

What is the shadow price of crime and bereavement to well-being?

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Abstract

This paper addresses the question of when and to what degree individuals are affected by positive and negative changes in their lives. We look at a wide range of shocks, including financial, marital, and personal shocks, but we are particularly interested in the impact of the deaths of partners and the occurrence of crime. We trace the impact of these shocks on life satisfaction before they actually occur (the anticipation effect), the adaptation to the shocks after they occur (the adaptation effect) and the happiness characteristics of individuals who are subject to these shocks (the selection effect). With an eye on the amount of compensation that would need to be paid to victims of crime and to the partners of those that die unnecessarily (for instance due to negligence or in an accident), we then compute the money equivalent of each shock, finding that the average criminal event can be off-set by a windfall income gain of about 14,000 US, whilst the loss of a partner is the most expensive shock that would have to be off-set by a windfall income gain of about 200,000 US.

1 Introduction

There has been a recent spate of studies in the economic literature on happiness that look at the importance of life events for happiness, and in particular the phenomenon of adaptation to such events. A general survey of this issue can be found in Clark, Frijters and Shields (2008). We intend in this paper to extend that literature by using more detailed data on the timing of life events, i.e. we use information about the quarter of the event rather than the year of the event as is usual at the moment, and we then draw out the policy implications by calculating the income equivalent value of these life events for which we introduce a novel method.

The paper has two distinct parts. The first part introduces a general model of the effects that life events have on life satisfaction. We formally define anticipation effects,

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selection effects, and adaptation effects. We provide estimates of these effects using an Australian panel survey. This extends the theoretical and empirical literature that has so far been almost exclusively focussed on adaptation effects. Various theoretical studies for instance rationalise the existence of adaptation in an evolutionary context and explore its implications for utilitarian accounting - see Menzel et al. (2002), Graham and Oswald (2005), Rayo and Becker (2007), and Dolan and Kahneman (2008). The emerging empirical literature on the impact of life events on happiness has also mainly focussed on adaptation. Life events that have been studied include unemployment (Lucas et al., 2004; Clark, 2006), marriage and divorce (Lucas and Clark, 2006; Zimmerman and Easterlin, 2006; Oswald and Gardner, 2006); income (Di Tella et al., 2005); and disability (Oswald & Powdthavee, 2008). A recent study that does examine both anticipation and adaptation is Clark et al. (2008). Using data from the German Socio-Economic Panel (GSOEP), Clark et al. define six life events (unemployment, marriage, divorce, widowhood, birth of child, and layoff) by observing year-to-year changes in individuals' answers to survey questions. Estimates from fixed-effects regressions, estimated separately for each life event, show strong evidence of anticipation and adaptation effects.¹

A limitation of the existing empirical literature, however, is that the timing of life events is poorly measured, i.e. events are simply defined as occurring 'sometime in the last 12 months'. Another problem is that one life event is almost invariably related to a set of concurring life events. For instance, divorce is often accompanied by a negative income shock as well as a shock to housing arrangements, making it hard to draw causal inferences if one only focuses on one particular life event. By using high-quality data from the Australian HILDA survey, we can overcome both problems at the same time. HILDA asks individuals to detail the quarter in which a life event occurred, which allows us to estimate anticipation and adaptation effects pertaining to the quarter in which it occurred. This will be particularly useful for investigating events that people adapt to within a relatively short period. In addition, HILDA has a large array of questions that allow us to simultaneously look at many events that are correlated with each other, including shocks to the employment of an individual (fired/promoted), to their family life (births/deaths/divorce), and to their physical person (crime/health).

The second part of the paper aims to draw out the policy implications of this strand of the life satisfaction literature by assigning monetary values to life events. One important reason to do this is that it is often the case that life events are caused by the actions of outside agents. For instance, government decisions can force individuals to move. Also, policy decisions are done on the basis of trade-offs between the monetary costs of policy and their benefit to life satisfaction, most prominently in the area of health provision. Individuals can also incur life shocks due to the actions of non-government agents, such as when they are a victim of crime or when their partner dies in a car accident or due to medical negligence. In all such cases, one needs to be able to assign a monetary value to a

¹Using data from the GSEOP and employing fixed-effect regressions to assess adaptation, Di Tella et al. (2005) conclude that they "cannot reject the null hypothesis that people adapt totally to income after four years".

life event in order to decide on the correct level of monetary compensation or on the optimal decision in the case of trade-offs.

There is a large empirical literature on the evaluation of unpriced goods, such as life events, with studies traditionally using either hedonic price methods or contingent valuation methods. The hedonic price method determines a value for a life event by estimating the effect that its occurrence has on the market value of a related good. For example, Gibbons (2004) values crime by estimating the impact that crime has on property prices. The hedonic price method has been used to value injury (Hersch, 1998), illness (Sandy and Elliot, 2005), and changes in climate (Maddison and Bigano, 2003; Rehdanz, 2006), amongst many other applications. The contingent valuation method uses surveys to calculate the amount of money an individual is willing to pay or willing to accept for a change in circumstances.² This approach is most often used to value environmental and health policies (Hanemann, 1994; Diener et al., 1998).

We introduce the problem of a compensation scheme by setting up the formal dynamic programming problem the compensation scheme must solve. Because compensation takes place in a dynamic environment, there is a whole set of compensation schemes with the same discounted effect on life satisfaction equal to the discounted effect of particular life events. Amongst this set, we choose the most obvious ones, i.e. the windfall compensation scheme whereby one gives a one-off payment, and the permanent compensation scheme whereby one gives a fixed additional amount of income for the duration of someone's life.

We then add to the monetary valuation literature by introducing a new method for calculating the compensation scheme that takes a two-step approach. We first calculate the Discounted Life Satisfaction effect (DLS), including anticipation and adaptation, of each event including a positive financial event, yielding a ratio between the DLS of any particular event and a positive financial shock. We then estimate how much additional income a positive financial event is worth by comparing the additional income observed for people who report to have a positive financial shock relative to those who did not receive the positive shocks, which then gives us a measure of how much the non-financial events is worth.

This new method by-passes the known difficulties of correctly estimating the importance of income for life satisfaction (see Clark, Frijters, and Shields who survey the methodological problems of identifying an income effect).

We contrast this new approach to the most standard approach in the happiness literature to compensation schemes. This second valuation approach is based on changes in life satisfaction caused by the occurrence of life events and contrast it to the happiness effect of income. One simply estimates life satisfaction regressions that include life events and income, and then calculates the trade-off between the satisfaction effect of income and the satisfaction effect of the life event. This is the approach that has been taken in studies valuating disease (Ferrer-i-Carbonell and Van Praag, 2002; Groot et al., 2004), airport noise (Van Praag et al., 2005), informal care (Van Den Berg and Ferrer-i-Carbonell, 2007), bereavement (Oswald and Powdthavee, 2008) and social networks (Powdthavee, 2008).

