

A SIMPLE STATISTICAL METHOD FOR MEASURING HOW LIFE EVENTS AFFECT HAPPINESS

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Background

Life events -- like illness, marriage, or unemployment -- have important effects on people. But there is no accepted way to measure the different sizes of these events upon human happiness and psychological health. By using happiness regression equations, economists have recently developed a method.

Methods

We estimate happiness regressions using large random samples of individuals. The relative coefficients of income and life events on happiness allow us to calculate a monetary 'compensating amount' for each kind of life event.

Results

The paper calculates the impact of different life events upon human well-being. Getting married, for instance, is calculated to bring each year the same amount of happiness, on average, as having an extra 70,000 pounds of income per annum. The psychic costs of losing a job greatly exceed those from the pure drop in income. Health is hugely important to happiness. Widowhood brings a degree of unhappiness that would take, on average, an extra 170,000 pounds per annum to offset. Well-being regressions also allow us to assess one of the oldest conjectures in social science -- that well-being depends not just on absolute things but inherently on comparisons with other people. We find evidence for comparison effects.

Conclusion

We believe that the new statistical method has many applications. In principle, it can be used to value any kind of event in life.

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KEY MESSAGES

Self-reported happiness or mental well-being scores can be used in a regression framework to calculate the value of different life events. For example, getting married is calculated to bring each year the same amount of happiness, on average, as having an extra 70,000 pounds of income per annum, and the psychic costs of losing a job greatly exceed the simple drop in income. The same framework can be used to address the question of whether well-being depends not just on absolute things but inherently on comparisons with other people. We have found some evidence that this is the case.

Medical Subject Headings: happiness; well-being; economics; income; health; marriage; unemployment.

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1. Introduction

Life has ups and downs. It would not be thought profound to say that someone who becomes unemployed or ill generally becomes less happy, or that someone who gets married or becomes richer generally becomes happier. But which is worse: divorce or unemployment? Which is better: a large pay rise or getting married? Until recently, there has been no way to assess the size of different life events upon psychological health and well-being.

In the last few years, economists have developed a way to measure, and to put a financial value upon, the happiness induced by different kinds of life events. To do so, they take random samples of individuals, record the mental well-being levels of the people in these samples at different points in time, study the incomes of and events that occurred to the individuals, and then use simple statistical methods (regression equations) to work out the implied consequences upon well-being of different occurrences in life. In this way, put loosely, economists use happiness surveys to average across individuals in order to understand a representative person.

Intuitively, what this method does is to face up to the fact that many factors shape human happiness. Relationships matter; health matters; money matters. Within an equation, these and other factors are allowed for at the same time, and their respective weights in well-being can then be calculated. The marginal impact of each life factor is assessed by reading off its coefficient in the well-being regression equation.

This paper is written for non-economists. It describes two aspects of recent economic and psychological research on subjective well-being measures. First, we show how regression analysis of subjective well-being scores can be used to construct a monetary valuation of life events. Loosely, this is done by dividing the estimated coefficient on income by the estimated coefficient on the life event being studied. The application of this method to both British and international data reveals that unemployment and ill-health, in particular, create enormous psychic costs for individuals -- in the sense that they can only be compensated by huge increases in income.

Second, we show that regression equations can be used to test the claim that happiness depends partly on comparisons (against, for instance, what one has relative to some reference level). In economics, such ideas can be found going back to the work of Adam Smith, and were famously revived by Veblen¹ and Duesenberry².

The subjective well-being literature is expanding fast. Such measures have been put to a variety of uses by economists -- in the analysis of sexual and racial disparities in labour market outcomes, the calculation of society's preferences over inflation and unemployment, the effect of income inequality and the value of democratic rights, amongst others.

One background question is whether it is possible to measure well-being at all using survey questions. Some sceptics argue: what can we learn by asking, say, if someone is satisfied with their life on a one to seven point scale? Maybe the people in data sets just argued with their partner, or have a hangover: these answers are not going to reveal anything of interest. Even worse, the extreme sceptics continue, different people may well understand the same satisfaction or happiness question

differently. Individual A may then say that she is happier than individual B, but not really “mean it”: the difference in their answers could be due to some difference in the way that the question is understood.

