

# **Estimating the cost of mental illness in Australia: A standard of living approach**

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## **Abstract**

Estimating the costs of mental health provides useful policy and managerial information to improve the quality of life of people living with a mental illness and their families. This paper estimates the costs of mental health in Australia using the standard-of-living approach. We analyse data from the Household, Income and Labour Dynamics in Australia Survey using an extended random-effects estimator. To the best of our knowledge, this is the first study to examine the cost of mental illness in Australia using the standard of living approach with a nationally representative longitudinal data set. Results from the main specification show that people with a mental illness need to increase their equivalised disposable income by 50% to achieve a similar living standard as those without a mental illness. The cost estimates vary considerably with measures of mental illness and standard of living. An alternative measure of mental illness using the first quintile of the SF-36 mental health score distribution resulted in an increase of estimated costs to 80% equivalised disposable income.

**Keywords:** Cost of mental illness; standard of living approach; panel data; extended random-effects estimator; Australia

**JEL Classification:** I10, I18

## **1. Introduction**

Mental illness includes a wide range of behavioural and psychological conditions from eating disorders to personality disorders [1]. Mental illness is a serious public health issue in many countries. In Australia, 3.2 million people have a mental illness that requires access to mental health services or medications [2]. Apart from requiring large public health expenditure, people with mental illness and their families also face difficulties in various aspects of life such as finding and maintaining jobs [3, 4]. The costs of mental illness are high. In Australia, the direct costs of mental illness were estimated to be \$A6.9 billion in 2010-2011, accounting for 7.7% of the total government health budget [5]. Previously in the UK, it was revealed that the cost of living with conduct disorders from childhood to the age of 28 was up to 10 times higher than for those living without a conduct problem [6]. However, limited research has been conducted to estimate the costs of mental illness in Australia from individual and household perspectives. This type of research will provide useful inputs for policy applications such as evaluating whether the current financial support for people with mental illness is enough. Further, Australia is on the verge of introducing a National Disability Insurance Scheme (NDIS), which supports all Australians with a disability, including mental illness to improve their lives [7]. Thus, an estimate of mental illness costs in Australia at present will also provide a useful reference for future evaluations of the NDIS.

This study makes three contributions to the literature by estimating the costs of mental illness in Australia using data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. First, it provides an updated estimate of the costs of mental illness in Australia using the HILDA data. Second, it exploits the longitudinal structure of the HILDA data to estimate both short-run and long-run costs of mental illness. Third, it controls for individual-specific unobserved effects by using an extended random-effects estimator.

The remainder of this paper includes a brief review of the literature in Section 2, a description of methods in Section 3 and data in Section 4. Section 5 presents the results and discussions, while Section 6 concludes.

## **2. A brief review of the literature**

A recent, comprehensive review of the cost of mental illness by Doran and Kinchin [5] found 45 studies from Australia, the United Kingdom (UK), Canada and New Zealand that applied diverse methods to estimate the cost of mental illness. Australia contributed almost half of the total studies reviewed with 22 studies, followed by Canada (12) and the UK (10). Among the types of mental illness, most studies focused on mental disorders (19), followed by depression (11) and schizophrenia (7). Most studies concentrated on estimating direct costs of mental illness, while only six estimated the indirect costs of mental illness. This trend may result in an under-estimation of mental health costs because indirect costs such as productivity loss could be much larger than direct costs [8-12].

Most studies, including those reviewed by Doran and Kinchin, estimated short-run costs of mental illness and its impacts. Only nine studies examined long-run costs, which were found significantly higher than the short-run costs. The long-term impacts of mental illness studied include educational outcomes, labour force engagement, lower productivity (via presentism, absenteeism and early retirement), and welfare dependency. Perhaps most alarmingly, the majority of studies revealed that the costs of mental illness are substantial and increasing. For example, the estimated excess costs of major depression in South Australia was \$A13,000 per case per year, of which costs to patients was \$A10,000 [10]. The relative cost of mental illness in Australia was also high: individuals with depression and other mental disorders had 97% less saving and retirement income by the age of 65 than those without a mental illness [13].

The review of Doran and Kinchin [5] was updated by searching for studies in other developed countries that have a similar level of economic development to Australia. In the USA, Marcotte and Wilcox-Gök [14] found that mental illness resulted in a lower income by up to \$US6,000 per year. Compared to the median income of nonfamily households, which is a proxy for equivalised income, of \$US25,000 [15], mental illness contributed to a 24% income reduction.

The cost of mental illness studies in the literature can be classified into two main approaches: bottom-up and top-down. The top-down approach estimates costs at national or regional levels, which can then project individual-level costs by dividing aggregated costs by the number of cases. The bottom-up approach estimates costs at

the individual level then aggregate these costs by the number of cases to obtain the national estimates. The bottom-up approach is more relevant to studies using survey data like this study. In particular, we select the Standard of Living (SoL) approach, which estimates the cost of mental illness as the amount of additional income needed to make the standard of living of people with an illness similar to that of people without mental illness [16]. This approach implicitly estimates both direct and indirect costs of mental illness. Also, with a relevant panel data specification, this approach allows the estimation of both short-run and long-run costs. This study will be the first application of the SoL approach to estimate the costs of mental illness in Australia.

