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Comment   Daniel McFadden

> Let there be granted to the science of pleasure what is granted to the science of energy, to imagine an ideally perfect instrument, a psychophysical machine, continually registering the height of pleasure experienced by an individual, exactly according to the verdict of consciousness, or rather diverging therefrom according to a law of errors. From moment to moment the hedonimeter varies; the delicate index now flickering with the flutter of the passions, now steadied by intellectual activity, low sunk whole hours in the neighbourhood of zero, or momentarily springing up toward infinity.
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> —Francis Y. Edgeworth, *Mathematical Psychics,* 1881

Angus Deaton studies the time series properties and sensitivity to economic events and context of subjective measures of hedonic experience and well-being that have been promoted by Danny Kahneman and others and adopted in popular surveys. Some interpreters of these measures have used them as proxies for or alternatives to traditional economic indices of well-

Daniel McFadden is the E. Morris Cox Professor of Economics at the University of California, Berkeley, the Presidential Professor of Health Economics at the University of Southern California, and a research associate of the National Bureau of Economic Research.

being such as expected present value of a life-cycle stream of felicities. Do these subjective measures approximate Edgeworth's hedonimeter or replace it with psychologically more fundamental indicators of the human condition? Can and should they be adopted as tools of economic policy analysis, used to monitor economic progress and assess policy alternatives? There are reasons to be skeptical, on two levels. The first is that these subjective measures are demonstrably sensitive to context, making it difficult to separate a well-being signal from the noise of measurement. The second is that neither the revealed well-being of economists nor subjective well-being of psychologists are entirely convincing scientific concepts, apart from difficulties of reliable measurement. Economists and psychologists have been critical of their own measures and even more critical of each other's. In the words of Danny Kahneman, "economists have preferences, psychologists have attitudes." While behavioral economics has taken on some of the attitudes of psychology, to the substantial benefit of economic science, economists have traditionally been and continue to be suspicious of subjective rather than revealed information on economic state. A little history may be instructive.

Fifty years ago, Angus Deaton's chapter could not have been published. The economics profession at that time derided Edgeworth's wistful call for a hedinometer and was wholly unreceptive to the proposition that stated preferences of consumers could be used in economic analysis. A famous encounter a few decades earlier characterized this economic thinking. In 1932, the iconic psychologist Leon Thurstone gave a paper at the second meeting of the newly formed Econometric Society that proposed direct recovery of preferences from elicited indifference points. Ragnar Frisch, Harold Hotelling, and Milton Friedman were all in the audience, and it is reported that they excoriated Thurstone, labeling his method totally unsuitable for recovering preferences that determined real economic behavior. This rejection of subjective data also pervaded other social sciences. For example, behavioral psychologists in the 1950s rejected subjective reports as unscientific and pursued a self-consciously observationalist path.

Since then, economists have grudgingly come to accept the proposition that subjective beliefs, perceptions, and intentions, carefully elicited, can reflect and predict economic behavior. Now, surveys routinely elicit subjective probabilities of future events, ratings of product attributes, and purchase intentions, and these are used by applied economists and market researchers to predict consumer response to news and to product innovations. Preference elicitation is more problematic. Market researchers have made wide use of conjoint analysis, an elicitation methodology that comes out of psychometrics, and contingent valuation, a version developed by resource economists, and have found these methods reasonably reliable for forecasting demand for new variants of familiar products. In transportation, quite a few studies have combined revealed and subjective preference data in applications where market outcomes of policy interventions allow

assessment of the usefulness of subjective data. Broadly, the findings are that stated preferences are substantially predictive, but not identical to revealed preferences, with differences that seem to be explained by context, salience, prominence, and social interaction effects; see Morakawa, Ben-Akiva, and McFadden (2002), Louviere, Hensher, and Swait (2000), and Louviere et al. (1999). Neuroeconomic studies provide some support for Bentham's notion of a utilitarian calculus of pain and pleasure that might be tracked by cognitive science. However, subjective preferences for unfamiliar alternatives with no direct market counterparts, such as protection of remote endangered species, are found to be extremely sensitive to elicitation format and context, and their use remains intensely controversial; see Green et al. (1998) and McFadden (2005).

