Two explanations to the willingness to accept and willingness to pay gap plus an alternative

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Abstract:

The gap between the willingness to accept and willingness to pay is the outcome of incomplete valuation. The problem therefore is more about completing the valuation procedure. The first part of the solution involves two items: one is the inclusion of the direct and indirect income effects and the other is the inclusion of the substitution effect between the numeraire good (i.e., income) and the good under consideration. The second part of the solution concerns the respective hedonic content of income, the good, and the setting. These two explanations point to a third solution that puts the setting together with the income and substitution effects.

Keywords: Willingness to accept; willingness to pay; subjective well-being

JEL Codes: A10; D00, D60; H40; Q50

1. INTRODUCTION

One of the sticking points in economics is that the theoretical equality of the willingness to accept (WTA) and willingness to pay (WTP) is not often validated by empirical work. In fact, the WTA-WTP gap can turn out to be a substantial amount. Henderson (1941) was the first to raise the problem in a commentary to Hicks (1939). Later, Krutilla (1967) pointed out the same issue in the context of environmental goods. Gregory and Brown (1999) and Harowitz and McConnell (2002) are the more recent surveys on the topic.

This paper argues that the equality of the WTA and WTP is possible if the corresponding

marginal utility of income, U_Y, is the same across alternative states (Hicks 1939; Hicks 1941). If so, the gains and losses of equal amounts of money necessarily indicate the same effects.[1] Results of Willig (1967) for the private goods and those of Mäler (1974) and Randall and Stoll (1980) for the public goods are therefore easy to comprehend. Otherwise, the income effects need to be fully accounted for in the valuation procedure. Along with the income effects, the substitutability of the good under consideration with its numeraire good (i.e., income) also needs to be included in the valuation procedure (Randall and Stoll 1980; Hanemann 1991).

This paper furthermore argues that the equality of the WTA and WTP is possible if there is no hedonic value to consider. Fundamentally, the hedonic explanation to the WTA-WTP gap is less about being familiar with transactions (List 2003), utilizing incentive-compatible mechanisms in the valuation procedure (Coursey et al. 1987; Plott and Zeiler 2005), or even incorporating the income and substitution effects pointed out earlier. Rather, the issue is more about the psychology with regard to income, the good, and/or the setting.[2] Income does not affect the valuation of the good if money does not assume the role of status symbol or basis for social comparisons (Frank 1985). Similarly, a good that is intended for exchange and not for use or enjoyment does not affect the outcome of the valuation (Kahneman et al. 1990). Otherwise, emotions (Damasio 1994; Loewenstein 1996; Peters et al. 2003) and moral considerations such as existence or intrinsic value (Boyce et al. 1992; Kahneman and Knetsch 1992) would be misrepresented as the valuation

[1] Constant utility across states requires the utility function to assume a symmetric sigmoid form. Kahneman and Tversky (1979) and Thaler (1980), in contrast, assume an asymmetric sigmoid form. They examine psychological utility on the *scenario* where a good is given or taken away from the person (and not really the economic utility on the good itself) and their findings indicate that U_Y is not constant across states. To verify, hold psychological utility constant across states then check out the slopes. Notice that U_Y for a gain of money (i.e., WTA) is *less* than U_Y for a loss of an equal amount of money (i.e., WTP) corresponding to their respective scenario. The WTA-WTP gap occurs even if response elicitation is controlled in the setup.

[2] An "endowment effect" is the effect associated with ownership, possession, entitlement, or claim, whereas a "reference effect" is contingent to, say, an endowment. The setting is the (nature of) endowment. Studies on endowment actually draw attention to the perception of the setting in explaining the WTA-WTP gap and not on income and/or the good *per se*.

of the good. The outcome and process to reach the outcome also do not matter in the valuation of the good if the setting is not relevant (Loewenstein and Prelect 1993; Redelmeier and Kahneman 1996; Köszegi and Rabin 2006). Otherwise, the setting wherein a good is received in an *ex ante* condition of, say, no possession or given up in an *ex ante* condition of possession is a relevant dimension in the valuation regardless if money involved or not (Kahneman et al. 1990; Kahneman et al. 1991; Knetsch 1995; Knetsch and Wong 2009). The same applies if the situation is risky (Kahneman and Tversky 1979) or riskless (Thaler 1980; Tversky and Kahneman 1991). In fact, differences in the valuations remain even if bi-directional compensations between losers and gainers of the transaction are allowed.

Discarding the empirical issues involved in carrying out the valuation of the good, the puzzle of the WTA-WTP gap is simply about incomplete valuation.[3] Completing the valuation is therefore the solution to the problem. One part of the solution is the "economics of valuation," which concerns the income and substitution effects, and the other is called the "psychology of valuation," which deals with the respective hedonic contents of income, the good, and the setting.

Lastly, the paper submits the subjective well-being (SWB) valuation procedure as a third solution to the problem. The SWB procedure is anchored on both income and substitution effects, but it has two formulations. The "exclusive" form discards all hedonic content of income, the good, and the setting. In contrast, the "inclusive" form maintains that the setting is relevant in the valuation procedure. Di Tella et al. (2001), Ferrer-i-Carbonell and van Praag (2002), and Welsch (2002) were the first to use (a version of) the exclusive procedure.[4] Welsch and Kühling (2009) and Frey et al. (2010) are recent surveys on the topic.

