

Do changes in the lives of our peers make us unhappy?

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Abstract

In this paper, we seek to explain the changes in aggregate happiness over the life-cycle. The advantage of looking at the aggregate level of happiness is that it solves the problems of missing peer effects and measurement error that plague models of individual level happiness, though the disadvantage is a dramatic loss of degrees of freedom. We use panel data from the Household Income and Labour Dynamics for Australia (HILDA), which allows us to construct an index of the severity of life changes for each age. This single-variable Stress Index is able to explain over 80% of the variation in happiness over time. Unexpectedly, aggregate ‘positive stress’ (such as marriage rates by age or levels of job promotion) have greater negative effects on aggregate life satisfaction than negative stress (such as negative financial events or deaths of spouses), which we interpret as a strong indication that what is deemed a positive event by the person involved is a highly negative event for his or her peers. We find some evidence that extraverted individuals get affected less negatively by stress. The happiness maximising policy is then to reduce changes over the life cycle to the bare minimum needed to sustain a dynamic economy and to sustain procreation.

JEL-Codes: C23, C25, I31.

Key-Words: Happiness methodology, life satisfaction, endogenous, models, age effects, personality effects, stress, change, life shocks, variables, aggregate, time series.

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1. Introduction

Whilst we have now had over 30 years of experience in running regressions on self-stated happiness, our ability to predict happiness has so far been rather poor. Recent economics papers manage to explain, at best, about 15% of the cross-sectional variance. For instance, Di Tella, MacCulloch, & Oswald (2001, p.340), using over 250,000 observations from twelve Western European countries, found that age together with demographic variables like gender, education, employment status, income, marital status and number of children explained 17% of the variance. Blanchflower & Oswald (2004), using sixteen socio-demographic variables, explain only 9% of the happiness of individuals in the US General Social Survey. Frijters & Beaton (2008), using a ‘kitchen sink’ set of nineteen socio-demographic variables and eight life event dummies, explain just 8% of the happiness of individuals in the German Socioeconomic Panel (GSOEP).

Only when one includes other subjective variables does the percentage of variance really go up. Ferrer-i-Carbonell & Frijters (2004) thus add subjective health which, added to the usual socio-economic variables, explained 26% of West German happiness. Personality factors and mood are able to increase this to about 60%. Yet, for economists, the explanation of one fairly subjective question by another is rather disappointing and raises the specter of endogeneity (Powdthavee, 2007). We’d prefer to be able to explain happiness by variables we can interpret as prices, constraints, and consumption. It is remarkable that, after more than a decade of intense economic research in this area (see Clark, Frijters, & Shields, 2008 for a survey), we have come no further than explaining 15% with socio-economic characteristics, just as Argyle (1999) reported that psychologists and demographers managed to explain in the decades prior.

In this paper, we hypothesise that there are two main problems with analyzing happiness at the individual level: unmeasured peer effects and measurement error. Almost no dataset is able to track all the peers of an individual and all the subtle interactions between them. As a result, we do not measure all the influences that friends, family, and neighbours exert on us daily.

A well-known example of missing peer effects arises when considering income. Results from happiness regressions consistently show a positive and significant coefficient for income; an increase in income makes us happier (Clark & Oswald, 1996; Di Tella et al., 2001; Winkelmann & Winkelmann, 1998). But, is the magnitude of the regression coefficient and the level explanation truly reflective of the effect of the income increase? Easterlin (2001) reminds us of the importance of peer influences. Whilst we get happier if our own income goes up, we get unhappier if the income of our peers goes up. We adjudge our happiness relative to the peers we compare ourselves with (Falk & Knell, 2004); all our friends, family, and acquaintances. For a model of individual level happiness to truly reflect the effect of the change in income on happiness, we need happiness and income data for an individual and all that individual's peers. Of course this is not possible because panel surveys like HILDA and GSOEP follow families, not individuals and all their peers; we have missing variables. This problem also appears for other variables like marriage events and children. Whilst the individual who marries is happier during the wedding, those attending may well feel jealous and be unhappier. Childless individuals might be more miserable when their friends have lots of children. Regression results for models of individual level happiness that lack peer variables will have low explanatory variables and will also suffer from bias if the observed characteristics correlate with the unobserved peer effects.

As to measurement error, no dataset that we know of is capable of perfectly measuring all the consumption variables economists think of as being important to the utility of individuals. Indeed, no variable we usually put on the right-hand side can be unequivocally interpreted as a certain unit of consumption of something. Income is for instance nearly always included in the list of explanatory variables, but it is known to be measured with a great degree of error (due to recall bias, missing compensation wage variation, contingent in-kind welfare, etc.) and even if it were perfectly measured, it would still only be a proxy for what we theoretically think is really important, i.e. consumption. Another such example is marriage. Researchers routinely add a marriage indicator in regressions, but not all marriages are the same. Some marriages 'work well' and 'produce' lots of unmeasured household goods, whilst others can be virtual prisons with negative production. Yet all that remains of this heterogeneity in actual married life is a single marriage dummy that is implicitly

hypothesized to have exactly the same effect on everyone. What holds for marriage can be argued to hold for every variable we routinely include on the right-hand side: we ignore the measurement error involved in our variables. Ignoring measurement error is almost unavoidable in any applied empirical work using many variables, but it may be one of the key reasons for our inability to explain more of the variation in happiness.

Our approach, which we believe to be entirely novel in the economic happiness literature, is to focus not on explaining individual happiness but on the aggregate happiness of individuals of the same age. We call this an aggregate model of happiness. The advantage of this aggregation is two-fold. One, when one uses averages, measurement errors get dampened because the signal to noise ratio increases. Second, and perhaps much more importantly, the average characteristics by age are likely to coincide with the average characteristics of the peers. Hence, peer effects which are almost impossible to identify at the individual level, because of the inability to include all the relevant peers, become within reach when one averages. Note that this doesn't mean we assume that the peers of an individual are others of the same age. Rather, it means that the average peer of the average individual is of the same age.

Drawing on the psychological literature, we then test the somewhat outrageous possibility that nearly all the cross-sectional variance in happiness is due to stress. We measure stress not by using subjective questions, but rather by measuring the believed cause of stress: a weighted average of the frequency of life events that psychologists have argued are the cause of stress. We test this hypothesis on the Household Income Dynamics for Australia, progressively expanding our aggregate model of happiness. By comparing the effect of stress at the aggregate level with the effect of the same life events at the individual level, we can also say something about the likely direction of peer effects and hence something about the data we are missing at the individual level. After testing the basic idea, which holds remarkably well (over 80% of variance is explained by a simple weighted average of life events), we expand the basic model to allow the effect of stress to differ by personality.

In the next sections we discuss the data and the measurement of our key variables in detail. The third section describes the methodology and goes through a succession of models. The final section briefly discusses the policy implications of our findings.

