Laboratory Evidence for Emotional Externalities: An Essay in Honour of EJ Mishan

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Abstract

Professor EJ Mishan was a world expert on the idea of externalities. In this essay we provide evidence for the intuitive idea of ‘emotional externalities’. These might be viewed as psychological spillovers from the well-being of one person upon the well-being of another. A new form of laboratory experiment is implemented. ‘Happiness’ answers are elicited in the first few seconds of the experiment. Tragic life events -- like family illness and bereavement -- are then studied. The paper documents evidence consistent with a powerful caring-about-others effect. The paper’s results also suggest an approximate equivalence between life-satisfaction data and happiness data.

Keywords: subjective well-being, happiness, life satisfaction, priming, experiments, surveys

JEL codes: D03, C83, C91

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Statistical offices should incorporate questions to capture people's life evaluations, hedonic experiences and priorities ... All these aspects of subjective well-being (cognitive evaluations, positive affects and negative affects) should be measured separately to get a satisfactory appreciation of people's lives. Which of these aspects matters more, and for what purpose, is still an open question.
Stiglitz et al., Commission on the Measurement of Economic Performance and Social Progress, 2009.

1. Introduction

Are human beings subject to ôemotional externalitiesô in which the well-being of one person indirectly influences the well-being of another? This is a question about the classic notion of externalities (Mishan 1971). The informal idea of emotional spillovers seems intuitive, and intrinsically human, but can formal evidence be provided, and if so how large are such spillovers?

This important issue has been studied in work by researchers such as Bobinac, van Exel, Rutten, and Brouwer (2010). They use subjective well-being data to estimate what they call the caring-about-effect within families (they also estimate the well-being consequences of being a care-giver). Their paper concludes that there are significant externalities -- ôspilloversô as they describe them -- from one personôs health on to anotherôs happiness. Yet one complication in this type of inquiry is that individuals can be influenced by problems of ôprimingô, which is the technical term for what lawyers would call leading-the-witness. For example, *before answering* the key well-being question in the Bobinac et al (2010) work, the individuals in the survey were required to describe health problems in their family. That can be seen as a form of leading the witness.

By exploiting a new method, and a laboratory setting, we show in this paper that the Bobinac et al (2010) result is robust to such objections. Emotional externalities from othersô health do seem to be real and large. We draw on methods also used in Oswald et al (2015).

Since at least the paper by Theodossiou (1998), health economists have studied psychological well-being regression equations. There is growing research into the microeconomics of human happiness at both an applied and theoretical level.[1] The recent report -- by a distinguished group of economists -- of a commission into the measurement of economic performance and social progress (Stiglitz et al., 2009) put subjective well-being into the limelight as a possible supplement to traditional measures of development such as GDP. Oswald and Wu (2010) have recently shown a match between subjective and objective well-being data.

Nevertheless, a natural, fair-minded, and oft-voiced concern is: can we actually trust survey-based self-reported measures of subjective well-being? This study tries to take that objection seriously. Its approach is different from, but complementary, to the work of Krueger and Schkade (2008), who offer a generally positive message about the value of self-reported well-being information. We design a new laboratory test for so-called priming effects. In it, we are deliberately able, like Kahneman and Deaton (2010), to distinguish between two forms of well-being: life evaluation and (immediate) óhappinessô or so-called positive affect. [2]

2.1 What is the Problem with óPrimingõ?

To be clear about the nature of a priming problem, consider the following simple example. Imagine a person whose underlying life satisfaction is given as 8 out of 10 on a linear one-dimensional scale. This might be the answer that would be reported by this subject the great majority of times she is asked to state her life satisfaction. It might genuinely reflect her hedonic feelings. However, imagine that, just prior to asking the question about life satisfaction, the survey first asks the subject whether there has been recent illness or bereavement in the family and she answers in the affirmative. This might remind her of the recent tragedy, reducing her happiness temporarily, and unfortunately at the precise time she is being asked to report her overall level of life satisfaction, possibly leading her to report a lower number than the ótrueô 8.

[1] This is a large literature. For some examples of recent contributions to the subjective well-being literature see Easterlin (1995, 2001), Frey and Stutzer (2002), Ferrer-i-Carbonell (2005), Layard (2008), Luechinger and Raschky (2009), Brandts et al. (2009). In a different way, Basu and Meltzer (2005) examined the caring-about effect in earlier work.

[2] Our work also follows in the spirit of Dolan and Kahneman (2008) by emphasizing experienced utility rather than decision utility.

This process -- of asking related questions which might create a wedge between underlying and reported subjective well-being (henceforth SWB) indices -- we can call ópriming+, and the potential for this phenomenon can lead to question marks over the stability and long-run usefulness of SWB data.

Our method of analysis is a laboratory experiment rather than an econometric study of secondary data. For it, we deliberately recruit subjects who are similar in terms of nationality and age. We ask them, right at the start of the experiment, to report their happiness on a 7-point scale. Crucially, this is the very first thing they do in the lab; these answers are taken as the appropriate well-being data, free of any priming. We then ask them to carry out various tasks and finally to complete an extensive questionnaire. At the end of this process, they are requested to report their life satisfaction on a 10-point scale. The tasks and questionnaire are long enough in duration to fill one hour of time. Among other issues, we are interested in the closeness of the correlation between the initial ópure+ well-being answer and the later one after the possible priming effects. The time gap and the difference in scale between the happiness and life satisfaction questions are designed to help prevent subjects from simply remembering their earlier report and restating it. It might be expected that (statistical) *power* might be an issue in such an approach. However, as made clear later, this does not appear in the data to be a major difficulty. Our sample is large enough to avoid it.

In the middle of the questionnaire, importantly, several questions about major recent life events are asked that might be expected to have strong priming effects on the individuals. For example, we ask whether respondents have experienced recent family bereavement, recent parental divorce, health difficulties (what we call ñnegative life eventsò), and any ñpositive life eventò. Should a person bias up or down their well-being answer at the end of the experiment, when compared to their initial reported level, in line with their answers to the life event questions, then we have found evidence of priming. Should the answers to both questions regarding SWB be consistent and unaffected by their answers to the life event questions, we have evidence that these events are already *factored into* their replies so that being reminded of them does not generate a priming distortion.

