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Daniel Sgroi, Eugenio Proto, Andrew J. Oswald
and Alexander Dobson

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Priming and the Reliability of Subjective Well-being Measures

Daniel Sgroi *

Eugenio Proto

Andrew J. Oswald

Alexander Dobson

Department of Economics

University of Warwick

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Abstract

Economists and behavioural scientists are beginning to make extensive use of measures of subjective well-being, and such data are potentially of value to policy-makers. A particularly famous difficulty is that of "priming": if the order or nature of survey questions changes people's likely replies then we have grounds to be concerned about the reliability of well-being data and inferences from them. This study tests for priming effects from important life events. It presents evidence from a laboratory experiment which indicates that subjective well-being measures are in general robust to such concerns.

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

JEL codes: D03, C83, C91

The relationship between life satisfaction and happiness, and the factors contributing to each, is not always straightforward ... for someone trained as a social scientist, the most direct way to tackle the question is just to go out and ask people--lots of people.

Benjamin S. Bernanke, Chairman of the Board of Governors of the Federal Reserve, May 2010.

1. Introduction

For the chairman of the Federal Reserve to be speaking on the topic of subjective well-being is a sign of the times. The recent report of the commission on the measurement of economic performance and social progress (Stiglitz et al, 2009) has put subjective well-being into the limelight as a possible supplement to more traditional measures of development such as GDP. But for many economists amid other concerns one is particularly problematic: can we trust the survey-based self-reported measures of subjective well-being that have been used to date? This question lies at the heart of this paper and to that extent it can usefully be considered complementary to Krueger and Schkade (2008) who offer a generally positive message about self-reported subjective well-being, and to lie alongside a psychology literature that is largely split on the stability and usefulness of self-reported measures.

When individuals are asked about their life satisfaction in a survey, are they able to distance themselves from the emotions generated by previous questions and recent events and provide a fair and stable assessment of their subjective well-being? In this paper we aim to deal with this problem, known in the psychology literature as the problem of "priming". We design a laboratory experiment in which individuals are asked to report their "happiness" at the beginning, and then we attempt to "prime" them by reminding them of various good or bad life events that they may have encountered recently, before asking them how satisfied they are with their lives at the end of the experiment. Our main result suggests that recent important life events are already fully incorporated into individuals' initial happiness reports, and hence have no additional impact on the final life satisfaction question despite our best attempts to prime our subjects. Generalizing from this, we argue that subjective well-being reports have a high degree of stability, and therefore resilience to potential priming, that allows us to be less concerned about the order or nature of questions in life satisfaction surveys. This is good news for the increasingly prominent "happiness economics" which seeks to use such subjective well-being data to supplement more traditional choice data to evaluate welfare.

To be clearer about the priming problem, let us consider an example. Imagine a subject whose underlying life satisfaction might be 8 out of 10 on a simple linear one-

dimensional scale. This might be the answer that would be given by this subject in the great majority of times that she is asked to report he life satisfaction and might genuinely reflect her own feelings. However, just prior to asking the question about life satisfaction the survey first asks the subject whether she has suffered a recent family bereavement and she answers in the affirmative. This might remind her of the recent tragedy, reducing her happiness temporarily but unfortunately at the precise time when she is asked to report her level of life satisfaction, possibly leading her to report a lower number than 8. This process of asking related questions which might create a wedge between underlying and reported subjective well-being (henceforth SWB) indices we can loosely call "priming" and the potential for this phenomenon has lead many psychologists to question the stability and long-run usefulness of SWB data.

Empirical investigation into the role of transitory mood, the potential influence of priming or specifically the impact of a prior question on responses to subjective well-being questions, has amassed over the last few years. Our intention is to search for the existence and scale of a priming effect and our method of analysis is a laboratory experiment in which we have full control over the nature and timing of questions. At a practical level, this involves first recruiting subjects who are similar in terms of nationality and age. We ask them to report their happiness on a 7-point scale. We then ask them to carry out various paid tasks and finally to complete an extensive questionnaire. At the end of this process we ask them to report their life satisfaction on a 10-point scale. The tasks and questionnaire are long enough in duration to fill an hour of time. This time gap and the difference in scale between the happiness and life satisfaction questions are intended to be enough to prevent subjects from simply remembering their earlier report and restating it. In the questionnaire several questions about important and recent life events are asked that might have a strong priming effect. We ask whether respondents have experienced recent close or distant family bereavement, recent parental divorce, health difficulties (what we call "negative life events") or a "positive life event". Should a subject bias up or down their happiness report at the end of the experiment when compared to their initial report, 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* and being reminded of them does not generate a priming effect.