We argue that subjective well-being numbers are meaningful and amenable to statistical analysis. Psychologists have made recent advances here -- showing that those who say that they are happy actually smile more, and are more likely to be described as happy by their friends (see some of the references contained in the earlier review by Oswald³). Other research has considered the role of well-being measures in predicting observable future behaviours or outcomes. Amongst others, it has been shown that measures of subjective well-being predict:

- Length of life Palmore⁴
- Coronary heart disease Sales and House⁵
- Quitting a job Freeman⁶, Akerlof, Rose and Yellen⁷, Clark⁸
- Absenteeism Clegg⁹
- Counter- and non-productive work Mangione and Quinn¹⁰
- The duration of unemployment Clark¹¹

Finally, some of the research uses measures that are closer to being medically conventional, such as GHQ mental-strain scores.

The next section introduces the idea of regression analysis of subjective well-being measures, and shows how the estimated parameters provide a simple measure of the valuation of life events. Section 3 considers how this form of statistical analysis can be used to test for absolute vs. relative influences upon mental well-being. What binds these two sections together is their use of regression analysis. The last section, 4, summarises.

2. The valuation of life events using subjective well-being data

Think of a person who experiences good and bad events. Imagine, too, that the person enjoys money -- preferring more income to less income. In principle, then, it might be possible to calculate how much extra income would have to be given to the person to compensate exactly (neither too much nor too little) for a bad occurrence in life. That amount of cash can be thought of as a measure of the unpleasantness of the event. Equivalently, good events can be studied.

The monetary valuation of events can be determined by using an equation in which the dependent variable is mental well-being or happiness. This is a type of utility function. When estimated as a regression equation using actual data, the equation might take the form:

$$u = A + \beta_1 S_1 + \beta_2 S_2 + \dots + \gamma Y + \theta' \underline{X} + \varepsilon \quad (1)$$

where u is a measure of individual utility or happiness or well-being, A is a constant, Y is some measure of income, the S_i are dummy variables for various kinds of labour market and life events (such as whether in work and whether married or single), and \underline{X} is a vector of other influences. The \underline{X} vector is known, in practice, to include demographic variables, regional location, day-of-the-week effects, variables from childhood such as whether parents divorced, and so on. The estimated coefficients from equation (1) can be used to calculate the pleasantness or unpleasantness of the S_i events. Imagine that an individual changes from employment to unemployment

(respectively states S_1 and S_2 , say³). The compensating differential for this transition is the amount of extra money, or increment to Y , which would be required exactly to compensate the worker for being unemployed, i.e. to keep the worker at the same level of subjective well-being.

Think of a level curve of equation (1), that is, one for a given value of u . From equation (1), the cost of unemployment, for an individual starting with income Y_0 , can then be thought of algebraically as

$$\text{SPU} = (\beta_1 - \beta_2) / \gamma. \quad (2)$$

In other words, an unemployed individual with income of $Y_0 + \text{SPU}$ would have the same level of well-being as an employed individual with income of Y_0 . Thus SPU (the "shadow price" of unemployment, in economists' language) is a measure of the unpleasantness of unemployment. Its units are financial, such as pounds sterling.

This method generalises. It has been used by economists to calculate the "shadow wage" (the sum which compensates workers for an extra hour of work¹²), the happiness loss from being black rather than white¹³, the value of a lasting marriage¹⁴, and the valuation of aircraft noise around Schipol airport¹⁵.

Table 1 presents some valuations of life events using data from the first seven waves of the British Household Panel Survey (BHPS): see <http://www.iser.essex.ac.uk/bhps> for more details. Two measures of subjective well-being are used. The first is the GHQ-12 measure of mental strain (see Appendix A), but reversed so that higher scores indicate higher well-being. The second is a question on overall happiness that is part of the GHQ-12. Both the GHQ-12 score and the responses to the happiness question are ordinal, so that a score of 4 does

³ The omitted category with respect to labour force status in the above illustration would be the inactive: those

not indicate exactly twice as much well-being as a score of 2. Linear methods such as ordinary least squares (OLS) are therefore inapplicable, and Table 1 reports results from ordered probits (although OLS results are qualitatively similar). A positive estimated coefficient in an ordered probit equation implies that that variable shifts the probability mass to the right, which increases the probability that a person will report high well-being.