²For discussions of contingent valuation, see Hausman (1993) and Carson et al. (2001).

It turns out that our new approach generates much lower shadow values of life-events than the traditional approach, which is logical because it recognises the fact that compensation has more than a momentary effect on life satisfaction.

The paper ends with conclusions.

2 Data

We use the first six waves of the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is a household-based longitudinal study that began in 2001 with 7,682 households and 19,914 individuals. Each year since, interviews have been conducted with all members of each household who are at least fifteen years old at the time of the interview. In these interviews, information is collected on labour force dynamics, education, income, family formation, health and other specialised topics.³

Life satisfaction is measured in HILDA annually using the response to the question

“All things considered, how satisfied are you with your life?”.

Respondents are told to

“pick a number between 0 and 10 to indicate how satisfied you are” and that “the more satisfied you are, the higher the number you should pick”.

The median and modal response to this question equals 8, and the distribution of responses is negatively skewed, with over three quarters choosing 7 or above.

The occurrence of life events are determined by responses in a section of HILDA’s self-completion questionnaire included in waves 2 to 5. Respondents are told

“We now would like you to think about major events that have happened in your life over the past 12 months. For each statement cross the YES box or the NO box to indicate whether each event happened during the past 12 months. If you answer “YES”, then also cross one box to indicate how long ago the event happened or started”.

Respondents are given 16 statements to evaluate; however, in this paper, we concentrate on the following 10:

1. Got married;
2. Separated from spouse or long-term partner;
3. Partner or I gave birth to, or adopted, a new child;
4. Serious personal injury or illness to self;

³HILDA is described in more detail in Watson and Wooden (2004).

5. Death of spouse or child;
6. Victim of a property crime (e.g. theft, housebreaking);
7. Fired or made redundant by an employer;
8. Major improvement in financial situation (e.g. won lottery, received an inheritance);
9. Major worsening in financial situation (e.g. went bankrupt);
10. Change of residence.

It is important to note that it is the use of these direct questions that allows us to determine the quarter in which a major life event occurred. Most other studies are unable to incorporate such information into their analyses, because the occurrences of life events are determined by observing year-to-year changes in individuals' answers to questions regarding their family and employment status.

The numbers of instances each life event occurs within our sample are displayed in the first column of Table 1. For each of these events we have a non-trivial number of occurrences, with changing residence the most prevalent event, and death of spouse or child the least prevalent event. Column 2 displays the mean number of life events experienced, conditional on having experienced a life event. For example, those individuals that have a major improvement in finances, experience on average 3.56 life events (including the financial improvement) within our time-frame. These figures range from 3.38 to 4.83, and demonstrate that individuals who experience one life event are likely to experience several others. The final five columns display the mean characteristics of individuals, conditional on having experienced a life event. They show that different types of individuals experience different types of life events, which makes it important to account for selection effects in our empirical models.

For our empirical analysis, dummy variables are created that represent the number of quarters prior to the first occurrence of a life event and the number of quarters after the last occurrence of a life event.⁴

⁴This approach allows us to include individuals who have experienced the same type of shock more than once. For example, within the span of our sample some individuals experience a major improvement in finances twice. An alternative approach for dealing with the second occurrence is to omit individuals from the sample once the second improvement occurs. This is effectively the approach taken by Clark, Diener et al. (2008). Instead, we estimate anticipation effects by examining life satisfaction prior to the first improvement and estimate adaptation effects by examining life satisfaction after the second improvement. We prefer this approach because it allows larger sample sizes; it effectively presumes that when the second shock occurs the adaptation to the first shock becomes complete.

3 Methodology

When considering the various determinants of life satisfaction, we have the following estimation equations in mind:

$$\begin{aligned}
 LS_{it} &= Z'_i \alpha^* + \sum_{s=t-T_1}^{t+T_2} X'_{is} \beta_s^* + u_{it} \\
 &= Z'_i \alpha^* + \sum_{s=t+T_1}^{t+T_2} X'_{is} \beta_s^* + X'_{it} \beta_t^* + \sum_{s=t-T_1}^{t-1} X'_{is} \beta_s^* + u_{it}
 \end{aligned} \tag{1}$$

and

$$\begin{aligned}
 LS_{it} &= \sum_{s=t-T_1}^{t+T_2} X'_{is} \beta_s + v_i + u_{it} \\
 &= \sum_{s=t+T_1}^{t+T_2} X'_{is} \beta_s + X'_{it} \beta_t + \sum_{s=t-T_1}^{t-1} X'_{is} \beta_s + v_i + u_{it}
 \end{aligned} \tag{2}$$

where LS_{it} is the life satisfaction of person i in period t ; Z_i is a vector of fixed individual characteristics, such as gender and education; X_{is} denotes a vector of shocks that occur at time s ; u_{it} is iid noise; and v_i is a fixed individual effect. The time periods s run in quarters. Hence the term $\sum_{s=t+T_1}^{t+T_2} X'_{is} \beta_s$ contains shocks that will occur in future quarters; $X'_{it} \beta_t$ contains the shocks occurring in the quarter before the interview (i.e. anywhere in the last 3 months); and $\sum_{s=t-T_1}^{t-1} X'_{is} \beta_s$ contains shocks that occurred in quarters preceding the current one.

In the second equation, one of the β_s has to be fixed because they are not all simultaneously identified. We take $\beta_{t+T_2} = 0$ as the natural normalisation (i.e. T_2 is so far into the future that we define it as having no effect on the present).

The difference between the first and the second equation is the individual fixed effect v_i which is only included in the second equation. The second equation is therefore more general than the first. In our empirical analyses, we will exploit the difference between the two equations in order to get at the question of the selectivity of the shocks. With these two equations in mind, we can define the following items of interest:

1. The anticipation effect of a shock. When we think of anticipation effects, we think of the importance of a shock for life satisfaction before it actually occurs, i.e. the effect of having a shock coming in the future. We can then formally define the total amount of anticipation as $\beta_{t+1} - \beta_{t+T_2}$, which is hence the effect of the shock the quarter before it happens minus the effect of a shock in the very far future. The anticipation path is given by $\{\beta_{t+T_2}, \beta_{t+T_2-1}, \dots, \beta_{t+1}\}$.
2. The adaptation effect after a shock. When we think of adaptation effects of a shock, we think of the decline in the satisfaction effect over time after the shock has occurred.