To anticipate our results, we find essentially no evidence of priming. The impact of both positive and negative recent life events seem to have a similar effect on both the initial

happiness report and final (post-attempted priming) life satisfaction report. What is even more remarkable is that the structure of the happiness and life satisfaction variables when joint regressed against the key independent variables are remarkably similar despite the differences in wording and scale. Again, if we could generalize our results to practical survey design, they would indicate that the terms "happiness" and "life satisfaction" are treated in a consistent way by subjects and that subjects are fully capable of adjusting their answers to deal with different scales. This is good news for researchers who make heavy use of survey data as it indicates a good deal of stability is likely across different surveys and over time.

A discussion of the motivation for assessing SWB measures including a review of the literature is presented in Section 2. Section 3 details the experimental methodology, the results are discussed in Section 4 and a conclusion is presented in Section 5. The full text of the experimental instructions, the questionnaires, GMAT MATH-style test and all tables are in the appendices.

2. Motivating and Literature Review

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.[1] 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 remaining impediment to usefulness is measurability. This has been the subject of a large and growing literature.

A number of empirical results suggest that responses to global SWB questions may vary with changes in context. Two particularly well-known examples are the current weather (Schwarz and Clore, 1983) and finding a dime under experimental randomisation (Schwarz, 1987). Lucas, Dyrenforth and Diener (2003) challenge these results both by questioning the strength of these effects and their robustness (which they justify through the apparent lack of

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

replication in the literature). Nevertheless if such shocks do have an effect and if rather than random they were systematic, we might have grounds to worry about the stability of reported SWB. This is exactly the problem relating to "priming" 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 Parkinson's 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 "cognitive aspects of survey methodology" 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,[2] but recall relevant information, evaluate a judgement, and format this according to the given response alternatives.[3] The immediate surveying context including preceding questions may also influence reported SWB by altering the subject's 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

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[2] Since the concepts of 'satisfaction' and 'happiness' 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.
[3] For overviews of this literature, see Schwarz (1999, 2007).

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 "probably 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." 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 (2003).

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.

The only similar previous 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 'present' 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 'past' 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 is 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 'true' 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

The data analysed below was gathered from the observed productivity and survey responses of 269 subjects over 12 sessions, each lasting around 45 minutes, of an experiment

conducted on 3 separate days in November 2009, December 2009 and January 2010 at the University of Warwick. The subjects were all students at the university, paid on average £11.37, including a £5 show-up fee. We also restricted the subject pool to a group with a relatively similar background since they were required to be British with English as their main language keeping 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 incentivised tasks and finally they completed a questionnaire that attempted to push a subset of the responders into an artificial affective "primed" state, from which we could infer to what extent the subsequent satisfaction question might be robust to such priming concerns. We will next go through each stage in detail.

The first task was to complete a single question on a spreadsheet that asked for a subjective assessment of happiness s 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

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This was followed by an incentivised task designed to measure productivity,[4] from which the contribution of effort and skill might be inferred. This first task was strictly mathematical, consisting of repeatedly adding together 5 random two-digit numbers, with payment dependent on the number of correct answers in 10 minutes. For instance, a typical set of numbers might have been:

Adding 2-digit Numbers

31	56	14	44	87	

The second task for subjects was to complete a simple 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. This

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[4] Also used by Niederle and Vesterlund (2007), Oswald, Proto and Sgroi (2009) and Proto, Sgroi and Oswald (2010).

was designed as a brief check on ability, as used before in the literature (Gneezy and Rustichini, 2000). For our purposes these two tasks have another use: they provide a distraction to fill the time between the initial happiness question and the final life satisfaction question which raises the potential for priming by reducing the chance that subjects might consciously try to provide a consistent answer across both happiness questions.

The Appendix includes a copy of the questionnaire that completes the experiment. This 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 4 questions concerning life events detailed in Figure 3 which might induce the experience of negative affect triggered by requested recollection, priming 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 may act to counter any effect of negative mood and/or priming from the previous 4 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 "completely dissatisfied" and 10 means you are "completely satisfied"?

That the scale of the initial happiness question differs from the final life satisfaction question serves to maximize the chance of priming by reducing the chance that subjects did not merely recall their earlier. When the final questionnaire was complete, subjects were paid individually, and asked to leave the laboratory. No subject was allowed to participate multiple times.