Angus considers two conceptually distinct subjective reports. The first are self-reported hedonic states, measures of experienced feelings such as joy, sadness, happiness, anger, stress, or worry. These could be collected contemporaneously by experience sampling, but in this study, they are obtained retrospectively by an approximation to the Day Reconstruction Method of Kahneman et al. (2004). The second is self-reported well-being (SWB), where respondents are asked to evaluate their life as a whole. These measures were proposed by Kahneman, Diener, and Schwarz (1999) and advanced by Kahneman et al. (2006), Kahneman and Krueger (2006), and others. The spirit of their approach is that these measures are predictive for behavior and revealing for human thinking, not that they mimic classical welfare measures. In fact, there is ample experimental evidence, much of it due to Kahneman, Schwartz, and other psychologists, showing that these are not measures of stable preferences. This has been taken as evidence that the economic concepts of preferences and life-cycle well-being are themselves flawed. Nevertheless, as the subjective measures have gained attention, it has been tempting for policymakers to treat them as empirical approximations to Edgeworth's hedinometer and use them for evaluation of economic events and policy. It would be a boon to economic analysis if these measures proved to be broadly reliable. However, there are many conceptual, behavioral, and psychometric issues in their use, and they deserve careful, critical assessment. In this comment, I will focus on dynamic transients in SWB, *cognitive bubbles* that are analogs of the bubbles that appear in asset markets. The presence of such bubbles does not invalidate SWB or stock prices as measures of the reality of evaluations, but they do complicate considerably the use of these measures as indicators of fundamentals.

For classical economic consumers with instantaneous utilities or felicities and life satisfaction characterized by expected present value of the stream of felicities, one could think of self-reported hedonic states as indicators for felicity and SWB as an indicator for expected present value of life-cycle utility. Suppose for the moment that these associations are valid. It is then instructive to work out for the neoclassical consumer what the relationship

between hedonic experience and changes in well-being should be. For the moment, put aside the issues of intertemporal separability and additivity of felicities that enter life-cycle utility and of intertemporal and interpersonal cardinality/comparability of the expected present value of a stream of felicities at various points in the life cycle. Consider the well-being at time T of a neoclassical consumer born at time zero. Let u_t denote instantaneous utility or felicity at time t, equal ideally to the experience that would be measured by Edgeworth's hedonimeter or the Day Reconstruction Method, and assume that felicity is scaled so that $0 \leq u_t \leq 1$. Felicity may depend on consumption of goods and services, and other variables such as health, and may be limited by budgets and other constraints, but for current purposes none of this needs to be made explicit. Let r denote a real discount rate, assumed constant for simplicity. Let S_t denote the probability of survival to time t, and $m_t = -d(\ln S_t)/dt$ denote the mortality hazard rate. Let $\mathbf{E}_T$ denote the expectation operator at time T, which incorporates subjective beliefs regarding the future, given all the information available at time T. The present value of the past stream of felicities up to T is $P_T = \int_0^T u_t \cdot e^{-r(t-T)}dt$. This expression is conditioned on realized felicities and survival to T and so does not involve survival probabilities or expectations. The present value of the future stream of felicities is $F_T = \int_T^\infty u_t \cdot (S_t/S_T) \cdot e^{-r(t-T)}dt$; this incorporates the probability of survival and further is random due to unrealized future economic events. Define neoclassical well-being as $W_T = (1 - \delta) P_T + \delta \mathbf{E}_T F_T$, with a weight δ to allow for the possibility that the past and future are treated differently, and $\delta = 1/2$ corresponding to the case of full expected present value of the life-cycle felicity stream. An important component of this formula, and potential source of volatility in neoclassical well-being, is the subjective expectation operator $\mathbf{E}_T$, which will react to news. While the most orthodox economists will insist that $\mathbf{E}_T$ mimics objective probabilities of future events, the market mechanisms that would force this outcome are notably incomplete, and the case for variable psychological influences on beliefs is strong. The rate of change in neoclassical well-being is