If we see the ‘full’ effect of a shock as the importance of the shock in the period it happens, i.e. β_t , and if we see the long-run effect of a shock as the effect still remaining long after it occurred, i.e. β_{t-T_1} , then we can define the adaptation effect after a shock as $\beta_{t-T_1} - \beta_t$. The adaptation path is given by $\{\beta_t, \beta_{t-1}, \dots, \beta_{t-T_1}\}$.

3. The selection effect of a shock. Here we think of the happiness characteristics of the type of person prone to get a shock, reflecting the idea that shocks do not happen randomly across the population but that some individuals are more prone to them than others. We can find this degree of selectivity by comparing the effect of a shock a long time before it occurs for the equation without fixed effects versus the equation with fixed effects, i.e. we can define the selection effect as $\beta_{t+T_2}^* - \beta_{t+T_2}$. Note that this is the same as the average of the v_i for all those who are subject to a shock, corrected for the known fixed factors Z_i . The interpretation of the selection effect is that it captures the average unobserved fixed characteristics of people who are subject to a specific shock.

4 Results

The matrix of estimated fixed effect coefficients $\{\hat{\beta}_{t+T_2}, \hat{\beta}_{t+T_2-1}, \dots, \hat{\beta}_{t-T_1}\}$ are shown in Table 2 and the matrix of estimated OLS coefficients $\{\hat{\beta}_{t+T_2}^*, \hat{\beta}_{t+T_2-1}^*, \dots, \hat{\beta}_{t-T_1}^*\}$ are shown in Table 3. As we can see, the coefficients of the fixed effects estimates are generally lower than those of the random effects estimates in Table 3. This is evidence of a significant degree of selection: bad things happen to those already unhappy and good things to those already happy, confirming a wide-spread belief in the literature that reverse causality is pervasive in life satisfaction (see Ferrer and Frijters 2004).

More importantly, when looking at the fixed-effect results, we see the strongest anticipation effects for the death of a relative and marriage: the death of a relative causes life satisfaction to be 0.477 lower two quarters before the event, whilst marriage causes life satisfaction to be 0.379 higher before the event. The events with the strongest momentary impact, i.e. β_t , are the worsening of finances (-0.546), death of a relative (-0.567), and marriage/separation (0.428 versus -0.493). In terms of adaptation effects, we see for all life events that the effect of an event 2 years afterwards is lower than the momentary effect, and that the remainder is not statistically different from zero for fired, marriage, birth, separation and changing residence.

Another striking aspect of the results is that there is clear evidence of asymmetry with regards to financial shocks: negative financial shocks are seen as about twice as bad as financial improvements are good. Also with regards to life itself there is an asymmetry: a birth of a new individual has a positive effect (0.241 in the first quarter) that is less than a half of the absolute effect of the death of a relative (-0.567 in the first quarter). This has a very immediate policy implication: unlike what naive utilitarianism would have one believe, it is not the case that one death and one birth cancel each other out in terms of effect on total social welfare. Preventing deaths is worth more than stimulating births. Interestingly,

there is no apparent asymmetry between the good and bad events related to relationships: the positive effect of marriage is of the same order of magnitude as the negative effect of separation.

4.1 Adaptation and Anticipation profiles

Table 2 has a large number of coefficients in it, many of which are insignificant due to a lack of data points. In order to get a stylised sense of these coefficients, we have produced smoothed graphs of these estimated coefficients in Figures 1 and 2. Each graph has two lines. The dashed line shows the coefficients of the fixed-effects estimate, with the effect in the 8 quarters before the events defined as zero. The profile of these dotted lines before the quarter of the event is the anticipation profile, which in the case of negative shocks is always negative and in the case of positive shocks is always positive. This gives tacit evidence to the notion that individuals do actively anticipate good and bad events. This in turn implies that regressions based on the effect of a life event in the year of occurrence (which implicitly defines the effect as the change in life satisfaction between last year and this year) would grossly underestimate the importance of life shocks.

Similarly, the profile after the quarter of the event shows the adaptation effect, which in all cases tends to dissipate the momentary shock, supporting the general theory that individuals adapt to most things to a considerable degree. For most events, the effect of a shock after 8 quarters has passed is about zero.

The numerical estimates of the anticipation, adaptation and selection effects are shown in Table ???. This table shows that anticipation is greatest for highly predictable events such as birth and marriage, and also for worsening financial shocks. Presumably individuals can see a demotion or a dismissal at work coming for a long time. Adaptation is strongest for marriage, separation and, again, financial shocks. Individuals seem to get over these things, although our data of course does not detail how they get over these things. It might well be the case for instance that individuals get over separation by finding a new partner. Selection effects are big and important, making it clear that cross-sections are uninformative about the causal effect of life events. Putting it bluntly, separation and negative financial shocks happen to those with an already miserable general disposition.

5 Part 2: valuing Life Events

5.1 The dynamic problem and two solutions to it

In this section we estimate the income required to compensate for the occurrence of certain life events. The studies we reviewed in the introduction use either revealed preference methods or direct stated preference methods to estimate the compensating income. Our method is based on estimating the amount of income an individual should receive after the occurrence of a life event, such that their discounted life satisfaction with the compensation is equivalent to the discounted life satisfaction if the life event did not occur. We have the following programming problem:

$$\sum_{s=0}^{T_i} (1 - \rho)^{s-t} LS_{it}(\text{no life event}) = \sum_{s=0}^T (1 - \rho)^{s-t} LS_{it}(\text{life event \& compensation})$$

with ρ a discount rate for future years, t the period in which the life event takes place, and $T_i - t$ the number of years that individual i still has to live. Note how one inevitably gets involved in the issue of discounting when one considers compensation to effects that are distributed over time.

There are many different compensation schemes that would solve this programming problem. We focus on schemes in which the individual receives compensation starting in the same period that the life event occurs. In other words, if an individual has a life event in period t , we ask how much additional income they must be given as a one-off or permanently in order to have the same discounted happiness as someone to whom the life event did not occur, where discounted happiness includes both adaptation and anticipation effects.

To determine the amount of compensating income we use two different approaches, which we describe and contrast briefly before giving a full account. In the first approach, we compare the discounted life satisfaction (*DLS*) effects from the life event ‘major improvement in finances’, with the discounted life satisfaction effects from the life events we wish to value (such as ‘death of spouse or child’). What we then essentially do is look at how many ‘major improvements in finances’ are necessary to off-set another life-change, after which we put a monetary figure on how much money is involved with a ‘major improvement in finances’ and hence with all other life-events.