### 3. Methods

Econometrically, the costs of mental illness using the SoL approach are specified as:

$$S_{it}^* = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 MI_{it} + \delta X_{it} + (\alpha_i + \varepsilon_{it}) \quad (1)$$

where  $S_{it}^*$  is a latent (unobserved) variable representing the standard of living of individual  $i$  at period  $t$ ;  $\ln Y_{it}$  is the natural logarithm of inflation-adjusted equivalised disposable income;  $MI$  is a dummy variable representing mental illness;  $X$  is a vector of individual, household and neighbourhood characteristics; and the composite error term consists of time-invariant individual-specific unobserved characteristics ( $\alpha_i$ ) and random noise ( $\varepsilon_{it}$ ).

The observed value  $S_{it}$  (e.g., financial satisfaction) is linked to the latent variable  $S_{it}^*$  as:

$$S_{it} = k \text{ if } \mu_{ik} \leq S_{it}^* \leq \mu_{i,k+1} \quad k=1,\dots,K \quad (2)$$

where individual-specific thresholds  $\mu_k$  are increasing with  $\mu_{i1} = -\infty$  and  $\mu_{iK} = +\infty$ .

The cost of mental illness under the SoL approach is defined as the additional amount of income ( $\Delta Y$ ) needed to keep the living standard of people with a mental illness ( $S_{\ln Y + \Delta Y | MI=1}$ ) equal to that of people without a mental illness ( $S_{\ln Y | MI=0}$ ). Replacing the value of income and mental health status for those with and without a mental illness into Equation (1), other variables remain unchanged and hence are dropped for brevity, results in the SoL estimation of additional income (cost of mental illness) as:

$$(\Delta Y + \ln Y)\beta_1 + \beta_2 = \beta_1 \ln Y \quad (3)$$

Particularly, the cost of mental illness using the SoL approach is the ratio of the mental illness and log of income parameters ( $-\beta_2/\beta_1$ ). This ratio is interpreted as the percentage of disposable income needed for individuals with a mental illness to reach the same level of standard of living of those without a mental illness.

Due to the presence of individual-specific unobserved characteristics  $\alpha_i$ , the composite error term may be correlated with other observable covariates. Thus, applying a standard regression to Equation (1) may produce biased estimates. Mundlak [17] proposed an extended random-effects estimator where the time-invariant individual unobserved characteristics ( $\alpha_i$ ) correlates with the individual-average of endogenous covariates:

$$\alpha_i = \gamma \bar{Z}_i + u_i \quad (4)$$

where  $Z_i$  is a set of potentially endogenous time-varying observable covariates, which is a subset of  $X_{it}$ ; and  $u_i$  is normally distributed with zero mean and standard deviation  $\delta_u$  and uncorrelated with  $Z_{it}$  or  $\bar{Z}_i$ . In this study, the potential endogenous time-varying observable variable is equivalised disposable income.

Replacing  $\alpha_i$  from Equation 4 into Equation 1 and applying a standard random-effect estimator can mitigate the effects of individual unobserved characteristics.

$$S_{it}^* = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 MI_{it} + \delta X_{it} + \gamma \bar{Z}_i + (u_i + \varepsilon_{it}) \quad (5)$$

A static specification like Equation 5, however, does not reflect the fact that costs of mental illness during the current periods could be affected by those in the previous periods. Thus, the lagged values of mental illness status and income have been included to specify this dynamic relationship:

$$S_{it}^* = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 MI_{it} + \beta_3 \ln Y_{i,t-1} + \beta_4 MI_{i,t-1} + \delta X_{it} + \gamma \bar{Z}_i + (u_i + \varepsilon_{it}) \quad (6)$$

The advantage of this specification is that it can separate the contemporaneous costs of mental illness (estimated using the current period parameters) with the long-run costs of mental illness (estimated using the previous period parameters).

The estimation of Equation 6 will be conducted using a random-effects ordered logit estimator. The logit distribution link function is selected instead of the normal

distribution link function (i.e., a probit estimator) due to its ability to perform a fixed-effects if statistical tests suggest that a random-effects estimator is not suitable.

## **4. Data**

### *4.1 Data source*

The data used in this study was from the first 16 waves of the Household, Income and Labour Dynamics in Australia (HILDA) Survey, which was a popular nationally representative longitudinal study in Australia. The annual survey began in 2001 and collected a wide range of information on relationships, child care, employment, income and health from all household members aged 15 years and older [18].

The survey attained a reasonably high response rate of 66% at the household level and 61% at the individual level [19]. The average retention rate of Wave 1 sample was relatively high, from 85.9% in Wave 2 to 55.6% in Wave 16 [20]. The average response rate was about 70% with slight variations across waves. The number of survey participants ranges from 13,969 in Wave 1 to 17,694 in Wave 16, and a large top-up of households occurred in Wave 11.

