gross household income or SF-6D. The data set includes a wide range of other variables that enable us to control for factors which also might affect subjective well-being. Other items include: having children, education, marital status, and employment status.

2.3. Econometric methods

As respondents were asked to rate their own life satisfaction and the resultant self-reported subjective well-being is a discrete ordered outcome, it is natural to consider methods such as ordered logit or ordered probit. The standard approach to panel data is to use fixed effects in a linear regression framework. However, it is well-documented that the usual linear regression procedures developed to accommodate fixed effects do not easily translate to non-linear models where outcomes are discrete (Greene, 2008).

Therefore we use a method recently developed by Baetschmann et al. (2011). As they colourfully state "...the situation is hopeless for the ordered probit", however, some progress has been made on developing fixed effects ordered logit models. Their proposed estimator builds on the idea that because there exists a conditional maximum likelihood (CML) estimator due to Chamberlain (1980) that is appropriate in the binary logit fixed effects case, one could utilise this estimator after reducing the ordered outcome to a binary one. In particular, Das and van Soest (1999) had previously suggested estimating fixed effects logits for all possible dichotomizing reductions and then combining the estimates by minimum distance estimation. The proposed Baetschmann et al. (2011) procedure is a one-step alternative that jointly estimates all dichotomizations subject to the restriction that coefficient vectors are equal across each dichotomization. This procedure introduces dependences between terms in the log-likelihood that needs to be accommodated by using a cluster-robust variance estimator. Their BUC (Blow-up and Cluster) estimator has several appealing features: (i) it is consistent unlike some other methods that have been proposed; (ii) it exhibits superior finite sample properties to the estimator of Das and van Soest (1999); (iii) it is easy to implement given a CML logit procedure.

The general specification of our model for individual $i = 1,\ldots, n$ in wave $t = 1,\ldots, 11$ is:

$$w^*_{it} = \beta_1 h_{it} + \beta_2 \log c_{it} + \beta_3 x'_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

where w^* refers to the latent construct experienced utility which is measured with the life satisfaction question. Informal care time is represented by the variable h. It is the weekly log transformed informal care hours variable. To be precise, it is weekly hours plus one to also include the people not providing informal care. This log transformed informal care hours variable is employed to compare our findings with those of Van den Berg and Ferrer-i-Carbonell (2007). Van den Berg and Ferrer-i-Carbonell (2007) emphasised "although at odds with the theory of diminishing marginal utility of leisure, the logarithmic specification for hours of informal care is introduced so as to deal with caregivers who over report their hours", as they had a sample of self selected caregivers likely over reporting the amount of care provided. It seems however more plausible to assume the negative association between informal care and wellbeing to be stronger if the amount of informal care time is larger, as we test in a second specification. In this specification h consists of dummy variables indicating providing 0 h, 1–20 h, or more than 20 h informal care per week. This distinction is similar

will use the term subjective well-being, although we will refer to the question as the life satisfaction question, because the survey asked for life satisfaction.

[3] Others have used alternative measures than the life satisfaction question like self-reported health; see Powdthavee and van den Berg (2011) for detailed discussion.

to Heitmueller's (2007) definition of informal care intensity. For our robustness checks we also use dummies indicating whether informal care is provided to somebody in the same household or to somebody outside the same household that proxy the impact of informal care on life satisfaction.

The variable c in Eq. (1) represents income. c is log transformed consistent with the usual assumption of decreasing marginal utility of income. x is a vector of observable control variables and the β's are coefficients. The μ and ε in Eq. (1) refer to unobservable characteristics. More precisely, μ_i is the time-invariant part of the unobservables, called the fixed effect, and is not necessarily assumed to be independent of the explanatory variables appearing in (1). ε_{it} is assumed to be conditionally independent and identically standard logistically distributed. The latent variable relates to the observed ordered variable, in formal terminology:

$$w_{it} = k \quad \text{if} \quad \tau_k < w_{it}^* \leq \tau_{k+1}, \quad k = 0, \ldots, K, \tag{2}$$

where τ are thresholds which are assumed to be strictly increasing ($\tau_k < \tau_{k+1}\ \forall k$) and $\tau_0 = -\infty$, $\tau_{K+1} = \infty$, and $K = 10$ as the answering categories of our self-reported life satisfaction question range from 0 to 10.