[TABLE 1 HERE]

Table 1 shows the estimated valuations of various life events, computed as shown in equation (2). A positive figure implies that an individual who moves from the first status to the second would need to receive that financial amount in order for their subjective well-being to be (just) unaffected by the transition in question. In other words, Table 1 tells us the value of the events that strike human beings. These are, of course, for the average individual. The regression method implicitly uses a best-fitting linear function and thus averages across the data points.

As with most regression analysis, the underlying assumption here is that a linear equation is a useful approximation to reality.

The largest valuation in these regressions comes from health. Someone whose self-reported health declines from excellent to good would require a payment of tens of thousands of pounds per month in order for the GHQ or happiness score to remain unchanged⁴. Unemployment (compared to employment) has a quantitatively smaller but still very large valuation. The vast majority of the well-being impact of

who neither work nor are unemployed.

⁴ This provides some quantitative support to the old adage "as long as you've got your health".

unemployment thus does not stem from the loss of wages (see also Clark and Oswald¹⁶, and Winkelmann and Winkelmann¹⁷). The main cost of job loss is psychological.

Marriage (compared to being single) is estimated to be worth about six thousand pounds a month, or in other words a little over 70,000 pounds per annum⁵. This is strikingly large. For instance, it is three times the average monthly household income in this sample. The cost of the end of a marriage seems to depend on how the breakdown occurs. Both widowhood (valued at approximately minus 170,000 pounds) and marital separation have high negative valuations, but the subjective well-being of the divorced is, in these data, not much lower than the well-being of the married, which implies only a small valuation. Some studies, however, have found divorced people have very low well-being.

One concern is individuals' unobservable heterogeneity. If people who marry were born happier than those who do not marry (as conjectured by Veenhoven¹⁸), then the subjective well-being gap between the married and single people may be a determinant of marriage, rather than a consequence of marriage. This is a technical problem. One route to a solution is to carry out the analysis in first-differences. This looks at the longitudinal change in individual subjective well-being when, say, the individual marries. The results using this approach turn out to be similar to those in Table 1.

3. Is well-being relative or absolute?

⁵ Blanchflower and Oswald (1999) find a similar figure of 60,000 pounds per annum using American GSS data.

This section takes a step further. It asks how happiness regression equations might be used to assess one of the oldest conjectures in social science – that well-being depends not just on absolute things but inherently on comparisons with other people.

Put differently, happiness may depend on the relative level of certain variables, rather than their absolute level. If we consider income, for example, we can think of the following utility or happiness functions:

Standard model: $u = W(y, \dots)$

Comparisons model: $u = W(y/y^*, \dots)$

The variable y^* here is what is sometimes called “comparison income” or “reference group income”. The central implication of comparison theory is that subjective well-being falls as those in the reference group earn more. This equation uses a ratio specification - y/y^* - but the comparison could be linear ($y-y^*$), or something more complicated.

It might be thought that the valuation method set out in earlier in this paper would be invalid if the comparisons model is true. But that is wrong. First, if the ‘comparison other’ against whom a man judges himself stays fixed (say, whatever good or bad happens to you your next door neighbour is still there), the technique described in the previous section goes through unchanged. Second, if the comparison level is itself endogenous, and thus moulded by circumstance, then a version of the earlier method is still correct. Its interpretation, however, then needs care. Because an explicit comparison variable y^* is not being held constant in the regressions, but is itself a function of life events, then what is effectively being

estimated is a reduced-form relationship between life events and well-being. Statistically that is not invalid; but it means, of course, that the exact transmission mechanism within the chain is not then uncovered; life events partly have their effect because they alter one's comparisons.

What have recent regression tests actually shown?

3.1 Income and subjective well-being

A number of studies, starting with Easterlin¹⁹, have used data at the country level to plot a country's average happiness against GNP per head (see also Hagerty and Veenhoven²⁰, Oswald³, and Veenhoven²¹). The resulting graphs typically show some evidence of a positive relationship, but not a strong one. In addition, the plot of well-being against prosperity does not look linear. Higher income is associated with higher happiness for poor countries, but the evidence is less strong among richer countries.

