Income and Happiness: An Analysis of Adaptation and Comparison Income Effects

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Abstract

This study examines the effects of adaptation and social comparison on the self-reported life satisfaction (happiness) of individuals in Australia based on panel data drawn from the five waves (2001-2005) of HILDA surveys. The estimated models provide no evidence of adaptation to income. However, results offer strong statistical support to the hypothesis that reference/ comparison group income has a negative effect on the self-reported well-being of individuals. The increase in comparison income hurts the poorer more than the richer one. Several other variables included into the model are found to have significant effects on happiness.

JEL Classification: D3, D6, I3

Key words: Life Satisfaction, Adaptation, Comparison Income

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1. Introduction

Economic theory suggests that a higher income allows an insatiable consumer to reach a higher indifference curve and achieve a greater level of utility. Yet the empirical literature on the relationship between self-reported life satisfaction (happiness) and income reports paradoxical results. On the one hand, richer countries are found to be happier than poorer countries; and within each country, the richer members of the society also tend to be happier than the poor (see Inglehart and Klingemann, 2000; Blanchflower and Oswald, 2004; Frey and Stutzer, 2002; Headey and Wooden, 2004). On the other hand, time-series analyses reveal that sustained growth of per capita income over the past few decades has failed to generate any noticeable improvement in self-reported satisfaction levels throughout many developed countries including Britain, France, Germany and the United States (Easterlin, 1995; Diener and Oishi, 2000; Inglehart and Klingemann, 2000).

Two theories are put forth to explain this paradox: adaptation and social comparison. The adaptation theory says that an increase in income will temporarily increase people's happiness, but over time they will adjust to their higher income such that their happiness reverts back towards its original level. If there is complete adaptation to income, then to remain at the same level of happiness, current income growth must match income growth from previous years. The theory of social comparison suggests that people do not assess their life in isolation from all others. Rather they compare their income and achievements with those around them, called the peer group (or reference group). An increase in the income of the peer group will have a depressing effect on an individual which reduces his life satisfaction. Thus, according to social comparison theory, it is one's relative income rather than one's absolute income which determines life satisfaction.

A number of studies have tested these theories using data largely from the developed world. One of the most regularly cited studies of adaptation is that of Brickman et al (1978), who show that recent lottery winners derived less pleasure than controls in a variety of ordinary events and were not in general happier than controls. Further studies on adaptation have produced mixed results. While Stutzer (2004) and Di Tella et al (2006) find supporting

evidence for adaptation in Switzerland and Germany respectively, Jørgensen and Herby (2004) and McBride (2001) generate much weaker conclusions when performing happiness regressions based on European Union member nations and the US respectively. These mixed results may be due to differences in data constraints or estimation methods, or alternatively they could indicate that some countries adapt to higher incomes while others do not.

There have been some studies in recent years exploring the effect of social comparison upon subjective well-being[1]. A widely used method to test the theory of social comparison is to introduce the mean income of the peer (reference) group, called the comparison income, into the regression equation. A negative and significant coefficient for comparison income would mean that social comparison reduces the level of happiness of an individual. Important amongst the studies that have found support for the social comparison hypothesis include Clark and Oswald, 1996; Neumark and Postlewaite, 1998; Solnick and Hemenway, 1998; McBride, 2001; Stutzer, 2004; Ferrer-i-Carbonell, 2005; Jørgensen and Herby, 2004; and Miles and Rossi, 2007. One of the few exceptions is Senik (2004), who finds that people in Russia are happier when their peers are earning higher incomes. Senik (2004) explains this unusual finding by suggesting that in Russia's unstable economy, people use others' incomes when forming their own income expectations for the future.

This study performs an empirical investigation of the adaptation and social comparison effects on happiness in Australia using data for 8530 individuals from each of the five waves (2001 to 2005) of the Household Income and Labour Dynamics in Australia (HILDA) surveys. In these surveys the individuals are asked to report their happiness (life satisfaction) on a scale from 0 to 10 - a standard procedure adopted in most international happiness surveys. The zero value on the scale is labelled as 'totally dissatisfied' and 10 is labelled as 'totally satisfied'. These self-reported happiness scores can be treated either as a latent variable (where comparability is assumed to be at the ordinal level) or as a cardinal variable. In the latter case, the satisfaction difference between 2 and 4 is assumed to be the

[1] We use 'self-reported life satisfaction', 'happiness' and 'subjective well-being' interchangeably throughout this paper.

same as between 4 and 6. Most economists treat self-reported satisfaction as an ordinal concept whereas the majority of psychologists and sociologists consider it to be cardinally measurable. In our model specifications, we shall treat self-reported satisfaction as a latent variable. However, we also perform the same regressions using the cardinality assumption to check the sensitivity of results.

There appears to have been no attempt to study adaptation and social comparison effects on happiness in Australia. The most closely related work comes from Headey et al (2004), who analyse the effect of income, as well as wealth and consumption, upon life satisfaction within several countries, including Australia[2]. Although social comparison is not incorporated into their analysis, the authors do discuss and attempt to quantify adaptation to income. However, since they had access to only two waves of the HILDA dataset at the time, Australia was left out of this analysis (Headey et al, 2004, pp. 20-22). Three years on, with five available waves of the HILDA data set, the investigation of adaptability to income in Australia is now more plausible.

