ECN 145 Lecture 14

Transportation Economics: Pricing I

Outline:

- 1) Perfect Competition
  - **many small firms, accept "market price"**
- 2) Monopoly
  - **one big firm, chooses the market price**
- 3) Social Optimum
  - **what would the gov't provide?**

(I) Perfect competition

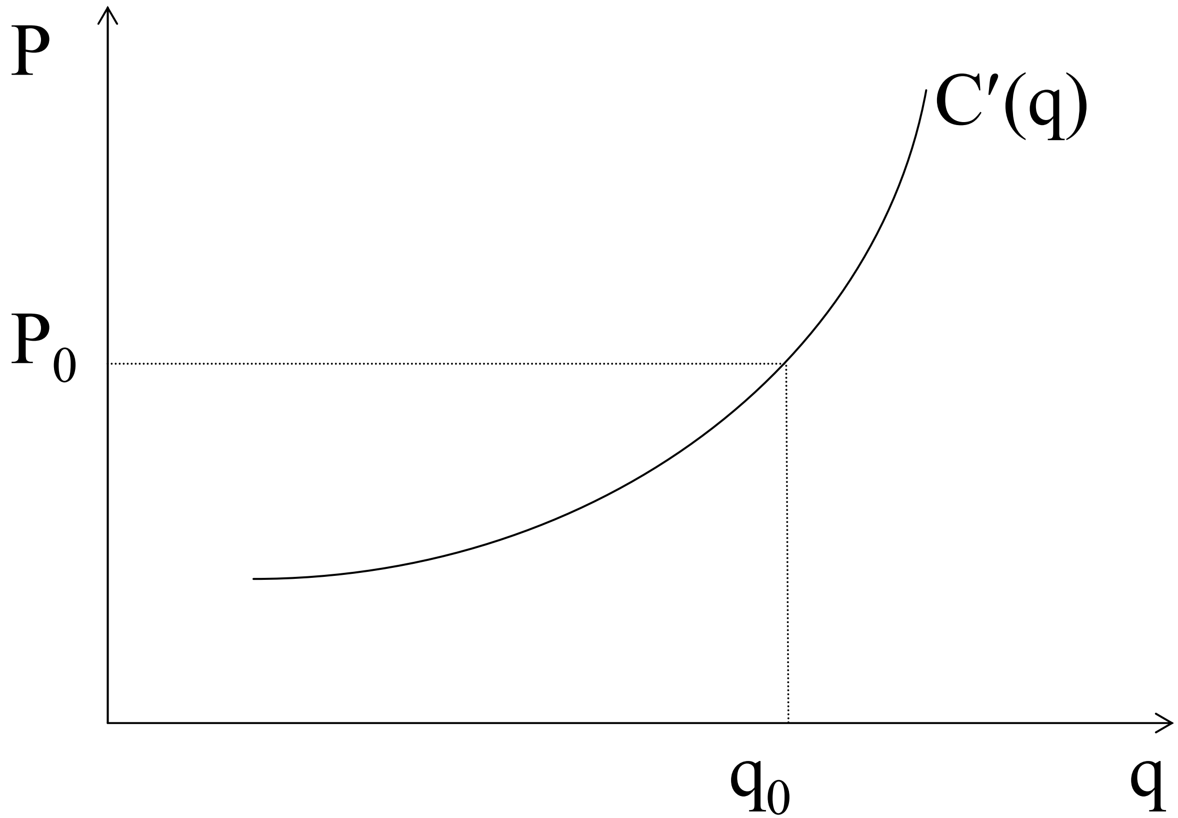
- Many firms, each with costs C(q), with C'>0, C''>0. Each accepts market price p as given. To maximize profits,