Part 2 presents the economics and psychology solutions to the puzzle of the WTA-WTP gap. The demonstration is done at the conceptual level in order to point out the possibility of the

[3] Given the WTA-WTP gap, WTP became the choice of valuation over WTA on the presumption that WTA is flawed. Knetsch (1990) and Gregory and Brown (1999) note that using WTP when WTA is appropriate implies two things. First, the good is undervalued. Second, allocative efficiency is effectively abandoned.

[4] To the best of my knowledge, no study has applied the inclusive SWB procedure.

incomplete valuation. Part 3 presents an alternative solution. Again, the demonstration is done at the conceptual level to draw attention to its parallels between the economics and psychology solutions as well as to bring out the strength of the alternative. What is asserted in the end is that an integrated approach might be more helpful in solving the incomplete valuation problem and in advancing the valuation procedure. The last part concludes.

2. FIGURING OUT THE WTA-WTP GAP

2.1. Incomplete Economics

Consider a standard utility function like $U = U(Y, Z)$, where Y is income and Z is the good. Y and Z are exogenous and assumed to carry no hedonic content. By convention, Y is the numeraire good, or the unit for valuation. Other attributes are excluded in the discussion in order to simplify the exposition. The usual assumptions about the utility function apply. Of course, the foremost assertion here is that choice-actions as manifested in buying and selling reflect true utility. Such assertion takes the market or pseudo-market as the principal site for a transaction. This textbook setup leads to the valuation of Z as:

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{U_Z}{U_Y} \qquad (1a)$$

Holding the utility constant at the *ex ante* state with increasing Z or holding the utility constant in the *ex post* state without increasing Z obtains the same valuation of Z in terms of Y. Such result is reached because U_Y (i.e., direct income effect) is unchanged across the alternative states. It is then easy to define the valuation of Z in terms of the alternative states, as follows:

$$\frac{U_Z}{U_{Y_{WTA}}} = \frac{U_Z}{U_{Y_{WTP}}} \qquad (1b)$$

where $U_{Y_{WTA}}$ is the marginal utility of income if money is received in the *ex post* state and $U_{Y_{WTP}}$ is

the marginal utility of income if money is paid in the *ex ante* state. If so, it does not matter if one ends up as the winner or loser as long as there is indifference to the outcome.

Therefore, it is easy to conclude that the valuations of Z are not going to be identical if U_Y across the alternative states is not the same precisely because it matters if the money is collected or given up. What occurs instead of Equation 1b is:

$$\frac{U_Z}{U_{Y_{WTA}}} > \frac{U_Z}{U_Y} > \frac{U_Z}{U_{Y_{WTP}}} \tag{2}$$

The change in U_Y in this case is a crucial explanation why WTA turns out to be larger than WTP. Larger amounts of money are necessary to reach the utility in the *ex post* state since the increases in Y lower $U_{Y_{WTA}}$ in the process. In contrast, smaller amounts of money are required to maintain the utility in the *ex ante* state since the decreases in Y increase $U_{Y_{WTP}}$ in the process. There must be some unaccounted income effect brought about by the changes in income. This conclusion is the same for both price-constrained and quantity-constrained valuations. The required correction is obvious.

The claim is that the utility function takes the form $U = F[Y, Z(Y)]$ if the indirect income effect is internalized in the valuation procedure. The expressions and assumptions are as defined earlier. In this case, however, Z is necessarily not anymore exogenous to Y, and its valuation is:

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{F_Z}{F_Y + F_Z \dfrac{dZ}{dY}} \tag{3a}$$

Suppose $F_Y > 0$. If $(F_{Y_{WTA}} > 0) \downarrow$ with the receipt of money, then $(F_Z \dfrac{dZ}{dY}) > 0$; and if $(F_{Y_{WTP}} > 0) \uparrow$ with the payment of money, then $(F_Z \dfrac{dZ}{dY}) < 0$. Suppose $\dfrac{dZ}{dY} > 0$. If so, the indirect income effect depends on F_Z, which is positive if Z is a *good* and negative when Z is a *bad*. By logical necessity, the accounting of the income effects works out Equation 2, thus $\dfrac{F_Z}{F_{Y_{WTA}} + F_Z \dfrac{dZ}{dY}} = \dfrac{F_Z}{F_{Y_{WTP}} + F_Z \dfrac{dZ}{dY}}$. The outcome is still the same if $\dfrac{dZ}{dY} < 0$.