We begin with a happiness equation which includes an adaptation function (defined over current and lagged values of individual income), comparison income and some control variables such as age, sex, education, marital status, employment status and work hours. The estimation of this equation, using an ordered probit model, suggests that the hypothesis of no adaptation to income cannot be rejected. With no evidence of adaptation, all the lagged income variables are dropped, and the model is re-estimated using panel data with individual random effects. Since these individual random effects might be correlated with a sub-set of explanatory variables, the Mundlak (1978) correction is introduced in the model to account for the possible correlations. In addition, an attempt is also made to test whether social comparison affects the well being of poor and rich differently. When studying the effects of social comparison, it is possible that the results are sensitive to the way in which

[2] The study focussed on five countries – Australia, Britain, Germany, Hungary, and the Netherlands. In all five countries, income and wealth measures were included in the analysis. However, since consumption figures were not available in Australia, Germany and the Netherlands, this variable was used only for Britain and Hungary.

peer groups are defined. For this reason, a sensitivity analysis will be carried out to check whether our empirical results are driven by the choice of peer group definitions.

The rest of paper is organised as follows. Section 2 details the model specifications and estimation. The data and variables are described in Section 3. Section 4 discusses the empirical results and presents a sensitivity analysis to check the robustness of results. Section 5 concludes the study.

2. Model Specification and Estimation

We begin with a model of happiness specified as

$$h_{it} = \alpha + A(\lambda, y_i) + \gamma \ln y^*_{it} + \delta x_{it} + \varepsilon_{it} \quad (1)$$

where h_{it} is the self reported level of life satisfaction (happiness) of the i-th individual, $A(\lambda, y_i)$ is the adaptation function, y^*_{it} is the mean income of the peer group which serves as a comparison income and x_{it} is a vector of control variables such as age, education, sex, marital status, employment status, number of hours worked, volunteer work, commuting time etc. ε_{it} is an error term subsuming the effects of unquantifiable variables and inaccuracy in reporting life satisfaction (for example, my 4 could be your 5 and vice versa). Following Layard (2005, p. 252), the adaption function can be specified as:

$$A(\lambda, y_i) = \beta(\ln y_{it} - \lambda \ln y_{it-1}) \quad (2)$$

where λ is an adaptation parameter and y_{it} and y_{it-1} are the current and previous years' incomes. β is a parameter expected to be positive. For complete adaptation $\lambda = 1$ which suggests that to remain at the same level of happiness, current income growth must match income growth from the previous year. For partial adaptability, $0<\lambda<1$ which implies that income growth can slow down without adversely affecting one's happiness level. There will be no adaptation to income if $\lambda=0$ implying that to remain at the same level of happiness, no income growth is required. In this situation an increase in income should lead to a higher level of happiness.

The adaptation function (2) assumes that people adapt to income growth from the previous year, i.e. adaptation is completed within one year. This may be a very restrictive and stringent assumption. Rather than adapting to income growth achieved in the previous year, people may adapt to an average growth of income achieved over the previous few years. Such a possibility may not be ruled out if incomes fluctuate during these years. A generalised adaptation function that accommodates this may be specified as follows.

$$\begin{aligned} A(\lambda, y_i, K) &= \beta(\ln y_{it} - \sum_{k=1}^{K} \lambda_k \ln y_{it-k}) \\ &= \beta(\ln y_{it} - \ln(\prod_{k=1}^{K} y_{it-k}^{\lambda_k}) = \beta(\ln y_{it} - \ln G(\lambda, y_i, K)) \end{aligned} \tag{3}$$

Note that $G(\lambda, y_i, K)$ is the weighted geometric mean income (WGMI) for $\lambda\tau = 1$, where λ is a vector of adaptation parameters and τ is a vector of unit values. For $\lambda\tau < 1$, $G(\lambda, y_i, K)$ is the weighted geometric sum of K period incomes (WGSI). For $\lambda_1=\lambda_2=\ldots=\lambda_K=0$, G(.) takes unit value implying no adaptation to income. For complete adaptation, $\lambda\tau= 1$ which implies that to remain at the same level of happiness, current income must increase at the rate at which the WGMI has grown. For partial adaptation, $\lambda\tau < 1$, which suggests that to remain at the same level of happiness, current income must grow at the rate at which the WGSI has grown. Note that WGSI<WGMI. Hence in the case of partial adaptability, a somewhat lower growth of current income can attain the same level of happiness. The choice of K in the function is left to the judgement of the researcher and may be influenced largely by the availability of data. Substituting (3) into (1) we have (model A):

$$h_{it} = \alpha + \beta \ln y_{it} + \sum_{k=1}^{K} \beta_k \ln y_{it-k} + \gamma \ln y_{it}^{*} + \delta x_{it} + \varepsilon_{it} \tag{4}$$

where $\beta_k = -\beta\lambda_k$ (k=1, 2, …, K). This equation forms the basis of testing adaptation to income in a recent paper by Di Tella et al (2006), though no mention is made of an underlying adaptation function. The adaptation functions (2) and (3) serve to provide an analytical support to the interpretation of adaptation implicitly built into (4). Treating self-reported life satisfaction h_{it} as a latent variable, an efficient estimation can be conducted using an ordered probit model.