2. Data

In this paper we use the first 6 waves of the ‘Household, Income and Labour Dynamics in Australia’ (HILDA) Survey. This is a household-based panel study which began in 2001 (HILDA, 2008b). It has the following key features:

- It collects information about economic and subjective well-being, labour market dynamics and family dynamics.
- Special questionnaire modules are included each wave including personality questions in wave 5.
- The initial Wave 1 panel consisted of 7682 households and 19,914 individuals.
- Interviews are conducted annually with all adult members of each household.
- Wave 6 (2006) tracks 12,905 individuals with 95% retention from Wave 5.

The happiness question is based on the Fordyce Global Happiness Scale. It asks ‘All things considered, how satisfied are you with your life?’ with the ordinal responses ranging from 0 (very unhappy) to 10 (very happy). It seeks to measure the aggregate utility from all the good and bad things that occur throughout our lives (Fordyce, 1988). Table 1 shows the sample averages for the 55,177 person-year observations we have available. Average life satisfaction is 7.94, which is relatively high compared to other Western countries (see Clark et al. 2008). Table 2 shows the sample averages of the life-events we will use to construct our measure of stress. As one can see, the HILDA includes many life events (21, as opposed to the GSOEP which has only 7). Also, there are many recorded life events by category. For instance, per person-year observation, 0.059 change jobs. That is a total of almost 3200 job changes over the 6 years of the sample. Similar high numbers of life events hold for all the other categories.

3. Methodology and analyses

Theoretical framework

Suppose the true model of the happiness (GS_{it}) of individual i in period t is given by:

$$GS_{it} = \beta_s X_{it} + \lambda X_{peer_{it}} + u_{it} \quad (1a)$$

Here, GS_{it} is affected by an individual's own circumstances (X_{it}) and those of the peers ($X_{peer_{it}}$), as well as random errors (u_{it}).

Suppose now that what is usually estimated in empirical happiness regressions is the following:

$$\begin{aligned} GS_{it} &= \beta Z_{it} + v_{it} \\ Z_{it} &= X_{it} + e_{it} \end{aligned} \quad (1b)$$

Here, Z_{it} is now a noisy measure of (X_{it}) that includes random measurement error (e_{it}). In the absence of peer effects, it is well-known that the estimate of β will be a downward biased estimate of the true β_s because of the presence of measurement error. In our case though, there is both measurement error and missing variables. What we then get as the asymptotic estimate of β is (neglecting errors that go to zero as i and t go to infinity):

$$\hat{\beta} = \left[\frac{\text{cov}(Z_{it}, GS_{it})}{\sigma_Z^2} \right] = \frac{\sigma_X^2 \beta_s}{\sigma_X^2 + \sigma_e^2} + \frac{\lambda \text{cov}(X_{it}, X_{peer_{it}})}{\sigma_X^2 + \sigma_e^2}$$

which is biased in two directions: biased towards zero because of measurement error and biased in an unknown direction (we have no a priori expectation of the sign of λ) due to the correlation between individual characteristics and the peer characteristics.

What we propose to estimate is:

$$\frac{1}{N_t} \sum_{i \in S(t)} GS_{it} = \beta \frac{1}{N_t} \sum_{i \in S(t)} Z_{it} + w_t \quad (1c)$$

Where $S(t)$ is the set of individual-year combinations with the same age t and N_t is the number of observations on age t . If we now presume that:

$$\frac{1}{N_t} \sum X_{it} = \frac{1}{N_t} \sum X_{peer_{it}}$$

then both the measurement error problem and the peer effects issue get ‘solved’ in the sense that the asymptotic estimate of the parameter now becomes:

$$\hat{\beta} = \beta_s + \lambda$$

which occurs because averaging gets rid (asymptotically) of the measurement error, and the assumption that the average peer is the same as the population average of the same age means we obtain a coefficient whose estimate we can interpret as the sum of the individual and peer effect. It is important to point out that this procedure gives very different results to simply including the average X by age in equation (1a) because the correlation between the characteristics of the actual peers of each individual and our artificial ‘aggregate peer’ may be very small. It is only for the aggregate of individuals of the same age that we assume the aggregate peer has the same characteristics as themselves.

The obvious disadvantage of averaging is that we have far fewer observations left than before: from 55,000 person-year observations, the data gets reduced to a mere 70 different age-happiness points. This means we should apply extreme care when choosing which variables we wish to include and hence we wish immediately to choose a variable that can be argued to be responsible for a lot of variation in happiness.

Our proposed ‘big variable’ is the stress caused by life events. Easterlin (2002, 2006) argued that life is a succession of little mishaps and triumphs that determine how we feel in the short-run, and big events that determine how we feel in the medium term (say, a year). Imagine the difference in our response on average day versus the response on a rainy day where we had missed our train and walked to work sans umbrella. We may have been perfectly happy before all this happened and self-rated a happiness level of seven. But, having been asked the happiness question after getting

wet and missing our train, and because we now feel miserable, we record a happiness level of five. Similarly, how we feel about a whole year will depend on the various positive and negative life events we and our peers have experienced.

Therefore,

Hypothesis #1: An Aggregate Model of Happiness based on the average stress of life events explains happiness over a lifetime.

How do we measure stress based on life events? One option is to include each life event in the regressions, but, given that there are 21 of them in this sample which are quite highly correlated, this is not statistically feasible. Yet, we can do this at the individual level, and Appendix E shows the result of a standard regression of the type in equation (1a) that thus ignores the peer effects and the measurement error problem. We do not discuss those results at this time, but will come back to them later.

Since we can't accurately gauge the stress of a life event from individual happiness responses in our sample, we adopt the expert judgment by psychologists as to the believed importance of individual events. Our measure of stress is then based on Social Readjustment Rating Scale Theory (Hobson et al., 1998). Developed by Holmes and Rahe in 1967, the Social Readjustment Rating Scale (SRRS)² has been one of the most widely used and cited assessment instruments in the literature on stress and stress management. A review of published research since 1967 in psychology, medicine, and business indicates over 4000 citations (Hobson et al., 1998). The basis for SRRS theory is that these psychologists believe all life events bring about change in our lives and change causes stress, and, greater levels of change make us unhappy (Chamberlain & Zika, 1992); the more salient the life event the greater the level of stress from that event. Also, stress is believed to be cumulative so the more events affecting us at a particular time in our lives, the greater our aggregate level of stress (Carlopio, Andrewartha, Armstrong, & Whetten, 2001) and the less

² The SRRS levels emerged from a US study of 3122 individuals and the review of the results by a panel of 30 professionals from the behavioural, medical, and social sciences (Hobson et al., 1998). The professional review panel was representative of the gender and ethnic diversity of present day U.S. society: 15 (50%) panel members were female; 15 (50%) male; 3 (10%) were African American; 3 (10%) Hispanic; 2 (7%) Asian, and; 22 (73%) white.

happy we are. For now, we take the SSRS weights as given, though we will return to the issue of whether these weights are really reasonable later.

