Consumer Surplus

ECON 370: Microeconomic Theory

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Gains from Trade

- We want a means for measuring the total benefits Consumers (and eventually Producers) get from trade
- We cannot use utility
  - First, there is no good way to measure utility
  - Second, utility is an ordinal concept—"Gain in utility" really has no meaning beyond saying that the consumer is better off
- So we use a willingness-to-pay measure
- In one form or another, we want to ask:
  - "What is the difference in value to you of the market outcome versus not participating in the market?"

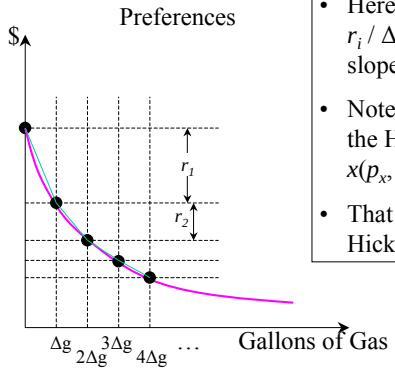
Gain from Entering the Market

- There are three measures of gains from trade:
  - Compensating Variation (CV)
    - This asks: "*Being in the market*, how much would you be willing to pay to avoid being excluded from it?"
  - Equivalent Variation (EV)
    - This asks: "*If you were not a participant in the market*, how much would you be willing to pay to end up at the market outcome?"
  - (Marshallian) Consumer Surplus
    - This is an approximate measure, while the other two are exact
- Generally, each will give different answers
  - But they will be identical for quasi-linear utility

Conceptual Approach

- To calculate gain from trade, we generally use a marginal approach
- Example:
  - Suppose Gasoline is only bought in whole gallons
  - Reservation price (r_1) of 1st gallon
    = most consumer would pay for 1st gallon
    = dollar equivalent of MU of 1st gallon
  - Same for $r_2 \ldots r_n$
  - Then $r_1 + \ldots + r_n$ = dollar equivalent of total change in utility from n gallons at zero price
  - $r_1 + \ldots + r_n - \boldsymbol{p_G n}$ = dollar equivalent of total change in utility from n gallons of gasoline at unit price of $\$p_G$

Estimating Reservation-Price Curve



- Here, reservation *price* for unit *i* is $r_i / \Delta g$, represented here by the slope
- Note that as $\Delta g \rightarrow 0$, this becomes the Hicksian demand curve: $x(p_x, p_y, u)$
- That is, it is represented by the Hicksian Substitution Effect

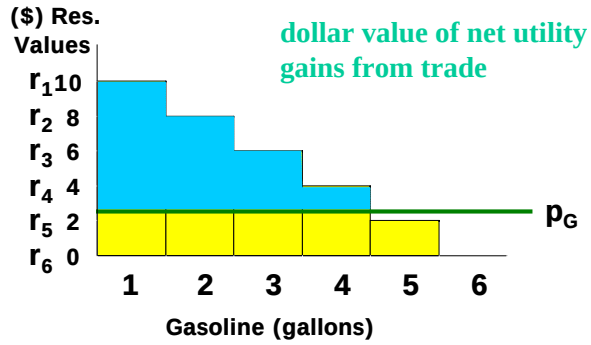
Dollar Equivalent Utility Gains

- Dollar equivalent net utility gain from trading in gas market at $\$p_G$
  - For 1st gal = $\$(r_1 - p_G)$
  - For 2nd gal = $\$(r_2 - p_G)$, etc.
  - Total dollar value of gain from trade
    $= \$(r_1 - p_G) + \$(r_2 - p_G) + \ldots$ for all *n*
- Consumer "surplus" - excess of marginal valuation over price paid

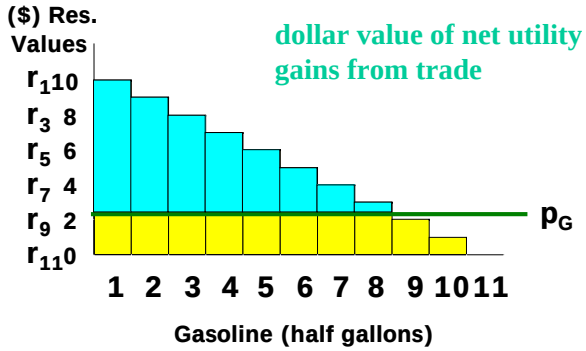
Reservation-Price Curve

- The Reservation-Price Curve is the plot of $r_1, r_2, \ldots, r_n, \ldots$ against *n*
- In general, it is not identical to the consumer's demand curve
- Nevertheless, when we use the Consumer Surplus method, we are effectively approximating the Reservation-Price Curve with the demand curve