The second basic approach takes income as being a separate variable from life events, re-estimate the models with income as a separate variable and then calculates the trade-offs. The second approach is more standard but has two major drawbacks. One is that income is seen as something separate from life-events, i.e. its changes are not itself subject to anticipation and adaptation. A more important and fundamental problem with looking at the coefficient on income is that it is hard to identify. Observed changes in income, which are in the data often driven by changes in life circumstances (moving, separating, being promoted, changes in the amount of subsidies and welfare received due to changes in family composition) are then all treated as one homogenous change in income. Additionally to this, it is the case that the timing of income changes is not very precise in the data (including our data), and that one from a theoretical point of view would want to measure consumption rather than income. All these problems can be seen as a form of measurement error in income changes, leading us to expect that income coefficients are grossly under-estimated in life-satisfaction regressions which in turn makes us expect the compensating income to be much greater in the second approach than in the first approach.

5.2 Discounted Life Satisfaction

We now describe the first approach in greater detail. The ratio of life satisfaction effects discounted back to 8 quarters before the period t event (so that anticipation effects are

captured) equals:

$$\frac{DLS(\text{life event})}{DLS(\text{finance improvement})} = \frac{(1-\rho)\beta_{t+7} + \dots + (1-\rho)^{14}\beta_{t-7} + (1-\rho)^{15} \frac{(1-(1-\rho)^{T_i-t-8})\beta_{t-8}}{\rho}}{(1-\rho)\alpha_{t+7} + \dots + (1-\rho)^{14}\alpha_{t-7} + (1-\rho)^{15} \frac{(1-(1-\rho)^{T_i-t-8})\alpha_{t-8}}{\rho}}$$

where $\{\alpha_{t+7}, \alpha_{t+6}, \dots, \alpha_{t-8}\}$ are the life satisfaction effects from a ‘major improvement in finances’ and $\{\beta_{t+7}, \beta_{t+6}, \dots, \beta_{t-8}\}$ are the life satisfaction effects from the life event under evaluation. The last terms of the denominator and the numerator capture the effect of the life events and the compensation scheme on the ‘rest of life’, which presumes that β_{t-8} and α_{t-8} reflect persistent effects. The estimated life satisfaction effects come from the fixed effect regression specified in equation 2 and are reported in Table 2. We do the calculations both for an annual discount rate ρ of 5 percent and of 10 per cent.

To convert these DLS ratios to dollar values we require an estimate of the income change that corresponds to the reporting of a ‘major improvement in finances’. Individuals will have different reasons for reporting a financial improvement, some of which may not even correspond to an increase in income, and some corresponding to income increases spread out over many years.

To estimate the income gain associated with an improvement in finances, we use the mean windfall income change of individuals who report a financial improvement and a positive windfall income. This corresponds to 591 observations out of the 1255 observations of positive improvements in finances. Windfall income consists of inheritance, bequests, redundancy/severance payments, parental transfers, payments from non-household members and other irregular sources of payments. Receipt of a windfall income is an important reason why many individuals report a financial improvement: the proportion of such individuals reporting a positive windfall income equals 0.43, whereas the proportion of all other individuals reporting a positive windfall income equals 0.15. This mean value of the windfall income is about 120,000 AUS, or close to 100,000 US\$.

The second approach we take can be described as the ‘classic’ approach to valuating any annuity by means of stated preferences. In the second approach used to determine the amount of compensating income, we estimate the following regression:

$$LS_{it} = \delta y_{it} + \sum_{s=t-T_1}^{t+T_2} X'_{is} \beta_s + v_i + u_{it}$$

where y_{it} equals the log household income of individual i in period t , and all other terms are defined as above. The estimated log household income coefficient from this model equals 0.056 and has a standard deviation of 0.010. In this specification, the effect of a permanent income shock on life satisfaction equals δ in all periods following the shock. Therefore, the permanent log income change Δy required to compensate for the life event equals:

$$\Delta y = \frac{(1-\rho)\beta_{t+7} + \dots + (1-\rho)^{14}\beta_{t-7} + (1-\rho)^{15} \frac{(1-(1-\rho)^{T_i-t-8})\beta_{t-8}}{\rho}}{(1-\rho)^8 \frac{(1-(1-\rho)^{T_i-t})\delta}{\rho}}$$

The absolute value of the income change will depend on the individual's initial income level, with wealthier individuals receiving higher absolute compensation. For this reason we present compensating income values for mean household income and median household income.

5.3 Results

The results for two compensation methodologies are reported in Table 5, where the top half relates to a discount rate of 5% and the bottom half to a discount rate of 10%.⁵ The first column in the top half shows the *DLS* ratios of each event relative to that of the improvement in finances. The largest *DLS* ratio is for the life event 'death of a spouse or child' and equals -1.56. This estimate indicates that the negative discounted life satisfaction effect from the death of a spouse or child is 1.56 times larger than the positive discounted life satisfaction effect from a major improvement in finances.

The second column of Table 5 shows the one-off windfall needed to compensate for the life event under consideration. This one-off windfall is negative for positive events and positive for negative events. Since the mean value of a windfall-related positive improvement in finances is about 120,000 Australian dollars (roughly 100,000 US\$), the value of each non-financial event is the *DLS* ratio times this value. This is highest for the death of a spouse or relative (176,000) and lowest for being fired, which only has an equivalent effect of 6,000. One of the reasons for this low value is that the effect of being fired is now net of any other associated life shock, such as a negative income shock: it is the pure 'emotional cost' of being fired.

The compensatory income needed for marriage and birth are negative, because they are positive events, and are both worth around 17,000 AUS. Somewhat surprisingly, the most positive shock is moving, worth around 53,000 AUS. The majority of this effect is long-run due to the fact that the effect of moving does not seem to wear off in our sample. Even though the short-run effect of moving is quite low, its discounted long-run effect is very high.

The third and fourth column contrast these values with the discounted value of the permanent change in income needed using the classic valuation method, evaluated at the mean and median income. These values are much larger, i.e. in the order of 3 times as large, with the usual finding that compensation needed at the mean income is higher than at the median income because incomes are higher than median incomes.

If we now look at what a 10% discount rate begets, we see that the general picture is much the same. Higher discounting makes anticipation effects relatively more important and adaptation effects less important, which especially increases the relative importance of illness and being fired. The *DLS* ratio of illness rises from

Hence, as expected, we indeed see that the income compensation needed is far greater under this second, more standard, approach. We attribute this to identification issues with

⁵For all events where there was no significant long-run effect we presumed these to be zero outside the time-period of the sample (more than 8 periods).

the coefficient in income arising from the fact that income changes captures an amalgam of life changes each with different effects, and with unknown timing, leading to classic downward bias in the income coefficient due to measurement error.

6 Conclusions

In this paper we addressed the question of when and to what degree individuals are affected by positive and negative changes in their lives, using the Australian HILDA panel data set whose main advantage is that it has extensive information on many life events as well as detailed information on the timing of these life-events.