Appendix B shows all the life events considered by SRRS theory, highlighting those life events available in our data set. Our measure of *Stress* by age is the simple average of the life events, weighted by the impact estimates of Table 3:

$$Stress_t = \sum_s SSRS_s * Le_{st} \quad 0 < SSRS < 1$$

Which defines *Stress* as the sum of the life events (*Le*) in the previous period (year) times the stress level (*SSRS*) for each type *s* life event³.

We begin testing Hypothesis #1 by using HILDA data to initiate the development of our aggregate model (2) of average happiness (*GS*) with 15 to 84 year olds as the time (t) reference:

$$GS_t = C + \delta(Stress_t) + \varepsilon_t \quad (2)$$

8.67	-1.18
(215.43)	(17.21)
$R^2 = .81$	

C is the underlying ‘stress-free’ level of happiness that is subject to changes arising from the *Stress* from life event shocks at a particular time in our lives.

Relative to models of happiness based on the individual, the aggregate model of happiness explains considerably more ($R^2 = 0.81$) of the variance in happiness (Appendix D, Table 6). Stress is strongly negatively related ($r = -0.90$) to happiness. Figures 1a and 1b reiterate the remarkably good empirical fit between happiness and stress by showing happiness by age and stress by age.

³ Table 2 in Appendix A list the twenty-one life events used from the HILDA, with Table 3 showing the stress level for each life type.

At age fifteen to nineteen we have a higher level of happiness because we have been exposed to less stress. In our mid-years we are exposed to more stress-creating life events and are subsequently less happy. As we grow older, we are subject to less stress and this leads to an increase in our happiness.

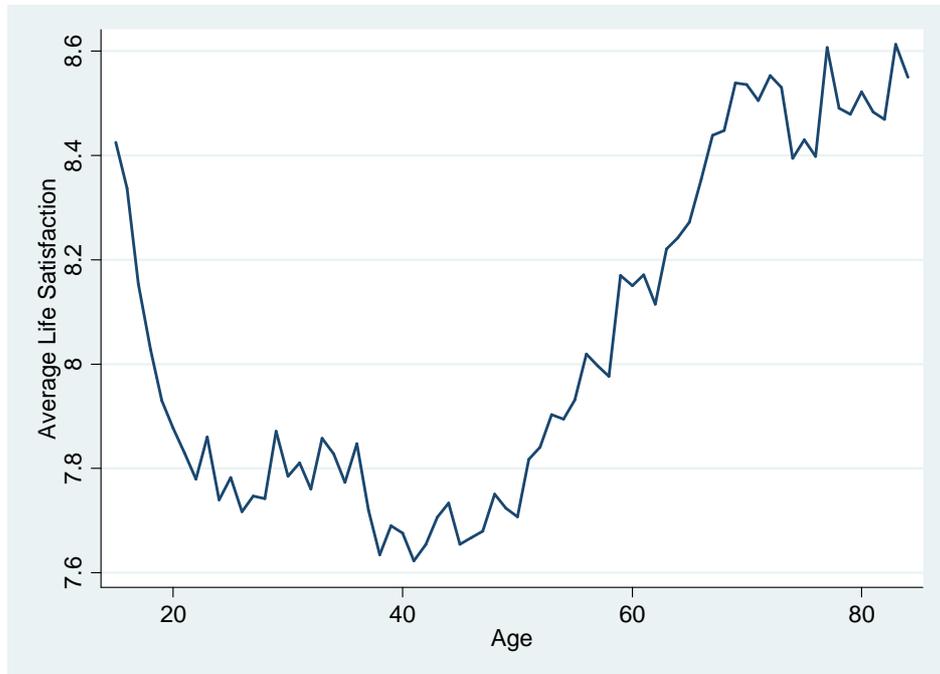


Figure 1a: Average happiness for Australians aged 15 to 84

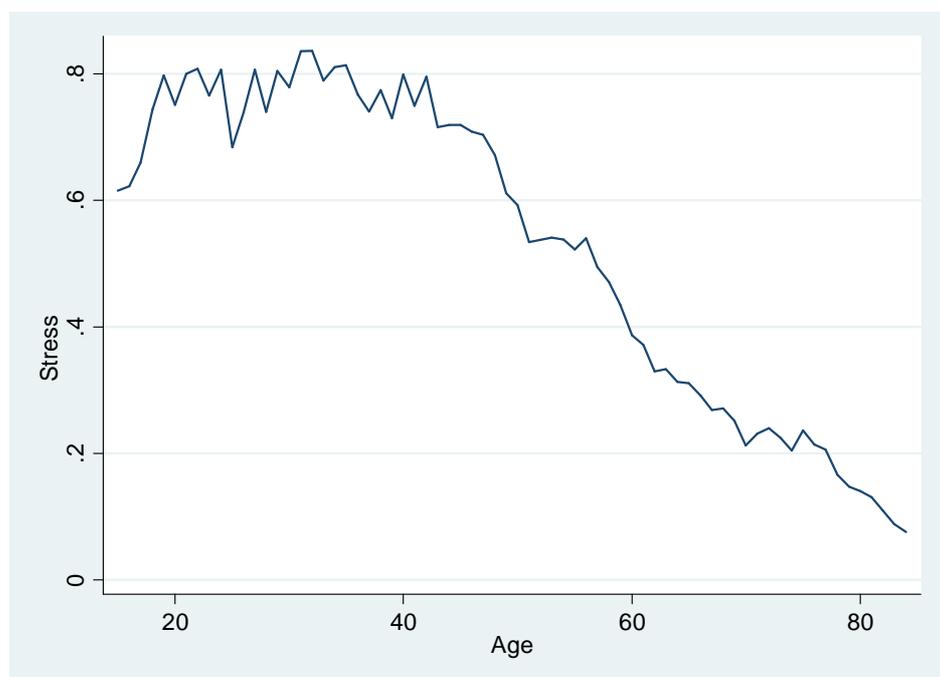


Figure 1b: Average stress level for Australians aged 15 to 84

These two figures are also informative in the sense of the time series properties of the two variables. It is known that if one regresses two lines with strong trends on each other that one gets a high spurious relation. This is clearly not the case with our data (nor in formal tests, available on request): life satisfaction is pretty much the same at age 18 as it is at age 80. Stress goes up, plateaus, and then almost linearly reduces.

A peculiar, so far implicit, aspect of the regression results for equation (2) is that *all* life events affect aggregate life satisfaction negatively. This differs considerably from what we see from models of individual happiness. Negative life events like unemployment or declining health have been shown to decrease our happiness (Clark & Oswald, 1994; Wilson, 1967) while positive life events like marriage or the birth of a child lead to increased happiness (Frey & Stutzer, 2005). Essentially, equation (2) presumes all those events that seem to be positive at the individual level are in fact still negative at the aggregate level due to missing peer effects: even though Tables 9 and 9 show that marriage, promotion and financial improvements increase life satisfaction at the individual level, equation (2) presumes they decrease life satisfaction at the age level because of the negative effect of these events on peers.