To anticipate the studyôs outcome, we replicate the nature of Bobinac et alôs (2010) finding on the caring-about effect (in a way in which priming problems are minimized).

The potential priming questions we use are not meant to be excessively intensive; rather, they are the sort that might reasonably appear in a survey. The impact of both positive and negative recent life events seem to have a similar effect on both the initial happiness and final (post-attempted priming) life satisfaction. Moreover, and encouraging scientifically, the regression-equation structures of the happiness and life satisfaction variables when jointly regressed against the key independent variables are similar despite differences in wording and scale. This appears to indicate that the terms ñhappinessò and ñlife satisfactionò are treated in a consistent way by laboratory subjects and that subjects are reasonably capable of adjusting their answers to deal with different scales. We establish this with chi-squared tests. As far as we know, this is the first time in the well-being that that has been done.

2.2 Literature

There appears to be no published research that does exactly what we later attempt. However, there is a prior literature on priming and on SWB that is of relevance to our work. Traditionally, empirical economic analysis has focused on observed choice behaviour, but increasingly this approach has been complemented by reports of SWB as a source of information relating directly to outcome-welfare.[3] To assess the usefulness of such data with respect to welfare, Bernheim (2008) identifies two distinct approaches: welfare defined by choice, or welfare defined by well-being through the achievement of objectives, or directly measurable. A reliance solely on revealed preference welfare analysis, can be defended in three ways: (i) if welfare is defined by choice, such measurement is irrelevant; (ii) if behaviour maximizes outcome welfare, such measurement is unnecessary; (iii) no relevant information regarding outcomes is available, and so such measurement is not possible. If we choose to define welfare in outcome-based terms but are unwilling to simply assume optimal behaviour (so that (i) and (ii) do not hold), the only

[3] For example, Di Tella, MacCulloch and Oswald (2001), Easterlin (2001), Stone, Schwartz, Broderick and Deaton (2010); for an overview, see Frey and Stutzer (2002).

remaining impediment to usefulness is measurability. This has been the subject of a large and growing literature. See, for example, Brouwer et al (2008).

A number of empirical results suggest that responses to global SWB questions may vary with changes in context. Two well-known examples are the current weather (Schwarz and Clore, 1983) and finding a dime under experimental randomisation (Schwarz, 1987). Lucas, Dyrenforth and Diener (2008) challenge these results both by questioning the strength of these effects and their robustness (which they justify through the apparent lack of replication in the literature). Furthermore, weather patterns or finding a dime are not endogenous to the survey-process. Nevertheless if such shocks do have an effect and if rather than random they were systematic and endogenous, we might have grounds to worry about the stability of survey-based reported SWB data. This is exactly the problem relating to ñprimingò a survey respondent. Every survey respondent faces the same immediate environment embodied by the series of questions asked prior to any request for a report on SWB and so any shock induced by the survey itself will potentially effect a large subset of all survey respondents if not all respondents. Our paper seeks to address exactly this issue: if an attempt is made to prime every respondent to a survey in the same way will there be a difference between their reported SWB absent the attempted priming and their reported SWB after the attempted priming?

There is already some evidence that the structure of a survey may have a significant impact. Question order effects, in particular, have been frequently discussed; for example, Schuman and Presser (1981), Strack, Martin and Schwarz (1988), Tourangeau, Rasinski and Bradburn (1991), and Pavot and Diener (1993). Smith, Schwarz, Roberts and Ubel (2006) study the impact of introductions. They observe a higher correlation between health satisfaction and life satisfaction (asked in that order) when the survey introduction suggests that the survey is of Parkinsonôs patients, conducted by a medical centre, rather than of the general population, conducted by a university, since the former is suggested to prime respondents with respect to health status concerns. In general, it has long been argued in an interdisciplinary literature known as ñcognitive aspects of survey methodologyò that self-reports (such as SWB measures) may be strongly influenced by features of the survey questions themselves, such as their wording, ordering, rating scales and format, since respondents not only have to determine the intended

meaning of a question,[4] but recall relevant information, evaluate a judgement, and format this according to the given response alternatives.[5]. The immediate surveying context including preceding questions may also influence reported SWB by altering the subjectôs current mood (see Diener, 1994). That transitory mood has an impact on reports of global SWB is documented for example in Schwarz and Clore (1983), Yardley and Rice (1991), and Pavot and Diener (1993).

However, there is also a literature on the stability of SWB over time (absent authentically significant events), and this can be assessed through a test-retest correlation. This reliability was recently assessed by Krueger and Schkade (2008), who report that two life-satisfaction measures two weeks apart exhibited a correlation of 0.59, in line with other similarly modest reliability estimates in the literature of 0.40 - 0.66 (Andrews and Whithey, 1976), and 0.50 - 0.55 (Kammann and Flett, 1983). These are lower than generally observed for standard microeconomic variables such as education and income (although these benefit from relative tangibility of characteristic), but Krueger and Schkade conclude that they are still ñprobably high enough to detect effects when they are present in most applications, especially if samples are large and the data are aggregated across people or activities.ò A summary of the argument against the case that SWB measures are strongly influenced by transient and irrelevant factors is given by Lucas, Dyrenforth and Diener (2008).

In this paper we test the strength of survey-based context effects by utilising two global measures of SWB, whilst preceding the latter measure with a series of questions relating to substantial life shocks, both positive and negative, including bereavement, illness, and divorce. Since answering such questions involves the recollection of information that might be considered relevant to global SWB, the enhanced accessibility of this information might lead to conceptual priming. Furthermore, since the life event questions relate to emotionally powerful experiences, they might also lead to transitory mood context effects, potentially leading to large net context effects.

[4] Since the concepts of ósatisfactionô and óhappinessô leave considerable scope for differences in interpretation, the very phrasing of SWB questions might be important; our paper provides a useful test of this issue.
[5] For overviews of this literature, see Schwarz (1999, 2007).

A related study was undertaken by Strack, Schwarz and Gschneidinger (1985), who find that when subjects are first asked to write down three positive events in their ópresentô life, their reported SWB is significantly higher than when first asked to write down three negative life events, but that this finding is reversed when the events concerned their ópastô life. However, the strength of such context effects may be due to the engaging nature of description, which might not be representative of typical survey questions; as such, we provide a test of the impact of life event questions that might be more relevant to the contexts faced in practice by participants under standard survey approaches.