We looked at a wide range of shocks, including financial, marital, and personal shocks, but we were particularly interested in the impact of the deaths of partners and the occurrence of crime. We traced the impact of these shocks on life satisfaction before they actually occur and labelled this the ‘anticipation effect’. We estimated the adaptation to the shocks after they occur, labelled the ‘adaptation effect’. We also compared the happiness of those subject to a shock with those not subject to it, a difference labelled as the ‘selection effect’. We found strong evidence for significant adaptation, anticipation and selection effects, which has several important methodological implications: it means cross-sectional data cannot tell one about the importance of life-events because cross-sections cant deal with selection effects; it means that studies using highly aggregated measures of lags and leads (such as yearly lags and leads) will miss a lot of the action in terms of adaptation and anticipation and will grossly under-estimate the full effect of a life event.

The events of greatest importance in terms of happiness turned out to be the death of a relative, marriage, and negative financial shocks. Apart from the death of a relative and changes in housing, individuals were found to fully adapt to all life-events after 2 years. Individuals adapted only 75% to the death of a relative after 2 years.

We introduced a new method of valuing life-events by comparing them not directly to an income coefficient, but rather to positive financial changes, such as bequests and gifts. We essentially worked out how much any life-event was worth in terms of these ‘windfalls’ and how much a windfall meant in terms of money. This gave a much lower, and probably much more realistic, amount of compensation than the classic approach of having income coefficients whose estimates are hard to interpret in the context of life events because household income changes represent a great variety of different events (including adolescents moving out of the house and taking their salary with them, which is not quite the same as getting a pay cut even though its effect on household income is the same).

With an eye on the amount of compensation that would need to be paid to victims of crime and to the partners of those that die unnecessarily (for instance due to negligence or in an accident), we then computed the money equivalent of each shock. We found that the average criminal event can be off-set by a windfall income gain of about 14,000 US, whilst the loss of a partner is the most expensive shock that would have to be off-set by a windfall income gain of about 200,000 US.