Through time, we see something similar. It is now known that happiness survey scores within a nation do not rise noticeably as that nation becomes wealthier (a discovery of Easterlin¹⁹, and recently updated in, for instance, Blanchflower and Oswald¹⁴). In other words, economic growth does not seem to buy happiness for the citizens of a country that is already rich.

The cross-section country-level evidence also suggests that the level of income, y , does not affect subjective well-being very strongly. However, if it is true that $W = W(y/y^*, \dots)$, then we would not expect to find a particularly strong relationship between \underline{W} and \underline{y} without having an idea of how y^* differs between individuals. This leads to the fundamental question: what determines the reference

income level y^* ? Who is in the reference group: against whom exactly do we compare ourselves? A number of concepts have been proposed:

- Peer group/people like me (same sex, age, education etc.), as in the research of the Leyden school (for example, van Praag and Kapteyn²², and Hagenaaars²³).
- Others in the same household.
- Myself in the past.
- Friends and neighbours.
- Others who work for the same firm.

Empirical research has addressed the first three, but has had little to say about the others, probably due to a lack of suitable data.

Some of our work, using the BHPS, has considered job satisfaction as a measure of well-being in the workplace. Job satisfaction in the survey is recorded on a one to seven scale, where one corresponds to "not satisfied at all with my job", seven corresponds to "completely satisfied", and the integers from two to six represent intermediate levels of satisfaction. The papers look for evidence of comparison effects, whereby job satisfaction depends not only on y , but on some measure of y^* as well. Empirically, the definitions of y^* have been as follows:

- The pay of "others like you", ie, with your educational and other personal characteristics²⁴.
- Partner's pay, and the pay of all other adults in the same household²⁵.
- The pay that you received in the same job one year ago²⁶.

Job satisfaction is shown to rise with own income, so that people like being paid a high salary, but to be lower when the value of y^* is higher. This is evidence consistent with the famous cartoon where an employee leans across the boss's desk and says "I was happy with my pay rise. But you went and ruined it by giving everyone else one too."

Intriguingly, we cannot statistically reject the hypothesis that a pay raise (of ten per cent, say) for everyone would leave no-one more satisfied. This seems consistent with the aggregate evidence that countries do not appear to feel more satisfied though the years as their real income goes up.

3.2 Unemployment and subjective well-being

An active research area in the analysis of well-being has been the effects of a person's labour market behaviour, and particularly whether he or she is unemployed. It has been known for a long time that the unemployed report significantly lower well-being scores than other labour force groups, and that losing your job matters far more than the associated lower income alone would imply. Recent work in economics has used large-scale datasets to address this question^{16, 27}. As far as is known, it holds in all western countries.

To show whether comparisons are important here also, we can look at the psychological impact of unemployment for two specific groups:

- Those who lived in high unemployment regions or high unemployment households, using British BHPS data and the GHQ-12 as a measure of subjective well-being;

- Those who have been unemployed more often in the past, using German GSOEP (see <http://www.diw.de/english/sop>) data, with life satisfaction as the well-being measure.

Multivariate regression techniques are again used. Well-being equations are estimated, using data on both the employed and the unemployed, of the following form:

$$w_i = \alpha + \beta_1 ue_i + \beta_2 ue^*_i + \beta_3 (ue_i \bullet ue^*_i) + \gamma' X + \varepsilon_i$$

where w_i is the well-being score of individual i , ue_i is a dummy variable showing whether the respondent is unemployed, and ue^*_i is the comparison unemployment rate. This latter variable is introduced both as a main effect and interacted with the individual's own unemployment status. Considering ue^* as regional unemployment, it may well be that higher regional unemployment reduces the well-being of those in employment, but increases the well-being of the unemployed. Jobless people may not blame themselves as much when they see many around them also out of work. We thus expect β_3 to have a positive coefficient: an individual's own unemployment has a smaller psychological impact when the individual is in a high unemployment region/household, or when the individual has been unemployed more often in the past.