Yet, the utility function takes the form $U = F[Y(Z), Z(Y)]$ in case the assumption of exogenous Y is relaxed (c.f., Cropper and Oates 1992), and Z is deemed divisible. In this case, the expression asserts that changes in the quantity and/or quality of Z can bring changes to Y, which needs to be included in the valuation. The substitution between Y and Z is reflected as follows:[5]

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{F_Z + F_Y \dfrac{dY}{dZ}}{F_Y + F_Z \dfrac{dZ}{dY}} \qquad (3b)$$

Now, $\frac{dY}{dZ} \to \infty$ if there is limited or no substitution and the required money to hold utility constant is large, $F_Y \to 0$, and $F_Y \frac{dY}{dZ} \to 0$. In this case, the valuation of Z reaches infinity. Second, $\frac{dY}{dZ} \to 0$ if there is substitution and the required money to hold utility constant turns small, $F_Y \to \infty$, and $F_Y \frac{dY}{dZ} \to 0$. In this case, the valuation of Z approximates zero.[6] The more important finding is that these equations specify $F_Z \frac{dZ}{dY}$ to be the missing element that explains the WTA-WTP gap.

The direct and indirect income effects are accounted in Equation 3a then the substitution effect is accounted in Equation 3b. These results spell out that the central elements in a valuation procedure in economics are the direct and indirect income effects.

2.2 Missing Psychology

The psychology of valuation looks at three things. First, considers Y in the utility function $U = U(Y, Z)$ as defined. If the hedonic content of Y is zero, then Equation 1a holds. But if money is a potent basis for assessing or comparing social status, then the hedonic content of Y is not trivial.

[5] The effect of Z or that of both Y and Z on another external variable like health can also be examined. In this case, the utility function takes the form, respectively, $U = F[[Y(Z), Z(Y)] + W(Z)]$ or $U = F[[Y(Z), Z(Y)] + W(Y, Z)]$, where W is the "health" function.

[6] Note the similarity with Randall and Stoll (1980) and Hanemann (1990).

Ignoring this aspect implies an incomplete valuation of *Z*.

Consider next *Z* in the same function. Goods that are generally intended for exchange do not carry any hedonic content regardless when or where trade occurs. Dispassionate or routine transaction rids *Z* of hedonic content. If so, Equation 1a also holds. In contrast, goods for use or enjoyment take on hedonic content. Attachment, sentiment, motivation, attention, etc. make "use value" more salient thereby producing loss aversion and reluctance to trade. In fact, the price of a good is not anymore a relevant consideration when "use value" governs both thinking and feeling. Ignoring this aspect implies an incomplete valuation of *Z*.

In view of the above discussions, the internalization of the hedonic contents of *Y* and *Z* leads the utility function to take the form *U = H[Y, Z, E(Y, Z)]*, where *E* is the "emotion" function. The other expressions and assumptions are as defined. For now, assume that the setting of *Z* is not relevant to the valuation procedure. As such,

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{H_Z + H_E \frac{\partial E}{\partial Z} + H_E \frac{\partial E}{\partial Y}\frac{dY}{dZ}}{H_Y + H_E \frac{\partial E}{\partial Y} + H_E \frac{\partial E}{\partial Z}\frac{dZ}{dY}} \qquad (4)$$

where $(H_E \frac{\partial E}{\partial Z} + H_E \frac{\partial E}{\partial Y}\frac{dY}{dZ})$ represents the hedonic content of *Y* and *Z* to be included in the valuation and $(H_E \frac{\partial E}{\partial Y} + H_E \frac{\partial E}{\partial Z}\frac{dZ}{dY})$ is the extension to the numeraire good. Logic dictates that $H_E > 0$, $\frac{\partial E}{\partial Z} > 0$, and $\frac{\partial E}{\partial Y} > 0$ if the hedonic contents are not trivial. These results indicate some important elements in the psychology of valuation.[7]

The third item to consider is that the setting is not trivial. That is, the setting in which *Z* is received under an *ex ante* condition of no possession and that in which *Z* is given up under an *ex ante* condition of possession matters. Suppose for now *Y* and *Z* do not carry hedonic content. The

[7] An important issue here is whether the fickleness, even fleeting, nature of emotions bring instability in the valuation procedure. If so, the results are deemed spurious. It is not straightforward to what extent Equation 2 is resolved with Equation 4 since there are no indirect income effects.

internalization of the setting requires the utility function to take the form $U = H[(Y, Z, Q(Z)]$, where Q is the "setting" function. The valuation of Z, in this case, is:

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{H_Z + H_Z \frac{dQ}{dZ}}{H_Y} \tag{5a}$$

where $H_Z \frac{dQ}{dZ}$ is the setting to be included in the valuation. Logic dictates $H_Z \frac{dQ}{dZ} > 0$ if Z is specific and tangible; otherwise, $H_Z \frac{dQ}{dZ} = 0$. Equation 5a is what the extant valuation procedures on endowment attempt to measure but it continues to be an incomplete valuation of Z because the income effects remain incomplete since the exchange of money is not trivial in the context where the endowment is not trivial.

Accordingly, allowing for the income effects means that the utility function take the form $U = H[Y, Z(Y), Q(Z)]$. Now, the valuation Z is:

$$\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{F_Z + H_Z \frac{dQ}{dZ}}{F_Y + F_Z \frac{dZ}{dY}} \tag{5b}$$

Notice that Equation 5b reverts to Equation 1 if both income effects and the setting do not matter at all.[8] More importantly, the interpretation of Equation 5a and 5b is essentially the same as with Equations 3a earlier even with the addition of $H_Z \frac{dQ}{dZ}$ in the expression. The results indicate that the setting is another important element in the psychology of valuation.