### *4.2 Variable selection*

#### Standard of living

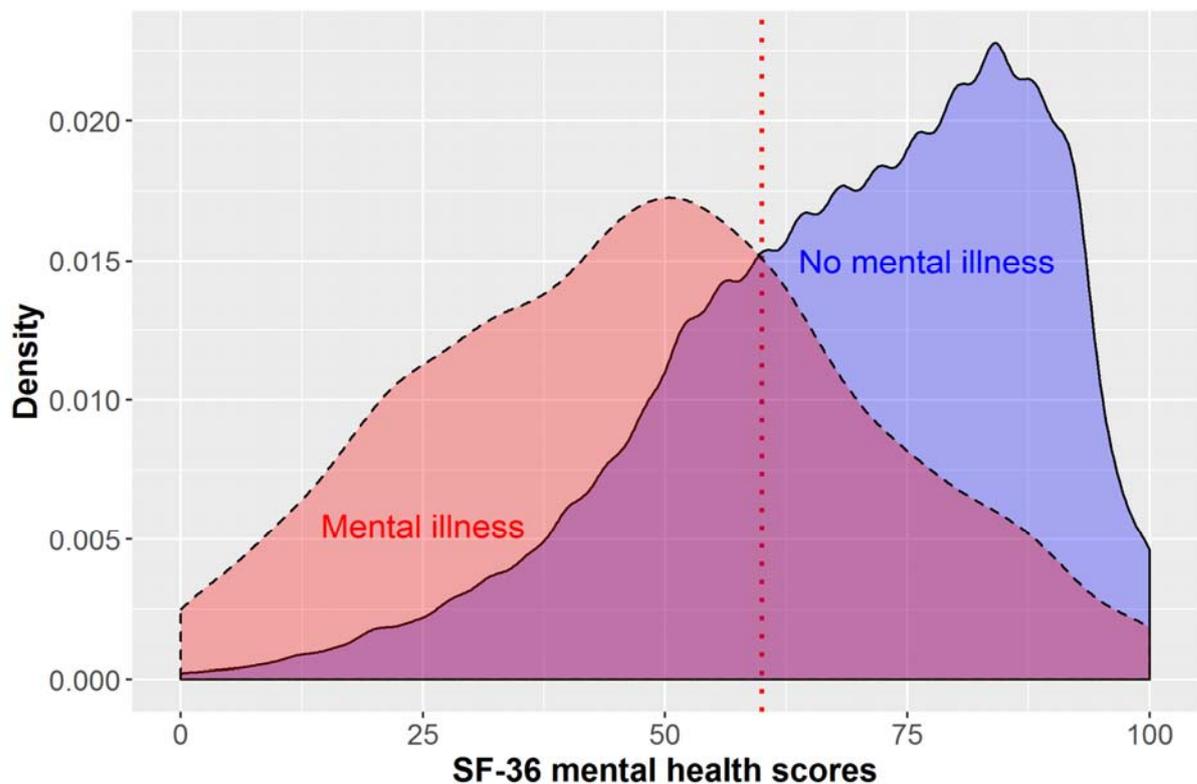
We measured the costs of mental illness using a standard of living approach. There were two main measures of the standard of living in the literature: overall wellbeing [21], and financial situation [22]. We prefer the financial satisfaction measure for several reasons. First, the financial situation is easier to adjust by changes in income. In contrast, overall wellbeing may include intangible factors and thus is difficult to improve with income alone. Second, results based on this can be easily translated into measurable policy targets, such as the optimal amount of financial support needed for people with a mental illness. In the HILDA survey, the financial satisfaction variable was a rank order with a range from 0 for “totally dissatisfied” to 10 for “totally satisfied”.

#### Mental illness and covariates

The HILDA survey included a direct question on mental illness “Do you have any long-term mental health condition – Any mental illness which requires help or

supervision?”. We chose a response to this question as the main measure of mental illness. On average, 5.6% of people responded to this question answered “yes”. However, this variable contained many missing observations. This question was not asked for 53% of the participants, and it was not available in the first two waves. Thus, an alternative measure of mental illness was constructed from the mental health component of the short-form 36 (SF-36) questionnaire. This questionnaire, developed by the RAND institution, contained 36 items to measure physical and emotional wellbeing [23].

The HILDA data possessed a summary score of the SF-36 mental health component. This score ranged from zero (very poor mental health) to 100 (perfect mental health). The distribution of SF-36 mental health scores showed that those with mental illness have substantially lower scores than those without a mental illness despite considerable overlap (see Figure 1). This overlapping region might include those who exercised a preventive effort (i.e., seek help for mental illness despite score highly in SF-36 mental health), and those who exercised a covering effort (i.e., do not seek help for mental illness despite score poorly in SF-36 mental health).



**Figure 1.** Distribution of SF-36 mental health scores by the mental illness status

Based on the distribution of SF-36 scores for mental illness in Figure 1 and the prevalence of mental illness in the Australian population, an alternative mental illness, an alternative measure of mental illness was defined as those with the SF-36 mental health score within the first quintile (i.e., a score less than or equal to 60). Thus, this choice of classification was in line with the Australian population prevalence that one in five adult Australians experienced some form of mental illness in the past 12 months [24]. The selected cut-off threshold also lied in the middle of the intersection between the SF-36 distributions by the self-reported mental illness status (the vertical dotted line in Figure 1).