For an economist, the sensitivity of global measures of SWB to survey-based context effects seems of particular importance. Not only may this give an indication of the reliability of global SWB measures; it might also suggest possible context-dependent judgement processes or heuristics, indicating the direction of the correction required to recover ótrueô underlying global SWB. Furthermore, such understanding could potentially lead to improved survey design to mitigate such problems, and so increased accuracy in measurement.

3. Experimental Methodology

Data were gathered on 269 subjects over 12 sessions, each lasting around 45 minutes, from an experiment conducted on 3 separate days in late 2009 and early 2010 at the University of Warwick.[6] The subjects were all students at the university, paid on average £11.37, including a £5 show-up fee (so on average they earned a little less than 20 US dollars). We restricted the subject pool to a group with a relatively similar background since they were required to have English as their main language to keep different social conventions about happiness reporting to a minimum.

Students were registered outside, before being brought into the experimental room and sat at separate computers, with partitions separating each. The time-line of the experiment was simple. First, a single happiness question was asked of each subject; next they undertook two

[6] 269 subjects is high for an experimental study, though of course no match for the many thousands who might typically take part in a large-scale survey. It is enough to obtain statistical significance throughout our data and there is no evidence of issues concerning the power of our tests.

incentivised tasks; finally, they completed a questionnaire that attempted to push a subset of the responders into an artificial affective ñprimedò state, from which we could discover to what extent the subsequent satisfaction question might be robust to such priming concerns.

The first task was to complete a question on a spreadsheet that asked for a subjective assessment of immediate happiness as follows:

Happiness

How would you rate your happiness at the moment (1-7)?

Note: 1 is completely sad, 2 is very sad, 3 is fairly sad, 4 is neither happy nor sad, 5 is fairly happy, 6 is very happy, 7 is completely happy

This was followed by a piece-rate task designed to measure productivity, from which the contribution of effort and skill could be inferred. This first (piece-rate) task was largely mathematical, consisting of repeatedly adding together 5 random two-digit numbers, with payment dependent on the number of correct answers in 10 minutes. The second task for subjects was to complete a 5-question GMAT MATH-style test. These questions were provided on paper, and the answers were entered into a prepared protected Excel spreadsheet. The full text of the test is listed in the Appendix. It was designed as a brief check on ability. [7]

One benefit of making the laboratory subjects do a period of mental-arithmetic questions is that it distracts them from their happiness answers. In our experiment, it is an advantage if their happiness answers are not at the front of their memory when they each come to answer a later life-satisfaction question.

The questionnaire that completes the experiment begins by eliciting a number of important subject characteristics: age, year of study, gender, mathematical training/qualifications and broad training/qualifications (a control for overall ability). This is followed by four questions concerning life events detailed in Figure 3, each of which might induce the experience of

[7] The current paper emerges from work reported more fully in Oswald et al. (2015) which seeks to evaluate the relationship between SWB and labor productivity after controlling for a variety of individual characteristics. Niederle and Vesterlund (2007) use numerical additions of a similar sort to our first task for their own experimental examination of gender-specific effects in different payment environments. A GMAT-style test much like our second task was also used as an ability control in Gneezy and Rustichini (2000).

negative psychological affect triggered by requested recollection, and thus act to ópriméo subjects for the subsequent questions:

Life has its ups and downs. During the last 5 years, have you experienced any of the following events (yes/no*)?*

If yes, please could you indicate how many years ago in the second column to the right.

For example, if this happened this year enter 0, for a year ago enter 1, etc. up to 5 years ago.

	yes/no	**number of years ago**
A bereavement in your close family? (e.g. parent/guardian, sibling)		
A bereavement in your extended family? (e.g. close grandparent, close aunt/uncle, close cousin, close friend)		
A parental divorce?		
A serious (potentially life-changing or life-threatening) Illness in your close family?		

There is also a fifth life/experience question, which enquires about positive life events detailed below:

	yes/just averagely good/no	**number of years ago**
Has anyone close to you had anything really good happen to them within the last 5 years? (yes/just averagely good/no)		

This can act to counter any effect of negative mood and/or priming from the previous four questions; however, nearly two thirds of subjects reported nothing good happening, giving sufficient variation in our data. After several buffer questions (concerning competition, cooperation, frequency of comparisons and status) to mask the objectives of the experiment, it was completed by a life satisfaction question as detailed below:

All things considered, how satisfied are you with your life as a whole these days, where 1 means you are ñcompletely dissatisfiedò and 10 means you are ñcompletely satisfiedò?

That the scale of the initial happiness question differs from the final life satisfaction question serves to maximize the chance of priming. It reduces the chance that subjects merely recalled, and mimicked, their earlier response. When the final questionnaire was completed, laboratory

subjects were paid individually, and asked to leave the laboratory. No subject was allowed to participate multiple times.

Our focus was on how on to give priming a good possible chance of influence in the laboratory experiment ï we provided temporal distance between both measures of SWB, the tasks provided a distraction which helped to raise the chance that subjects would not simply remember their earlier answer, we changed the scale of the SWB question, and then we tried to bring to mind their most important recent memories of emotional events, on the basis that if we could not find priming under these circumstances then we could be more confident that priming is reasonably unlikely in larger-scale surveys.[8]

4. Results

Table 1 gives an overview of the means and standard deviations in the data set. From Table 1, approximately 27% of the laboratory subjects reported illness in their close family.

We start with simple histograms and a plot. Then we move to Ordered Probit and OLS estimations, and an investigation of the marginal impact of a change in one happiness measure on the other. Finally, and perhaps the most appropriate of the various tests for priming, we provide a Bivariate Ordered Probit estimation that includes a tranche of Chi-squared tests designed to check whether the two sets of well-being answers -- the one at the start and the one an hour later at the end -- have approximately the same structure. To anticipate the remainder of the section, despite our best efforts to prime the subjects, one result is that our evidence lends support to the notion that life satisfaction reports are robust to priming.

4.1 An Initial Graphical Analysis

If we treat the data cardinally, the simple Pearson correlation coefficient between happiness and satisfaction is 0.51.

[8] We also included a wide variety of different tasks and questions throughout - leaving subjects in as much doubt as possible about the aims of the experiment to minimize any potential for a ñdemand effectò or reciprocity towards the experimenter.