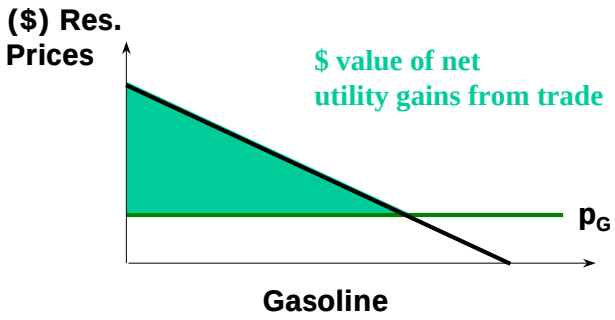
Example Reservation-Price Curve



Reservation Price Curve for Half Gallons



Infinitely Divisible Quantities of Gas



Measuring Reservation-Price Curve

- Reflects value (MU) of each additional unit
- Does not reflect price reduction on previous units of good -- increase in real income
- This income increase causes IE's on x_1 demand
- For normal good, IE means x_1 demand greater
- So ordinary demand reflects larger x_1 due to IE
- Reservation-price curve is same as Hicksian demand curve (as we saw before)

Compensating and Equivalent Variation

- In general, we are interested in the welfare effects of *changes* in prices
- The two *exact* methods generally used are the Compensating and Equivalent Variations
- Note that the two approaches will generally not give the same numerical answer
  - Since they are based on different index prices, then…
  - In effect they are measured in different units

Compensating Variation

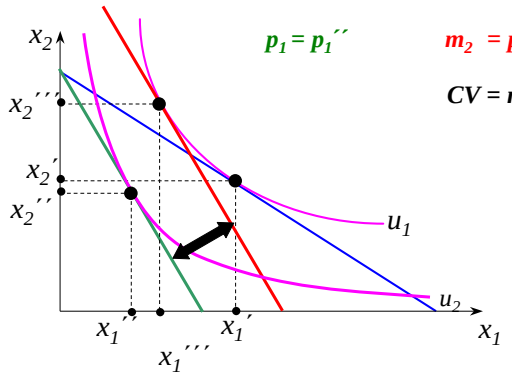
- *Compensating Variation* (CV) is
  - the minimum compensation needed
  - *after* the price increase
  - to get back to the old utility level (or indifference curve)
- Reflects new prices
- Reflects old utility level
- Example: Analyze effects of increase in p_1

Compensating Variation: Graph

$p_1 = p_1'$ $\quad m_1 = p_1'x_1' + p_2x_2'$

$p_1 = p_1''$ $\quad m_2 = p_1''x_1''' + p_2x_2'''$

$CV = m_2 - m_1$



Equivalent Variation

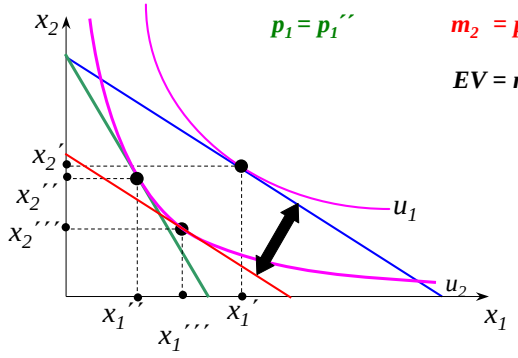
- *Equivalent Variation* (EV) is
  - the maximum the consumer is willing to pay
  - *before* the price increase
  - to avoid the price change;
  - Or, equivalently, the amount the consumer would have to pay before the price increase to be as well off (or on the same indifference curve) as he will be after the price increase
- EV= max willingness to pay to avoid price increase
- Reflects old prices
- Reflects new utility level
- Example: Analyze effects of increase in p_1