$$\max_{q} pq - C(q) \Rightarrow p = C'(q)$$

- or, Price = Marginal costs
- Graph this as,

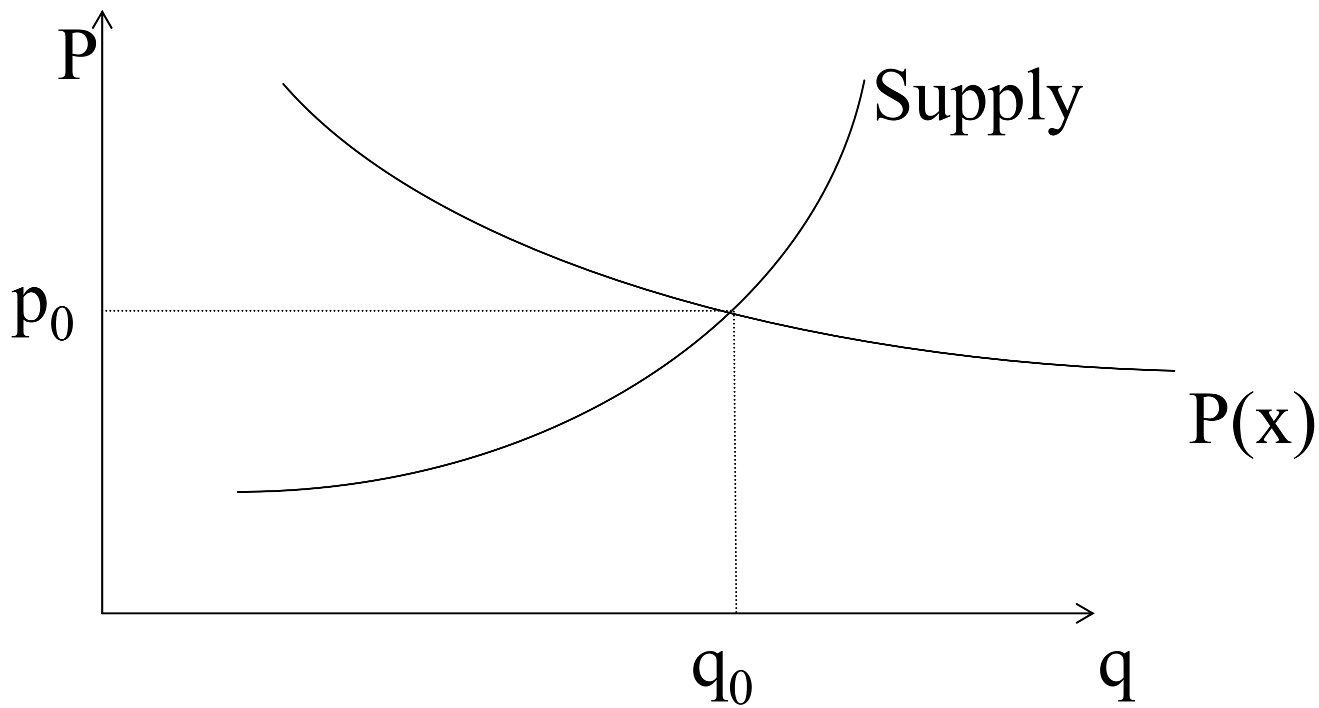
Price = Marginal Cost

- The marginal cost curve is the “supply curve” for an individual firm:



Supply = Demand

- Adding up the firm's supply horizontally, we will get total market supply, and equilibrium p_o, q_o:



(II) Monopoly

- Single firm, with costs C(q), where C'>0, C''><0. It recognizes that when it sells *more*, the price will *fall*.
- How does revenue change with q?