It should by now be clear that our focus was on giving priming the best possible chance of success in our laboratory experiment – we provided temporal distance between both measures of SWB, distracted our subjects with mundane tasks, to maximize the chance that subjects would not simply remember their earlier answer, changed the scale of the SWB question, and then 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 most confident that priming is unlikely in the case of large-scale surveys.[5]

4. Results and Discussion

The aim of this section is to evaluate whether the priming questions had an impact on reported happiness. We investigate this using a variety of methods starting with simple histograms and a plot, through Ordered Probit and OLS estimations and a thorough investigation of the marginal impact of a change in one happiness measure on the other. Finally the most conclusive test for priming is a Bivariate Ordered Probit estimation including a tranche of Chi-squared tests designed to check whether the two reports were essentially identical. To anticipate the remainder of the section, despite our best efforts to prime the subjects, our evidence leads us to support the notion that life satisfaction reports are robust to priming. Table 1 gives an overview of the data.

4.1 An Initial Graphical Analysis

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[5] 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 as possible to keep the potential for any "demand effect" or reciprocity towards the experimenter to a minimum.

A good place to start the analysis of our results is to examine the SWB reports directly. To this end Figure 1 provides histograms of the initial "Happiness" and final "Satisfaction" measures by full sample, and by gender-specific subsamples. Figure 1 indicates that the shape of the distributions for both measures is very similar, both for the entire sample and for the male and female subsamples. However, considering only the overall distributions is not conclusive, because different subjects can be primed both positively and negatively by the experiment and might coincidentally "net out", so a more specific analysis allowing us to disentangle the positive and negative priming is necessary. This will also enable us to check whether there is any difference between negative and positive priming.

Figure 1: Histograms of the initial happiness and final satisfaction report
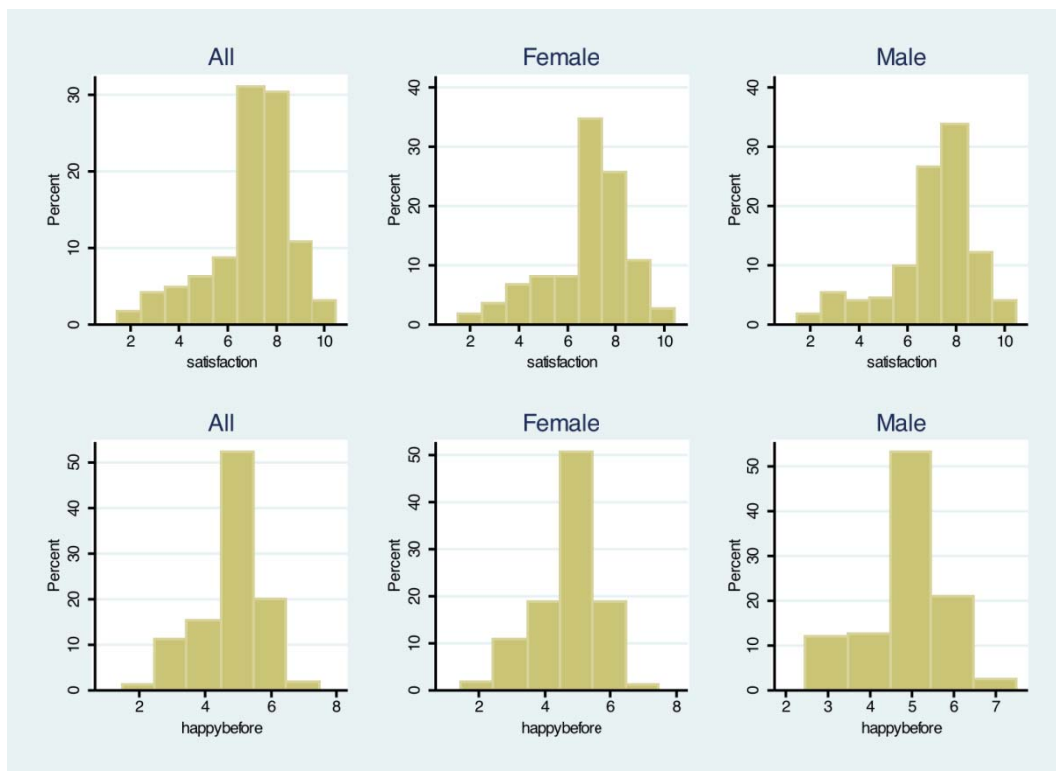
4.2 Univariate Life Satisfaction Equation Regressions

Here we carry out 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:[6]

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

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[6] 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.

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

Let us start with a set of regressions of the form of Equation 1, the results of which are presented in Table 2. Regressions (1) – (3) in Table 1 are Ordered Probits and (4) – (6) are OLS. In (1) and (4) we regress the initial happiness variable, "Happiness" on a variety of independent variables and in (2) and (5) do the same for the final life satisfaction measure "Satisfaction".