If the dependent variable in (1) were observed then standard linear panel methods, such as the within transformation, could be employed to eliminate the fixed effects. That is not possible here and brute force estimation achieved by including dummy variables for each individual is also not appropriate because of the incidental parameters problem. The Baetschmann et al. (2011) BUC estimator is a way of getting around these estimation problems.

For comparison purposes a pooled OLS model with cluster robust standard errors (Cameron and Trivedi, 2009) and a standard linear regression fixed effects model with robust standard errors (Wooldridge, 2002) are also estimated and the results compared to those obtained from the BUC estimator. Ferrer-i-Carbonell and Frijters (2004) had previously found using German data that the assumption of cardinality associated with applying linear regression is unlikely to lead to inferences that were qualitatively different from those obtained from ordered models. What they did stress was the need to accommodate individual fixed effects; this did matter for inferences. Our results provide a further comparison with a different set of data and hence shed some light on the generalisability of their previous findings.

The derivation of marginal rates of substitution, in other words the money and health equivalents, is formally described in Van den Berg and Ferrer-i-Carbonell (2007) and we do the calculation in terms of the latent construct. They are necessary to be able to compare the economic significance of our results as we cannot compare the coefficients of the fixed effects OL with the coefficients of the pooled OLS and the linear fixed effects.

3. Results

3.1. Descriptive statistics

Table 2 gives the frequencies on the life satisfaction scale for the total sample and by caregiving status. The distributions for both groups are similar. It is worth noting that less than 7% of the caregivers and less than 6% of the non-caregivers rate their life satisfaction lower then 6.

Table 3 shows the characteristics of the sample; 9% of the sample provides informal care for on average 15 h per week. The majority (78%) of the caregivers were caring for someone outside the household, while 22% lived with the care recipient. Caregivers in the same household provide on average 7.8 h more care per week then caregivers caring for someone outside the household: 21.0 versus 13.2 h

Table 2
Distribution of life satisfaction.

LSAT (%)	All	Caregivers	Non-caregivers
0	0.12	0.17	0.11
1	0.17	0.20	0.17
2	0.36	0.47	0.35
3	0.72	0.97	0.69
4	1.15	1.58	1.11
5	4.04	5.36	3.92
6	5.77	6.89	5.66
7	18.87	19.43	18.81
8	33.64	32.57	33.74
9	22.02	20.58	22.16
10	13.14	11.76	13.27
Number of observations	115,411	10,183	105,228
Number of individuals	23,285	10,183	22,516

respectively. In comparison two percent of the full sample provides care to someone in the same household and 7% of the full sample to someone outside the same household. As expected informal caregivers are more likely to be female and slightly older compared with non-caregivers; see also Australian Bureau of Statistics (2003). Although caregivers' income and health-related quality of life differ statistically significantly from non-caregivers, the magnitudes of the differences are quite small.

3.2. Estimation results

Tables 4 and 5 present the regression results for pooled OLS, linear fixed effects and fixed effects OL. Table 4 gives the association between the weekly log transformed informal care hours and life satisfaction and Table 5 the association between respectively providing less and more than 20 h informal care per week and life satisfaction where the results have to be interpreted compared with people not proving informal care.

Table 4 results shows that the weekly log transformed informal care hours are negatively associated with life satisfaction in pooled OLS and log transformed income is positively associated with life satisfaction in pooled OLS. Exploiting the panel nature of our data enables controlling for correlated unobservables by using fixed effects. After controlling for fixed effects, there is still a positive and statistically significant association between income and life satisfaction (linear fixed effects). If we compare the coefficients of the pooled OLS and the linear fixed effects (we cannot compare the coefficients of the fixed effects OL), the change in coefficients suggests there are biases due to not controlling for fixed effects. The number of individuals in the fixed effects OL is lower than in the linear fixed effects because people without variation in self-reported life satisfaction over time are excluded.