$$d[p(q)q]/dq = p(q) + p'(q)q$$

- Marginal revenue = Price - drop in revenue from price fall

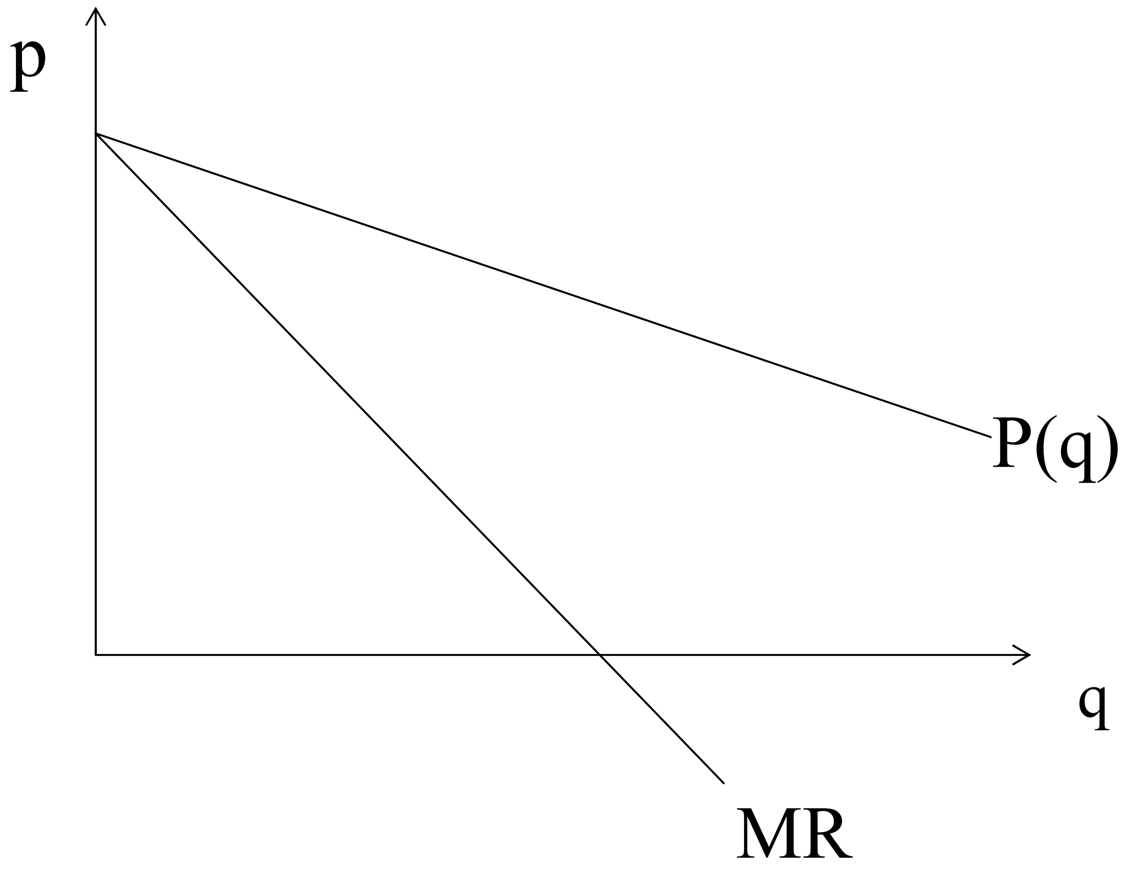
Marginal revenue

- We can write marginal revenue as,
- MR = $[p(q) + p'(q)q]$
- = $p(q)[1 + p'(q)q / p(q)]$
- = $p(q)[1 - (1/E)]$
- where $E = -p / p'(q)q$ is the elasticity
- So MR > 0 if only if E > 1.

Marginal revenue, E.g. 1

- With linear demand, $P=\alpha-\beta q$
- MR = $[p(q)+p'(q)q]$
- = $(\alpha-\beta q) - \beta q$
- = $(\alpha-2\beta q)$
- so that MR is also linear, and is twice as steep as demand
- $E=-p/p'(q)q$ = $(\alpha/\beta q)$-1

Marginal revenue, graph



Monopoly problem:

- To maximize profits:

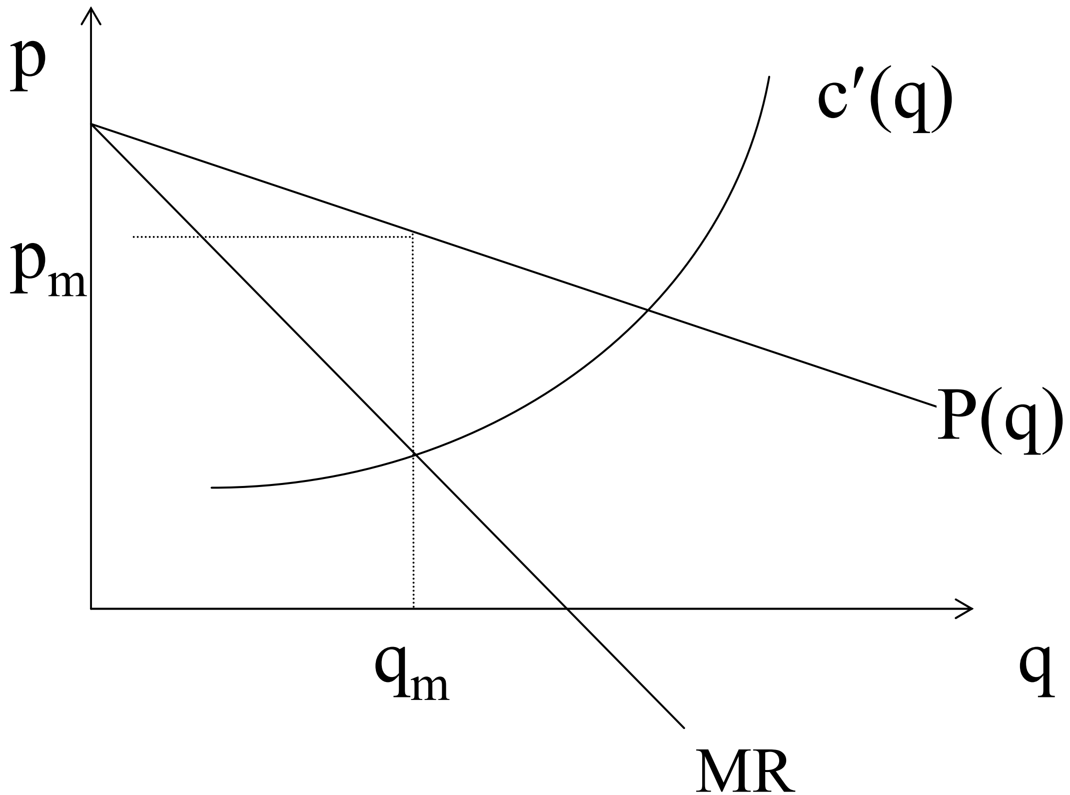
$$\max_{q} p(q)q - c(q) \Rightarrow [p(q) + p'(q)q] = c'(q)$$