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[8] Putting the economics and psychology of valuation together obtains a utility function of the form $U = H[(Y(Z), Z(Y), E(Y, Z), Q(Z)]$, where Y and Z are assumed endogenous to each other and the three elements of hedonic content are assumed not trivial. Thus, $\frac{\partial U/\partial Z}{\partial U/\partial Y} = \frac{H_Z + H_Y \frac{dY}{dZ} + H_Z \frac{dQ}{dZ} + H_E \frac{\partial E}{\partial Z} + H_E \frac{\partial E}{\partial Y}\frac{dY}{dZ}}{H_Y + H_Z \frac{dZ}{dY} + H_E \frac{\partial E}{\partial Y} + H_E \frac{\partial E}{\partial Z}\frac{dZ}{dY}}$ is the valuation of Z. As with footnote 7, $(H_E \frac{\partial E}{\partial Z} + H_E \frac{\partial E}{\partial Y}\frac{dY}{dZ})$ and $(H_E \frac{\partial E}{\partial Y} + H_E \frac{\partial E}{\partial Z}\frac{dZ}{dY})$ might introduce instability and volatility to the valuation procedure.

3. The Alternative: Subjective Well-Being Approach to Valuation

The subjective well-being (SWB) procedure, as an alternative to the ones presented in the earlier sections, asserts three things. First, choice-action does not reflect true utility. So going back to classical utility is the right direction to pursue because analysis is then anchored on personal experience. Yet, the shift does not really bring a fundamental change in the manner by which utility analysis *per se* is conducted, except that doing so allows for a second assertion, namely: a market or pseudo-market setting is not a helpful framework in the context of valuation. The discomfort with choice-action and the market is really about what meaning to put on the valuation of a good when a person is not capable, even powerless, in changing the situation given corporate power, political expediency, and class interest. Put in another way, choice-action and the market are not anymore necessary if the numeraire good (e.g., income) that serves as the anchor for the valuation procedure is well defined. The third assertion is the following: the hedonic contents of income, the good, and the setting might be the ones being valued and not the good itself. The proposal is to decouple emotions from the procedure but retain the elements for a complete valuation procedure. Nevertheless, the setting may be a valuable aspect to consider given that the nature of endowment can have an effect on the valuation of a good.

Since true utility is an internal state of being, the SWB procedure begins with a claim that the self-reported state of being exhibits a positive monotonic transformation of the underlying true utility. That is, $SWB_i \equiv h[U_i(\cdot)]$, where *SWB* is the self-reported state of being, $SWB_2 > SWB_1$ if $U_2(\cdot) > U_1(\cdot)$, and state $i+1$ is deemed superior to state i for $i = 1,\ldots, n$. Note that SWB does not involve its hedonic component given that the hedonic contents of Z and Y are discarded in this context.[9] The contention is that a person is able to distinguish the alternative states of being

[9] Studies find that SWB is comprised of the separable and independently measurable components of affect and satisfaction (Lucas et al. 1996; Diener and Emmons 1985). "Affect" is the hedonic component of the state of being and it is separable into positive and negative feelings (Watson et al. 1988). "Judgment" is the

regardless of what metric is used for the self-assessment. The implication then is as follows: a "better" situation that is judged superior to that of a "good" situation is viewed as such; similarly, a "good" situation that is judged superior to that of a "bad" situation is viewed as such, etc.[10]

Therefore, the SWB function takes the familiar set up of $SWB = H(Y, Z)$. The expressions and assumptions are as defined. In this case, however, Z is deemed as an "external" variable that is inserted in the SWB function for the purpose of the valuation (c.f., footnote 5), albeit Z contributes in some way or another to the state of being. This setup is saying that joint evaluations are precluded so the valuation procedure is focused on Z alone. In discarding the hedonic contents of Y and Z, issues like familiarity or understanding of the good, the money used in and the nature of the transaction, etc., become immaterial. In effect, the assessment of feelings or emotions does not affect the valuation of the good.

As such, the valuation of Z is $\frac{\partial SWB/\partial Z}{\partial SWB/\partial Y} = \frac{H_Z}{H_Y}$ (c.f., Equation 1a). The following expressions are obtained if income effects and then substitution effect, respectively, are introduced:

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self-assessment of life in general. Judgment is generally more stable than affect.

Studies find that measures of SWB are reliable, robust, and valid. Reliability tests using self-assessments obtained from one person but at different points in the same interview (Ehrhardt et al. 2000) or from the same person but at different periods (Krueger and Schkade 2008) give consistent and stable results. People who say they are happy at time t are generally also happy in time t+1, excluding any extraordinary or dramatic life events between the two periods. Validity tests find strong evidence that measures of SWB capture what they are suppose to measure. Studies find people with high subjective well-being smile more (Ekman et al. 1990; Pavot et al. 1991) and they are rated with high subjective well-being by their spouses, relatives, or peers (Costa and McRae 1988; Sandvik et al. 1993). Even studies in neuroscience find a tight correspondence between subjective well-being and the location of brain activity associated with well-being (Davidson 2003; Urry et al. 2004).