Other variables used in the analysis were age, gender, ethnicity, marital status, education level, employment of the respondents, household size, disposable income, and region of residence. The annual income variable was adjusted for inflation using the Australian consumer price index with the reference period of 2016. Disposable income was converted to equivalised disposable income using the modified OECD-equivalence scale, which allocates a weight of 1.0 to the first adult, 0.5 to each of the remaining adults and 0.3 to each child [25].

### *4.3 Descriptive statistics*

Table 1 shows that there are systematic differences between the two groups in most variables. Few exceptions included gender, employment status, and education levels. The standard of living was substantially lower among individuals with a mental illness. On average, people with a mental illness were not happy with their financial situation (score 4.9 out of 10) while those without mental illness were relatively happy (score 6.2 out of 10). People with a mental illness also had lower levels of satisfaction with life, as evidenced by an average score of 6.5, while the respective figure for those without a mental illness was 7.6.

People without mental illness were also better-off with an average equivalised disposable income of \$A44,215 per year, which was about 10% higher than the respective figure of \$A40,315 among people with a mental illness. As expected, individuals with self-reported mental illness have a substantially lower SF-36 mental health score with the mean of 48 out of 100 while the respective figure for those without a self-reported mental illness is 69 (this comparison is based on the sample of

self-reported mental illness, the full sample average of the SF-36 mental health score is 74, and the first quintile is 60).

**Table 1.** Descriptive statistics by self-reported mental illness

Variables	No mental illness		Mental illness		Difference (p-value)
	Mean	SD	Mean	SD	
SoL: Financial satisfaction	6.18	2.46	4.87	2.76	<0.01
SoL: Overall life satisfaction	7.62	1.74	6.46	2.33	<0.01
SF-36 mental health score	69.05	19.09	47.97	22.72	<0.01
Equivalised income (A\$, 2016 prices)	44,215	53,225	40,315	51,212	<0.01
Log of equivalised income	10.46	0.68	10.38	0.65	<0.01
Age of respondent	55.47	19.14	42.99	16.80	<0.01
Gender of respondent (male=1)	0.46	0.50	0.46	0.50	0.81
Indigenous status	0.04	0.19	0.06	0.24	<0.01
Household size	2.47	1.38	2.65	1.52	<0.01
<i>Employment status</i>					
Employee	0.79	0.40	0.85	0.36	<0.01
Employee of own business	0.06	0.23	0.05	0.21	0.16
Self-employed	0.14	0.35	0.09	0.29	<0.01
Unpaid family worker	0.01	0.09	0.01	0.10	0.77
<i>Married status</i>					
Legally married	0.50	0.50	0.29	0.45	<0.01
<i>De facto</i>	0.10	0.30	0.15	0.36	<0.01
Separated	0.03	0.18	0.05	0.23	<0.01
Divorced	0.09	0.29	0.12	0.33	<0.01
Widowed	0.11	0.32	0.03	0.18	<0.01
Never married & not in <i>de facto</i>	0.16	0.37	0.35	0.48	<0.01
<i>Education status</i>					
Post graduate	0.03	0.17	0.02	0.14	<0.01
Graduate diploma	0.04	0.20	0.03	0.17	<0.01
Bachelor	0.09	0.28	0.08	0.27	0.16
Diploma	0.08	0.27	0.08	0.27	0.38
Certificate III/IV	0.21	0.41	0.21	0.41	0.38
Year 12	0.11	0.32	0.16	0.36	<0.01
Year 11 and below	0.44	0.50	0.43	0.50	0.38
Undetermined	0.001	0.03	0.002	0.05	0.01
<i>Socio-economic advantage (lower quintiles indicate more disadvantaged)</i>					
SEIFA Q1	0.27	0.44	0.33	0.47	<0.01
SEIFA Q2	0.22	0.41	0.24	0.43	<0.01
SEIFA Q3	0.19	0.39	0.17	0.38	<0.01
SEIFA Q4	0.17	0.37	0.14	0.35	<0.01
SEIFA Q5	0.15	0.36	0.12	0.32	<0.01