We also investigate differences between caregivers and non-caregivers, and between intensive caregivers (over 20 h per week). Table 5 provides further evidence on the association of informal care hours and life satisfaction by comparing people providing more than 20 h informal care per week with people providing less than 20 h per week. It suggests a statistically significantly negative association between providing 1–20 h informal care per week and more than 20 h and life satisfaction. Both effects are compared with not providing informal care. The estimated coefficients are statistically significant in the three estimation models. A further comparison of the point estimates of providing more than 20 h informal care with providing 1–20 h care, suggests the negative association with wellbeing of providing a substantial amount of informal care is larger. The chi-square/p-values for testing the hypothesis that effects are the same are 23.33/0.0000 (pooled OLS),

Table 3
Sample characteristics.

	Total		Caregivers		Non-caregivers	
	Mean/%	SD	Mean/%	SD	Mean/%	SD
LSAT (mean)	7.93	1.48	7.78	1.57	7.95	1.47
INF (%)	0.09	0.28	1.00	0.00		
INFH (mean)	1.32	8.50	14.99	24.77		
INF1-20(%)	0.07	0.26	0.82	0.39		
INF > 20(%)	0.02	0.13	0.18	0.39		
INFH if INF1-20 (mean)			5.73	5.07		
INFH if INF > 20 (mean)			56.01	34.01		
HOU (%)	0.02	0.14	0.22	0.42		
NHOU (%)	0.07	0.25	0.78	0.42		
INFH if HOU (mean)			21.03	29.97		
INFH if NHOU (mean)			13.20	22.72		
INC (mean)	83,543.37	73,827.70	79,712.67	74,096.80	83,914.07	73,791.40
SF6D (mean)	0.78	0.12	0.76	0.13	0.78	0.12
CHIN (%)	0.35	0.48	0.22	0.41	0.36	0.48
CHIH (%)	0.37	0.48	0.41	0.49	0.37	0.48
CHINH (%)	0.38	0.49	0.54	0.50	0.37	0.48
EDU (mean)	10.76	1.46	10.60	1.49	10.77	1.45
NEV (%)	0.24	0.42	0.13	0.34	0.24	0.43
MAR (%)	0.63	0.48	0.73	0.44	0.62	0.48
DIV (%)	0.13	0.34	0.13	0.34	0.13	0.34
OUT (%)	0.33	0.47	0.41	0.49	0.32	0.47
FULL (%)	0.42	0.49	0.34	0.47	0.43	0.50
PART (%)	0.21	0.41	0.23	0.42	0.21	0.41
UNE (%)	0.03	0.18	0.03	0.17	0.04	0.19
MALE (%)	0.47	0.50	0.38	0.49	0.48	0.50
AGE (mean)	43.90	18.16	51.00	14.46	43.21	18.34
Number of observations	115,411		10,183		105,228	
Number of individuals	23,285		4190		22,516	

31.24/0.0000 (linear fixed effects), and 16.53/0.0000 (fixed effects OL) and hence can be rejected.

The results of the other control variables in Tables 4 and 5 are not, in general, unexpected. Living together/being married is associated with higher life satisfaction while being divorced and being unemployed are associated with lower satisfaction. Higher education seems also negatively associated with life satisfaction which seems odd at first glance but not necessarily inconsistent with previous research, see for instance Hartog and Oosterbeek (1998). Children at home are negatively associated with life satisfaction but the statistical significance of the children not at home variable differs between the three estimation techniques. These results have to be interpreted compared with no children.