To test if this really holds at the aggregate level we apply model (3) by splitting the *Stress* variable into *Positive_Stress* and *Negative_Stress* where positive stress is made up of those life events that show up in Table 8 as having a positive effect on the individual. Figure 2 shows the evolution by age of this positive stress and negative stress:

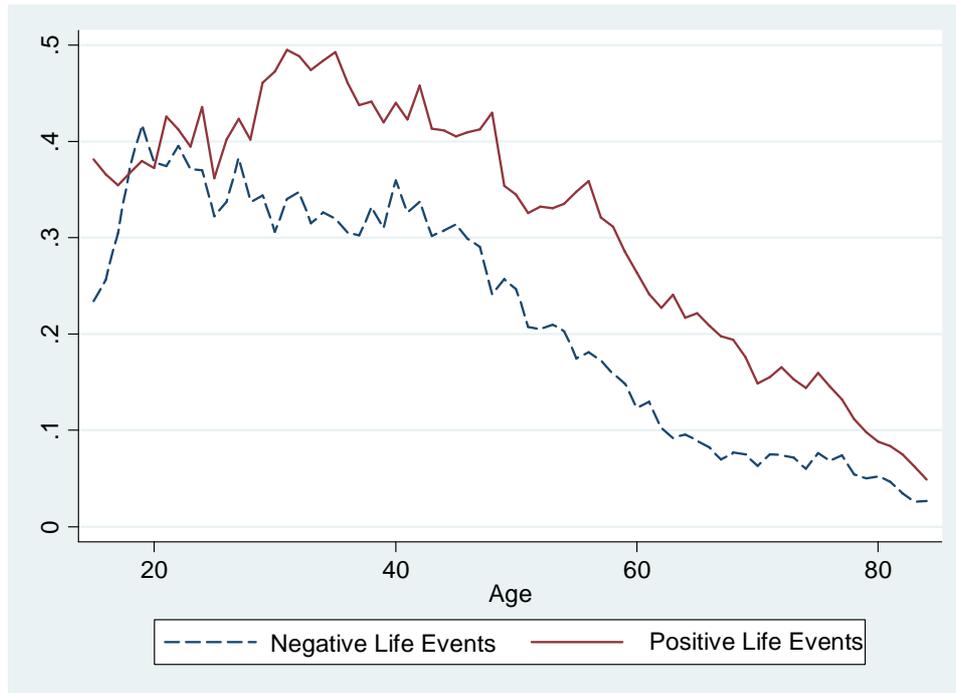


Figure 2: Average stress level from positive and negative life events; Australians aged 15 to 84

From which we see that positive events happen more in mid-life (promotions, marriages, income increases), whilst negative events are more concentrated earlier on (injuries to family members, crime).

When we now look at how positive stress and negative stress affect happiness, we get:

$$GS_t = C + \delta_1(Positive_Stress_t) + \delta_2(Negative_Stress_t) + \epsilon_t \quad (3)$$

8.73	-1.76	-0.57
(177.83)	(5.13)	(1.58)

$$R^2 = .82$$

When disaggregated into positive and negative events we find that both positive and negative life events reduce happiness, but that the effect of positive life events is stronger and more significant. This is quite revealing. Why do life events that are positive at the individual level, suddenly become negative in the aggregate? Within the context of equation (1) the reason is the peer effects: what makes us happier at the individual level can increase the jealousy, frustration, and hence stress levels of our peers. On aggregate, it is clear that the peer effect dominates the individual effect.

More unhappiness is created by promotions, marriages, births, etc., via our peers than we gain personally. This obviously has very strong policy ramifications since it would mean nearly all life events not essential for our continued survival should be reduced to a minimum, *Ceteris Paribus*.

We have so far relied only on fairly ‘objective’ variables to explain life satisfaction. These life events do not reasonable suffer from endogeneity problems to the same extent that, for instance, health or mood does: it is not our unobserved individual proclivities to be happy that cause our friends to marry and get promotions. We now introduce more subjective variables and turn to the hypothesis that stress may not be equally bad for everyone and that the importance of personality for life satisfaction is mainly in terms of how personality allows us to cope with stress.

Psychologists have long argued that the level of stress is not only affected by the number of life events, but is directly affected by personality (Mroczek & Kolarz, 1998). We test this in steps. First we look whether there is any residual effect of personality on happiness, after which we test whether its effect is as an intermediate to the effect of stress. The ‘direct effect of personality’ is usually argued to hold mainly for extraversion and emotional stability. Costa & McCrae (1980) and Headey (2008) identified an increased variance in the happiness of extraverts (talkative, outgoing, lively) and neurotics (moody, touchy, jealous, temperamental) exhibiting lower levels of emotional stability. In (4), we look at the direct effects of personality traits on happiness (*GS*):

$$GS_t = C + \delta(Stress_t) + \lambda_1 Pa_t + \lambda_2 Pex_t + \lambda_3 Pem_t + \lambda_4 Pc_t + \lambda_5 Po_t + \varepsilon_t \quad (4)$$

9.35	-1.54	-0.21	3.84	-0.74	-1.40	-1.53
(2.54)	(10.91)	(0.29)	(5.62)	(1.03)	(2.22)	(2.43)

$R^2 = .88$

The personality traits are the average at each age for the individuals measured in the HILDA on a scale of 1 (lowest) to 7 (highest); using Goldberg's Big-Five⁴ personality factors (Saucier, 1994):

<i>Pa</i>	agreeableness
<i>Pex</i>	extraversion
<i>Pem</i>	emotional stability ⁵
<i>Pc</i>	conscientiousness
<i>Po</i>	openness.

Personality has a direct effect on happiness; increasing the level of explanation from $R^2 = .82$ to $.88$, whilst the effect of *Stress* reduces by a mere thirteen-percent. *Stress* remains by far the most important variable, which, from an economist's point of view, is heartening because it suggests real events can trump subjective perceptions in the ability to explain life satisfaction.

Looking at each trait, extraversion has a significant positive direct effect on happiness (Table 6). Extraversion and neuroticism impact life satisfaction through daily emotional experiences (Howell, 2006). Extraversion is associated with high levels of positive effect, a positive outlook on life, better health, higher levels of success in marriage, work and other aspects of our lives; this positive reinforcement makes us happier (Lyubomirsky, King, & Diener, 2005). Conscientiousness and openness make us unhappier. Conscientiousness impacts happiness through daily behavioural choices (Howell, 2006). We can imagine the systematic, procedural organised person getting unhappy when life event changes upset the equilibrium of their orderly environment. The openness items in the personality measure tap the notion of intelligence (creative, intellectual, imaginative). Cognitive level (intelligence) is highly positively correlated with education level (Rindermann, 2008), and, higher levels of education translates to reduced happiness (Clark & Oswald, 1996). We can imagine a creative intellectual worrying about the problems of the world (like the environment) and seeking answers to improve the situation, at the expense of their

⁴ See Appendix C for an explanation of the Big-Five personality factors.

