1 Integrating WtP/WtA and Equivalent/Compensating Variation

John Bates

2 Valuation (especially non-market commodities)

based on micro-economic theory of the consumer

work with i**ndirect** utility $\psi(Y,\mathbf{p})$

(maximum utility obtainable given income Y and commodity prices **p**)

If prices change to **p'** , impact on ψ.

"value" of price change measured by the "Compensating Variation" (CV)

defined by $\psi(Y +CV,\mathbf{p'}) = \psi(Y,\mathbf{p})$

CV is the minimum income "compensation" after price change to maintain original utility

CV may be positive or negative, dependent on direction of price change

3 Valuation ctd

alternative measure is the "Equivalent Variation", EV

EV is maximum amount to have the price change reversed

$$\psi(Y–EV,\mathbf{p}) = \psi(Y,\mathbf{p'})$$

In general, CV ≠ EV

no inherent preference

difference corresponds to that between Laspeyres and Paasche indices.

alternative first order approximations

true measure is likely to be "somewhere in-between"

4 Consumer Surplus (CS).

alternative measure widely used in practice

In origin based on **aggregate** (Marshallian) demand curve.

marginal consumer has no CS, but others have increasing amounts

(most consumers value the commodity at more than they have to pay)

total CS defined as "area under demand curve, above current price

possible to re-interpret in terms individual consumer.

5 Consumer surplus ctd

theoretical weakness of CS: fails to take account of income effects

strictly only valid if marginal utility of income remains constant as price changes

However, in many practical cases price change is small

we assume approximately constant marginal utility of income

$\Rightarrow$ CV = CS = EV

6 Figure 1

7 "Willingness to pay"

For single commodity valuation, easier to work with indifference curves between commodity and "money".

For **quality** variations, consider family of curves U(R,Q)

R is residual income after paying for commodity
Q is the quality of the commodity

utility will increase with both Q and R

now draw curves with Y-axis defined as **expenditure** P on commodity.

With fixed income Y, P = Y – R

8 Figure 2

9 Indifference curve analysis

curvature explained by

a) diminishing marginal utility from quality improvements
b) budget effect on ability to purchase other commodities

initial curve $U(P,Q) = U^0$ passes through origin – base (P^0, Q^0),

now consider quality increase q.

Offering this without charge increases utility to U^+

$U(P, Q) = U^+ = U(P^0, Q^0+q)$.

10 Indifference curve analysis ctd

CV is the payment to return to original utility U^0 .

coincides with standard definition of "willingness to pay" (WtP).

EV is amount to be given to him in base position to reach U^+ **without** the increase in quality.

coincides with standard definition of "willingness to accept" (WtA).

11 Income effects

When will CV = EV?

depends on whether the indifference curves are parallel relative to the P-axis

this “parallel-ness” is reflected in the “marginal utility of income” .

When P is small relative to Y, expect $|CV-EV|$ will be small.

12 CV & EV versus WtP and Wta

example suggests that terms (CV, EV) and (WtP,WtA) coincide.

In fact, dependent on **direction** of utility change.

Consider alternative with quality **reduced** by q

In this case, CV corresponds with Willingness to **Accept**, and EV with Willingness to **Pay**.

Hence, potential for confusion

two sets of terms cover same range of cases, but interpretation is different.

13 Empirical Methodology

aim is to estimate CV or EV (or, in appropriate circumstances, CS)

if the improvement introduced **and** price increased by true valuation,
consumer’s behaviour should be unaltered (same **utility**).

14 Transfer Price (or Contingent Valuation)

aims to obtain **direct** assessment of individual’s valuation, in terms of WtP.

Unfortunately, practical experience reveals serious problems,
in particular, the need to ensure that we are indeed on the same indifference curve.

What is the most you would be willing to pay in order to gain an improvement of X?

many respondents give “extreme” values (eg zero willingness to pay, demands for very high compensation)

14 Stated Preference (SP)

For these and other reasons, SP methods have become the preferred approach for non-market valuations.

less powerful than TP, but less susceptible to misinterpretation.

they permit estimation of families of indifference curves $U(P,Q) = k$

chosen combination assumed to have higher utility

aim of **analysis** is to devise utility formula to explain choices

presentational problems associated with indifference avoided

However, indifference curves ultimately required
Hence, data must be sufficiently rich to estimate tradeoffs with confidence.

Given $U(P,Q) = k = \beta_P P + \beta_Q Q$ (say),

valuation of Q given by negative marginal rate of substitution

$CV = \beta_Q / \beta_P$

John Bates

John Bates is a mathematical economist, specializing in transport problems, and has worked as an independent consultant for the last 28 years. He has been at the forefront of transportation demand modelling, has considerable expertise in evaluation methodology, and has been a leading figure in the development of stated preference techniques within the transport field.