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Figures

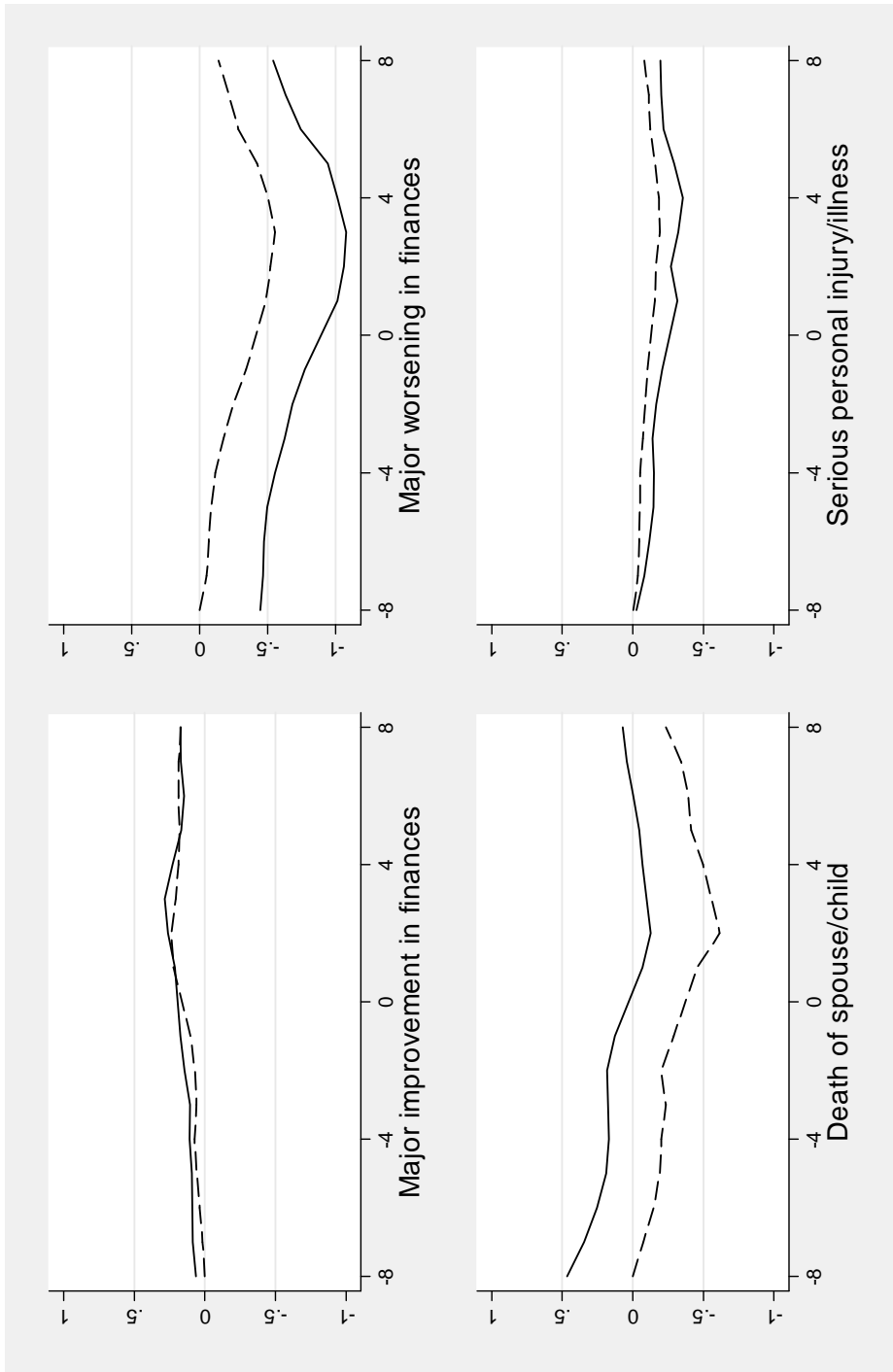


Figure 1 Estimated Effect of Life Event on Life Satisfaction by Quarter

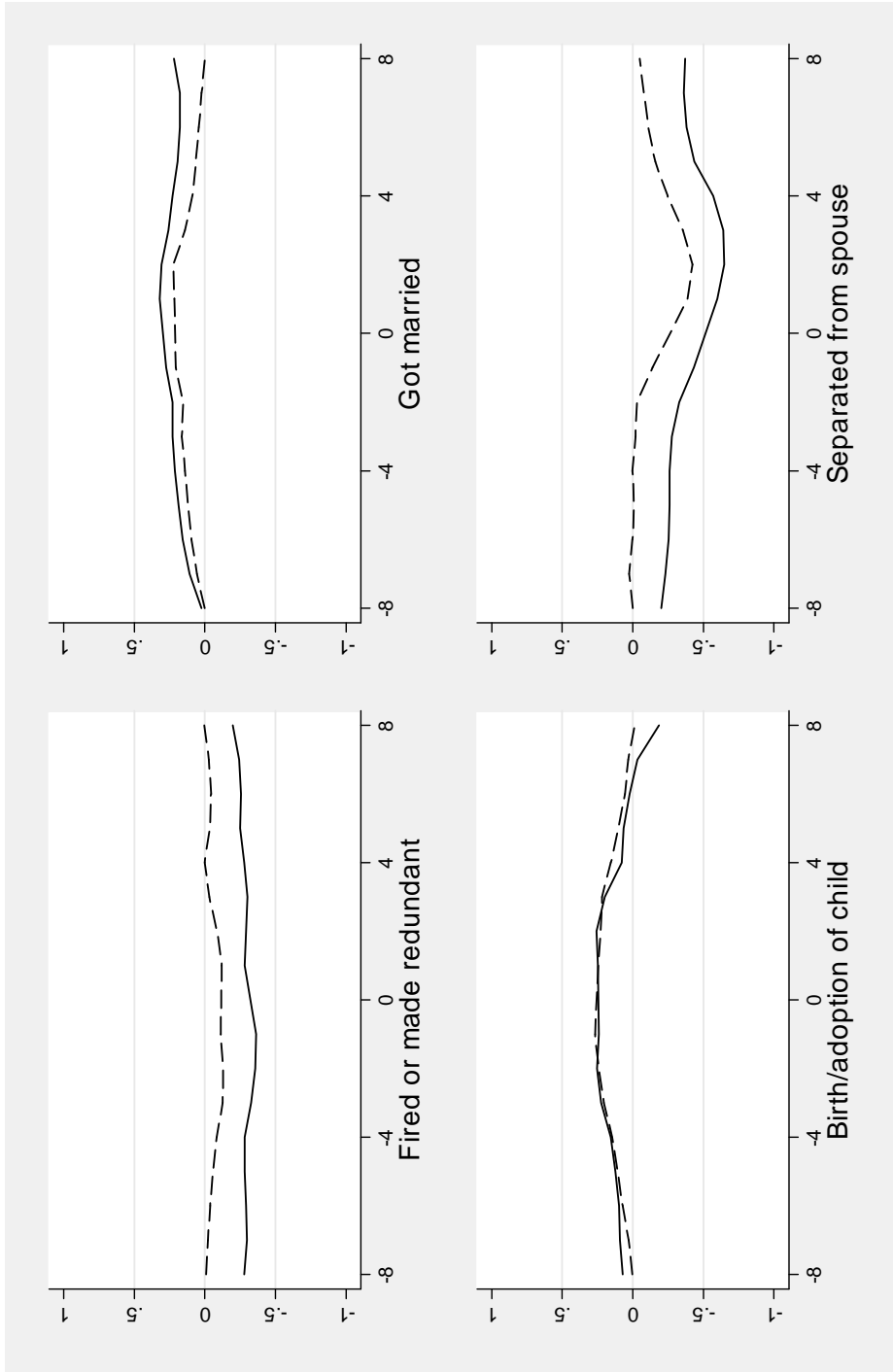


Figure 2 Estimated Effect of Life Event on Life Satisfaction by Quarter

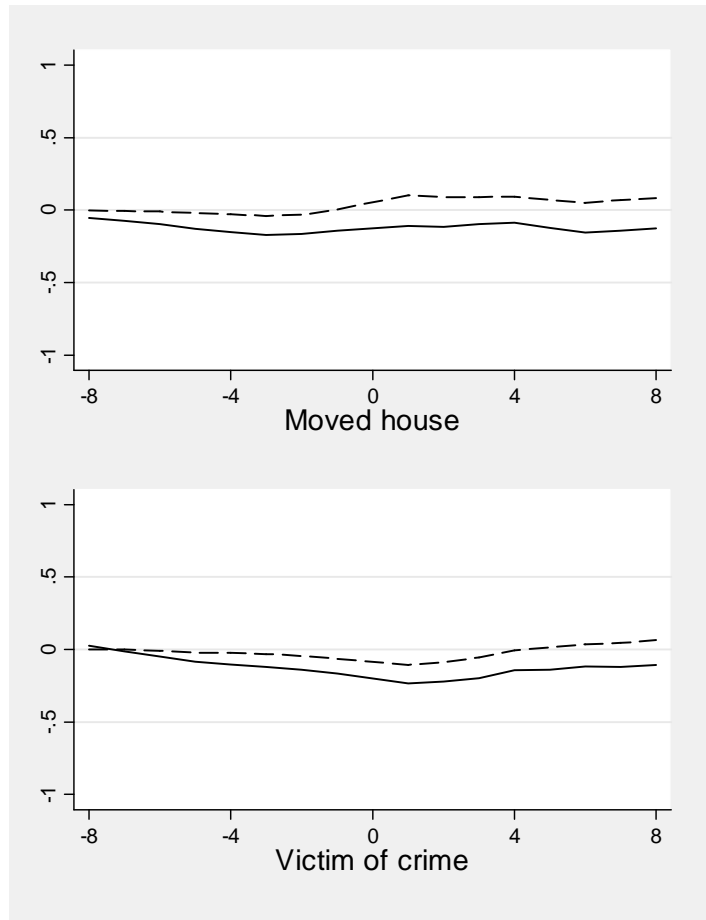


Figure 3 Estimated Effect of Life Event on Life Satisfaction by Quarter

Table 1 Descriptive Statistics by Life Events

| Life Events | Number of Occurrences | Means - Conditional on Occurrence of Life Event | | | | | |
|-----------------------|-----------------------|---|------|------|--------|----------|--------|
| | | Life events | Age | Male | Income | Employed | Degree |
| Finances Improve | 1368 | 3.56 | 42.0 | 0.51 | 80,758 | 0.74 | 0.27 |
| Finance Worsen | 1180 | 4.83 | 40.2 | 0.50 | 53,747 | 0.57 | 0.20 |
| Death of Spouse/Child | 346 | 3.38 | 55.5 | 0.42 | 43,315 | 0.38 | 0.11 |
| Illness | 3751 | 3.57 | 47.5 | 0.52 | 60,275 | 0.51 | 0.19 |
| Fired | 1344 | 4.15 | 35.2 | 0.61 | 68,375 | 0.65 | 0.20 |
| Marriage | 1112 | 3.85 | 35.5 | 0.50 | 76,258 | 0.79 | 0.30 |
| Birth | 1596 | 4.16 | 31.8 | 0.45 | 78,056 | 0.61 | 0.31 |
| Separation | 1817 | 4.48 | 33.8 | 0.45 | 57,703 | 0.71 | 0.17 |
| Change Residence | 8105 | 3.71 | 33.6 | 0.47 | 64,622 | 0.72 | 0.24 |
| Victim of Crime | 2474 | 3.86 | 38.1 | 0.52 | 72,406 | 0.72 | 0.24 |

Note: Figures for male, employed and degree are percentages. Income is total household income in 2001 prices.

