

# **Integrating WtP / WtA with Equivalent / Compensating Variation**

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# Valuation

- Valuation (especially non-market commodities) based on micro-economic theory of the consumer
- work with **indirect** utility  $\psi(Y, p)$ 
  - maximum utility obtainable given income  $Y$  and commodity prices  $p$
- If prices change to  $p'$ , impact on  $\psi$



# Valuation (2)

- Value of price change measured by the “Compensating Variation” (CV)
- CV defined by  $\psi(Y + CV, p')$  =  $\psi(Y, p)$
- CV is the minimum income “compensation” after price change to maintain original utility
- CV may be positive or negative, dependent upon direction of price change



# Valuation (3)

- Alternative measure is the “Equivalent Variation” (EV)
- EV is maximum amount to have the price change reversed
- EV is defined as  $\psi(Y-EV, \mathbf{p}) = \psi(Y, \mathbf{p}')$
- In general,  $CV \neq EV$



# Valuation (4)

- No inherent preference between CV and EV
- Difference corresponds to that between Laspeyres and Paasche indices
- Alternative first order approximations
- True measure is likely to be “somewhere in-between”



# 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



# Consumer Surplus (CS) (2)

- Total CS defined as “area under demand curve, above current price”
- Possible to re-interpret in terms of individual customer
- Theoretical weakness of CS
  - fails to take account of income effects
  - strictly valid only if marginal utility of income remains constant as price changes

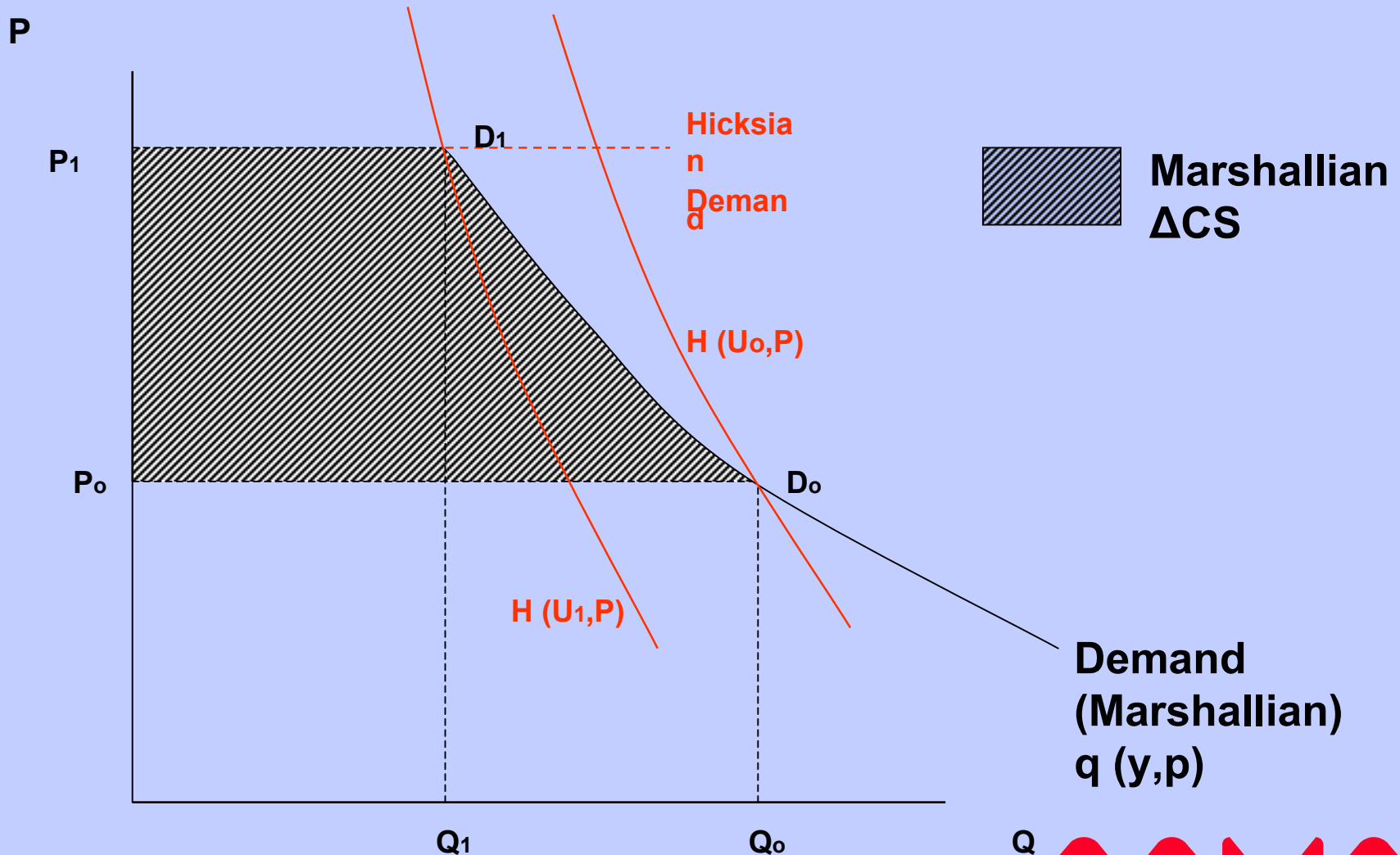


# Consumer Surplus (CS) (3)

- However, in many practical cases price change is small
- We can assume approximately constant marginal utility of income
  - $\Rightarrow CV = CS = EV$