$$\frac{dW_T}{dT} = (1 - 2\delta)u_T + rW_T + m_T \cdot \delta \mathbf{E}_T F_T + [\mathbf{E}_T F_T - P_T]\frac{d\delta}{dT} + \delta\frac{d\mathbf{E}_T}{dT}FT.$$

Notable features of this derivative are (a) that it will depend on current felicity only to the extent that δ differs from 1/2, (b) the effect of the discount rate r and mortality rate m_T is to increase W_T with age, and (c) changes in attention to the future, influencing δ, and news, influencing $\mathbf{E}_T$, are potentially strong sources in volatility of W_T. As in Hall (1978), the effect of news entering $\mathbf{E}_T$ may give W_T the properties of a random walk.

If subjective measures of hedonic experience and well-being did proxy the parallel economic concepts of felicity and life-cycle expected present value of the felicity stream, then SWB would be an integral of hedonic experience over time, weighted for time discounting and adjusted for beliefs regarding

future events. Then, the rate of change in SWB would follow a formula analogous to the one in the preceding and would be correspondingly sensitive to changes in the weight δ given to the future rather than the past and changes in beliefs as the result of news. Then, one might expect self-reported hedonic states to reflect current experience and be largely independent of subjective probabilities of future events and changes in SWB to have some of the properties of a random walk. Subjective probabilities may loom large in this calculus, turning on the manner in which low-probability, large-impact, ambiguous future events are processed by the consumer. In this respect, the stock/flow relationship between hedonic experience and SWB should be similar to the stock/flow relationship between the current profits of a firm and its stock price, where beliefs about uncertain future events may react strongly to current information on cash flows. It is possible that one of the reasons that the Dow Jones Industrial Average (DJIA) and the measure studied by Angus, Gallop's SWB are so closely associated through the Great Recession is that both are reacting strongly to changing subjective probabilities of the same dreaded events.

Now the psychologists have convincing experimental evidence that SWB is not a simple integral of hedonic experience. For example, retrospective evaluation of a hedonic episode, which is similar to SWB, depends more on peak and last experience than integrated experience. Nevertheless, it seems likely that SWB will be as sensitive as its neoclassical counterpart to changes in orientation to the future versus the past and to news that changes beliefs regarding future events. An additional issue for both neoclassical consumers and for SWB is that subjective probabilities of future events may shadow current hedonic experience, for example, the claimed phenomenon that your sensory experience is amplified when you know you are to be hanged tomorrow.

A consistently-elicited self-reported well-being measure may exhibit transients that are primarily due to changes in subjective probabilities for the future, rather than discounted experience. Psychological experiments find that humans have difficulty forming consistent subjective probabilities and behavioral responses for remote, rare, highly consequential events, in some cases overestimating the probability and reacting strongly and in other cases through denial or fatalism ignoring the possibility of these events. Thus, SWB is likely to be unevenly sensitive to the prospect of events viewed with dread, such as the accidental death of oneself or a family member, a financial catastrophe that wipes out assets, or a natural or man-made disaster. A little news may lead to an exaggerated change in SWB that is not just the accumulation of current hedonic experience, particularly when an event such as a bank failure, a terrorist attack, a tornado, or a plane crash leads the consumer to dread events that had previously been denied. The behavior of humans as social animals, using information networks for news and behavioral exemplars, can introduce further instabilities, the panic responses

of herds. As a result, SWB may exhibit dynamic transients that can be interpreted as cognitive bubbles, responding to and feeding the perceptions of others regarding future events.