The changes in coefficients between the linear fixed effects and the pooled OLS point at biases to not controlling for fixed effects. The linear fixed effects and the fixed effects OL almost always agree in terms of the sign of the estimated coefficients and the level of statistical significance. This consistency in findings of the linear fixed

Table 4
Estimation results log INF; dependent variable LSAT.[a]

Independent variables	Pooled OLS		Linear fixed effects		Fixed effects OL	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*z*-Value
Log INF	−0.112***	−9.600	−0.067***	−8.150	−0.094***	−5.780
Log INC	0.086***	14.070	0.041***	9.780	0.043***	5.170
MALE	−0.086***	−4.710	N.A.		N.A.	
CHIH (*ref.* = *CHIN*)	−0.297***	−15.770	−0.160***	−11.660	−0.173***	−4.770
CHINH (*ref.* = *CHIN*)	0.062***	2.840	0.013	0.790	−0.024	−0.510
EDU	−0.054***	−7.790	−0.067***	−10.680	−0.354***	−7.570
MAR (*ref.* = *NEV*)	0.309***	13.340	0.233***	13.200	0.463***	9.200
DIV (*ref.* = *NEV*)	−0.205***	−5.510	−0.293***	−9.540	−0.376***	−4.920
FULL (*ref.* = *OUT*)	−0.200***	−9.750	−0.090***	−5.930	−0.045	−1.220
PART (*ref.* = *OUT*)	0.001	0.050	0.029**	1.980	0.098***	2.910
UNE	−0.500***	−13.210	−0.265***	−9.610	−0.317***	−6.350
Intercept	7.725***	79.630	8.320***	102.210		
Adjusted R^2	0.0371					
R^2 within			0.0129			
R^2 between			0.0292			
R^2 overall			0.0314			
Pseudo R^2				0.0128		
Number of observations	115,411		115,411		N.A.	
Number of individuals	23,285		23,285		13,515	

[a] Coefficients for wave dummies not reported.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.

Table 5
Estimation results INF1-20 and INF > 20; dependent variable LSAT.[a]

Independent variables	Pooled OLS		Linear fixed effects		Fixed effects OL	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*z*-Value
INF1-20 (*ref.* = *INF0*)	−0.177***	−7.410	−0.079***	−4.990	−0.122***	−3.440
INF > 20 (*ref.* = *INF0*)	−0.490***	−7.680	−0.329**	−7.380	−0.445***	−5.600
Log INC	0.086***	14.090	0.041***	9.780	0.043***	5.170
MALE	−0.086***	−4.690	N.A.		N.A.	
CHIH (*ref.* = *CHIN*)	−0.296***	−15.720	−0.159***	−11.640	−0.172***	−4.740
CHINH (*ref.* = *CHIN*)	0.062***	2.830	0.013	0.750	−0.024	−0.520
EDU	−0.054***	−7.770	−0.067***	−10.700	−0.354***	−7.570
MAR (*ref.* = *NEV*)	0.309***	13.340	0.233***	13.180	0.462***	9.200
DIV (*ref.* = *NEV*)	−0.205***	−5.320	−0.294***	−9.570	−0.377***	−4.930
FULL (*ref.* = *OUT*)	−0.199***	−9.690	−0.090***	−5.940	−0.045	−1.210
PART (*ref.* = *OUT*)	0.002	0.010	0.029*	1.950	0.098***	2.910
UNE (*ref.* = *OUT*)	−0.499***	−13.190	−0.266***	−9.620	−0.317***	−6.360
Intercept						
Adjusted R^2	0.0371					
R^2 within			0.0131			
R^2 between			0.0292			
R^2 overall			0.0314			
Pseudo R^2				0.0129		
Number of observations	115,411		115,411		N.A.	
Number of individuals	23,285		23,285		13,515	

[a] Coefficients for wave dummies not reported.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.

effects and fixed effects OL as well as the changes in coefficients between when comparing the pooled OLS with the linear fixed effects confirm the conclusion of Ferrer-i-Carbonell and Frijters (2004) that accounting for fixed effects is more important than accounting for the ordinal nature of the dependent variable.

We also explored differences by gender. These results are presented in Table 6. Both the log transformed hours informal care and the dummies 1–20 h and more than 20 h are statistically significant for females. This is also true for males, except for the dummy 1–20 h informal care per week.