⁵ Neuroticism is the inverse of Emotional Stability.

happiness. The personality variables that have an insignificant direct effect on happiness are emotional stability and agreeableness.

Agreeableness relates to those who exhibit sympathy and are warm, kind and cooperative towards others. The coefficient is non-significant but negative, probably because agreeableness acts indirectly through daily behavioural choices (Howell, 2006). The non-significance and negative coefficient for emotional stability defies current literature; Costa & McCrae (1980) and Furnham & Petrides (2003) found that emotional stability positively affects happiness. Perhaps this is because emotional stability impacts happiness through daily emotional experiences (Howell, 2006); we need to examine the indirect effect of personality on the life events that impact our lives and lead to the stress that affects or happiness.

We thus turn next to the role of personality as an intermediary of stress. The longitudinal study of McCrae & Costa (1995) found that the personality traits affected how we react to situations that confront us throughout our lives. Happiness pursuing persons behave differently and have a more positive notion of happiness (Rojas, 2007). Headey & Wearing (1989) found that stable personality traits of emotional stability, extraversion, and openness to experience predispose people to experience moderately stable levels of favourable and adverse reaction to life events; personality plays a role in how we react to the life events that confront us throughout our lives. In finalising our Aggregate Model of Happiness (5), we evolve the model (4) by adding the indirect effect of each personality trait and the Stress from life events on happiness.

$$GS_t = C + \delta_1 Stress_t + \lambda(P_t)' + \eta(Stress_t * P_t)' + \varepsilon_t \quad (5)$$

where

$$\lambda = \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \end{bmatrix} \quad \eta = \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \end{bmatrix}$$

and

$$P = \begin{bmatrix} Pa \\ Pex \\ Pem \\ Pc \\ Po \end{bmatrix}$$

The results are shown in Table 6.

The first striking aspect is that happiness is almost completely explained ($R^2 = .95$) by this set of variables. Since we are now up to 11 variables explaining 70 data points, a high R^2 was to be expected, but 0.95 is simply a novelty in this literature.

The inclusion of the indirect effects of personality (P) and $Stress$ has reduced the direct effect of $Stress$ by 56% which suggests strong intermediate effects of personality on the experience of stress. Also, the direct effect of the personality traits has changed; openness and conscientiousness have both become insignificant. Only extraversion remains as a mildly significant personality factor directly affecting happiness. Otherwise, the effect of personality is entirely through stress, with the main interactions being for extraversion and stress.

Interestingly, openness worsens stress. It appears that creative intellectuals (= open) worry when they are confronted with the problems (life event shocks) of the world and in seeking answers do so at the expense of their happiness. Extraverts are the

opposite. In their daily reactions to life event shocks, the positive outlook of extraverts makes them experience their own life shocks and that of their peers as, on the whole, positive events out of which they get enjoyment. In this final model, on average, a one standard deviation increase in stress translates to a .17 unit decrease in happiness (holding the personality variables at their mean). A one standard deviation increase in extraversion has a minimal direct effect on happiness; less than 0.05 units. The effect from a one standard deviation in openness*stress decreases happiness by 0.865 units but the indirect effect of a one standard deviation increase from extraversion*stress has the largest effect with a 1.043 unit increase in happiness. Thus, extraverts react positively to events and benefit from situations that would make those with a high degree of openness less happy. Conditional on the other factors, conscientiousness no longer significantly affects happiness, neither directly nor indirectly. Similarly, emotional stability has no conditional effect on happiness.

Importance of the SRRS weights

In order to see whether the main results are highly dependent on the SRRS scales, we ran equation (2) in Table 7 with the eleven life events that made the biggest contribution to aggregate stress, adding them in sequentially. When we include all 21 life events (not shown), standard deviations become very large and all significance is lost. Table 7 shows that there is general non-robustness of the effects of individual life events. Personal injury for instance has a strongly negative effect in the first 4 specifications, with a coefficient of -0.014 if it is included as the only life event. When all 11 life events are included, personal injury has a coefficient of -0.001 and is insignificant. Similar parameter instability holds for being a victim of violence (which has a positive coefficient!) and financial stress, which we attribute to the strong multi-collinearity between the frequency of these life events.

Despite the multi-collinearity problem which makes it hard to take the relative magnitudes at face value, Table 7 does confirm that positive life events can have strong negative effects on aggregate happiness. Having just married and an improvement of finances all have significant negative aggregate effects, whereas they are strongly positive at the individual level. Indeed, the negative effect of improvement in finances is the single highest coefficient in the final specification. Interestingly, the other significant negative variables are separated and worsening of

finances. It is tempting to think of this group of variables as highly visible variables that are likely to affect friends and families. Given that we do not want to put too much emphasis on these results due to the multi-collinearity problem, we do not want to overplay this interpretation and merely note that the main thrust of the analyses based on a particular weighting of the life events is also evident if we use unweighted aggregate life events.

4. Conclusions

This paper tried to overcome the problems of measurement error and missing peer effects in happiness regression by aggregating happiness by age. The key assumption under which this aggregation allows us to say something about peer effects is the assumption that the aggregate peer of the aggregate individual is someone of the same aggregate age.

We hypothesised that happiness is almost entirely explained by the direct effects of the stress from the life event shocks, mediated by our personality. We found that the use of these explanatory variables could indeed explain over 90% of the variation in aggregate happiness. Of particular interest is the finding that both negative and positive life events bring about aggregate unhappiness. It might not be surprising that negative events stress us. Aristotle already said that we humans focus our energies in pursuit of virtuous happiness and hence become unhappy at negative events: we plan, set expectations, and are delightedly happy when our plans are achieved and our expectation met; yet we are disappointedly unhappy when they are not (Aristotle, 1819, p. 234, 254, 257). However, the finding that positive events (the ‘fruits of our planning’, if you like) bring aggregate unhappiness makes no sense at the individual level. Our interpretation is that the positive feelings we individually get from promotions, marriages, births, etc., are swamped by the stress this causes amongst our friends and family!

The happiness maximising policy recommendation, *Ceteris Paribus*, is that we should minimise life event shocks on society. All changes that are not essential to procreation and minimum needs appear to lead to net loss of life satisfaction. At face value, this would mean the divorced should be taxed because their actions have negative effects on their peers; people who go to jail or move house should be taxed to compensate the

misery they are causing their neighbours and friends, etc. These fairly radical conclusions of course should require deeper examination. Mainly, replication of our results to other countries would generate more variation and would allow richer specifications to be run. Also, should these results turn out to be robust; we might have to reconsider whether happiness is such a good measure of social utility. If, in order to be happy, we have to force everyone to lead exceedingly dull lives, perhaps happiness is not everything after all.