More flexibly, Figure 1 provides histograms of the initial ñHappinessò and final ñSatisfactionò measures. The shape of the distributions for both measures is similar, both for the entire sample and for the male and female subsamples. Considering only the overall distributions is not sufficient, because different subjects can be primed both positively and negatively by the experiment and might coincidentally ñnet outò. Thus a more specific analysis, allowing us to disentangle positive and negative priming, is necessary.

4.2 Univariate Life-Satisfaction Regression Equations

We report a number of Ordered Probit and OLS estimations of life satisfaction equations, where the latent data-generating process is assumed to be of the form:[9]

$$U_i = \alpha_i + \sum \beta_k x_{ki} + \sum \gamma_l q_{li} + e_i \qquad (1)$$

Here U_i is the *measured* utility of individual *i*, in this case his/her reported life satisfaction, x_k are ók ô controls, including demographic characteristics and (in most instances) reported happiness prior to the priming questions, and q_l are the ól ô priming questions.

We start with a set of regressions of the form of Equation 1, the results of which are presented in Table 2. Regressions (1) ï (3) in Table 1 are Ordered Probits and (4) ï (6) are OLS. In regressions (1) and (4), we regress the initial well-being variable ñHappinessò on a variety of independent variables, and in (2) and (5) do the same for the final life satisfaction measure ñSatisfactionò.

In Table 2, *a key substantive finding is the coefficient of -0.701 (t-statistic 0.164) on Illness in the Family* (one of the principal negative life event questions which ask whether subjects have experienced a serious illness in their close family). The null hypothesis of zero can be rejected at any conventional level of significance in probit and OLS specifications. It means that, presumably without being aware of it, the occurrence of illness in their family has depressed

[9] Ordered Probits and Bivariate Ordered Probits are likely the best forms of regression but we also included OLS estimations for comparison. As should be apparent the results are effectively the same whether the regression is carried out via Ordered Probit or OLS.

their own happiness ratings. There has been no priming of the subjects that would otherwise account for the result.

This is a large effect and not merely one that is statistically significant. In cardinal terms, from column 4 of Table 2, it is approximately six tenths of one happiness point. This is more than half of a standard deviation in happiness.

Comparing regressions (2) and (3), and in their OLS specification (5) and (6), in Table 2, provides an initial evaluation of whether priming is a problem. In particular, if the coefficient of a variable, say A, is statistically significant in the Satisfaction equations (2) and (5), but it is not significant when we use the variable Happiness, we can argue that there is no priming in the Satisfaction measure, since the level of Happiness -- measured at the beginning, before the potential priming -- explains the variation of variable A as well.

Whether the dependent variable is the initial Happiness measure in regressions (1) and (4), or the final Satisfaction measure, in regressions (2) and (5), of Table 2, the results are similar. Variables ñAgeò (subjectôs age), ñYear of Studyò (the number of years of study at university), ñMaleò (the gender dummy ï 1 for male, 0 for female) and ñGMATò (the performance in the GMAT MATH-style test) have coefficients that are not statistically significantly different from zero.

Comparing regressions (1) and (2) in Table 2, the strongest variables are ñIllness in the Familyò and ñGood Eventò (relating to a potential positive life event). Both influence the SWB variables in the direction to be expected. ñBereavementò and ñParental Divorceò do not enter statistically significantly. ñHigh School Gradesò is marginally statistically significant in regressions (2) and (5) in Table 2, though only at the 10% level. This high-school variable is a ratio formed by taking the number of school level exams as the denominator and the number at the highest possible grade as the numerator. The subjects in our study typically performed very well at school; though the direction of priming consequences is not clear, because subjects may have

underperformed relative to their own expectations.[10] The regressions also included a full set of session dummies (for brevity, those coefficients are omitted here).

Staying with Table 2, and examining regressions (3) and (6), we find that when we add the initial ñhappinessò variable to our satisfaction regressions we lose all significant impact from the main priming questions. This indicates that the issues relating to the priming questions (such as recent bereavement and illness in the family) are already incorporated in the initial happiness assessment. There are small, insignificant negative coefficients associated with Illness. The coefficients associated with parental divorce and bereavement are very small, statistically insignificant, and sometimes even positive. The positive life event variable (Good Event) is positive though insignificantly different from zero. Indeed, beyond the strong relationship between the two SWB measures, only the High School Grades variable, which is a measure of educational achievement, has significant explanatory power. Overall, this provides evidence for a lack of priming on life events questions, but since High School Grades remains significant, we cannot rule out absolutely every kind of priming, or at least some form of focus bias, at this stage.[11]

We can also take a closer look at whether ñHappinessò is an important and significant indicator of ñSatisfactionò in regressions (3) and (6) in Table 2. If this is significant and powerful, we have evidence that the two measures are strongly related despite the potential for priming prior to the asking of the life satisfaction question.

ñHappinessò is indeed statistically significant (at the 1% level) in regression (3) of Table 2. The OLS results concur and suggest that a rise in ñHappinessò has a substantial association with ñSatisfactionò. To allow more detail on this, an analysis of the marginal effects is reported in

[10] High School Grades also differ from the other possible priming questions, since this was essentially under the control of the subjects, while the other variables are more likely to be exogenous (or under the control of other agents), though this distinction is by no means clear cut.

[11] An alternative explanation (and it may be that both play a role, to a greater or lesser extent) could be that educational achievement matters for broad evaluations of ólife satisfactionô, but less with óhappinessô, perhaps due to the fact that responders might, on average, interpret the latter as hedonic in nature relative to the former. However, anticipating the results of Section 4.3, we see that under the more robust Bivariate Ordered Probit estimation any support for priming due to the High School Grades question disappears.

Table 3 (calculated using regression (3) in Table 2). The marginal effects are not trivial to calculate because any change in ñHappinessò has consequences throughout the distribution of the ñSatisfactionò variable, but powerful effects are discernible across the distribution: whether we consider a pure marginal effect (from a unit increase in Happiness) or a half standard deviation shift, the estimated effect is a similar upward push at the higher end of the ñSatisfactionò distribution and downward pull at the lower end.