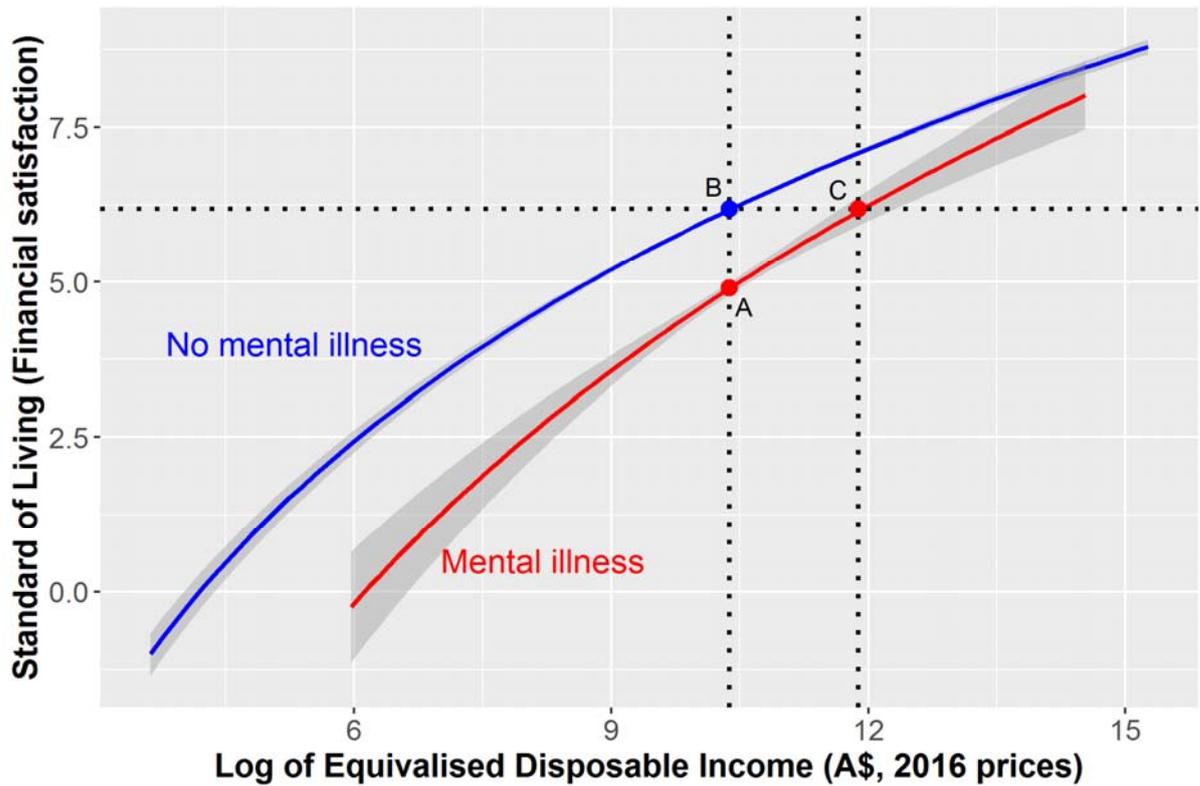
People with a mental illness were relatively younger (42 vs 55 years old) and tended to live in larger households, but the magnitude of the differences was negligible. Disadvantaged individuals, including those with indigenous background or residing in a region with the lowest Socio-Economic Index for Areas (SEIFA) score quintile, were also more likely to have a mental illness. Marriage seemed to have protective effects on mental illness. Those who were legally married had a lower incidence of mental illness while the reverse occurred in other types of marital status, except the minority group of widows.

## **5. Results and Discussions**

### *5.1 Explorative examination*

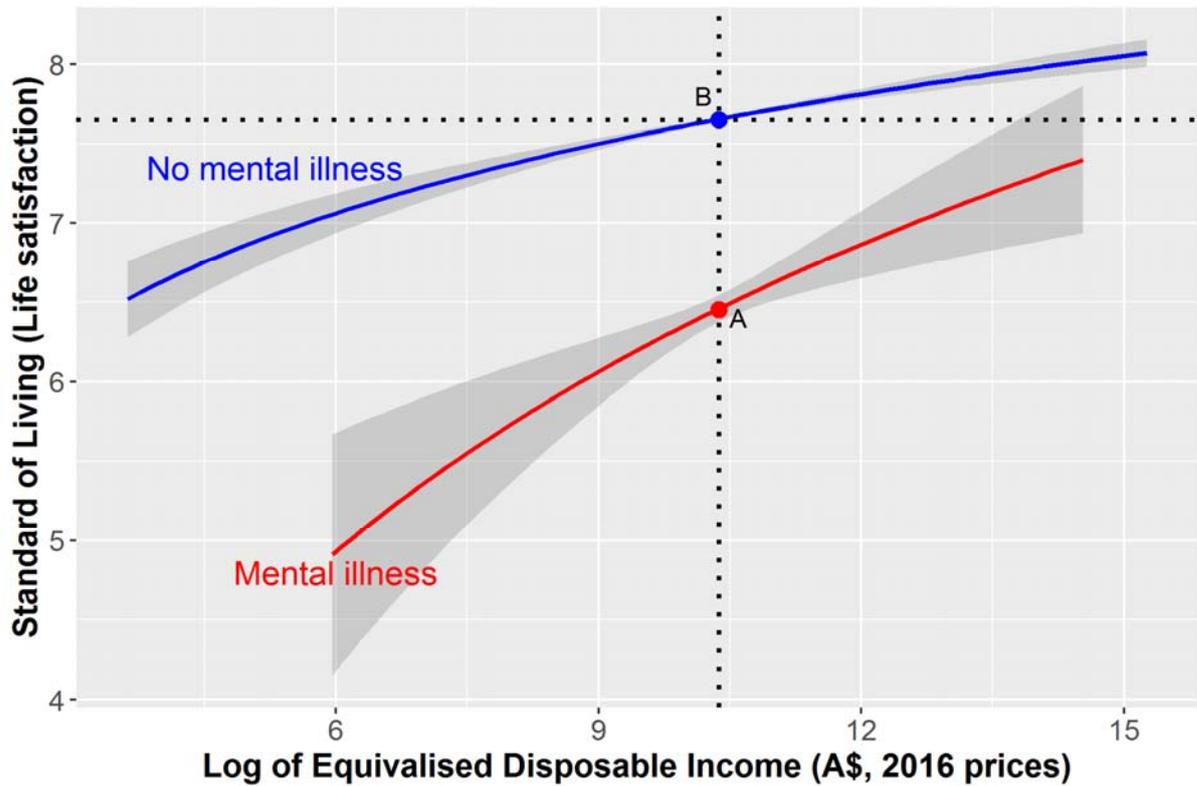
First, the relationship between income and financial satisfaction by the mental illness status is explored to illustrate the cost estimation using an SoL approach. A smoothing plot in Figure 2 shows that individuals with mental illness have lower SoL than those without mental illness. Interestingly, at the lower end of the income spectrum (i.e., the log of income is less than 6), individuals without a mental illness earn less. Since disposable income includes all sources, it is possible that support from the government has cushioned the income of individuals with a mental illness from falling past a certain threshold. At the high end of the income spectrum, those with a mental illness are projected to catch up with those without a mental illness, but the statistical confidence for this trend is low (i.e., large confidence intervals).