Comparing regressions (2) and (3) and in their OLS specification (5) and (6) in Table 2, we can provide an initial evaluation of whether priming is a problem. In particular if the coefficient of a variable, say A, is significant in the Satisfaction equations (2) and (5), but it is not significant when we introduce the variable Happiness, we can argue that the 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.

In general 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, most of the results look similar. Variables "Age" (subject's age), "Year Study" (the number of years of study at university), "Male" (the gender dummy – 1 for male, 0 for female) and "GMAT" (the performance in the GMAT MATH-style test) are not significant. Comparing (1) and (2) it is clear that the two most significant variables are "Illness" (one of the key negative life event questions which ask whether subjects have experienced a serious (potentially life-changing or life-threatening) Illness in their close family) and "Good Event" (relating to a potential positive life event). Both are significant and move both SWB variables in the direction you would expect. Interestingly "Bereavement" and "Parental Divorce" relating to the bereavement and parental divorce questions are not significant. We might conjecture about why this is the case but this is not strictly our concern here, instead we should note that this lack of significance is consistent across both measures and both formulations.[7] "High School Grades" is also significant in (2) and (5) though only at the 10% level. This 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 and so this might be seen as a possible positive

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[7] For a full discussion of the results on parental divorce see Proto, Sgroi and Oswald (2010).

priming question, though this is not clear as the subjects may have underperformed relative to expectations despite performing very well in general.[8] The regressions also included a full set of session dummies which are omitted from the Table 2 for clarity.

Staying with Table 2, and examining regressions (3) and (6), we find no significant impact of the main priming questions. There are very small, insignificant negative coefficients associated with the question concerning Illness. The coefficients associated with parental divorce and bereavement are very small, insignificant and even positive. The positive life event question (Good Event) is also positive though once again insignificant. 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 any priming or at least some form of focus bias, at this stage.[9]

We can also take a closer look at whether "Happiness" is an important and significant indicator of "Satisfaction" in regressions (3) and (6) in Table 2. In other words if this is significant and powerful we have more evidence that the two measures are strongly related despite the potential for priming prior to the Satisfaction question. "Happiness" is indeed highly significant (at the 1% level) in regression (3) of Table 2 and the OLS results confirm this and also indicate that a rise in "Happiness" has a powerful effect on "Satisfaction". To give more detail on this, a full analysis of the marginal effects appears in Table 3 (calculated using regression (3) in Table 2). The marginal effects are complex as any change in "Happiness" has an effect throughout the distribution of the "Satisfaction" variable, but we see powerful effects across the distribution: whether we consider a pure marginal effect (from a unit increase in Happiness) or a half standard deviation shift, the effect is a similar upward push at the higher end of the "Satisfaction" distribution and downward pull at the lower end.

Table 4 provides an alternative look at the distribution of the "Satisfaction" variable given that the initial "Happiness" variable is set at 4.83, which is the average value seen in the sample, and is 69% along the unconditional happiness distribution. All other variables in

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[8] 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.

[9] 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 'life satisfaction', but less with 'happiness', 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.

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 that is theoretically completely average across all independent variables and in the Happiness report. What is remarkable 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 – which is almost identical to the distributional position of his/her Happiness report. Put simple, anyone who is about 70% along the Happiness dimension is most likely to be also 70% along the Satisfaction dimension despite the potential for priming between the two reports. This provides another indication of the consistency of the two measures though as with the univariate regressions this is merely indicative and a purer test for priming requires a bivariate analysis which will be the topic of our next section.

4.3 Joint Life Satisfaction Equation Regressions and Tests

So far we have seen strong evidence that the initial and final measures of SWB are strongly related and that there is surprisingly little priming despite the deliberate attempt to give priming the best possible chance. However, we have yet to jointly regress both measures on the full set of independent variables including the potential priming. To this end we carry out a Bivariate Ordered Probit regressing both happiness measures as reported in Table 5. Here the regression equation 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 'k' controls, including demographic characteristics, for each measure and q_l a matrix of two sets of the 'l' priming questions, again, for each happiness measure.

Table 5 indicates that there are no gender effects. Moreover, the two key life event questions relating to Bereavement and Illness, that were important in the individual regressions remain key for the bivariate regression. They are once again significant and have a predictable sign.

What we need to understand is whether the coefficients can be thought of as essentially identical (given appropriate rescaling). Hence, we carry out a series of Chi-squared tests as reported in Table 6. Consistent with our earlier analysis, we find we cannot

reject the hypothesis that coefficients have an identical effect on Happiness and Satisfaction in combination (see Table 6a).