Table 4 provides an alternative. It examines the distribution of the ñSatisfactionò variable given that the initial ñHappinessò variable is set at 4.83, which is the average value seen in the sample, and is 69% along the unconditional happiness distribution. Other variables in the happiness regression are also set at their arithmetic average for the sample (for example, the average age is 19.59 years and gender is set at 53% male, 47% female), so we are essentially looking at the postulated distribution of satisfaction for a subject who is theoretically typical across all independent variables and in the happiness answer. What is noticeable is that this theoretically average subject would be most likely to report a satisfaction value of 7, which is 70% along the unconditional satisfaction distribution ï which is almost identical to the distributional position of his/her reported happiness.

Put more simply, such a calculation suggests that someone who is approximately 70% along the happiness dimension is likely to be 70% along the satisfaction dimension (despite the potential for priming between the two answers). This provides another indication of the consistency of the two measures, although as with the univariate regressions this is merely indicative, and a purer test for priming arguably requires a bivariate analysis which is the topic of the next section.

4.3 Joint Life Satisfaction Equation Regressions and Tests

We now carry out a Bivariate Ordered Probit esimation. It is reported in Table 5. The regression equation structure is essentially the same as in equation (1) except that each measure (happiness and satisfaction) is regressed on the set of independent variables under the assumption that the errors are jointly normal distributed. U_i in (1) can now be considered to be a vector of the *measured* utility of individual *i* using both reported measures (happiness and satisfaction), with

x_k now a matrix of two sets of ók ô controls, including demographic characteristics, for each measure and q_l a matrix of two sets of the ól ô priming questions, again, for each happiness measure. Table 5 indicates that there are no gender effects. The two life event questions relating to bereavement and illness, which were important in the individual regressions, remain important in the bivariate regression.

To try to understand whether the coefficients can be thought of as the same (given rescaling), we carry out a series of Chi-squared tests. These are listed in Table 6. Consistent with the earlier analysis, it is not possible to reject the null hypothesis that variables in combination have an identical effect on happiness and satisfaction (in Table 6a).

We do not stop with Table 6a since it is (just) possible that there might be priming in one direction generated by a positive life question but that this is precisely compensated by the negative questions priming subjects in the opposite direction - thus leaving a false overall impression of a lack of priming. We check for this possibility by separately running individual Chi-squared tests on Good Event, Bereavement, Illness, Parental Divorce, High School Grades and Additions. In Tables 6b to 6g, the hypothesis that the respective coefficients are equal cannot be rejected for these variables with the single exception of Illness. However, the interesting thing about the result on the Illness variable is that the effect of this variable seems stronger *prior* to the attempted priming, since it the coefficient is larger in the initial happiness regression than in the final satisfaction regression. Such a result suggests that if there is a differential effect stemming from the illness variable it is *not* due to priming in the traditional sense, but may be related to differences between perceptions about the two SWB questions.

To summarize, from both the Bivariate Ordered Probit estimation and the set of Chi-squared tests there is no evidence of positive priming from the Good Event or High School Grade variables and no evidence of negative priming from the Family Illness, Bereavement and Parental Divorce variables.

5. Conclusions

Are emotional externalities real and large? Modern work by Bobinac and co-authors (2010) has provided evidence of a caring-about effect: the health of one person creates emotional externalities on others. The weakness of this potentially important conclusion is the problem of priming (namely, that of ódeading the witnessô, or more formally that the order of survey questions can alter peopleôs replies). Hence the caring-about effect could be an illusion.

This study suggests that it is not. We suggest and implement a new form of experiment. In it, peopleôs well-being answers are elicited in the first few seconds. A strong and subconscious[12] caring-about effect still emerges ï thereby replicating and buttressing Bobinac et alôs original result. Table 2 reveals that those with illness elsewhere in their family report approximately 0.6 points lower on a happiness questionnaire without having been first reminded of that family illness. This is more than one half of a standard deviation in well-being. Using chi-squared tests, we also document new evidence -- in Tables 3 to 5 -- for the equivalence of life-satisfaction and happiness.

The broader background to the study is that it is offered as a contribution to the emerging literature on the microeconomics of well-being. This studyôs results are not due to low statistical power and can be replicated in sub-samples. We first ask for a happiness level. That is the step that offers a more suitable testing framework than has previously been possible. Then we expose our subjects to a variety of tasks and distractions; they are then questioned about major positive and negative life events; then, approximately one hour after the experiment began, we ask them to report their level of life satisfaction. In many cases, our subjects had experienced significant life shocks in recent years, and reminding them of these might in principle have fundamentally distorted their later answers to the subjective well-being questions. Despite potentially severe priming effects, that did not happen.

We hope that our methodology might be used fruitfully in other settings. As will be clear to the reader, this work follows in an intellectual path pioneered, many decades earlier, by Professor EJ Mishan. We must hope he might have approved of the unusual idea of using well-being data.

[12] The reason that it can be described as subconscious is that, as shown in Table 2, people mark lower on their happiness score sheets even though they have not been reminded of illness in their family (or of anything else ï because happiness answers are obtained before any other questions are asked).

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Appendix A: Tables

Table 1: Data description

Variable	#Observations	Mean	Std Error	Min	Max
(Initial) Happiness	269	4.84	0.94	2	7
(Final) Satisfaction	268	7.02	1.67	2	10
Illness in Family	267	0.27	0.44	0	1
Year of Study	259	2.06	1.13	1	5
Male	261	0.52	0.50	0	1
High School Grades	255	0.54	0.26	0	1
Additions	267	18.10	6.86	2	50
Gmat MATH	269	3.06	1.47	0	5
Bereavement	267	0.54	0.50	0	1
Good Event	268	1.03	0.80	0	2
Age	259	19.61	1.55	18	30
Parental Divorce	268	0.10	3.02	0	1

Table 2: Regressions of initial reported happiness and final reported life satisfaction on various independent variables