$$\text{or} \quad p(q)[1-(1/E)] = c'(q)$$

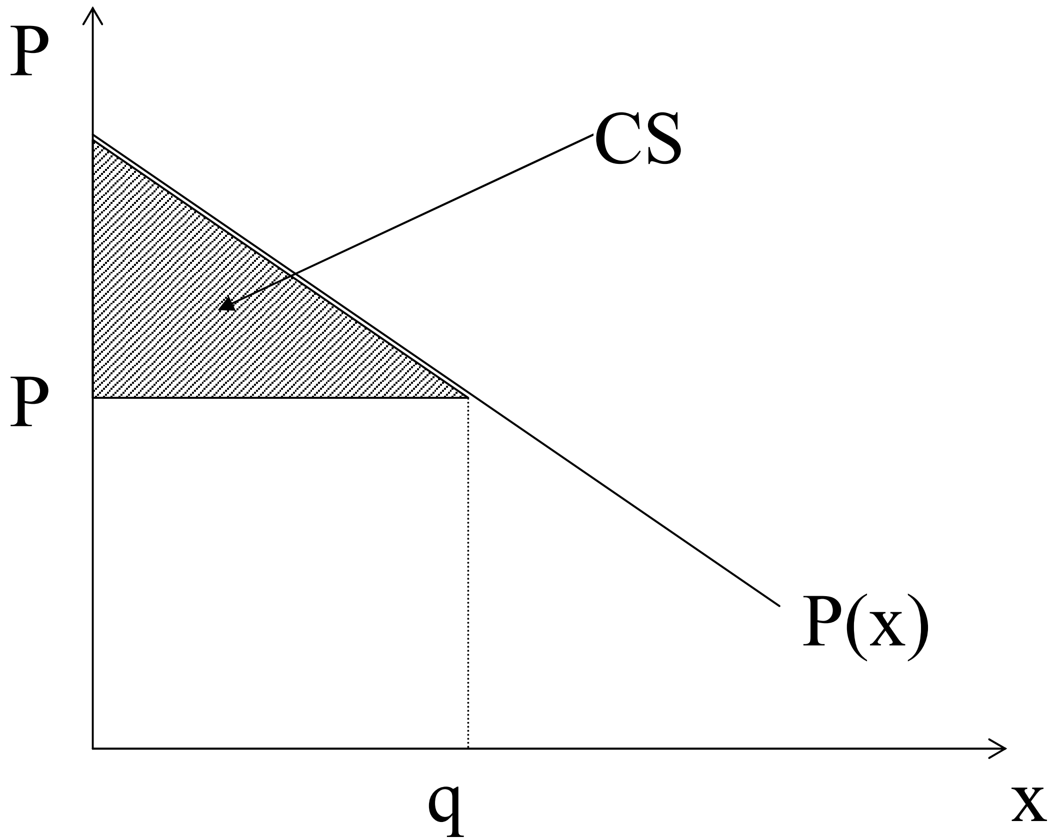
- i.e., Marginal revenue = Marginal costs
- Graph this as:

Marginal revenue = Marginal Cost

- The intersection of MR and MC is the “point” of optimal supply, p_m, q_m:



Consumer Surplus (review)

- 

(III) Social Optimum:

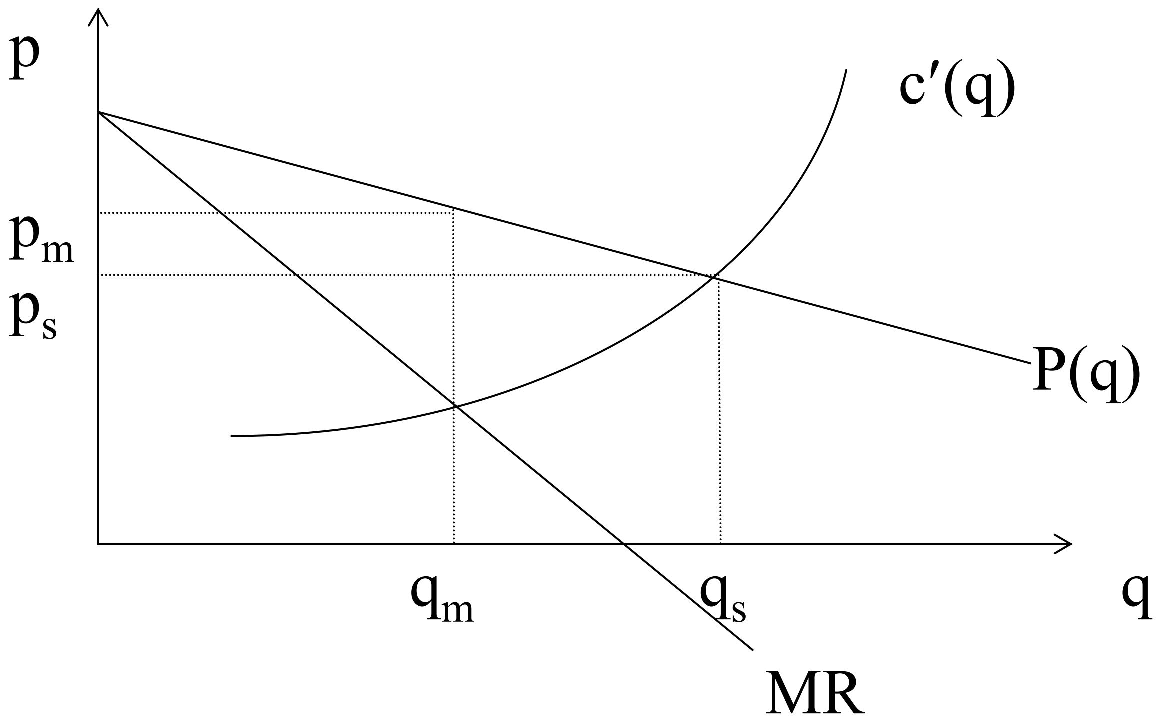
- Measure social welfare=CS - Costs
- To maximize social welfare:

$$\max_{q} \int_0^q P(x)dx - c(q) \Rightarrow p = c'(q)$$

- i.e., Price = Marginal costs
- Graph this as:

Price = Marginal Cost

- The intersection of P(q) and MC is the point of optimal social welfare, supply, p_s, q_s:



Public Policy

- How to ensure that a monopoly charges the social optimum, p_s, q_s?
- 1) encourage entry and competition
  - **(e.g., telephones, Microsoft antitrust case)**
- 2) establish p_s at a price ceiling
  - **(e.g. utility and telephone companies)**
- 3) Have the government be the provider
  - **(e.g. roads, transit, etc.)**

Policy Problem 1:

- If a company, or the government, charge price=marginal cost, but there are *increasing returns to scale,* then:
- $$p = MC < AC$$
- so, Revenue = $p \cdot q$ < Costs = $AC \cdot q$
- Either the company, or the government, is making losses! So public policy in the form of *subsidies* are needed.

Policy Problem 2:

- It may be that *private* costs and benefits differ from *social* costs and benefits:
- e.g. 1) pollution - has a extra *social* cost that private firm might ignore
- So policy is need for this ***externality***
- e.g. 2) waiting time in transit - a *social* cost that a private firm might ignore?

Example: Transit Authority

- Final output: q = total passengers on buses per peak hour. Produced with:
- vehicles per peak hour V, with cost c_p
- waiting time, valued at v_T^W
- Suppose waiting time =1/2V. Then total costs of buses and waiting are,

$$C_B = c_p V, \qquad C_W = \frac{v_T^W q}{2V}$$

The *gov't* transit authority's problem:

- Choose V to $\min \; C_B + C_W$
- subject to: $q \le NV$ N=bus capacity
- **Question**:
- would a *private firm* running the transit also take into account consumer's waiting time?
- **Answer:**
- yes, to some extent.

Private pricing for transit

- Suppose that the private transit charges price "p" per bus trip
- But then the "full price" for consumers equals
- $p_f = p + \text{waiting time} = p + (v_T^W / 2V)$
- where v_T^W is the value that consumers put on waiting time

Revenue for transit

- Write "full price" as a inverse demand $p_f(q)$
- With price p per bus trip, total revenue is,
- $$p\,q = q[p_f - (v_T^W / 2V)]$$
- $$= q p_f(q) - (v_T^W q / 2V)$$
- where $C_W = (v_T^W q / 2V)$ is the total waiting time

The *private* transit authority's problem:

- Choose V and q, to:

$$\max \; pq - C_B = p_f(q)q - C_W - C_B$$

- subject to: $q \leq NV$
- So that *given* optimal q*, then V is chosen to :

$$\min \quad C_B + C_W$$

- differentiate w.r.t number of buses, V:

The *gov't* transit authority's problem:

- Choose V and q, to:

$$\max \int_0^q p_f(x)dx - C_W - C_B$$

- subject to: $q \leq NV$
- So that *given* optimal q**, then V is chosen to :

$$\min \quad C_B + C_W$$