[10] Strictly speaking, cardinality is not required in order to perform the SWB procedure. Most applications of the SWB procedure use (interpersonal comparable) ordinal values. But cardinality becomes necessary when the analysis proceeds from valuation to welfare implications of the valuation. The appendix offers a procedure for obtaining interpersonally comparable cardinal values of SWB.

$$\frac{\partial SWB/\partial Z}{\partial SWB/\partial Y} = \frac{H_Z}{H_Y + H_Z \dfrac{dZ}{dY}} \tag{6a}$$

and

$$\frac{\partial SWB/\partial Z}{\partial SWB/\partial Y} = \frac{H_Z + H_Y \dfrac{dY}{dZ}}{H_Y + H_Z \dfrac{dZ}{dY}} \tag{6b}$$

The above setup is called "exclusive" SWB procedure (c.f., Equations 3a and 3b). There is no doubt that the above equations are facsimiles to those in Section 2.1, thus validating the assertion that there is no fundamental change in the way the valuation of the good is carried out. However, the point here is that the alternative procedure is a better setup because it bypasses the issues that burden the extant procedures.

The setting can be accommodated in the valuation procedure in the same manner as Z is introduced as an external variable in the SWB function (c.f., footnote 5). In doing so, the setting is introduced but the assessment of feelings or emotions that are associated with the setting are precluded. The SWB function thus takes the form $SWB = H[[Y, Z(Y)] + Q(Z)]$ or $SWB = H[[Y(Z), Z(Y)] + Q(Z)]$ depending on the assumptions on Y and Z. Respectively, the valuations of Z are:

$$\frac{\partial SWB/\partial Z}{\partial SWB/\partial Y} = \frac{H_Z + H_Z \dfrac{dQ}{dZ}}{H_Y + H_Z \dfrac{dZ}{dY}} \tag{7a}$$

or

$$\frac{\partial SWB/\partial Z}{\partial SWB/\partial Y} = \frac{H_Z + H_Y \dfrac{dY}{dZ} + H_Z \dfrac{dQ}{dZ}}{H_Y + H_Z \dfrac{dZ}{dY}} \tag{7b}$$

The above setup is the so-called "inclusive" SWB procedure. Moreover, these expressions are able to resolve Equation 2. The analyses of Equations 6a and 6b as well as 7a and 7b are the same as those of Equations 3a and 3b as well as 5a and 5b.[11] The central issues of direct and indirect

[11] Suppose $H_Y > 0$ and $H_Z \dfrac{dQ}{dZ} > 0$. The receipt of money means $(H_{Y_{WTA}} > 0) \downarrow$ and $(H_Z \dfrac{dZ}{dY}) > 0 \uparrow$, whereas

income effects and setting are fully accounted with Equation 7a, whereas the substitution effect is accounted with Equation 7b. Putting the important elements of the economics and psychology of valuation together, Equations 7a and 7b therefore present a valuation procedure that is not only dispassionate but also complete.

4. CONCLUSION

The paper argued that incomplete valuation is the cause of the WTA-WTP gap, and so complete valuation is the solution to the problem. The first solution concerns the inclusion of the income and substitution effects. The second solution concerns the inclusion of the hedonic content of income, the good, and the setting. Pursuing the first solution alone fulfills the expectations for the efficient allocation of goods but does not fulfill psychological expectations, especially when moral satisfaction like existence or intrinsic value, emotion, and other factors like attitude and personality are relevant. Pursuing the second solution alone fulfills the psychological expectations but does not fulfill efficiency requirements, especially if scarcity is relevant. Moreover, the focus on the hedonic content might result in emotion as the one being valued and not the good *per se*. Finally, the paper presented the subjective well-being approach to valuation as an alternative to the extant procedures. The third solution decouples choice-action, market, and hedonic values from the valuation procedure even as it takes into account income and substitution effects as well as the relevance of the setting in the valuation of the good. It thus presents an approach that is not only dispassionate but also productive in advancing the economics and psychology of valuation.

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the payment of money means $(H_{Y_{WTP}} > 0) \uparrow$ and $(H_Z \frac{dZ}{dY}) < 0 \downarrow$. Let $\frac{dZ}{dY} > 0$. The indirect income effect depends on H_Z (again, Equations 3a and 3b). By logical necessity, $\frac{H_Z + H_Z \frac{dQ}{dZ}}{H_{Y_{WTA}} + H_Z \frac{dZ}{dY}} = \frac{H_Z + H_Z \frac{dQ}{dZ}}{H_{Y_{WTP}} + H_Z \frac{dZ}{dY}}$ resolves Equation 2. The outcome is the same if $\frac{dZ}{dY} < 0$.