VARIABLES	(1) Initial Happiness (O. Probit)	(2) Final Satisfaction (O. Probit)	(3) Final Satisfaction (O. Probit)	(4) Initial Happiness (OLS)	(5) Final Satisfaction (OLS)	(6) Final Satisfaction (OLS)
Illness in Family	-0.701***	-0.347**	-0.00283	-0.577***	-0.574**	-0.0213
	(0.164)	(0.153)	(0.160)	(0.133)	(0.249)	(0.224)
Age	-0.0991	0.0351	0.0943	-0.0784	0.0629	0.138
	(0.0692)	(0.0660)	(0.0670)	(0.0575)	(0.108)	(0.0936)
Year of Study	0.0869	-0.0652	-0.121	0.0651	-0.141	-0.203*
	(0.0912)	(0.0870)	(0.0879)	(0.0757)	(0.142)	(0.123)
Male	0.102	0.123	0.0955	0.0649	0.146	0.0835
	(0.152)	(0.145)	(0.146)	(0.126)	(0.237)	(0.205)
High School Grades	0.115	0.555**	0.600**	0.0674	0.889*	0.825**
	(0.296)	(0.281)	(0.284)	(0.244)	(0.458)	(0.395)
Additions	0.00904	0.0196*	0.0176	0.00808	0.0319*	0.0242
	(0.0116)	(0.0110)	(0.0111)	(0.00953)	(0.0179)	(0.0155)
Gmat MATH	-0.0170	0.00541	0.0155	-0.00949	0.0372	0.0462
	(0.0541)	(0.0514)	(0.0518)	(0.0448)	(0.0842)	(0.0726)
Bereavement	-0.102	0.0190	0.0710	-0.0740	0.0453	0.116
	(0.143)	(0.136)	(0.137)	(0.118)	(0.222)	(0.191)
Good Event	0.213**	0.202**	0.123	0.167**	0.302**	0.142
	(0.0893)	(0.0847)	(0.0860)	(0.0733)	(0.138)	(0.120)
Parental Divorce	0.320	0.187	0.0349	0.265	0.408	0.154
	(0.235)	(0.222)	(0.225)	(0.193)	(0.362)	(0.314)
(Initial) Happiness			0.683***			0.958***
			(0.0836)			(0.107)
Constant				5.921***	4.495**	-1.179
				(1.123)	(2.110)	(1.926)
Session dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	251	251	251	251	251	251
R-squared				0.166	0.101	0.335

Note: Regression (1) is an Ordered Probit in which initial reported happiness (gained at the start of the experiment before the potential ñprimingò) is regressed on various independent variables. Regression (2) is an Ordered Probit which regresses final reported life satisfaction (reported at the end of the experiment after the potential ñprimingò) on the same set of independent variables. Regression (3) is an Ordered Probit which regresses final reported life satisfaction on the same group of independent variables and also on initial reported happiness. The major priming variables -- Illness and Good Event -- cease to be significant in regression (3) indicating that they are fully incorporated into initial reported happiness. Regressions (4) ï (6) carry out the respective regressions but using ordinary least squares. Standard errors are in parentheses and significance is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1. Cuts and session dummies are omitted for brevity.

Table 3: Marginal effects of a change in the initial reported happiness on the distribution of reported life satisfaction

The change in the happiness report	Av change across distribution	2	3	4	5	6	7	8	9	10
from 1 to 7	0.1951	-0.2339	-0.2357	-0.1611	-0.1319	-0.0988	-0.0165	0.3074	0.3529	0.2175
+ half of one standard	0.0540	-0.0086	-0.0282	-0.0381	-0.0513	-0.0611	-0.0557	0.1314	0.0900	0.0217
+1 unit	0.0585	-0.0083	-0.0291	-0.0406	-0.0558	-0.0674	-0.0621	0.1455	0.0962	0.0216

Note: To give an example of how the marginal change measure works glance at the ñ+1 unit of reported happinessò row. This measures the impact of a marginal increase of reported happiness by 1 across the entire distribution. For instance if reported happiness was one unit higher then the likelihood of a report of 8 out of 10 for satisfaction would go up by 14.55% but the chance of a 6 out of 10 would fall by 6.74%. Similarly the top row reports the impact of a shift from the lowest report (1 out of 7) to the highest (7 out of 7) on the entire distribution of satisfaction reports while the second row measures the impact of an increase in half a point of standard deviation in the happiness report. The satisfaction level of 1 is not reported (it is the residual value).

Table 4: Imputed distribution of final reported life satisfaction when all variables including initial reported happiness are set at their mean values

Satisfaction level	2	3	4	5	6	7	8	9	10
Probability	0.004	0.019	0.034	0.061	0.104	0.362	0.316	0.087	0.012

Note: The ñHappinessò value of 4.83 is the average initial reported happiness level in the sample. The other average values are reported in Table 1. The satisfaction level of 1 is not reported (it is the residual value).

Table 5: Joint regression of initial reported happiness and final reported life satisfaction on various independent variables using Bivariate Ordered Probit estimation

VARIABLES	(1) Initial reported happiness (start of experiment)	(2) Final reported life satisfaction (end of experiment)
Illness in Family	-0.698***	-0.343**
	(0.164)	(0.153)
Age	-0.0994	0.0347
	(0.0690)	(0.0660)
Year of Study	0.0905	-0.0649
	(0.0910)	(0.0869)
Male	0.0989	0.122
	(0.152)	(0.145)
High School Grades	0.101	0.558**
	(0.296)	(0.281)
Additions	0.00942	0.0199*
	(0.0115)	(0.0110)
Gmat MATH	-0.0167	0.00731
	(0.0540)	(0.0514)
Bereavement	-0.107	0.0175
	(0.142)	(0.135)
Good Event	0.206**	0.205**
	(0.0892)	(0.0847)
Parental Divorce	0.315	0.185
	(0.233)	(0.222)
Session Dummies	Yes	Yes
Observations	251	251

Note: The joint estimation technique (Bivariate Ordered Probit) estimates the impact of the independent variables on the two dependent variables (initial reported happiness and final reported life satisfaction) simultaneously. Standard errors are in parentheses; significance is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1. Cuts and session dummies are omitted for brevity.