We further explored the inclusion of dummy variables distinguishing provision of informal care in and outside the same household instead of the dummies representing providing less and more than 20 h informal care per week. Both dummies were statistically significant. Also the income variable (coefficient 0.043) was statistically significant in this specification. The household sharing dummies had somewhat different effects by gender. The results show slightly larger and statistically significant coefficient estimates for the variables of interest in case of females and smaller (but not statistically significant for same household) estimates for males.

3.3. Money equivalents

As the coefficients of results of the pooled OLS, linear fixed effects OL cannot be compared with the fixed effects OL ones and to give an indication of the economic significance of our findings, we present the money equivalents based on Table 4. From the pooled OLS results, the calculated money equivalent of informal care per hour is 78.12. The linear fixed effects money equivalent of

Table 6
Results specification tests main variables; fixed effects OL; dependent variable LSAT.[a]

	Log INF	INF1-20[b]	INF > 20[b]	HOU[b]	NHOU[b]	Log INC
Females	−0.096***					0.049***
	(−4.530)					(4.520)
Males	−0.087***					0.038***
	(−3.530)					(2.870)
Females		−0.149***	−0.484***			0.049***
		(−3.110)	(−4.790)			(4.500)
Males		−0.083	−0.359***			0.038***
		(−1.590)	(−2.830)			(2.870)
In and outside household carers						
Full sample: females and males				−0.224***	−0.168***	0.043***
				(−3.140)	(−4.650)	(5.160)
Females				−0.292***	−0.194***	0.049***
				(−2.930)	(−4.010)	(4.510)
Males				−0.125	−0.126***	0.037***
				(−1.290)	(−2.360)	(2.840)

[a] *z*-values in brackets.
[b] Ref. = INF0.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.

informal care per hour is 105.20 and the fixed effects OL is 115.20. This again is consistent with Ferrer-i-Carbonell and Frijters (2004) suggesting that accounting for fixed effects in the calculation of the money equivalents is more important than accounting for the ordinal nature of the dependent variable.

3.4. The inclusion of health-related quality of life and health equivalents

As we also have information on respondents' health-related quality of life we re-estimate the fixed effects OL including the SF-6D. Including this variable in the model seems to take away part of the caregiving effect in all specifications, as none of the care-giving variables are statistically significant at conventional levels. The most likely explanation is that providing informal care has an impact on health-related quality of life. Health-related quality of life seems therefore endogenous and should not be included as a control variable. As a consequence we do not calculate the health equivalents.

4. Conclusion and discussion

Our study explores the relationship between subjective well-being as assessed by self rated life satisfaction, and various indicators of informal caregiving. On balance, our results are consistent with the existence of a negative effect of increasing caregiving on well-being.

The statistically significant association between log transformed weekly hours informal care is consistent with Van den Berg and Ferrer-i-Carbonell (2007). Main differences are that our sample also includes non-caregivers, their sample was older and was recruited through carers' groups so may be more likely to include those providing more hours of care. This is an important replication of the effect in a representative sample of the Australian population.

Exploiting the panel nature of our data enables controlling for correlated unobservables by using fixed effects. After controlling for fixed effects, there is still a positive and statistically significant association between informal care and wellbeing as well as between income and wellbeing (both linear fixed effects and fixed effects OL). If we compare the coefficients of the pooled OLS and the linear fixed effects, the change in coefficients suggests there are biases due to not controlling for fixed effects. The linear fixed effects and the fixed effects OL are almost always consistent in terms of the sign of the estimated coefficients and the level of statistical significance. Combined with the changes in coefficients between the pooled OLS with the linear fixed effects, the consistency in findings of the linear fixed effects and fixed effects OL confirms the conclusion of Ferrer-i-Carbonell and Frijters (2004) that accounting for fixed effects is more important than accounting for the ordinal nature of the dependent variable. This was also confirmed by the comparison of the calculated hourly money equivalents of informal care between the pooled OLS, the linear fixed effects and the fixed effects OL.

Well-being was assessed by means of a life satisfaction question which although widely used is difficult to interpret. In order to assess its economic significance, we have calculated the money equivalents. While there are many conceptual and theoretical problems with using these sorts of equivalence approaches, this does at least provide some sense of the size of the impact compared to changes in income. However, these values should not be simply transferred to cost-benefit and cost-utility analyses as their interpretation is not straightforward.