The inferences on adaptability can be drawn as follows. If β is positive (and statistically significant) then for a complete adaptation, $(\beta+\Sigma\beta_k) = 0$. There will be an evidence of partial adaptability if $\beta > 0$, $(\Sigma\beta_k) < 0$ and $(\beta+\Sigma\beta_k) > 0$. The hypothesis of no adaptation can not be rejected if $\beta > 0$ and $\beta_1 = \beta_2 = \ldots = \beta_K = 0$.[3] In the latter case, the model can be estimated with panel data which enables us to accommodate individual random effects.

$$h_{it} = \alpha + \beta \ln y_{it} + \gamma \ln y^{*}_{it} + \delta x_{it} + \eta_i + u_{it} \qquad (4)$$

where η_i is an individual random effect and u_{it} is the usual error term assumed to be uncorrelated with obervable variables. The individual random effect which captures the effects of personal traits such as pessimism or optimism, depression and intelligence of individuals may be correlated with some of the observable variables such as current income, work hours and commuting time. For example, a depressed person may work less leading to the loss of job and income, or a less motivated person may not take up a lucrative job which involves long hours in commuting to work place. A widely used solution to this problem is suggested in Mundlak (1978). He accounts for the relationship between individual random effects and some of the observable variables by assuming the following structure of correlation (also see Hsiao, 1986; Ferrer-i-Carbonell (2005).

$$\eta_i = \omega_i + \sum_j \phi_j \ln \bar{z}_{ji} \qquad (5)$$

The individual random effect is decomposed into two components: (i) a pure random effect, ω_i which is not correlated with observable explanatory variables, and (ii) a component correlated with a subset, z_{ji} of observable explanatory variables. $\bar{z}_{ji}$ is the average of z_{ji} across years. The correlation between $\bar{z}_{ji}$ and the random effect is assumed to be of the form $\phi_j \ln \bar{z}_{ji}$. As emphasised in Ferrer-i-Carbonell (2005), ϕ_j represents only a statistical correction, and no specific significance should be attached to its magnitude and sign. Substituting (5) into (4) we have the following equation (model B), estimable by ordered probit.

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[3] The hypothesis of no adaptation may not also be rejected if $\Sigma\beta_k = 0$. This is a somewhat weaker condition than $\beta_1 = \beta_2 = \ldots = \beta_K = 0$. It may also be noted that the testing of $(\beta+\Sigma\beta_k) = 0$ is equivalent to the testing of $\lambda\tau = 1$, the testing of $(\beta+\Sigma\beta_k) > 0$ is equivalent to the testing of $\lambda\tau < 1$, and the testing of $\Sigma\beta_k = 0$ is equivalent to the testing of $\lambda_1 = \lambda_2 = \ldots = \lambda_K = 0$. The testing of adaptability hypothesis in terms of β's is easier than in terms of λ's.

$$h_{it} = \alpha + \beta \ln y_{it} + \gamma \ln y^{*}_{it} + \delta x_{it} + \sum_{j} \phi_{j} \ln \bar{z}_{ji} + \omega_{i} + u_{it} \qquad (6)$$

All the models specified above assume that comparison income effects on the happiness of poorer and richer individuals are identical. In the present context, the poorer are those whose incomes are lower than the comparison (reference) income, and the richer are those with incomes above the comparison income. It is possible that comparison income hurts the poorer individuals more than the richer individuals. It is also equally possible that comparison income hurts the poorer individuals only. That is, it may not hurt the richer individuals at all. The latter possibility is consistent with Runciman's (1966) theory of relative deprivation which says that a person suffers from relative deprivation if his income is lower than his peers, his deprivation is zero otherwise. To test these possibilities (or say hypotheses), we specify a dummy variable,

$$\text{RICHER} = (\ln y^{*}_{it}) \quad \text{if } y_{it} > y^{*}_{it} \qquad (7)$$

$$= 0 \qquad \text{if } y_{it} \leq y^{*}_{it}.$$

Equation (6) is, thus, extended to (model C):

$$h_{it} = \alpha + \beta \ln y_{it} + \gamma \ln y^{*}_{it} + \gamma_{1} \text{ RICHER} + \delta x_{it} + \sum_{j} \phi_{j} \bar{z}_{ji} + \omega_{i} + u_{it} \qquad (8)$$

Here the effect of peer group income upon the happiness of a poorer individual is captured by γ and that of a richer individual by $\gamma + \gamma_1$. If $\gamma < 0$ and $\gamma_1 > 0$ but less than $|\gamma|$, then it would imply that comparison income adversely affects the happiness of both the richer and poorer individuals but the effect is weaker for richer individuals. $\gamma + \gamma_1 = 0$ provides support for Runciman's theory of relative deprivation, meaning that peer group income does not affect the happiness of richer individuals.