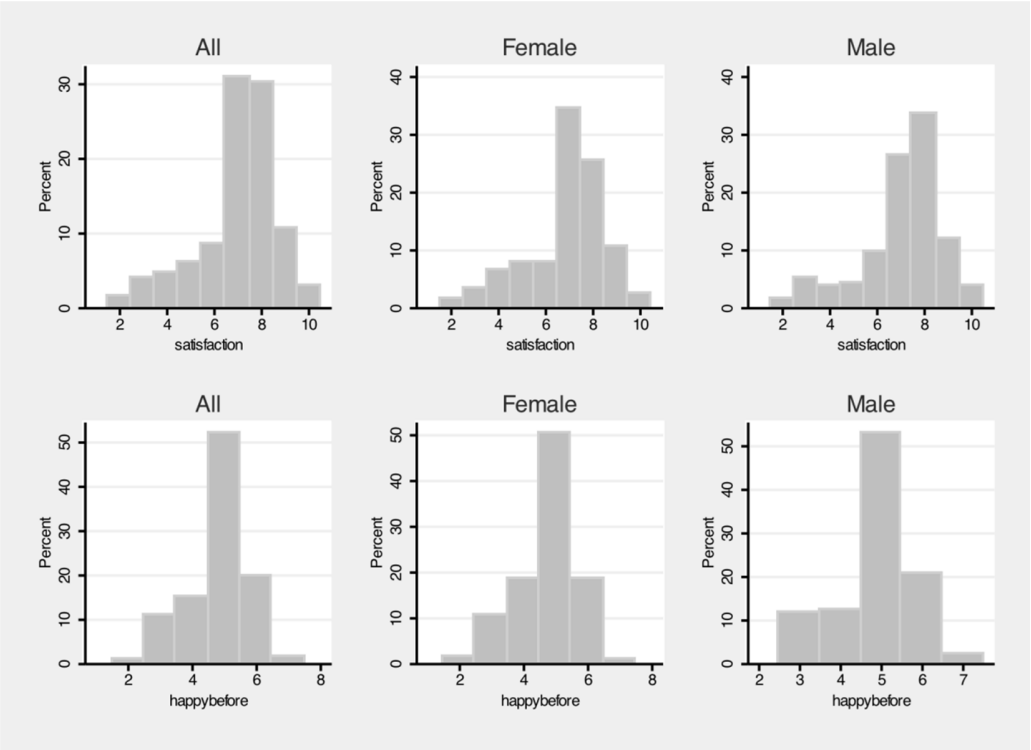
Table 6: Chi-squared tests which examine whether the coefficients on initial reported happiness differ from those on final reported life satisfaction

(a) Test on H0 of [Happiness]All coeff. - [Satisfaction]All coeff. = 0 Chi2(21) = 21.86 Prob > Chi2 = 0.4074
(b) Test on H0 of [Happiness]Good Event - [Satisfaction]Good Event = 0 Chi2(1) = 0.00 Prob > Chi2 = 0.9860
(c) Test on H0 of: [Happiness]Bereavement - [Satisfaction]Bereavement = 0 Chi2(1) = 0.78 Prob > Chi2 = 0.3781
(d) Test on H0 of: [Happiness]Illness - [Satisfaction]Illness = 0 Chi2(1) = 4.80 Prob > Chi2 = 0.0285
(e) Test on H0 of: [Happiness]Parental Divorce - [Satisfaction]Parental Divorce = 0 Chi2(1) = 0.32 Prob > Chi2 = 0.5743
(f) Test on H0 of: [Happiness]High School Grades - [Satisfaction]High School Grades = 0 Chi2(1) = 2.42 Prob > Chi2 = 0.12
(g) Test on H0 of: [Happiness]additions = [Satisfaction]additions chi2(1) = 0.84 Prob > chi2 = 0.3603

Note: The Chi-squared tests were performed on the Bivariate Ordered Probit regression in Table 5. With one exception, the Chi-squared tests are passed, in the sense that the null hypotheses that the coefficients on the Good Event, Bereavement, Illness, Parental Divorce and High School Grades parameters are identical in both parts of the Bivariate Ordered Probit cannot be rejected either jointly (tested in part a) or individually (tested in parts b through g respectively). The exception is that of the individual test on Illness.

Appendix B: Figures

Figure 1: Histograms of the final satisfaction and initial happiness levels



Note: ósatisfactionô is the subjective well-being measure reported at the end of the experiment and óhappybeforeô is the subjective well-being measure reported at the start of the experiment.

Appendix C: Experimental Instructions

Notes: X is the experimenter; Y, Z, etc. are assistants. Parts in the square brackets are descriptive and were not read out to subjects.

Instructions

[Subjects are registered and invited to enter room]

Welcome to the session. My name is X, and working with me today are Y and Z. Together we will be carrying out some research and your input will be extremely valuable to us. You will be asked to perform a small number of tasks and will be paid both a show-up fee (of £5) and an amount based on how you perform. Please do not talk to each other at any stage in the session. If you have any questions please raise your hands, but avoid distracting the others in the room.

You will now receive ID cards and you are asked to sit at the computer corresponding to the ID number. Everything is done anonymously ï your performance will simply be recorded based on the ID card, and not your names. You will find some paper and a pen next to your computer ï use them if you wish. Please do not use calculators or attempt to do anything other than answer the questions through mental arithmetic. If we observe any form of cheating it will invalidate your answers and you will be disqualified.

[Questionnaire 1: initial happiness question]

First of all please maximize the file called ñIntro.xlsò and complete the question as indicated. Once you have done this, please save and close the file.

[Wait for questionnaire 1 to be completed – no time pressure but typically 1-2 minutes is enough]

Look away from your screens for a moment. You will next have 10 minutes to add a sequence of numbers together and enter your answers in a column labeled ñanswerò. Please do your best as you will be paid based on the number of correct answers that you produce at a rate of 25p per correct answer. When the ten minutes are up I will ask you to stop what you are doing. When asked to stop please leave the software open on you screens as we will need to visit your computers to save your work. Now look at your screens. You will find that a file called ñNumberadditions.xlsò is open but minimized on your screen. Please now open the file by clicking on the tab. You have ten minutes!

[10 minutes: numerical additions]

Please stop what you are doing. We will now visit your computers and save your work. They will also place a sheet faced down next to your keyboards. Please do not turn over the sheet until I ask.

[Y and Z move to terminals, save the files and maximize the "GMAT" files]

For the second task we would like you answer a small number of questions. You will see that the file in front of you allows you to enter a letter from ñaò to ñeò, corresponding to a multiple-choice answer. You will have 5 minutes to attempt these questions, and once again your payment depends upon how many you get correct at a rate of 50p per correct answer. Please turn over the sheets and begin. You have 5 minutes.

[5 minutes: GMAT MATH-style test]

Please stop what you are doing. We will once again visit your computers and save your work.