REFERENCES

Andrews, F. and Withey, S. (1976). *Social indicators of well-being: America's perception of life quality*, New York: Plenum

Becker, G., DeGroot, M. and Marschak, J. (1964). "Measuring utility by a single-response sequence method," *Behavioral Science*, 9(3): 226-232

Boyce, R., Brown, T., McClelland, G., Peterson, G., and Schulze, W. (1992). "An experimental examination of intrinsic values as a source of the WTA-WTP disparity," *American Economic Review*, 82(5): 1366-1373

Brickman, P. and Campbell, D. (1971). "Hedonic relativism and planning the good society," in M. Appley (eds.), *Adaptation-level theory* (pp. 287-302), New York: Academic Press

Campbell, A., Converse, P. and Rodgers, W. (1976). *The quality of American life*, New York: Russell Sage

Cantril, Hadley (1965). *The pattern of human concerns*, New Brunswick: Rutgers University Press

Clark, A., Diener, E., Georgellis, Y., and Lucas, R. (2008). "Lags and leads in life satisfaction: A test of the baseline hypothesis," *Economic Journal*, 118(529): F222-F243

Costa, P. and McCrae, R. (1988). "Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO personality inventory," *Journal of Personality and Social Psychology*, 54(4): 853-863

Coursey, D., Hovis, J., and Schulze (1987). "The disparity between willingness to accept and

willingness to pay measures of value," *Quarterly Journal of Economics*, 102(3): 679-690

Davidson, R. (2003). "Affective neuroscience and psychophysiology: Toward a synthesis," *Psychophysiology*, 40(5), 655-665

Derrick, W., Kruger, J., Napa-Scollon, C., Diener, E. (2003). "What to do on spring break? The role of predicted, on-line, and remembered experience in future choices," *Psychological Science*, 14(5): 520-524

Dhar, R. and Wertenbroch, K. (2000). "Consumer choice between hedonic and utilitarian goods," *Journal of Marketing Research*, 37(1): 60-71

Di Tella, R., MacCulloch, R., and Oswald, A. (2001). "Preferences of inflation and unemployment: Evidence from surveys of happiness," *American Economic Review*, 91(1): 335-341

Diener, E. and Emmons, R. (1985). "The independence of positive and negative affect," *Journal of Personality and Social Psychology*, 47(5): 71-75

Diener, E., Emmons, R., Larsen, R., and Griffin, S. (1985). "The satisfaction with life scale," *Journal of Personality Assessment*, 49(1): 71-75

Easterlin, R. (1974). "Does economic growth improve the human lot? Some empirical evidence," in: P. David and M. Reder (eds.), *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz* (pp. 89-125), New York: Academic Press

Easterlin, R. (2001). "Income and happiness: Towards a unified theory," *Economic Journal*, 111(473): 465-484

Ehrhardt, J., Saris, W., and Veenhoven, R. (2000). "Stability of life satisfaction over time: Analysis of change in ranks in a national population," *Journal of Happiness Studies*, 1(2): 177-205

Ekman, P., Davidson, R., and Friesen, W., (1990). "The Duchenne smile: Emotional expression and brain physiology II," *Journal of Personality and Social Psychology*, 58(2): 342-353

Ferrer-i-Carbonell, A. and van Praag, B. (2002). "The subjective costs of health losses due to chronic diseases: An alternative model for monetary appraisal," *Health Economics*, 11(8): 709-722

Frank, R. (1985). *Choosing the right pond: Human behavior and the quest for status*, New York: Oxford University Press

Frederick, S., and Loewenstein, G. (1999). "Hedonic adaptation," in D. Kahneman, E. Diener, and N. Schwarz (eds.), *Well-being: The foundations of hedonic psychology* (pp. 302-329), New York: Russell Sage Foundation

Frey, B., Luechinger, S., and Stutzer, A. (2010). "The life satisfaction approach to environmental valuation," *Annual Review of Resource Economics*, 2010(1): 139-160

Gilbert, D. (2006). *Stumbling on happiness*, London: Harper Perennial

Gregory, T. and Brown, R. (1999). "Why the WTA-WTP disparity matters," *Ecological Economics*, 28(3): 323-335

Hanemann, M. (1991). "The willingness to pay and willingness to accept: How much can they differ?," *American Economic Review*, 81(3): 635-647

Harowitz, J. and McConnell, K. (2002). "A review of the WTA/WTP studies," *Journal of Environmental Economics and Management*, 44(3): 426-447

Headey, B. and Wearing, A. (1989). "Personality, life events, and subjective well-being: toward a dynamic equilibrium model," *Journal of Personality and Social Psychology*, 57(4): 731-739

Henderson, A. (1941). "Consumer's surplus and the compensating variation," *Review of Economic Studies*, 8(2): 117-121

Hicks, J. (1939). *Value and Capital: An inquiry into some fundamental principles of economic theory*, Oxford: Oxford University Press

Hicks, J. (1941). "The rehabilitation of consumer surplus," *Review of Economic Studies*, 8(2): 108-116

Kahneman, D. and Knetsch, J. (1992). "Valuing public goods: The purchase of moral satisfaction," *Journal of Environmental Economics and Management*, 22(1): 57-70

Kahneman, D. and Tversky, A. (1979). "Prospect theory: An analysis of decisions under risk," *Econometrica*, 47(2): 263-291

Kahneman, D., Knetsch, J. and Thaler, R. (1990). "Experimental tests of the endowment effect and the Coase Theorem," *Journal of Political Economy*, 98(6): 1325-1348