To increase the SoL of those with a mental illness from the mean of 4.9 (see Table 1) to that of people without a mental illness (i.e., move from point A) their log of income needs to increase from the mean level of 10.38 to 11.88 per year. The parameter of log income ( $\beta_1$ ) is the slope at point A (i.e., the “rise”/“run” ratio AB/BC), while the parameter of mental illness ( $-\beta_2$ ) is the gap in the SoL between the two groups (i.e., AB). Thus, the cost of mental illness ( $-\beta_2/\beta_1$ ) is BC or 1.5 times of annual equivalised disposable income. However, this graph neither control for any covariates nor control for the potential endogeneity of income and hence it may present over- or under-estimation of the cost of mental illness.



**Figure 2.** Income and SoL by self-reported mental illness status (shaded areas represent 95% confidence intervals)

The cost illustration is also explored by using the level of satisfaction with life as a proxy for SoL (Figure 3). Income alone may not help people with mental illness to achieve the same level of satisfaction with life as those without a mental illness (i.e., the horizontal line from point B does not intersect the red curve). Although cost estimates from this sketch may not be precise, it seems to confirm the hypothesis that life satisfaction may include intangible factors that are difficult to compensate by income alone (i.e., to move along the red curve in Figure 3). Thus, apart from income, productivity shifters such as better communication [26] are needed to improve the life satisfaction of individuals with a mental illness (i.e., to shift the red curve in Figure 3 upward).



**Figure 3.** Income and SoL (measured by overall life satisfaction) by self-reported mental illness status

### 5.2 Extended random-effects estimates

Table 3 shows that both the current and lag period of income is positively associated with SoL and individuals with a mental illness have a significantly lower SoL. On average, individuals with a mental illness need an increase of their equivalised disposable income by 50% to have a similar level of SoL as those without a mental illness. The long-run costs, estimated as the ratio of lagged parameters, are three times higher than the short-run costs for self-reported mental illness.

Parameters of the between-wave mean of log income are not significantly different from zero, suggesting that a random-effects estimator is preferred. This finding is strengthened by the significance of the likelihood ratio test, which rejects the null hypothesis that parameters of the selected estimator (extended random-effects ordered logit) are similar to those obtained from an ordered logit estimator. Also, the standard deviation of the individual unobserved effects ( $\delta_i$ ) is significantly different from zero.