In this view of the evolution of SWB, an event such as the failure of Lehman Brothers can have a large impact, even on individuals who have no assets or income at immediate risk, because of dread of the possibility of a depression. Suddenly, a range of outcomes previously denied becomes possible. If, subsequently, the worst case outcomes are not realized, there may be a sense of relief and a rationalization that because the worst did not happen, it is fated to not happen in the future. As a result, SWB may rebound in the other direction.

At least some of the evidence that Angus has collected on the behavior of the Gallup measure of self-reported well-being through the Great Recession seems to be consistent with the development of cognitive bubbles induced by changing levels of dread about worst case outcomes. This, in turn, suggests considerable caution in attributing changes in SWB over the course of the recession to real changes in economic circumstances of individual consumers. Aside from the events of losing one's job or house, the economic effects of the recession are mostly on future prospects rather than current circumstances. Nevertheless, SWB may react strongly due to increased dread. Then, SWB may provide valuable information on beliefs and how they evolve. However, it is unlikely to be a reliable indicator of objective life-cycle economic status.

There are substantial conceptual, behavioral, and psychometric issues in measurement of hedonic state and life-cycle well-being, some related to the possibility of cognitive bubbles, others to the sensitivity of self-reports to the framing and context of the elicitation. Angus has discussed some of these. Many of these issues were originally documented in the research of Kahneman and of Norbert Schwarz, both occasional coauthors of Angus. One is the "hedonic treadmill," the finding that humans adapt quickly and achieve homeostasis under widely varying objective conditions. For example, studies by Norbert Schwarz find that people rate their home community highly, even after forced migration to places they rate lowly before the fact, and find that paraplegics and nonparaplegics are equally happy after the fact of injury. Applied to SWB, one can expect this to trend to similar equilibrium levels even under substantially different economic circumstances. As Angus notes, this drives a wedge between ex ante and ex post subjective evaluation of policy changes, even if reported satisfaction is exactly accurate. Another important psychometric effect is sensitivity to context. A study, again by Norbert Schwarz, finds that college students give very different satisfaction ratings to college life depending on whether they had previously been asked about the quality of their sex life. Angus notes that this is an important issue in the Gallup measures of SWB, finding that they are quite sensitive to the presence of earlier questions that focus on politics. This appears to

be the explanation for the strong April 6 effect he observes. It would not be surprising if external political information effects, such as media coverage, also have an influence. My preceding discussion of cognitive bubbles suggests that news that has modest implications for individual economic status, such as an election outcome, could through social networks and key pundits nevertheless have a large effect on SWB. Context operates by forming a frame of reference in which elicitations are interpreted and also by altering the salience of various factors and ease of reconstruction and retrieval of experience and memory. Thus, hedonic evaluations obtained by the Day Reconstruction Method can be influenced by first asking the subject to recall the best or worst thing that happened to them yesterday. It is worth noting that many of the effects at issue here also appear, in muted form, in objective questions. For example, if a respondent is asked to list household assets, frames that mention and prioritize asset categories can change reports, a phenomenon observed in the Health and Retirement Study (HRS). Similarly, one should expect that order and context will matter in the collection of data on self-reported health conditions and overall health state and expect variations in self-reported health status (SRHS) that are sensitive to news that influences beliefs.

In summary, economists should give Angus's chapter careful attention. Directly elicited measures of well-being have the potential to tell us a lot about the formation of beliefs and the evaluation of hedonic experience. As to whether they are sufficiently reliable to be used to evaluate economic events and policies, I am skeptical—I suspect cognitive bubbles will introduce too much volatility. However, more analysis is needed. Finally, economists should take seriously the position of psychologists like Kahneman and Schwarz that there are no stable underlying economic preferences or perceptions, and psychological moods, affect, and attitudes are all there is. If this is so, the deep conceptual question is where economic policy analysis can find an anchor.

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