We do not stop with Table 6a since it is possible that there might be priming in one direction generated by a positive life question but that this is precisely compensated for by the negative life event questions priming subjects in the opposite direction leaving the false overall impression of a lack of priming. We check for this possibility by also running individual Chi-squared tests on Good Event, Bereavement, Illness, Parental Divorce, High School Grades and Additions separately. From Table 6b to 6g, we note that the hypothesis that the respective coefficients are equal cannot be rejected for all of these variables with the exception of Illness. However, the startling 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 significantly larger in the initial Happiness regression than in the final Satisfaction regression. This 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 the Bivariate Ordered Probit estimation and the full tranche of Chi-squared tests there is no evidence of positive priming from the Good Event or High School Grade questions and no evidence of negative priming from the Bereavement, Illness and Parental Divorce questions.

5. Conclusion

We find no evidence of priming in a controlled laboratory experiment in which we purposefully attempted to prime our subjects. The paper has suggested a new approach to the problem. We first ask for a happiness report and then expose our subjects to a variety of distracting tasks, then subject them to questioning on recent positive and negative life events and then ask them to report life satisfaction. In many cases our subjects had experienced significant life shocks in recent years and reminding them of this might in principle have influenced their answers to the subjective well-being questions. However, their second reports were strongly consistent with their first answers despite this potential priming effect. Hence, subjects appear to be capable of distinguishing between global subjective well-being (such as happiness or life satisfaction typically requested in surveys) and their short-run mood (that might be generated by the priming effect).

A simple plot of our data provided the first evidence that the two well-being measures were strongly correlated despite our attempt to prime the subjects to create a wedge between

their two reports. Next we carried out a number of Ordered Probit and OLS regressions which verified the influence of some of the life events upon reported happiness and life satisfaction, but we saw that these effects essentially vanished when the initial happiness measure was included in a regression of the final measure on the full set of characteristics and life event variables. This indicates that *important life events were likely already factored into the initial happiness report*, which provides additional evidence against priming. Finally, we carried out a Bivariate Ordered Probit and a related series of Chi-squared tests to check whether we could reasonably assume that the two well-being measures were essentially identical. Our results indicated that we could, with the single exception of the variable that related to recent family illness (however, even here the results indicated that the issue was unlikely to be negative priming). Our results seem to indicate that survey data are surprisingly robust to priming concerns.

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Table 1: Data description

Variable	#Observations	Mean	Std Error	Min	Max
(Initial) Happiness	269	4.84	0.94	2	7
(Final) Satisfaction	268	7.01	1.67	2	10
Age	259	19.61	1.54	18	30
Year Study	259	2.06	1.13	1	5
Male	261	0.52	0.5	0	1
High School Grades	255	0.53	0.25	0	1
Additions	267	18.10	8.86	2	50
Gmat MATH	269	3.06	1.46	0	5
Bereavement	269	0.53	0.49	0	1
Good Event	268	1.02	0.44	0	1
Parental Divorce	268	0.1	3.01	0	1

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

VARIABLES	(1) Initial Happiness	(2) Final Satisfaction	(3) Final Satisfaction	(4) Initial Happiness	(5) Final Satisfaction	(6) Final Satisfaction
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 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)
Illness	-0.701***	-0.347**	-0.00283	-0.577***	-0.574**	-0.0213
	(0.164)	(0.153)	(0.160)	(0.133)	(0.249)	(0.224)
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 "priming") 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 "priming") 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 providing evidence of a lack of priming. Regressions (4) – (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 clarity.

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 "+1 unit of reported happiness" 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 "Happiness" 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)
Age	-0.0994	0.0347
	(0.0690)	(0.0660)
Year 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)
Illness	-0.698***	-0.343**
	(0.164)	(0.153)
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) simultaneous. 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 clarity.

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. All of these Chi-squared tests are passed indicating 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) with the exception of the individual test on Illness.

Appendix B: 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 – 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 – 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 "Intro.xls" 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 "answer". 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 "Numberadditions.xls" 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.

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 "a" to "e", 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 – 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 today's session.

[Payments handed out and receipts signed]

Appendix C: 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 '1' is 'Predominantly competitive' and '5' is 'Predominantly

cooperative'?

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 '1' is 'Not at all important' and '5' is 'Very important'?"

All things considered, how satisfied are you with your life as a whole these days, where 1 means you are "completely dissatisfied" and 10 means you are "completely satisfied"?

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 D: 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 "basis points" 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, because——.

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 ——.

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.