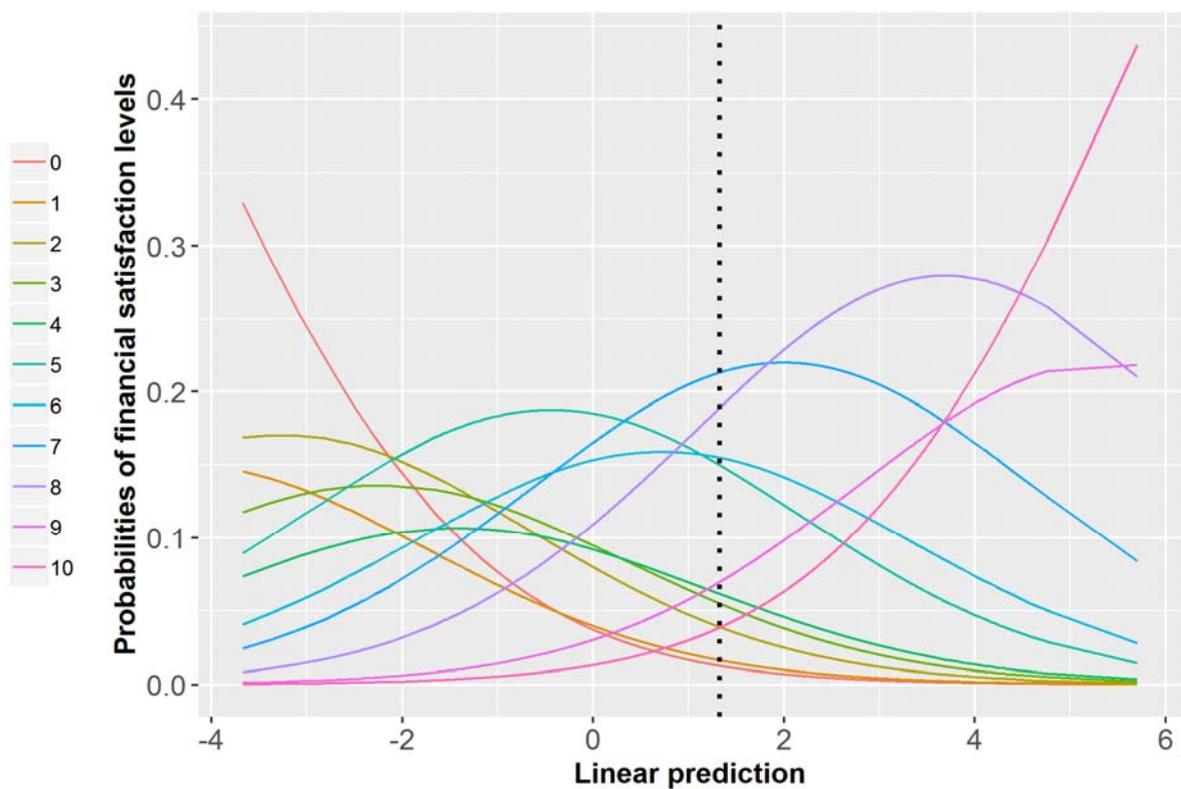
**Table 3.** Costs of mental illness (Main specification: Equation 6)

Covariates	Mental illness measures			
	Self-report		SF-36	
	Coef.	SE	Coef.	SE
<i>Current period</i>				
Mental health status ( $\beta_2$ )	***-0.35	0.12	***-0.58	0.02
Log of income ( $\beta_1$ )	***0.70	0.05	***0.72	0.02
<b>Short-run cost (<math>-\beta_2/\beta_1</math>)</b>	<b>50%</b>		<b>80%</b>	
<i>Lag Period</i>				
Mental health status ( $\beta_4$ )	***-0.44	0.13	***-0.31	0.02
Log of income ( $\beta_3$ )	***0.29	0.05	***0.24	0.02
<b>Long-run costs (<math>-\beta_4/\beta_3</math>)</b>	<b>152%</b>		<b>129%</b>	
Wave-mean of log income	-0.87	0.91	0.35	0.24
Age	***0.02	0.00	***0.01	0.00
Sex (male=1)	0.12	0.09	0.01	0.04
Indigenous status (Y=1)	0.09	0.27	-0.06	0.12
Household size	-0.03	0.03	** -0.02	0.01
<i>Education (Base=undetermined education level)</i>				
Postgraduate	-1.27	1.80	-0.07	1.07
Grad diploma	-1.57	1.79	-0.03	1.07
Bachelors	-1.43	1.79	-0.24	1.07
Diploma	-1.47	1.79	-0.43	1.07
Certificate III or IV	-1.88	1.79	-0.46	1.07
Year 12	-1.73	1.79	-0.48	1.07
Year 11 and below	-1.74	1.79	-0.20	1.07
<i>Employment (Base=unemployed)</i>				
Employee	*0.47	0.26	0.04	0.11
Employee of own business	*0.52	0.29	*0.21	0.12
Employer/Self-employed	0.03	0.26	-0.11	0.11
<i>Marital status (Base=never married and not in de facto)</i>				
Legally married	***0.36	0.12	***0.14	0.04
<i>De facto</i>	0.14	0.11	***-0.12	0.03
Separated	***-0.81	0.19	***-0.93	0.06
Divorced	***-0.54	0.16	***-0.64	0.06
Widowed	-0.11	0.28	**0.24	0.12
<i>SES status (Base=5<sup>th</sup> SEIFA quintile, highest SES)</i>				
SEIFA Quintile1	** -0.26	0.12	0.03	0.04
SEIFA Quintile2	** -0.25	0.11	-0.02	0.03
SEIFA Quintile3	*** -0.32	0.11	0.02	0.03
SEIFA Quintile4	** -0.22	0.11	-0.02	0.03
Time trend	0.02	0.02	**0.01	0.01
Constant	-4.89	9.68	***7.02	2.69
$\delta_i$	***4.10		***3.48	
Observations	9,126		86,604	
Individuals	2,989		14,033	
Likelihood ratio test: $\chi^2(1)$	***2940		***30822	

Note: Significant levels: .01 - \*\*\*; .05 - \*\*; Threshold parameters ( $\mu_s$ ) are not presented for brevity.