3. Data and Variables

This study makes use of panel data obtained from the Household Income and Labour Dynamics in Australia (HILDA) surveys, which asks detailed questions about economic and subjective well-being, as well as labour market and family dynamics. We make use of information contained within the annual personal and household questionnaires from the years 2001-2005 inclusive. This study includes only those people who responded to each of the five available waves of the HILDA surveys. As a result, there are 9,311 individuals

and 46,555 observations (i.e. 9311×5) available for analysis. On those occasions when individual records missing data for one or more variables included in the regression, all observations for that individual during that year are dropped from the regression analysis. Hence observations have varied from 6163 to 8530 per wave depending on the model specification and variable requirements.

The variables used in the estimation are measured as follows. Life satisfaction (happiness or well being) is measured on a scale numbered from zero to ten according to each person's response to the following question: "All things considered, how satisfied are you with your life?"[4] Individual income is defined as financial year disposable personal income. All incomes are converted into constant 2001 prices using consumer price indices available from the Australian Bureau of Statistics (ABS, 2007). To prevent zero income values from being treated as missing data, $1 is added to all incomes before taking the log values.

The definition of peer group income is one of the arbitrary decisions involved in happiness research. While some people may compare themselves with siblings or childhood friends, others may compare themselves with colleagues at work or those with a similar level of educational attainment. Unfortunately little information can be derived from household surveys, including HILDA, regarding the group of people against which an individual compares his income. It is therefore left to the researcher to define the peer group. We define peer groups by age and education, whereby all those who are within 15 percent of the individual's age and have attained the same level of education form the peer group[5]. The mean income of the peer group is called the comparison income or simply the peer

[4] While the validity of self-reported happiness statistics has been a source of considerable debate in recent years, existing studies appear to suggest that there is a lot of important and reliable information contained within these figures (see Layard, 2005; Gilbert, 2006; Schimmack, 2006 among others). This paper assumes therefore that the self-reported happiness statistics used here are valid, and does not explore this issue any further.

[5] This means, for instance, that a 20 year old male compares himself only with those people aged between 17-23 years, while a 50 year old male will compare himself only with those people aged between 43-57 years within his education category. A person's education level is categorised into one of two groups: those who have attained a university degree and those who have not.

income. To check the sensitivity of results, an experiment is made by defining peer group based on age, education and sex.

Most of the control variables consist of individual characteristics. Marital status: a set of dummies depending on whether the respondent is married, divorced, separated or widowed (those who have never married serve as the reference group); employment status: a set of dummy variables depending on whether the respondent is employed (reference group), unemployed, or not in the labour force; education: a dummy variable for graduates (university degree holders), with those who have 'no degree' acting as the reference group; sex: a dummy variable based on whether the respondent is male (reference group) or female; health condition: a dummy variable for those who suffer from poor health (those in good health serve as the reference group); location: a dummy variable for those who live within a major city, with those who live outside a major city taken as the reference group; race: a dummy for indigenous people (those who are 'not indigenous' serve as the reference group); volunteer: a dummy for those who perform one or more hours of volunteer or charity work on an average per week (those who do not perform volunteer work serve as the reference group). This variable is not commonly included in happiness equations, but seems justifiable in the sense that performing volunteer work can make people feel that they are helping others and that they are leading a meaningful life. Care performed: a dummy if the respondent has to care for a disabled spouse or relative (those who do not have to provide care are taken as the reference group); bad upbringing: a dummy variable according to whether one's parents ever got divorced or separated, with those whose parents never got divorced or separated acting as the reference group. Other control variables are continuous variables. Commuting time: this variable is not typically included in happiness studies, but seems worthy of inclusion, since the time taken to commute to and from work could be otherwise spent either earning money at work or pursuing leisure. Work hours: this variable is also not often included in happiness regressions. It is included here due to the dictum of traditional economic theory which says that work produces disutility and represents a loss of leisure time.

3. Empirical Results

We begin our discussion of happiness with some basic statistics. The estimates of mean levels of income and happiness scores reported in Table 1 and displayed in Figure 1 reveal that while the level of income has grown the happiness score has fallen slightly during the years 2001-2005. The average happiness scores decline as we move from first quintile group to the fourth quintile with a mild increase in the fifth quintile group of individuals in the income distribution (Table 2). While a high income allows people to buy expensive cars and latest technologically advanced goods and enjoy luxurious leisure activities, our aggregate statistics reveal that happiness does not seem to increase with higher income. It is yet to be seen with our regression models whether it is income habituation or social comparison or other negative of modern society that neutralise the possible positive effects of income on self-reported life satisfaction predicted by mainstream utility theory.