Empirically, unemployment always has a strong and well-defined negative impact on well-being. However, this impact is mitigated by the unemployment of others and by one's own past unemployment: β_3 is positive and significant. In Great Britain, an unemployed man in a region with 20-25% unemployment would have the

same level of well-being as an average employed man elsewhere. In other results, an employed man in a household where all other adults work is estimated to have the same level of well-being as a jobless man in a household where all others are unemployed. Last, the psychological cost of current unemployment is estimated to be zero for a man who has been unemployed for 60% of the time over the past three years.

Much more needs to be done to understand adaptation and how human beings choose their 'comparison other'.

4. Conclusion

Economists have started to study happiness. They have developed a simple method for valuing life events. It relies on regression equations in which happiness or mental strain is a dependent variable. The method estimates that marriage brings approximately the same amount of happiness, on average, as having an extra 70,000 pounds of income per annum. Widowhood brings a degree of unhappiness that would take, on average, an extra 170,000 pounds per annum to offset. Physical health is shown to be one of the most important variables explaining human well-being. The psychic losses from unemployment are much larger than the purely financial ones, and so on. The technique described in this paper can be used to put a value -- positive or negative -- on almost any kind of event in life. We have described three or four examples.

It is possible that this method will become widely used in social science.

Appendix A

Table 1 uses a measure of mental stress known as a GHQ level (where GHQ stands for General Health Questionnaire). The twelve questions used to create a so-called GHQ-12 mental well-being measure for each person appear in the BHPS questionnaire as follows:

1. *Here are some questions regarding the way you have been feeling over the last few weeks. For each question please ring the number next to the answer that best suits the way you have felt.*

Have you recently....

a) *been able to concentrate on whatever you're doing ?*

<i>Better than usual</i>	<i>1</i>
<i>Same as usual</i>	<i>2</i>
<i>Less than usual</i>	<i>3</i>
<i>Much less than usual</i>	<i>4</i>

then

- b) *lost much sleep over worry ?*
- e) *felt constantly under strain ?*
- f) *felt you couldn't overcome your difficulties ?*
- i) *been feeling unhappy or depressed ?*
- j) *been losing confidence in yourself ?*
- k) *been thinking of yourself as a worthless person ?*

with the responses:

<i>Not at all</i>	<i>1</i>
<i>No more than usual</i>	<i>2</i>
<i>Rather more than usual</i>	<i>3</i>
<i>Much more than usual</i>	<i>4</i>

then

- c) *felt that you were playing a useful part in things ?*
- d) *felt capable of making decisions about things ?*
- g) *been able to enjoy your normal day-to-day activities ?*
- h) *been able to face up to problems ?*
- l) *been feeling reasonably happy, all things considered ?*

with the responses:

<i>More so than usual</i>	<i>1</i>
<i>About same as usual</i>	<i>2</i>
<i>Less so than usual</i>	<i>3</i>
<i>Much less than usual</i>	<i>4</i>

TABLE 1. Valuation of Life Events Using Well-being Ordered Probit Regression Equations.

British Household Panel Survey WAVES (1991 TO 1997) POOLED

GHQ-12 equation Happiness equation

Valuation of Life Events (£)

Employment to Unemployment	-15 000	-23 000
Single to Married	n.s.	6000
Married to Separated	-8000	-11 000
Married to Divorced	-1000	n.s.
Married to Widowed	-7000	-14 000
Health excellent to Health good	-10 000	-12 000
Health excellent to Health fair	-32 000	-41 000

Notes. These are the value of life events, expressed in pounds. They are monthly figures. Hence a move from employment to unemployment would have to be compensated, according to the first estimate in the first column, by a monthly payment of 15,000 pounds sterling.

n.s. = Not significantly different from zero.

The first column is derived from a well-being equation in which the dependent variable is the (negative of) a GHQ score. The second column is derived from a well-being equation in which the dependent variable is a reported happiness level.

Average monthly household income (in 1992 Pounds) over the whole sample is just under £2000.

At the time of writing the value of one pound sterling is approximately 1.5 US dollars.

The regressions use a sample of approximately 7500 individuals, sampled annually.

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