The strength of this study is the use of a large (over 20,000 respondents with over 10,000 caregivers in any of the waves), nationally representative sample comprising both caregivers and non-caregivers. The HILDA data also contains a comprehensive range of items, including income, health-related quality of life and individual characteristics. Our study therefore does not involve selection bias compared to other studies on informal caregiving using samples approached via support centres or via care recipients.

Although the panel nature of the data allowed us to control for the presence of unobserved individual effects, a potential weakness of our study is that there might be time varying unobservables that could affect subjective well-being and care-giving, or for instance subjective well-being and work or subjective well-being and marital status. Future research should consider further exploring them especially with respect to the selection into care-giving.

Informal care provision was assessed by means of a simple time use question, asking how much time is spent on a range of activities, including informal care, during a typical week. It has been argued that these kind of aggregated questions involve an underestimation of time use (Van den Berg and Spauwen, 2006). Therefore, actual time spent caring may be higher than the survey results indicate. Also, our informal care measures do not capture the timing of care (Hassink and Van den Berg, 2011). Providing a few hours of informal care during the weekends may have a different impact on carer wellbeing compared with for instance a similar total amount of care but provided on a daily base which is something future research could try to capture.

The HILDA data defines informal care as caring for a disabled spouse or disabled adult relative, or caring for elderly parents or parents-in-law. Therefore the caregiving measure does not include caring for friends or other people who are not related to the carer which obviously limits the generalisibility of our findings.

Designing sustainable long term care systems is one of the main challenges policy makers face in high income countries; see for instance Schut and Van den Berg (2010). It is crucial for designing long term care policies to get a better understanding of the impact of providing informal care on carers. Our paper provides empirical evidence based on panel data which confirms previous findings based on cross-sectional data that providing informal care is correlated with subjective well-being losses. The subjective well-being as assessed by self rated life satisfaction does not allow us to distinguish the positive and negative effects of caregiving within the same individual; indeed it may well be the case that all caregivers experience both positive and negative effects but the balance differs per subgroup. Future research might therefore consider measuring overall well-being using measures of affect containing positive and negative dimensions (McKennell, 1978; Veenhoven, 2008). It would be interesting to compare them with measuring well-being using self rated life satisfaction as well as trying to identify subgroup differences. Another crucial area for further research is whether this subjective measure captures similar or different things than other measures of impact of providing informal care on carers like forgone labour market opportunities, forgone wages, and/or forgone health. As stated in the introduction, subjective well-being measures capture respondents' own internal judgement of well-being as opposed to social indicators research that measures people's objective circumstances in a given cultural or geographic unit (Diener and Suh, 1997). One could however also argue that in theory people's objective circumstances are captured by measures of subjective well-being because subjective well-being measures are proxies for experienced utility (Kahneman et al., 1997). Our empirical evidence in relation to health-related quality of life suggests this might be true as this study shows that overall caregivers do not experience a much reduced health-related quality of life, even though caregiving requires a substantial

time commitment. It also shows that including respondents' health-related quality of life in the regressions seems to eliminate the informal care effect. It has however also been argued that subjective well-being measures capture intangible impacts, e.g. Ferrer-i-Carbonell and Van Praag (2002) in their application of chronic diseases but not necessarily forgone labour market opportunities due to having a disease. If this would be true, subjective well-being measures as used in this paper should be complemented by other measures which capture for example the income losses and morbidity impacts of care-giving. More work is therefore necessary to contest how comprehensive measures of subjective well-being are. This is crucial to inform policy. If they are comprehensive they could potentially substitute for existing measures but if they are not it is crucial to not ignore other than subjective well-being impacts of care-giving in public policy discussions. We also encourage further research from different countries having different cultures and views of responsibilities of the state and the private/family and females versus males. This empirical evidence would be helpful to inform policy makers to understand the impact of caregiving as the demand for informal care likely increases, and design the appropriate long term care policies and support services for this often unrecognised army of workers.

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