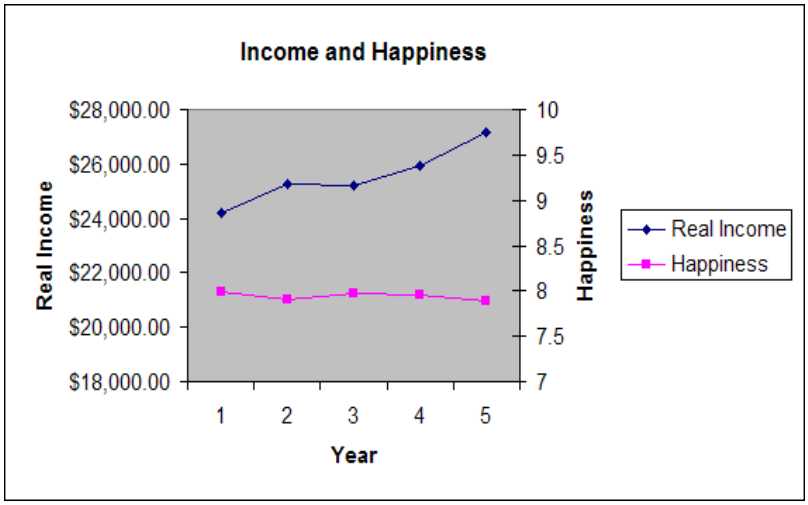
Table 1: Income and Happiness

Year	Average Real Income	Average Happiness Score
2001	$24,202	7.99
2002	$25,241	7.91
2003	$25,218	7.98
2004	$25,926	7.95
2005	$27,185	7.89

Table 2: Happiness by Quintile Groups of the Distribution of Individual Income

Quintiles of the distribution of individual Income	Happiness Scores				
	2001	2002	2003	2004	2005
1st	8.09	8.05	8.13	8.01	7.99
2nd	8.09	7.93	8.07	8.01	7.93
3rd	7.92	7.82	7.92	7.93	7.87
4th	7.9	7.85	7.86	7.84	7.74
5th	7.96	7.89	7.94	7.96	7.9

Figure 1



4.1 Estimation Results

First of all model A which includes current and four lags of individual's income, peer group income and other relevant control variables is estimated with the ordered probit. The results are presented in Column 1 of Table 3. The first point to note is that current income has a positive but statistically insignificant effect on self-reported satisfaction. This poses questions about the possibility of adaptation to income. If people do not grow significantly happier after an increase in personal income, there is little chance of capturing adaptation in the empirical results, as people have nothing to which they can adapt. The results for the lagged income variables confirm this. Aside from the third income lag, all other lagged income variables are positive but not statistically significant. The third income lag is negative but it too is not statistically significant. The null hypothesis of $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ is also not rejected. Thus, there seems to be no evidence of adaptation to income in this study[6]

[6] We re-estimated model A (equation 4) with three, two and one year lag income with random effects ordered probit. The results are presented in Columns. 1 through 3 of Appendix Table A. When three lags are used, the coefficient of the current income turns significant but the coefficients of other lags remain statistically insignificant. When the third lag is dropped, current income effect turns insignificant, the coefficient of one year lag becomes positive and statistically significant, and the coefficient of second lag stays insignificant. When the second lag is dropped, coefficients of the current and one year lagged incomes show no changes in their magnitude and signs. Thus, none of these experiments provide any support for adaptability. In another experiment, we included the variable 'RICHER' in model A and estimated with four, three, two and one lag year of income. These results, presented in Columns 4 through 7 of Appendix Table A, lend no support to the

With no supporting evidence for adaptation, the income lags are dropped. The model B (equation 6) is estimated using the panel data set for the period, 2001 to 2005). This model incorporates individual random effects and makes use of the Mundlak correction (as discussed earlier) to address the possible correlation between unobservable personal traits and a sub-set of explanatory variables. The results are presented in Column 2 of Table 3. Once again, current income has no statistically significant effect upon life satisfaction. However, an increase in the average income level of the individual's peer group, categorised in terms of age and education, has a negative effect on the individual's life satisfaction. Its coefficient is -0.407, and this is significant at 1% level of confidence. Thus, the results appear to offer statistical support to the hypothesis that self-reported well-being depends on the reference/comparison group income. These results are quite similar to those for the British workers reported in Clark and Oswald (1996).

We now turn to the estimation results based on model C (equation 8), which is intended to test the differential effects of peer group income on the well-being of poorer and richer individuals. The comparison income effect is negative (-0.399), and this is statistically significant at 1% level of confidence. The variable 'RICHER' has a positive coefficient (0.007) and it is significant at 1% level of confidence. This suggests that the effect of comparison income on the well-being of richer individuals is somewhat weaker. In other words, the comparison income hurts poorer individuals more than the richer ones. Clearly, these results provide no support to Runciman's theory of relative deprivation, which says that peer group income does not hurt the richer individuals.

The coefficients of control variables seem to be mostly in line with our expectations. Happiness is U-shaped in age, minimising at around 25 years. This is consistent with existing research for other countries though the age at which lowest happiness is observed varies across studies, see Blanchflower and Oswald (2004) and Frijters et al (2004). Females are significantly happier than males. Suffering from poor health has a negative

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adaptability hypothesis. In our final experiment, we re-estimated these models assuming the cardinality of life satisfaction responses and found no support for the adaptability hypothesis. These results are not reported to save space.

and significant effect (-0.306) upon life satisfaction. The coefficient of 'Married' is 0.384 and significant and the coefficients of 'Separated' and 'Divorced' are respectively -0.405 and -0.206 and statistically significant. Thus, being married contributes to happiness, while becoming separated or divorced causes a reduction in life satisfaction. Married life more than neutralises the consequences of poor health. Living in a major city has a negative and significant effect upon life satisfaction.