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Appendix A: HILDA panel data sample averages

Table 1: Sample averages for individuals in the HILDA; N = 55,177

Variable:	Mean	s.d.	Min	Max
Individuals in the HILDA waves 2 to 6 (2002 to 2006)	11,035	155.16	10,869	11,255
happiness	7.94	1.49	0	10
age	43.61	17.67	15	93
age*age	2214	1672	225	8649
time* time	2858.5	2048.03	225	7056
ln (weekly household income)	5.188	3.145	0	9.195
weekly household income (\$)	1054.29	1050.01	1	9845
pension Income (\$)	97.28	162.67	0	3000
female	.530	.499	0	1
education years	12.68	1.785	9	18
married	.520	.500	0	1
separated	.035	.183	0	1
never married	.231	.421	0	1
divorced	.087	.282	0	1
widowed	.048	.214	0	1
employed	.646	.478	0	1
unemployed	.034	.180	0	1
disability	.234	.423	0	1
health	3.391	.959	1	5
health a year ago	3.075	.688	1	5

Table 2: Sample averages for life events affecting individuals in the HILDA⁶; N = 55,177

Variable:	Mean	s.d.	Min	Max
spouse/child death	.007	.078	0	.87
death of a relative	.086	.246	0	.79
personal injury	.067	.218	0	.78
jailing of self	.002	.034	0	.76
injury to a family member	.121	.296	0	.72
property crime victim	.039	.160	0	.70
victim of violence	.012	.091	0	.69
just separated	.027	.131	0	.66
just reconciled	.007	.070	0	.66
fired from job	.019	.108	0	.64
worsening finances	.018	.104	0	.62
death of friend	.066	.189	0	.61
friend jailed	.007	.064	0	.56
just married	.011	.068	0	.43
start new job	.059	.148	0	.43
just pregnant	.021	.089	0	.41
moving house	.061	.133	0	.35
improved finances	.011	.058	0	.33
promoted at work	.021	.081	0	.33
birth of child	.011	.060	0	.33
just retired	.006	.041	0	.28

6 The data used in this paper were extracted using the Add-On package PanelWhiz v2.0 (Nov 2007) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated DO file to retrieve the HILDA data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are my own. (Haisken-DeNew & Hahn, 2006)

Appendix B: Stress levels for different life events

Table 3: All the Stress levels from the Social Readjustment Rating Scale⁷

Stress Level	Life Event
.87	<i>Death of a spouse</i>
.79	<i>Death of a close family member</i>
.78	<i>Major injury or illness to self</i>
.76	<i>Detention in gaol or other institution</i>
.72	<i>Major injury or illness to close family member</i>
.71	Foreclosure on a loan/mortgage
.71	<i>Divorce</i>
.70	<i>Victim of crime</i>
.69	Victim of police brutality
.69	Infidelity
.69	<i>Experiencing domestic violence/sexual abuse</i>
.66	<i>Separation with spouse/mate</i>
.66	<i>reconciliation with spouse/mate</i>
.64	<i>Being fired/laid-off/unemployed</i>
.62	<i>Experiencing financial problems/difficulties</i>
.61	<i>Death of a close friend</i>
.59	Surviving a disaster
.59	Becoming a single parent
.56	Assuming responsibility for a sick or elderly loved one
.56	Loss or major reduction in health insurance/benefits
.56	<i>Self/close family member being arrested for violating the law</i>
.53	Major disagreement over child support/custody/visitation
.53	Experiencing/involved in a car accident
.53	Being disciplined at work/demoted
.51	Dealing with an unwanted pregnancy
.50	Adult Child moving in with parent/parent moving in with adult child
.49	Child develops behavioural or learning problems
.48	Experiencing employment discrimination/sexual harassment
.47	Attempting to modify addictive behaviour of self
.46	Discover/attempt to modify addictive behaviour of close family member
.45	Employer reorganising/downsizing
.44	Dealing with infertility/miscarriage
.43	<i>Getting married/remarried</i>
.43	<i>Changing employers/careers</i>
.42	Failure to obtain/qualify for a mortgage
.41	<i>Pregnancy of self/spouse</i>
.39	Experiencing discrimination/harassment outside the workplace
.39	Release from gaol
.38	Spouse/mate begins/ceases work outside home
.37	Major disagreement with boss or co-worker
.35	<i>Change in residence</i>
.34	Finding appropriate child care/day care

⁷ The highlighted and italicised life events are in the HILDA panel data waves 2 to 6.

Appendix C: The Big Five Personality Traits

The thirty-six items tapping personality in the HILDA are based on Saucier's (1994) edited version of Goldberg's (1990) Big-Five personality factors. These factors are: 1) agreeableness; 2) extraversion; 3) emotional stability; 4) conscientiousness, and; 5) openness to experience. Openness refers to the extent to which people are sensitive, flexible, creative or curious. Low scored individuals tend to be more resistant to change and less open to new ideas, they are more fixed in their ways. Agreeableness refers to traits where we are courteous, good-natured, kind and considerate of others; this is a trait that develops trust. People with low agreeableness tend to be uncooperative, short-tempered and irritable; they are hard to deal with. Conscientiousness refers to people who are careful, dependable and self-disciplined; they have a will to achieve. Low conscientiousness tends to predict carelessness, disorganisation and sloppy work. Emotional stability and extraversion are the two traits that are most considered to impact on happiness (Costa & McCrae, 1980; Diener, Sandvik, Pavot, & Fujita, 1992; Pavot, Diener, & Fujita, 1990; Sahoo, Sahoo, & Harichandan, 2005). Individuals exhibiting a low level of emotional stability (high in neuroticism) suffer from negative affect and dissatisfaction while those high in extraversion exhibit positive affect, satisfaction, and higher levels of happiness (Costa & McCrae, 1980; Furnham & Petrides, 2003). Costa & McCrae (1992) note that our personality traits, relative to others, can change over time (Figures 3a to 3e).

Wave 5 of the HILDA (HILDA, 2008b, p. 10) measured personality traits on a seven-point scale and the five trait factors are composed by taking the average of the items. The higher the score from the items in Table 4, the better that personality trait describes the respondent.

- Extroversion – talkative, bashful (reversed), quiet (reversed), shy (reversed), lively, and extroverted.
- Agreeableness - sympathetic, kind, cooperative, and warm.
- Conscientiousness - orderly, systematic, inefficient (reversed), sloppy (reversed), disorganised (reversed), and efficient.
- Emotional stability - envious (reversed), moody (reversed), touchy (reversed), jealous (reversed), temperamental (reversed), and fretful (reversed).

- Openness to experience - deep, philosophical, creative, intellectual, complex, imaginative.

Table 4: The HILDA personality questionnaire (Cheng & Furnham, ; HILDA, 2008a)

B19 How well do the following words describe you? For each word, cross one box to indicate how well that word describes you. There are no right or wrong answers.

(Cross one box for each word.)

Does not describe me at all

1 2 3 4 5 6 7

Describes me very well

1 2 3 4 5 6 7

talkative	jealous
sympathetic	intellectual
orderly	extroverted
envious	cold
deep	disorganised
withdrawn	temperamental
harsh	complex
systematic	shy
moody	warm
philosophical	efficient
bashful	fretful
kind	imaginative
inefficient	enthusiastic
touchy	selfish
creative	careless
quiet	calm
cooperative	traditional
sloppy	lively

HILDA results (Figures 2a to 2e) show very small personality trait changes. On average, Australians become: more agreeable (+2.4%); less extraverted (-1.6%); more emotionally stable (+7.9%); more conscientious (+5.9%), and: less open (-5.2%) to changes over their lifetime.