Tables

Table 2 Fixed Effect Estimates of the Impact Life Events have on Life Satisfaction

| Quarters | Finances Improve | Finances Worsen | Death of relative | Illness | Fired | Marriage | Birth | Separation | Change residence | Victim of crime |
|----------|-------------------|--------------------|--------------------|--------------------|--------------------|-------------------|-------------------|--------------------|-------------------|--------------------|
| -7 | 0.033 (0.094) | -0.053 (0.106) | -0.036 (0.169) | -0.158* (0.060) | -0.235* (0.097) | 0.077 (0.114) | 0.097 (0.093) | 0.039 (0.093) | -0.062 (0.050) | -0.006 (0.075) |
| -6 | -0.005 (0.100) | -0.210 (0.116) | -0.290 (0.199) | -0.022 (0.067) | 0.216* (0.107) | 0.200 (0.119) | -0.102 (0.093) | 0.154 (0.107) | 0.070 (0.053) | 0.077 (0.087) |
| -5 | 0.065 (0.105) | -0.058 (0.116) | -0.098 (0.202) | 0.022 (0.068) | 0.035 (0.123) | 0.083 (0.089) | 0.201* (0.096) | 0.020 (0.088) | -0.036 (0.054) | -0.069 (0.102) |
| -4 | 0.084 (0.068) | -0.043 (0.083) | -0.306* (0.140) | -0.045 (0.045) | -0.092 (0.072) | 0.168 (0.102) | 0.177* (0.074) | -0.127 (0.072) | -0.016 (0.040) | -0.039 (0.050) |
| -3 | 0.096 (0.082) | -0.188* (0.092) | -0.083 (0.149) | -0.105* (0.054) | -0.218* (0.087) | 0.060 (0.101) | 0.144 (0.083) | 0.104 (0.080) | -0.071 (0.043) | 0.003 (0.064) |
| -2 | -0.028 (0.089) | -0.335* (0.101) | -0.477* (0.183) | -0.073 (0.061) | -0.084 (0.095) | 0.379* (0.107) | 0.280* (0.082) | -0.027 (0.092) | -0.026 (0.046) | -0.021 (0.074) |
| -1 | 0.063 (0.089) | -0.208* (0.100) | 0.033 (0.166) | -0.062 (0.058) | -0.064 (0.097) | 0.084 (0.080) | 0.321* (0.085) | -0.045 (0.077) | -0.051 (0.047) | -0.141 (0.081) |
| 1 | 0.256* (0.064) | -0.546* (0.078) | -0.567* (0.139) | -0.169* (0.041) | -0.110 (0.067) | 0.428* (0.094) | 0.241* (0.067) | -0.493* (0.065) | 0.119* (0.035) | -0.100* (0.047) |
| 2 | 0.236* (0.077) | -0.506* (0.084) | -0.556* (0.146) | -0.151* (0.049) | -0.171* (0.080) | 0.141 (0.096) | 0.212* (0.075) | -0.340* (0.074) | 0.089* (0.037) | -0.114 (0.059) |
| 3 | 0.230* (0.083) | -0.520* (0.091) | -0.803* (0.165) | -0.177* (0.054) | 0.077 (0.086) | 0.146 (0.102) | 0.241* (0.075) | -0.491* (0.083) | 0.077* (0.039) | -0.025 (0.067) |
| 4 | 0.149 (0.076) | -0.642* (0.085) | -0.362* (0.134) | -0.241* (0.047) | 0.002 (0.081) | 0.102 (0.071) | 0.190* (0.073) | -0.245* (0.063) | 0.137* (0.038) | -0.029 (0.066) |
| 5 | 0.190* (0.081) | -0.210* (0.093) | -0.540* (0.171) | -0.029 (0.053) | -0.061 (0.089) | -0.143 (0.133) | -0.01 (0.083) | 0.002 (0.085) | -0.037 (0.045) | 0.041 (0.057) |
| 6 | 0.195* (0.088) | -0.415* (0.103) | -0.353* (0.178) | -0.161* (0.061) | -0.082 (0.092) | 0.122 (0.110) | 0.108 (0.086) | -0.16 (0.092) | 0.093* (0.047) | 0.032 (0.071) |
| 7 | 0.207* (0.093) | -0.175 (0.106) | -0.467* (0.196) | -0.210* (0.067) | -0.021 (0.098) | 0.054 (0.117) | 0.041 (0.086) | -0.156 (0.102) | 0.058 (0.048) | 0.018 (0.077) |
| 8 | 0.169* (0.054) | -0.140* (0.064) | -0.231* (0.100) | -0.077* (0.039) | 0.005 (0.059) | 0.000 (0.063) | -0.014 (0.057) | -0.045 (0.054) | 0.085* (0.035) | 0.065 (0.045) |

Note: All coefficient estimates are from one model including all life events. Standard errors in parentheses. * represents significance at .05 level. The constant and year-dummy coefficients are omitted. Number of person-year observations equals 64,686.