Kahneman, D., Knetsch, J. and Thaler, R. (1991). "Anomalies: The endowment effect, loss aversion, and status quo bias," *Journal of Economic Perspectives*, 5(1): 193-206

Knetsch, J. (1990). "Environmental policy implications of disparities between willingness to pay and compensation demanded for measures of values," *Journal of Environmental Economics and Management*, 18(3): 227-237

Knetsch, J. and Wong, W.-K. (2009). "The endowment effect and the reference state: Evidence and manipulations," *Journal of Economic Behavior & Organization*, 71(2): 407-413

Köszegi, B. and Rabin, M. (2006). "A model of reference-dependent preferences," *Quarterly Journal of Economics*, 121(4): 1133-1165

Krueger, A. and Schkade, D. (2008). "The reliability of subjective well-being measures," *Journal of Public Economics*, 92(8-9): 1833-1845

Krutilla, J. (1967). "Conservation reconsidered," *American Economic Review*, 57(4): 777-786

Loewenstein, G. (1996). "Out of control: Visceral influences on behavior," *Organizational Behavior and Human Decision Processes*, 65(3): 272-292

Loewenstein, G. and Prelec, D. (1993), "Preferences for sequences of outcomes," *Psychological Review*, 100(1), 91-108

Lucas, R., Diener, E., and Suh, E. (1996). "Discriminant validity of well-being measures," *Journal of Personality and Social Psychology*, 71(3): 616-628

Lucas, R., Clark, A., Georgellis, Y., and Diener, E. (2004). "Unemployment alters the set point for life satisfaction," *Psychological Science*, 15(1): 8-13

Mäler, K.-G. (1974). *Environmental economics: A theoretical inquiry*, Washington, D.C.: Resources for the Future

Pavot, W., Diener, E., Colvin, R., and Sandvik, E. (1991). "Further validation of the satisfaction with life scale: Evidence for the cross-method convergence of well-being measures," *Journal of Personality Assessment*, 57(1): 149-161

Peters, E., Slovic, P., and Gregory, R. (2003). "The role of affect in the WTA/WTP disparity," *Journal of Behavioral Decision Making*, 16(4): 309-330

Plott, C. and Zeiler, K. (2005). "The willingness to pay – willingness to accept gap, the 'endowment effect', subject misconceptions, and experimental procedures for eliciting valuations" *American Economic Review*, 95(3): 530-545

Randall, A. and Stoll, J. (1980). "Consumer's surplus in commodity space," *American Economic Review*, 70(3): 449-455

Redelmeier, D. and Kahneman, D. (1996). "Patients' memories of painful medical treatments: Real-time and retrospective evaluations of two minimally invasive procedures," *Pain*, 66(1), 3-8

Sandvik, E., Diener, E., and Seidlitz, L. (1993). "Subjective well-being: The convergence and stability of self-report and non-self-report measures," *Journal of Personality*, 61(3): 317-342

Schkade, D. and Kahneman, D. (1998). "Does living in California make people happy? A focusing illusion in judgments in life satisfaction," *Psychological Science*, 9(5): 340-346

Shogren, J., Shin, S., Hayes, D., and Kliebenstein, J. (1991). "Resolving differences in willingness

to pay and willingness to accept," *American Economic Review*, 84(1): 255-279

Thaler, R. (1980). "Toward a positive theory of consumer choice," *Journal of Economic Behavior & Organization*, 1(1): 39-60

Thaler, R. (1999). "Mental accounting matters," *Journal of Behavioral Decision Making*, 18(3): 183-206

Tversky, A. and Kahneman, D. (1974). "Judgment under uncertainty: Heuristics and biases," *Science*, 185(4157): 1124-1131

Tversky, A. and Kahneman, D. (1991). "Loss aversion in riskless choice: A reference dependent model," *Quarterly Journal of Economics*, 106(4): 1039-1061

Urry, H., Nitschke, J. Dolski, I., Jackson, D., Dalton, K., Mueller, C., Rosenkranz, M., Ryff, C., Singer, B., and Davidson, R. (2004). "Making a life worth living: Neural correlates of well-being," *Psychological Science*, 15(6): 367-372

Vickrey, W. (1961). "Counterspeculation, auctions, and competitive sealed tenders," *Journal of Finance*. 16(1): 8-37

Watson, D., Clark, L. and Tellegen, A. (1988). "Development and validation of brief measures of positive and negative affect: The PANAS scale," *Journal of Personality and Social Psychology*, 54(6): 1063-1070

Welsch, H. (2002). "The preferences over prosperity and pollution: Environmental valuation based on happiness surveys," *Kyklos*, 55(4): 473-494

Welsch, H. and Kühling, J. (2010). "Using happiness data for environmental valuation: issues and applications," *Journal of Economic Surveys*, 23(2): 385-406

Willig, R. (1976). "Consumer's surplus without apology," *American Economic Review*, 66(4): 589-597

APPENDIX

The only way to know the subjective well-being of a person is to ask the person directly. A way to do so is to use the standard metric called "life satisfaction." Cantril (1965) is one of the earliest studies to measure subjective well-being using the single-item question on a ladder format about life satisfaction. Other formats are possible like a scaled horizontal line (Campbell et al. 1976) or putting faces at the end-points (Andrews and Withey 1976). Diener et al. (1985) used the multiple questions format about life satisfaction. The Cantril scale is still used today by the Gallup World Polls. The World Values Survey discards the ladder schema of the Cantril scale and uses instead a scaled line schema. The one-item life satisfaction question in the World Values Survey is like:

All things considered, how satisfied are you with your life as a whole these days? 0 means you are "completely dissatisfied" and 10 means you are "completely satisfied".