Those who are unemployed or out of the labour force are less satisfied with life compared to those who are employed[7], although it is worth noting that the number of hours spent working each week has a negative impact upon life satisfaction. Being out of the labour force hurts more than having divorced. Those who perform volunteer or charity work tend to be happier than those who do not, whereas those who have to care for a disabled spouse or relative tend to be less satisfied than those who do not. The response of happiness to 'Degree' is positive and significant in Model A implying that higher education enhances happiness. In models B and C, 'Degree' retains a positive sign but turns statistically insignificant. Thus, the effect of higher education on happiness does not seem to be unambiguous. Commuting time, race and widowhood do not have a significant effect upon life satisfaction.

4.2 Sensitivity Analysis

It is worth noting that definitions of relevant peer groups are quite arbitrary, and it is possible that empirical results are sensitive to the manner in which relevant peer groups are defined. For this reason, this study provides the results of an alternative definition of peer groups. Instead of forming peer groups in terms of age and education, the peer groups are defined in terms of age, education, and sex. The results of model C incorporating new comparison incomes are presented in Column 4 of Table 3. The coefficient of comparison income is negative (-0.407) and statistically significant at 1 per cent level of confidence. The coefficient of 'RICHER' is positive (0.003) and significant at 15 per cent level of significance. The coefficents associated with mean work hours and mean income used in

[7] This is consistent with the negative effect of unemployment on happiness in Australia recently reported in Carroll (2007) based on data from the first three waves of HILDA survey.

the Mundlak correction are statistically insignificant. We dropped these two variables and reestimated the model. These results are presented in Column 5 of Table 3. The coefficient of comparison income has remained almost the same but the coefficient of 'RICHER' has improved in terms of both magnitude and the level of statistical significance. Thus, the hypothesis that the comparison income hurts the poorer more than the richer, still holds.

Some researchers have assumed cardinality of the responses when performing happiness regressions (for examples, see Ferrer-i-Carbonell and Frijters, 2004). To ascertain how this assumption may influence empirical results, we repeated all estimations treating the individual responses on the 0-10 scale as cardinal measures of satisfaction. The results are presented in Table 4. The hypothesis of no adaptation to income is not rejected; the income coefficient is once again positive but statistically insignificant. Comparison income has negative effect on the happiness of both poorer and richer individuals, and the effect on the former is still stronger. On a close comparison of Table 4 with Table 3 one can see that the cardinality assumption does not affect the signs or significance of most of the variables included in this study

4. Conclusions

This study has examined the effects of adaptation and social comparison on the self-reported life satisfaction of individuals in Australia based on panel data drawn from the five waves (2001-2005) of the HILDA surveys. Alternative models of happiness are estimated using appropriate econometric techniques. The Layard's adaptation function is generalised and introduced into the model. The data show that over the period 2001-2005, the incomes have grown steadily yet the happiness scores have marginally fallen. The econometric results provide no evidence of adaptation to income. Even though the hypothesis of adaptation is rejected by the Australian longitudinal data, our generalisation of Layard's adaptation function may be considered as a step forward in testing adaptability to income.

The results offer strong statistical support to the hypothesis that reference group/ comparison income has a negative effect on the self-reported well-being of individuals. The increase in peer group income hurts the poorer more than richer. Such differential negative externalities of social comparison may be taken into account when designing optimal tax policies.

Happiness is U-shaped in age, minimising at around 25 years. Females are significantly happier than males. Suffering from poor health has a negative and significant effect upon life satisfaction. Living in a major city has a negative and significant effect upon life satisfaction. Being married contributes to happiness, while becoming separated or divorced causes a reduction in life satisfaction. Married life more than neutralises the consequences of poor health. Those who are unemployed or out of the labour force are less satisfied with life compared to those who are employed, although it is worth noting that the number of hours spent working each week has a negative impact upon life satisfaction. Being out of the labour force hurts more than having been divorced. Those who perform volunteer or charity work tend to be happier than those who do not, whereas those who have to care for a disabled spouse or relative tend to be less satisfied than those who do not. Commuting time, race, and widowhood do not have a statistically significant effect upon life satisfaction. The results are insensitive not only to the choice of peer group definitions but also to our conceptualization of self reported life satisfaction responses.

