

Change in SS are areas, usually triangles or trapezoids

## 4.1 Knowing the slope or Price elasticity of demand

MPC - Marginal Private Cost  
MSC - Marginal Social Cost

### 4.1.1 Linear demand curve

$q = \alpha_0 + \alpha_1 p$  where:  $q$  = quantity at Price =  $p$

$\alpha_0$  quantity if  $p = 0$   
 $\alpha_1$  change in  $q$  if Price increases by 1

$$\epsilon_d = \alpha_1 \frac{p}{q} \rightarrow \alpha_1 = \epsilon_d \frac{q}{p}$$

Construction of a linear demand curve to measure changes in SS requires an estimate of slope or  $\epsilon_d$  and  $p$  and  $q$  of  $\epsilon_d$

### 4.1.2 Constant elasticity demand curve

$$q = \beta_0 p^{\beta_1} \rightarrow \ln(q) = \ln(\beta_0) + \beta_1 \ln(p)$$

$$\text{Area} = \left(\frac{1}{\beta_0}\right)^{1/\beta_1} \left(\frac{q_i^p - q_0^p}{p}\right) \text{ where } p = 1 + \left(\frac{1}{\beta_1}\right)$$

## 4.2 Extrapolating from a few observations

## 4.3 Econometric Estimation w/ many observations

Linear regression is a good starting point

### 4.3.1 Model specification

$$q = F(p, I, T)$$

$\downarrow$     $\downarrow$     $\downarrow$   
 Price   Income   Temperature

OLS = ordinary least squares

### 4.3.2 Types of data

Cross-sectional vs time series

$\downarrow$  single on multiple units    $\downarrow$  repeated on same unit

GLS = generalized least squares

Can mix cross-sectional + time series

### 4.3.3 Identification

Endogenous Variables: Variables determined simultaneously

Exogenous Variables: Variables that are fixed or determined outside the model

### 4.3.4 Confidence intervals

### 4.3.5 Prediction vs Hypothesis testing

## Appendix 4A Multiple Regression

Independent = explanatory

$\beta_0$  = intercept parameter or constant

$R^2$  = square of correlation between actual + predicted value of dependent variable

Multicollinearity = explanatory var can be written as linear combo of others