[Questionnaire 2: control questions, life event questions and final life Satisfaction question]

I would now like to ask you complete a questionnaire which should be open in front of you on your allocated computer. It is vital for our research that you answer as honestly as you can, and I would like to stress to you that as with the rest of your input today, your questionnaire answers are entirely anonymous: we will only link your answers to the specific computer ID which you were randomly allocated at the start of today's proceedings. I would also like to stress that your payment does not depend upon your questionnaire answers. Completing the questionnaire is not a timed event, so please do not feel the need to rush. If you have any questions concerning the questionnaire or if anything is not clear please raise your hands and someone will come over and attempt to deal with your question. When you are done please save the questionnaire and then close Excel and wait a moment for the others to finish and to await further instructions. If you wish we can come to your computer and save the file for you ï it is however vital that the file is saved before Excel is closed.

[Wait for questionnaire to be completed – no time pressure, but typically 10 minutes is enough]

Hopefully you have all had a chance to complete the questionnaire. If you need more time, then please raise your hand. If everyone has completed their questionnaires, please make sure it is saved and close Excel.

Now please leave the pen on your desk but bring all of the paper which was distributed with you (the test paper and the scrap paper) which we will destroy. It is essential that you bring your computer ID card when you come up for payment as it is only through this card that we can administer payment. You will also need to sign a receipt for your payments. Please now form an orderly queue to the side of the room and keep some distance from the person at the front while they are being paid.

Many thanks for taking part in todayôs session.

[Payments handed out and receipts signed]

Appendix D: Questionnaires

Questionnaire 1

Happiness

How would you rate your happiness at the moment? (1-7)

Note: 1 is completely sad, 2 is very sad, 3 is fairly sad, 4 is neither happy nor sad, 5 is fairly happy, 6 is very happy, 7 is completely happy

Note: Answering this questionnaire was the first task required of the subjects.

Questionnaire 2

Please insert your answers into the shaded boxes to the right: please scroll down until you have reached the end of the questionnaire as indicated.

Details

What is your age?

Are you a 1st year, 2nd year, 3rd year, graduate student, or other? (1/2/3/G/O)

What is your gender? (M/F)

School Record

Have you taken GSCE or equivalent in maths? (yes/no)

IF SO:

What was the highest grade possible for this course? (A/A*/etc.)

What was your grade?

Give a percentage if you know it

Have you taken A-level or equivalent in maths? (yes/no)

IF SO:

What was the highest grade possible for this course?

What was your grade?

Give a percentage if you know it

How many school level qualifications have you taken (including GCSEs, A-levels and equivalent)?

How many of these qualifications were at the best grade possible? (e.g. A* in GCSE, A is A-level, etc.)

University Record

Are you currently or have you ever been a student (yes/no)

If yes, which degree course(s)?

IF you are a second or third year student what class best describes your overall performance to date? (1/2.1/2.2/3/Fail)	
IF you are a third year AND took part in the room ballot, were you allocated a room on campus?	

General Questions

Life has its ups and downs. During the last 5 years, have you experienced any of the following events (yes/no*).*
If yes, please could you indicate how many years ago in the second column to the right.
For example, if this happened this year enter 0, for a year ago enter 1, etc. up to 5 years ago.

	yes/no	**number of years ago**
A bereavement in your close family? (e.g. parent/guardian, sibling)		
A bereavement in your extended family? (e.g. close grandparent, close aunt/uncle, close cousin, close friend)		
A parental divorce?		
A serious (potentially life-changing or life-threatening) Illness in your close family?		

	yes/just averagely good/no	**number of years ago**
Has anyone close to you had anything really good happen to them within the last 5 years? (yes/just averagely good/no)		

On a five point scale, how competitive or cooperative do you consider yourself with regard to others, where ó1ô is óPredominantly competitiveô and ó5ô is óPredominantly cooperativeô?	
How often do you think you make comparisons between yourself and others? (often/sometimes/never/don't know)	
On a five point scale, how important do you consider social status, where ó1ô is óNot at all importantô and ó5ô is óVery importantô?ò	
All things considered, how satisfied are you with your life as a whole these days, where 1 means you are ñcompletely dissatisfiedò and 10 means you are ñcompletely satisfiedò?	

END OF QUESTIONNAIRE

Note: Answering Questionnaire 2 was the final task required of the subjects, occurring after Questionnaire 1, the numerical additions and the GMAT MATH-style test.

Appendix E: GMAT MATH-style Test

Questions

Please answer these by inserting the multiple choice answer a, b, c, d or e into the GMAT MATH spreadsheet on your computer.

1. Harriet wants to put up fencing around three sides of her rectangular yard and leave a side of 20 feet unfenced. If the yard has an area of 680 square feet, how many feet of fencing does she need?

a) 34
b) 40
c) 68
d) 88
e) 102

2. If $x + 5y = 16$ and $x = -3y$, then $y =$

a) -24
b) -8
c) -2
d) 2
e) 8

3. If ñbasis pointsò are defined so that 1 percent is equal to 100 basis points, then 82.5 percent is how many basis points greater than 62.5 percent?

a) .02
b) .2
c) 20
d) 200
e) 2,000

4. Which of the following best completes the passage below?
In a survey of job applicants, two-fifths admitted to being at least a little dishonest. However, the survey may underestimate the proportion of job applicants who are dishonest, becauseð ï .

a) some dishonest people taking the survey might have claimed on the survey to be honest.
b) some generally honest people taking the survey might have claimed on the survey to be dishonest.
c) some people who claimed on the survey to be at least a little dishonest may be very dishonest.
d) some people who claimed on the survey to be dishonest may have been answering honestly.
e) some people who are not job applicants are probably at least a little dishonest.

5.People buy prestige when they buy a premium product. They want to be associated with something special. Mass-marketing techniques and price-reduction strategies should not be used because ð ï .

a) affluent purchasers currently represent a shrinking portion of the population of all purchasers.
b) continued sales depend directly on the maintenance of an aura of exclusivity.
c) purchasers of premium products are concerned with the quality as well as with the price of the products.
d) expansion of the market niche to include a broader spectrum of consumers will increase profits.
e) manufacturing a premium brand is not necessarily more costly than manufacturing a standard brand of the same product.