Table 3: Ordered Probit Estimates of Happiness Models

Explanatory Variables	With peer groups based on age and education			With peer groups based on age education and sex	
	Model A (Eqn. 4)	Model B (Eqn. 6)	Model C (Eqn. 8)	Model C (Eqn. 8)	Model C (Eqn. 8) (Restricted version)
	(1)	(2)	(3)	(4)	(5)
ln (Income)	0.014 (0.010)	0.009 (0.006)	0.004 (0.006)	0.006 (0.006)	0.008 (0.006)
ln (Income-1)	0.003 (0.009)				
ln (Income-2)	0.006 (0.009)				
ln (Income-3)	-0.010 (0.009)				
ln (Income-4)	0.005 (0.007)				
ln (Peer Income)	-0.967** (0.152)	-0.407** (0.049)	-0.399** (0.049)	-0.407** (0.047)	-0.412** (0.047)
RICHER			0.007** (0.002)	0.003++ (0.002)	0.004+ (0.002)
Age	0.028** (0.010)	-0.022** (0.007)	-0.022** (0.007)	-0.024** (0.007)	-0.021*** (0.007)
Age-squared	-0.0002+ (0.0001)	0.0004** (0.0001)	0.0004** (0.0001)	0.0004** (0.0001)	0.0004** (0.0001)
No Degree	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Degree	0.317** (0.067)	0.054 (0.041)	0.060 (0.041)	0.062 (0.041)	0.071 (0.041)
Male	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Female	0.105** (0.025)	0.135** (0.033)	0.143** (0.033)	0.044 (0.038)	0.056 (0.037)
Employed	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Unemployed	-0.280* (0.136)	-0.468** (0.081)	-0.488** (0.082)	-0.469** (0.082)	-0.451** (0.081)
Not in Labour Force	-0.200* (0.093)	-0.285** (0.068)	-0.306** (0.069)	-0.287** (0.069)	-0.279** (0.069)

	(1)	(2)	(3)	(4)	(5)
Good Health	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Poor Health	-0.410** (0.028)	-0.307** (0.021)	-0.306** (0.021)	-0.306** (0.021)	-0.307** (0.021)
Living Outside City	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Living in City	-0.124** (0.024)	-0.179** (0.028)	-0.182** (0.028)	-0.181** (0.028)	-0.189** (0.028)
Not Indigenous	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Indigenous	0.280* (0.116)	0.084 (0.160)	0.078 (0.160)	0.074 (0.160)	0.072 (0.159)
Never Married	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Married	0.272** (0.036)	0.384** (0.038)	0.382** (0.038)	0.385** (0.038)	0.389** (0.038)
Separated	-0.226** (0.079)	-0.405** (0.064)	-0.409** (0.064)	-0.408** (0.064)	-0.407** (0.064)
Divorced	-0.172** (0.061)	-0.206** (0.060)	-0.210** (0.060)	-0.207** (0.060)	-0.198** (0.060)
Widowed	0.073 (0.070)	-0.073 (0.072)	-0.079 (0.072)	-0.067 (0.072)	-0.057 (0.072)
Care Not Performed	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Care Performed	-0.126** (0.043)	-0.075* (0.030)	-0.075* (0.030)	-0.076* (0.030)	-0.076* (0.030)
Not Volunteer	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Volunteer	0.098** (0.028)	0.079** (0.022)	0.080** (0.022)	0.078** (0.022)	0.078** (0.022)
Good Upbringing	Ref. Group	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Bad Upbringing	-0.051 (0.039)	-0.141** (0.052)	-0.140** (0.052)	-0.144** (0.052)	-0.144** (0.052)
ln (Work Hours)	-0.064* (0.027)	-0.085** (0.022)	-0.092** (0.022)	-0.086** (0.022)	-0.076** (0.021)
ln (Commuting)	-0.029+ (0.017)	0.001 (0.015)	-0.001 (0.015)	-0.001 (0.015)	-0.005 (0.014)
ln (Mean Income)		0.014 (0.015)	0.011 (0.015)	0.014 (0.015)	

	(1)	(2)	(3)	(4)	(5)
ln (Mean Work hours)		0.028 (0.019)	0.024 (0.019)	0.027 (0.019)	
ln (Mean Commuting)		-0.120** (0.036)	-0.124** (0.035)	-0.118** (0.036)	-0.079** (0.029)
H_o: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ χ^2 Ho: $\beta_1 + \beta_2 = \beta_3 = \beta_4 = 0$ χ^2	1.64 0.43				
Wald-statistic	908.09**				
Likelihood Ratio χ^2		1238.78**	1249.23**	1246.89**	1244.02**
No. of observations	8,530	30,815	30,815	30,815	30,878

Note: Standard errors are reported in parentheses. In Model A, standard errors are robust to heteroskedasticity. In all remaining models, results are derived using the REOPROB command in STATA 10.0. Unfortunately, there is currently no procedure that can be used to generate robust standard errors when using the REOPROB command. For this reason, the standard errors presented in Models B, and C are not robust to heteroskedasticity. **, *, + and ++ denote levels of significance respectively at 1, 5, 10 and 15 per cent.