Table 3 OLS Estimates of the Impact Life Events have on Life Satisfaction

| Quarters | Finances | | | Death of | | | Victim of | | | |
|----------|-------------------|--------------------|-------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| | Improve | Worsen | relative | Illness | Fired | Marriage | Birth | Separation | Moved | crime |
| -8 | 0.066 (0.044) | -0.443* (0.053) | 0.469* (0.081) | -0.022 (0.030) | -0.277* (0.047) | 0.021 (0.051) | 0.062 (0.048) | -0.204* (0.044) | -0.049 (0.028) | 0.027 (0.036) |
| -7 | 0.017 (0.109) | -0.507* (0.124) | 0.183 (0.203) | -0.167* (0.071) | -0.343* (0.112) | 0.223 (0.133) | 0.325* (0.107) | -0.177 (0.108) | -0.171* (0.060) | -0.059 (0.088) |
| -6 | 0.156 (0.117) | -0.585* (0.138) | 0.456 (0.235) | -0.026 (0.080) | -0.236 (0.124) | 0.109 (0.138) | -0.096 (0.107) | -0.286* (0.129) | -0.030 (0.063) | 0.052 (0.103) |
| -5 | 0.230 (0.127) | -0.335* (0.137) | 0.055 (0.247) | -0.209* (0.081) | -0.431* (0.150) | 0.232* (0.101) | 0.086 (0.112) | -0.348* (0.103) | -0.029 (0.065) | -0.138 (0.124) |
| -4 | 0.049 (0.078) | -0.481* (0.094) | 0.123 (0.164) | -0.160* (0.052) | -0.240* (0.082) | 0.165 (0.121) | 0.119 (0.086) | -0.255* (0.083) | -0.165* (0.045) | -0.121* (0.056) |
| -3 | 0.116 (0.089) | -0.743* (0.101) | 0.179 (0.169) | -0.137* (0.059) | -0.271* (0.094) | 0.207 (0.110) | 0.311* (0.089) | -0.184* (0.087) | -0.239* (0.047) | -0.099 (0.069) |
| -2 | 0.144 (0.099) | -0.729* (0.112) | 0.237 (0.205) | -0.056 (0.069) | -0.496* (0.104) | 0.332* (0.118) | 0.267* (0.089) | -0.391* (0.103) | -0.142* (0.051) | -0.111 (0.082) |
| -1 | 0.194 (0.101) | -0.486* (0.110) | 0.264 (0.185) | -0.244* (0.065) | -0.429* (0.110) | 0.203* (0.082) | 0.215* (0.093) | -0.386* (0.084) | -0.111* (0.052) | -0.206* (0.092) |
| 1 | 0.217* (0.070) | -1.089* (0.081) | -0.123 (0.160) | -0.340* (0.043) | -0.250* (0.072) | 0.466* (0.103) | 0.215* (0.070) | -0.666* (0.067) | -0.110* (0.032) | -0.228* (0.048) |
| 2 | 0.216* (0.079) | -1.121* (0.086) | -0.198 (0.160) | -0.231* (0.050) | -0.289* (0.080) | 0.310* (0.100) | 0.323* (0.075) | -0.562* (0.074) | -0.118* (0.033) | -0.268* (0.059) |
| 3 | 0.384* (0.088) | -0.922* (0.097) | -0.036 (0.180) | -0.262* (0.057) | -0.340* (0.089) | 0.165 (0.106) | 0.199* (0.076) | -0.776* (0.085) | -0.106* (0.035) | -0.13 (0.068) |
| 4 | 0.277* (0.083) | -1.201* (0.085) | -0.052 (0.139) | -0.471* (0.046) | -0.272* (0.084) | 0.261* (0.066) | 0.077 (0.074) | -0.597* (0.060) | -0.037 (0.035) | -0.202* (0.069) |
| 5 | 0.009 (0.093) | -0.730* (0.105) | -0.139 (0.204) | -0.127* (0.061) | -0.235* (0.103) | -0.092 (0.155) | -0.073 (0.094) | -0.18 (0.098) | -0.221* (0.049) | -0.08 (0.063) |
| 6 | 0.128 (0.097) | -0.969* (0.116) | -0.107 (0.202) | -0.219* (0.068) | -0.172 (0.100) | 0.274* (0.122) | 0.207* (0.091) | -0.330* (0.102) | -0.134* (0.049) | -0.181* (0.078) |
| 7 | 0.286* (0.103) | -0.432* (0.117) | 0.255 (0.225) | -0.258* (0.076) | -0.403* (0.107) | 0.084 (0.130) | -0.035 (0.093) | -0.539* (0.116) | -0.154* (0.050) | -0.100 (0.085) |
| 8 | 0.172* (0.040) | -0.547* (0.046) | 0.068 (0.074) | -0.192* (0.030) | -0.193* (0.042) | 0.221* (0.045) | -0.184* (0.041) | -0.367* (0.039) | -0.126* (0.024) | -0.107* (0.031) |

Note: All coefficient estimates are from one model including all life events. Standard errors in parentheses. * represents significance at .05 level. The constant and year-dummy coefficients are omitted. Number of person-year observations equals 64,686.

Table 4 Anticipation, Adaptation and Selection Effects

| | Immediate | Anticipation | Adaptation | Selection |
|--------------------------|-----------|-------------------------------|---------------------------|-----------------------------------|
| | β_t | $\beta_{t+1} - \beta_{t+T_2}$ | $\beta_{t-T_1} - \beta_t$ | $\beta_{t+T_2}^* - \beta_{t+T_2}$ |
| Finances improve | 0.256* | 0.063 | -0.087 | 0.066 |
| Finances worsen | -0.546* | -0.208* | 0.406* | -0.443* |
| Death of spouse or child | -0.567* | 0.033 | 0.336* | 0.469* |
| Illness or injury | -0.169* | -0.062 | 0.092* | -0.022 |
| Fired or made redundant | -0.110 | -0.064 | 0.115 | -0.277* |
| Marriage | 0.428* | 0.084 | -0.428* | 0.021 |
| Birth | 0.241* | 0.321* | -0.255* | 0.062 |
| Separation | -0.493* | -0.045 | 0.448* | -0.204* |
| Moved | 0.119* | -0.051 | -0.034 | -0.049 |
| Victim of crime | -0.100* | -0.141 | 0.165* | 0.027 |

Note: Figures used to calculate effects are taken directly from Tables 2 and 3. * represents significance at .05 level

Table 5 Compensating Income Values for Life Events

| Life Event | Income Shock | | Log Income | |
|-------------------|--------------|-------|---------------|-----------------|
| | -DLS Ratio | Value | Value at Mean | Value at Median |
| 5% Discount Rate | | | | |
| Death of relative | 1.56 | 178.3 | 411.1 | 346.9 |
| Illness/injury | 0.52 | 59.2 | 150.1 | 126.6 |
| Fired | 0.06 | 6.9 | 198.8 | 167.8 |
| Marriage | -0.15 | -16.5 | -278.3 | -234.8 |
| Birth | -0.17 | -18.3 | -318.9 | -269.1 |
| Separation | 0.14 | 14.9 | 335.8 | 283.3 |
| Moved | -0.46 | -53.0 | -134.5 | -113.5 |
| Victim of crime | 0.03 | 2.7 | 65.0 | 54.9 |
| 10% Discount Rate | | | | |
| Death of relative | 1.65 | 187.6 | 520.6 | 439.3 |
| Illness/injury | 0.55 | 62.2 | 188.8 | 159.3 |
| Fired | 0.09 | 10.2 | 209.7 | 176.9 |
| Marriage | -0.23 | -24.5 | -300.3 | -253.4 |
| Birth | -0.25 | -26.8 | -338.4 | -285.6 |
| Separation | 0.19 | 20.7 | 340.9 | 287.7 |
| Moved | -0.44 | -50.8 | -154.8 | -130.7 |
| Victim of crime | 0.04 | 4.1 | 69.4 | 58.6 |

Note: DLS denotes discounted life satisfaction. Dollar value figures in \$1,000 units.