Figures 3a to 3d: Change in personality factors over time for Australians aged 15 to 84; scale is 1 to 7.

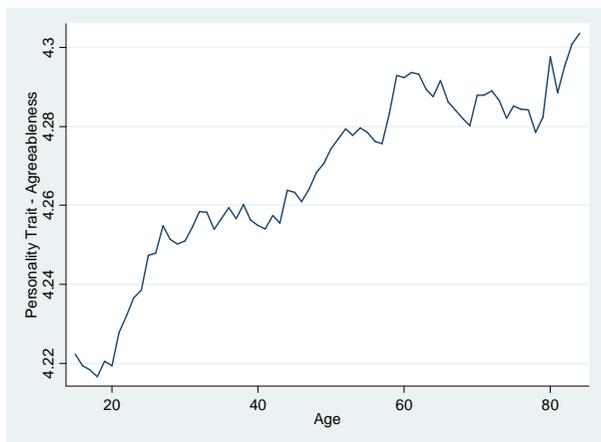


Figure 3a: Agreeableness by Age

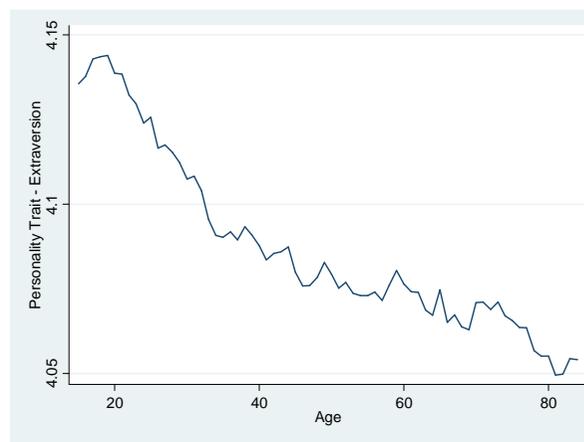


Figure 3b: Extraversion by Age

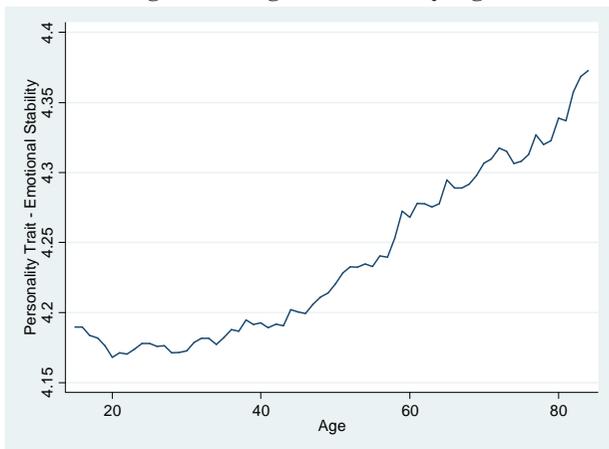


Figure 3c: Emotional Stability by Age

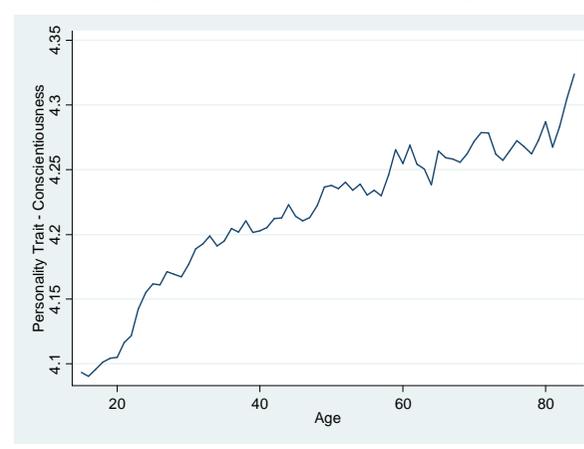


Figure 3d: Conscientiousness by Age

Figure 3e: Change in personality over time for Australians aged 15 to 84

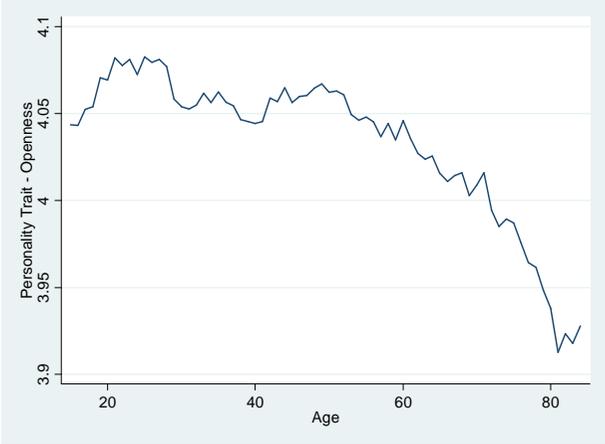


Figure 3e: Openness by Age

Appendix D: Descriptive Statistics and Regression Results for the Aggregate Model of Happiness

Table 5: Descriptive statistics for the aggregate variables used in models (1) to (6); $N = 70$

Variable	Mean	s.d.	Min	Max
Average overall life satisfaction by age (self-assessed on a scale of 0 to 10)	8.041	.317	7.646	8.556
Stress/1000 (sum of life events at each age)	.531	.248	.076	.836
Positive_Stress/1000 (average sum of positive life events at each age)	.315	.130	.049	.495
Negative_Stress/1000 (average sum of negative life events at each age)	.216	.123	.026	.417
Average of Personality Traits by Age (self-assessed on a scale of 1 to 7)				
agreeableness	4.275	.037	4.199	4.402
extraversion	4.082	.030	4.025	4.164
emotional stability	4.254	.082	4.132	4.519
conscientiousness	4.228	.059	4.084	4.366
openness	4.030	.050	3.842	4.099
Indirect effect of Personality Traits & Stress/1000				
agreeableness * stress	2.310	1.024	.396	3.555
extraversion * stress	2.221	.997	.373	3.419
emotional stability * stress	2.284	.1	.402	3.491
conscientiousness * stress	2.277	1.001	.398	3.506
openness * stress	2.197	.987	.361	3.391

Table 6: OLS regressions results for nested Aggregate Models of Happiness for Australians aged 15 to 84; N = 70