Equivalent Variation: Graph

$p_1 = p_1'$ $\quad m_1 = p_1'x_1' + p_2x_2'$

$p_1 = p_1''$ $\quad m_2 = p_1'x_1''' + p_2x_2'''$

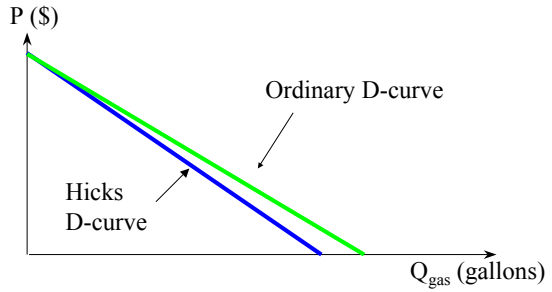
$EV = m_1 - m_2$



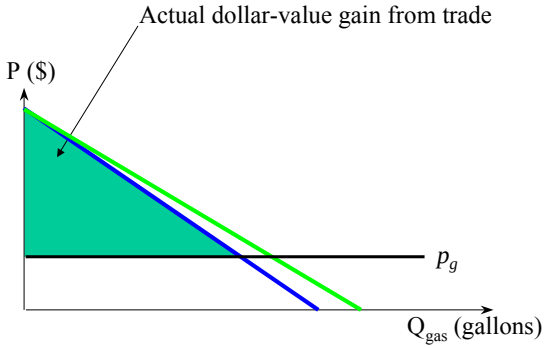
Consumer's Surplus

- We usually use *consumer surplus* as our measure of gains from trade
- *Approximate* measure of net utility gain
- Equals area under ordinary demand curve
- Approximates area under reservation-price curve (or Hicksian demand curve)
- We use it because it is generally much easier to determine the ordinary demand curve than the Hicksian demand curve or the Equivalent or Compensated Variation

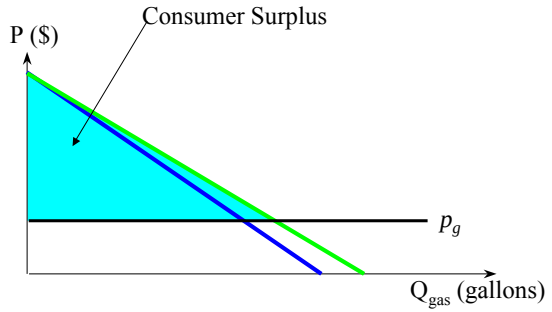
Consumer's Surplus: Graph



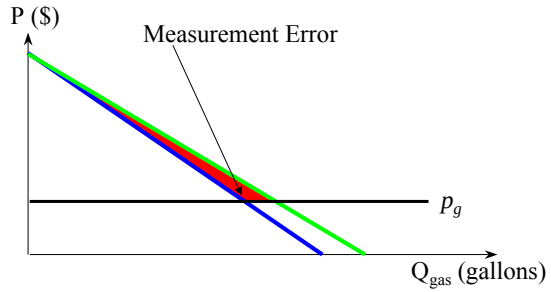
Consumer's Surplus: Graph



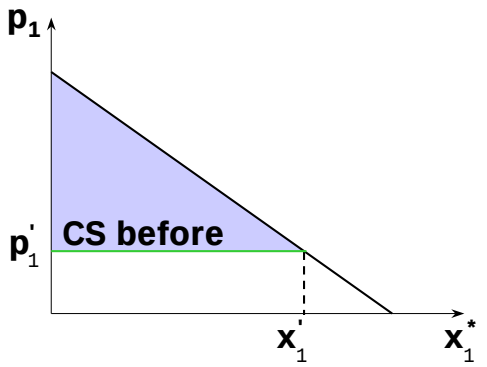
Consumer's Surplus: Graph



Consumer's Surplus: Graph



Changes in Consumer's Surplus



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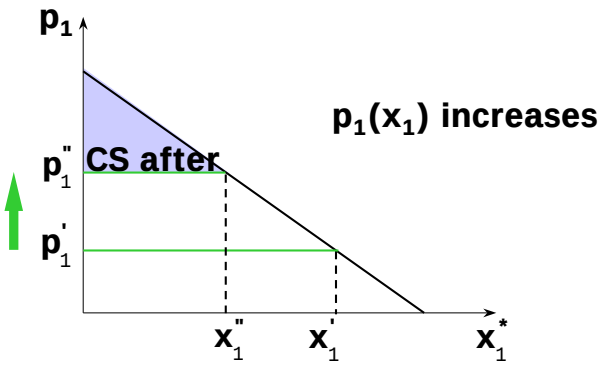

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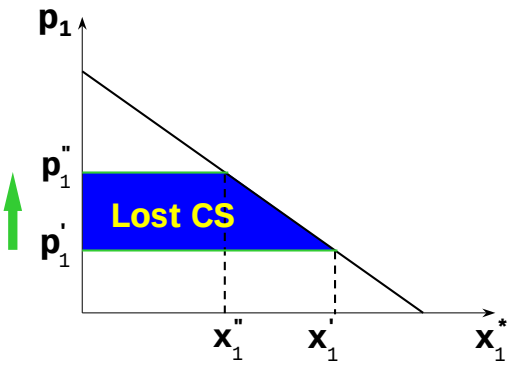

Producer's Surplus: Preview

- Producers also gain from trade
  - Sell at single market price
  - Marginal cost typically increases w/ output
  - Can measure gains from trade to producers using "producer surplus" (PS)
- Total gains from trade = CS + PS

Producer's Surplus: Graph