Table 4: Estimates of Happiness Models Assuming Cardinality of Self Reported Life Satisfaction Responses

Explanatory Variables	With peer groups based on age and education			With peer groups based on age education and sex
	Model A (Eqn. 4)	Model B (Eqn. 6)	Model C (Eqn. 8)	Model C (Eqn. 8)
	(1)	(2)	(3)	(4)
ln (Income)	0.021 (0.014)	0.009 (0.006)	0.003 (0.006)	0.005 (0.006)
ln (Income-1)	0.002 (0.0013)			
ln (Income-2)	0.011 (0.013)			
ln (Income-3)	-0.010 (0.012)			
ln (Income-4)	0.007 (0.009)			
ln (Peer Income)	-1.385** (0.200)	-0.325** (0.049)	-0.314** (0.049)	-0.325** (0.046)
RICHER			0.008** (0.002)	0.005* (0.002)
Age	0.042** (0.013)	-0.025** (0.007)	-0.025** (0.007)	-0.026** (0.007)
Age-squared	-0.0003* (0.0001)	0.0004** (0.0001)	0.0004** (0.0001)	0.0004** (0.0001)
No Degree	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Degree	0.472** (0.088)	0.055 (0.036)	0.059* (0.036)	0.064+ (0.035)
Male	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Female	0.148** (0.034)	0.128** (0.029)	0.137** (0.029)	-0.018 (0.034)
Employed	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Unemployed	-0.453* (0.196)	-0.451** (0.085)	-0.474** (0.085)	-0.458** (0.085)
Not in Labour Force	-0.251* (0.122)	-0.258** (0.066)	-0.282** (0.067)	-0.265** (0.067)

	(1)	(2)	(3)	(4)
Good Health	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Poor Health	-0.574** (0.039)	-0.300** (0.021)	-0.299** (0.021)	-0.299** (0.021)
Living Outside City	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Living in City	-0.151** (0.032)	-0.149** (0.026)	-0.153** (0.026)	-0.152** (0.026)
Not Indigenous	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Indigenous	0.328* (0.149)	0.086 (0.148)	0.081 (0.148)	0.081 (0.147)
Never Married	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Married	0.364** (0.051)	0.360** (0.037)	0.358** (0.037)	0.360** (0.037)
Separated	-0.412** (0.122)	-0.509** (0.080)	-0.513** (0.080)	-0.513** (0.080)
Divorced	-0.285** (0.089)	-0.239** (0.065)	-0.243** (0.065)	-0.242** (0.065)
Widowed	0.099 (0.092)	-0.060 (0.077)	-0.069 (0.077)	-0.059 (0.077)
Care Not Performed	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Care Performed	-0.167** (0.058)	-0.071* (0.030)	-0.071* (0.030)	-0.071* (0.030)
Not Volunteer	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Volunteer	0.158** (0.036)	0.085** (0.020)	0.085** (0.020)	0.084** (0.020)
Good Upbringing	Ref. Group	Ref. Group	Ref. Group	Ref. Group
Bad Upbringing	-0.071 (0.055)	-0.157** (0.051)	-0.155** (0.051)	-0.157** (0.051)
ln (Work Hours)	-0.061+ (0.036)	-0.069** (0.021)	-0.078** (0.021)	-0.072** (0.021)
ln (Commuting)	-0.035 (0.022)	-0.004 (0.014)	0.003 (0.014)	0.004 (0.014)
Constant	20.574** (1.761)	11.351** (0.398)	11.336** (0.398)	11.487** (0.389)

	(1)	(2)	(3)	(4)
ln (Mean Income)		0.016 (0.014)	0.012 (0.014)	0.014 (0.014)
ln (Mean Work hours)		0.042* (0.018)	0.037* (0.018)	0.040* (0.018)
ln (Mean Commuting)		-0.099** (0.030)	-0.103** (0.030)	-0.099** (0.030)
H_o: $\beta_1 = \beta_2 = \ldots = \beta_K = 0$ F-value (4, 8505)	0.45			
Wald Statistic		1075.52**	1088.97**	1088.20**
No. of observations	8,530	30,815	30,815	30,815

Note: Model A is estimated by OLS and models B and C are estimated by GLS with random effects. Standard errors are reported in parentheses and are robust to heteroskedasticity. **, *, and + denote levels of significance respectively at the 1, 5 and 10 per cent.

Appendix Table A

Ordered Probit Estimates of Happiness Model A (Equation 4) with Alternative Lags of Income and with and without 'RICHER' variable

Variables	Model A (Equation 4) (without 'RICHER' variable			Model A (Equation 4) after including 'RICHER' variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(Income)	0.028** (0.008)	0.012 (0.007)	0.009 (0.006)	0.005 (0.010)	0.020 (0.009)	0.005 (0.007)	0.003 (0.006)
ln(Income-1)	0.010 (0.009)	0.019* (0.007)	0.011* (0.005)	0.001 (0.009)	0.008 (0.008)	0.017* (0.007)	0.009+ (0.005)
ln(Income-2)	0.007 (0.008)	0.002 (0.006)		0.004 (0.009)	0.005 (0.008)	0.001 (0.006)	
ln(Income-3)	-0.001 (0.008)			-0.011 (0.009)	-0.007 (0.007)		
ln(Income-4)				0.004 (0.007)			
All other variables included in estimation. Results not presented							
Wald statistics				920.91**			
Likelihood Ratio χ^2	1162.9**	1363.0**	1501.0**		1171.4**	1373.6**	1514.7**
No. of observations	16030	23746	31562	8530	16030	23746	51562

Note: **, * and + denote respectively significant at the 1, 5 and 10 per cent.

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