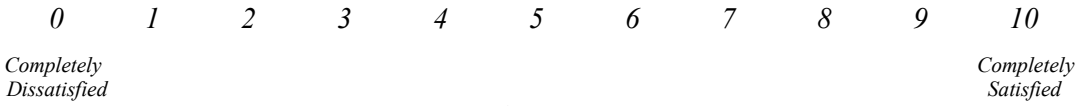

Figure 1

The schema in Figure 1 presumes no adaptation or habituation (Brickman and Campbell 1971; Easterlin 1974; Headey and Wearing 1989; Frederick and Loewenstein 1999; Easterlin 2001; Lucas et al 2004; Clark et al. 2008) and cognitive bias (Tversky and Kahneman 1974; Redelmeier and Kahneman 1996; Schkade and Kahneman 1998; Thaler 1999; Derrick et al.

2003). Otherwise, there are "squishing effects" (Gilbert 2006) that result in a compression of the scale downwards to 0 or upwards to 10. Figures 2a and 2b illustrate how squishing might distort the scale.

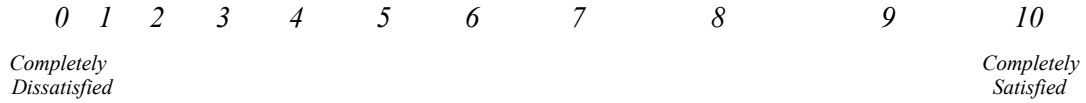

Figure 2a

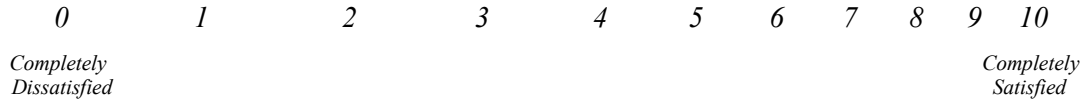

Figure 2b

The above situation causes problems in the data analysis. Thus, dealing with squishing is very important because a stable metric guarantees cardinal values. (The law of large numbers is not an adequate solution to the squishing problem if the noise in the data is strong enough. In addition, there is no counterfactual to use as benchmark with regard to the noise in the data.) The next issue is the comparability of the information. The issue in this case is whether people interpret the scale like Figure 1 as such or whether there are variations in the interpretation of the scale like Figure 3 below. If so, a person who indicates a 5 using Figure 1 is equivalent to another person who reports a 10 using Figure 3, albeit the former is in a worse state than the latter. Thus, the values are not comparable.

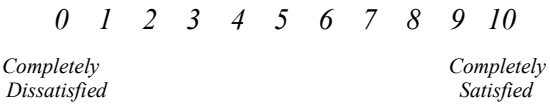

Figure 3

The proposal here is to introduce a cue in the question. Thus, the life satisfaction question now becomes:

All things considered, how satisfied are you with your life as a whole these days? 0 or 0% means you are "completely dissatisfied" and 10 or 100 % means you are "completely satisfied".

0	1	2	3	4	5	6	7	8	9	10
Completely Dissatisfied										*Completely Satisfied*

Figure 4

Therefore, the introduction of 0% and 100% at the end-points of the scale induces a cognitive process that makes a person see each interval as worth 10%. The schema is called "half-empty glass" effect. Put simply, a half-empty glass is seen as a half-empty glass regardless of the size of the glass. The half-empty glass is also a half-empty glass regardless of who is looking at the glass or where the glass is placed. This time, if a person reports a 5 (i.e., 50%), then it really means a 5; but, more importantly, it is comparable to a 5 of another person.[12] There is no need to use finer cue intervals because the goal is simply to exclude the schemas like Figures 2a, 2b, and 3.

[12] If affect is the relevant measure to consider, then a neutral cue like "5 or 50%" (qualified as neutral or neither happy nor unhappy) is introduced in question, thus:

How happy are you with your life? 0 or 0% means you are "completely happy," 5 or 50% means neutral or neither happy nor unhappy; and 10 or 100% means you are "completely happy"?

0	1	2	3	4	5	6	7	8	9	10
Completely Unhappy										*Completely Happy*

The 0 to 10 scale is the appropriate schema than a negative-to-positive values schema for the happiness version of the cued question because "completely unhappy" should only mean an absence of positive affect and not (automatically) negative affect. But recoding the data to mimic the Likert scale is possible, say:

-5	-4	-3	-2	-1	0	1	2	3	4	5
Completely Unhappy										*Completely Happy*