# Figure 1: Hicksian and Marshallian demand curves



# “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 the commodity
  - Q is the quality of the commodity

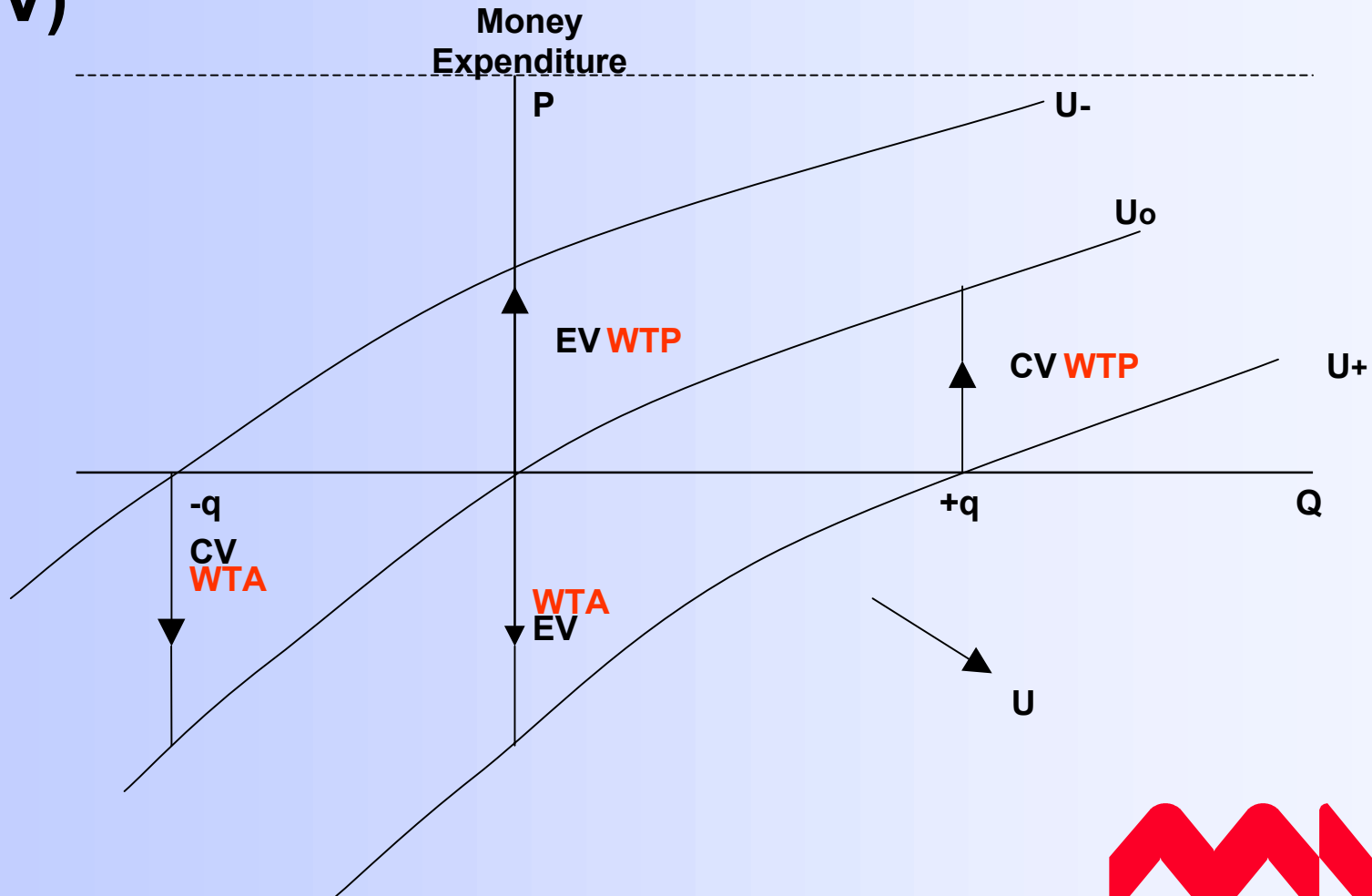


# “Willingness to Pay” (2)

- Utility will increase with both Q and R
- now draw curves with Y-axis defined as **expenditure** P on commodity
- With fixed income Y,  $P = Y - R$



# Figure 2: Willingness to pay/accept (WtP/WtA) and compensating and equivalent variation (CV and EV)



# Indifference Curve Analysis

- **Curvature explained by**
  - diminishing marginal utility from quality improvements
  - 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  $q$**



# Indifference Curve Analysis (2)

- Offering this without charge increases utility to  $U^+$ 
  - $U(P, Q) = U^+ = U(P^0, Q^0+q)$
- CV is the payment to return to original utility  $U^0$
- Coincides with standard definition of “willingness to pay” (WtP)



# Indifference Curve Analysis (3)

- EV is the amount to be given to consumer in base position to reach  $U^+$  **without** the increase in quality
- Coincides with standard definition of “willingness to accept” (WtA)



# 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, we expect  $|CV - EV|$  will be small



# CV and EV vs WtP and WtA

- Example suggests that terms (CV, EV) and (WtP, WtA) coincide
- In fact, however, dependent upon **direction** of utility change



# CV and EV vs WtP and WtA (2)

- 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



# Empirical Methodology

- Aim is to estimate CV or EV
  - or in appropriate circumstances, CS
- If the improvement is introduced **and** price is increased by true valuation, consumer's behaviour should be unaltered (same **utility**)
- Alternative approaches
  - Transfer Price
  - Stated Preference



# 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



# Transfer Price (or Contingent Valuation) (2)

- *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



# 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  $U(P,Q) = k$



# Stated Preference (SP) (2)

- Chosen combination assumed to have higher utility
- Aim of **analysis** is to devise utility formula to explain choices
- Presentational problems associated with indifference avoided



# Stated Preference (SP) (3)

- 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

- $CV = \beta_Q / \beta_P$