The results using the SF-36 score show that the estimated short-run cost rises substantially to 80% of equivalised disposable income. The higher estimated cost using this alternative measure of mental illness despite its higher prevalence (first quintile or 20%) suggests that the cost associated with “covering” mental illness could be larger than that of “preventing” mental illness.

Parameters of other covariates are in line with observations in the descriptive statistics. Marital status matters. Those legally married have a level of satisfaction and financial situation higher than those who never married. However, parameters of ordered logit estimator cannot be interpreted directly as marginal effects. A line graph on the relationship between linear and probability predictions in Figure 4 makes the interpretation easier (the graph for SF-36 measure of mental illness is similar and hence is not presented for brevity).



**Figure 4.** Linear and probability predictions, self-reported mental illness measure

Positive parameters increase the mean linear prediction (dotted vertical line in Figure 4), leading to higher probabilities for a better SoL, proxied by the level of satisfaction with the financial situation. Negative parameters have reverse effects. For example, the

parameter of legally married is 0.36 (i.e., the vertical dotted line moves to the right by 0.36), indicates that legally married increases the probability of having a financial satisfaction score  $>7$  compared to those never married. In contrast, individuals who are separated (parameter of -0.8) or divorced (parameter of -0.5) have higher probabilities of having a score  $<5$  on financial satisfaction compared to those who never married. Other significant determinants include age, socioeconomic status (SES), and employment status. Results using SF-36 to measure mental illness is similar except that the household size becomes significant.

#### *Robustness check*

To check the robustness of results, the level of satisfaction with life is used as a proxy for SoL. The results in Table 4 confirm our expectation that this choice results in very high-cost estimates. The short-run cost of mental illness increases to four folds for self-reported mental illness and nine folds for SF-36 mental health scores.

**Table 4.** Robustness test: using satisfaction with life to measure SoL

Selected parameters	Mental illness measures					
	Self-reported		SF-36 (RE)		SF-36 (FE)	
	Coef.	SE	Coef.	SE	Coef.	SE
<b><i>Current period</i></b>						
Mental health status ( $\beta_2$ )	***-0.59	0.13	***-1.37	0.02	***-1.19	0.03
Log of income ( $\beta_1$ )	***0.15	0.05	***0.15	0.02	***0.12	0.02
Short-run cost ( $-\beta_2/\beta_1$ )	4.00		9.38		9.87	
<b><i>Lag period</i></b>						
Mental health status ( $\beta_4$ )	***-0.39	0.13	***-0.54	0.02	***-0.32	0.02
Log of income ( $\beta_3$ )	0.01	0.05	***0.09	0.02	***0.08	0.02
Long-run cost ( $-\beta_4/\beta_3$ )	39.00		5.74		4.16	
Wave-average of log income	-0.72	0.94	***-1.74	0.25		
Observations	9,127		86,605			
Individuals	2,987		33,938			
Random-effects ( $\delta_u$ )	***4.51		***4.36			
LR test: $\chi^2(1)$	***2939		***30822			

Note: Significant levels: .01 - \*\*\*; .05 - \*\*; .1 - \*. Other covariates include age, gender, ethnicity, education level, marital status and employment status of the respondent, household size, SEIFA quintile, and a time trend.

Caution is needed when interpreting the results of this specification due to two reasons. First, the lag of income is not significant for self-reported mental health. Second, the wave-average of income is significantly different from zero for SF-36

measures of mental illness, suggesting that a random-effects estimator is not suitable. Thus, a fixed-effects ordered logit estimator using the “blow-up and cluster” (BUC) approach by Baetschmann, Staub [27] was also conducted for this specification. The results reveal a similar conclusion: costs for mental illness are much higher when the level of satisfaction with life is selected to measure SoL.

## **6. Conclusion**

This paper examined mental illness costs in Australia using the SoL approach. We found that individuals with a mental illness need to increase their equivalised disposable income by 50% to reach the same standard of living as those without a mental illness. The estimated cost increases to 80% when using the first quintile score of the SF-36 mental health component to measure mental illness. One possible reason for this finding is that many people may have poor mental health but have not looked for help. This finding suggests that a greater focus on de-stigmatising mental illness and promoting positive help-seeking behaviours by those suffering is required. The long-run estimated cost is three times larger than that in the short-run. The disposable income used in this study includes all sources of income; this finding suggests that current financial support for people with mental illness may not be enough to cover their extra expenses due to poor mental health. The upcoming National Disability Insurance Scheme (NDIS) is expected to improve the health outcomes and SoL of people with a disability, including mental illness. Thus, the findings from this study can be used as a reference for the future cost of mental illness estimation after the full implementation of the NDIS in Australia.

This study has several limitations on the measurement of mental illness. The direct question suffers from many missing observations. The relatively low prevalence of mental illness using this direct question (5.6%) suggested that many participants with mental health issues could have skipped this question to avoid being stigmatized. The threshold of SF-36 mental health score was selected based only on the prevalence of mental illness in Australia. Also, it is possible that the SF-36 mental health score may not cover all types of mental illness.

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