Variable:	Stress (2)		Stress Valency (3)		Stress + Direct Personality (4)		The Aggregate Model of Happiness Stress + Direct Personality + Indirect Stress*Personality (5)	
	coefficient	t-value	coefficient	t-value	coefficient	t-value	coefficient	t-value
Stress/1000	-1.18	(17.21)			-1.54	(10.91)	-0.68	(2.54)
Positive_Stress/1000			-1.76	(5.15)				
Negative_Stress/1000			-.572	(1.58)				
Average Personality								
Agreeableness					-0.21	(0.29)	-0.55	(1.07)
Extraversion					3.84	(5.62)	1.62	(2.64)
Emotional Stability					-.074	(1.03)	-0.17	(0.34)
Conscientiousness					-1.40	(2.22)	0.004	(0.01)
Openness/Intellect					-1.53	(2.43)	-0.39	(0.73)
Stress * Personality								
Agreeableness * Stress							4.15	(0.95)
Extraversion* Stress							10.43	(5.71)
Emotional Stability * Stress							0.44	(0.22)
Conscientiousness * Stress							1.83	(0.79)
Openness/Intellect * Stress							-8.65	(5.17)
constant	8.67	(215.43)	8.73	(177.83)	9.35	(2.54)	6.63	(2.42)
R ²	0.81		0.82		0.88		0.95	

Tables 7a & 7b: OLS regressions for eleven important life events; N = 70

Variable:	Model (2)		Model (2)		Model (2)	
	coefficient	t-value	coefficient	t-value	coefficient	t-value
personal injury	-0.014	(6.16)	-0.011	(6.96)	-0.010	(6.87)
just separated			-0.012	(9.39)	-0.008	(2.56)
just reconciled					-0.011	(1.07)
victim of violence						
worsening finances						
constant	8.76	(73.15)	8.38	(110.87)	8.83	(110.14)
R²	0.36		0.72		0.73	

Variable:	Model (2)		Model (2)		Model (2)	
	coefficient	t-value	coefficient	t-value	coefficient	t-value
personal injury	-0.011	(8.92)	-0.005	(3.75)	-0.001	(0.61)
just separated	-0.017	(5.97)	-0.012	(4.44)	-0.008	(2.46)
just reconciled	-0.007	(0.88)	-0.004	(0.57)	-0.001	(0.08)
victim of violence	0.018	(6.58)	0.014	(5.49)	0.009	(3.77)
worsening finances			-0.015	(5.53)	-0.009	(3.36)
improved finances					-0.034	(5.02)
fired from job					0.001	(1.18)
death of a spouse/child					0.007	(1.20)
just married					-0.007	(2.03)
just pregnant					-0.003	(0.69)
birth of child					0.005	(0.81)
constant	8.83	(141.10)	8.67	(145.70)	8.55	(147.7)
R²	0.84		0.88		0.94	

Appendix E: Results for the Model of Individual Level of Happiness

Table 8: The determinants of Life Satisfaction for Australians; Pooled OLS regression results for individuals in the HILDA; N = 55,177⁸

Variable:	Age		Age + Age ²		+ Demographics		+ Life Events	
	coefficient	t-value	coefficient	t-value	coefficient	t-value	coefficient	t-value
age	.0080	22.24	-.0451	26.01	-.0478	22.81	-.0450	21.33
age*age			.0005	31.29	.0007	31.05	.0006	29.32
ln (weekly household income)					.0158	5.70	.0114	4.13
pension Income (\$)					-.0001	2.30	-.0001	1.72
female					.0853	7.16	.0857	7.24
education years					-.0622	17.99	-.0616	17.85
married					.1620	6.76	.1148	4.73
separated					-.6360	16.59	-.4891	12.50
never married					-.2031	8.36	-.1701	6.91
divorced					-.2288	7.56	-.2128	7.06
widowed					-.1641	4.24	-.1687	4.35
employed					-.1323	7.45	-.0881	5.20
unemployed					-.3826	11.12	-.2706	7.85
disability					-.0798	5.07	-.0591	3.77
health					.5140	72.02	.4923	68.89
health a year ago					.1252	13.98	.1233	13.85
spouse/child death							-.2995	4.01
death of a relative							.0184	0.77
personal injury							-.1268	4.62
jailing of self							.0379	0.23
injury to a family member							-.0876	4.03
property crime victim							-.2560	7.08
victim of violence							-.5945	9.20
just separated							-.5987	12.40
just reconciled							-.1893	2.20
fired from job							-.2474	4.46
worsening finances							-1.2115	21.54
death of friend							.0938	3.04
friend jailed							.0880	0.97
just married							.3015	3.48
start new job							-.1504	3.55
just pregnant							.3192	3.93
moving house							.0411	0.89
improved finances							.5446	5.47
promoted at work							-.0497	0.68
birth of child							.2479	2.09
just retired							.7762	5.49
constant	7.5938	451.84	8.6336	232.26	7.2077	102.42	7.2998	102.49
R ²	0.01		0.03		0.17		0.19	

⁸ These pooled OLS regression results are for Australians aged 15 to 84 in the HILDA panel data waves 2 to 6 for the period 2002 to 2006.

Table 9: The determinants of Life Satisfaction for Australians; Fixed-effect regression results for individuals in the balanced HILDA panel; N = 55,177⁹

Variable:	Age		Age + Age ²		+ Demographics		+ Life Events	
	coefficient	t-value	coefficient	t-value	coefficient	t-value	coefficient	t-value
age	-.0233	7.16	-.0488	5.30	-.0501	5.09	-.0450	4.55
age*age			.0003	2.96	.0004	4.18	.0004	3.63
ln (weekly household income)					.0115	3.13	.0094	2.58
pension Income					-.0001	1.45	-.0001	1.17
female								
education years					-.0310	2.01	-.0362	2.35
married					-.0501	1.06	-.1217	2.37
separated					-.6000	9.02	-.4815	6.96
never married					-.2228	5.68	-.1304	3.30
divorced					-.3025	4.36	-.2922	4.17
widowed					-.6463	7.19	-.6206	6.68
employed					-.0095	0.42	-.0027	0.12
unemployed					-.1840	5.30	-.1571	4.52
disability					-.0255	1.55	-.0182	1.11
health					.2479	25.84	.2394	24.99
health a year ago					.0890	10.36	.0844	9.81
spouse/child death							-.1721	2.45
death of a relative							-.0205	0.97
personal injury							-.0937	3.72
jailing of self							.0092	0.05
injury to a family member							-.0424	2.12
property crime victim							-.1507	4.59
victim of violence							-.2574	4.10
just separated							-.4554	9.98
just reconciled							-.0156	0.20
fired from job							.0276	0.55
worsening finances							-.6187	11.75
death of friend							.0366	1.29
friend jailed							.0138	0.15
just married							.2884	3.36
start new job							.0417	1.06
just pregnant							.2944	4.07
moving house							.2533	5.87
improved finances							.3299	3.74
promoted at work							.0497	0.728
birth of child							.3624	3.70
just retired							.0364	0.28
constant	7.5938	451.84	9.443	45.53	8.605	33.72	8.624	33.84
R ² (overall)	0.01		0.00		0.04		0.04	

⁹ These fixed-effect regression results are for Australians aged 15 to 84 in the HILDA panel data waves 2 to 6 for the period 2002 to 2006.