

# Introduction to Location Theory

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ECON 166

Prof. J. M. Pogodzinski

Lecture 5

# Agenda for Lecture 5

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Tales of Three Other Cities

Introduction to Location Models – continued

Profit maximization – general framework

Principle of *Median* Location

Agglomeration Economies

    Economies of Urbanization

    Economies of Localization

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# Tales of Three Other Cities

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- Growth patterns of the three other cities
  - Employment distribution of the three other cities
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# More about Profit Maximization

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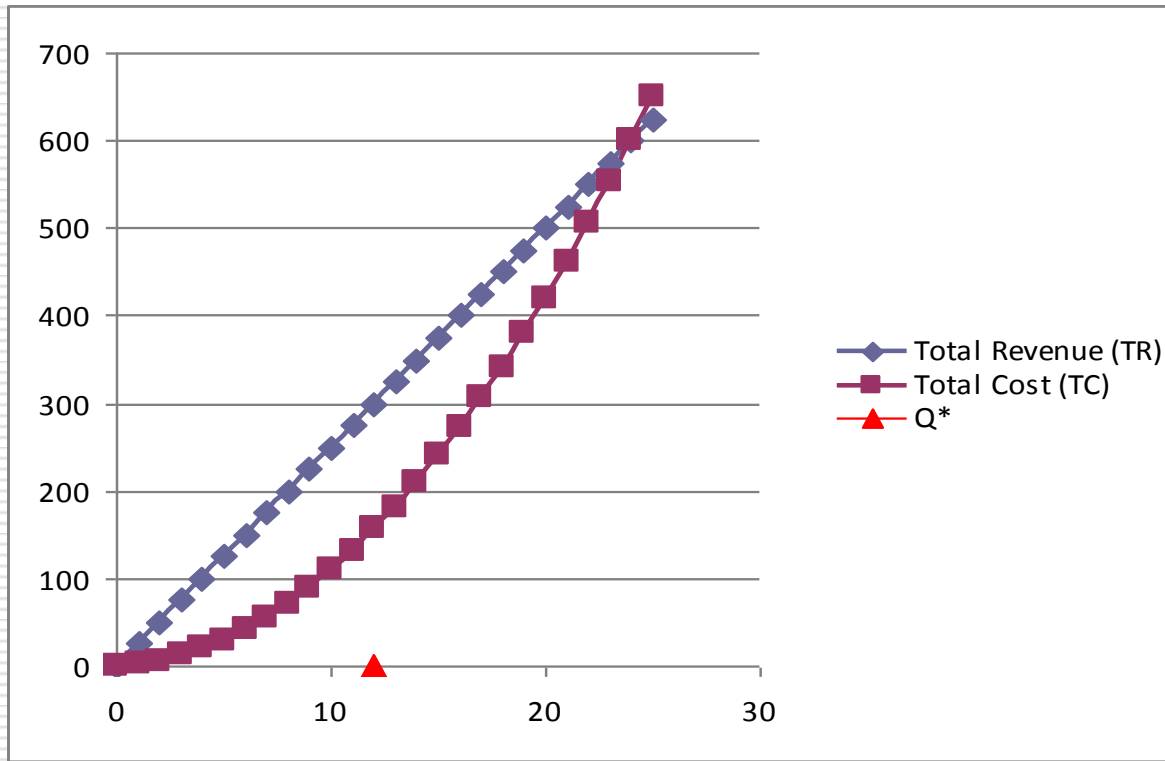
- Profit maximization when price depends on quantity (market-powerful firm)
  - Profit maximization when price is given (independent of quantity) – perfectly competitive firm
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# Profit Maximization

Perfectly Competitive Firm – see [ue\\_lecture\\_4.xls](#)

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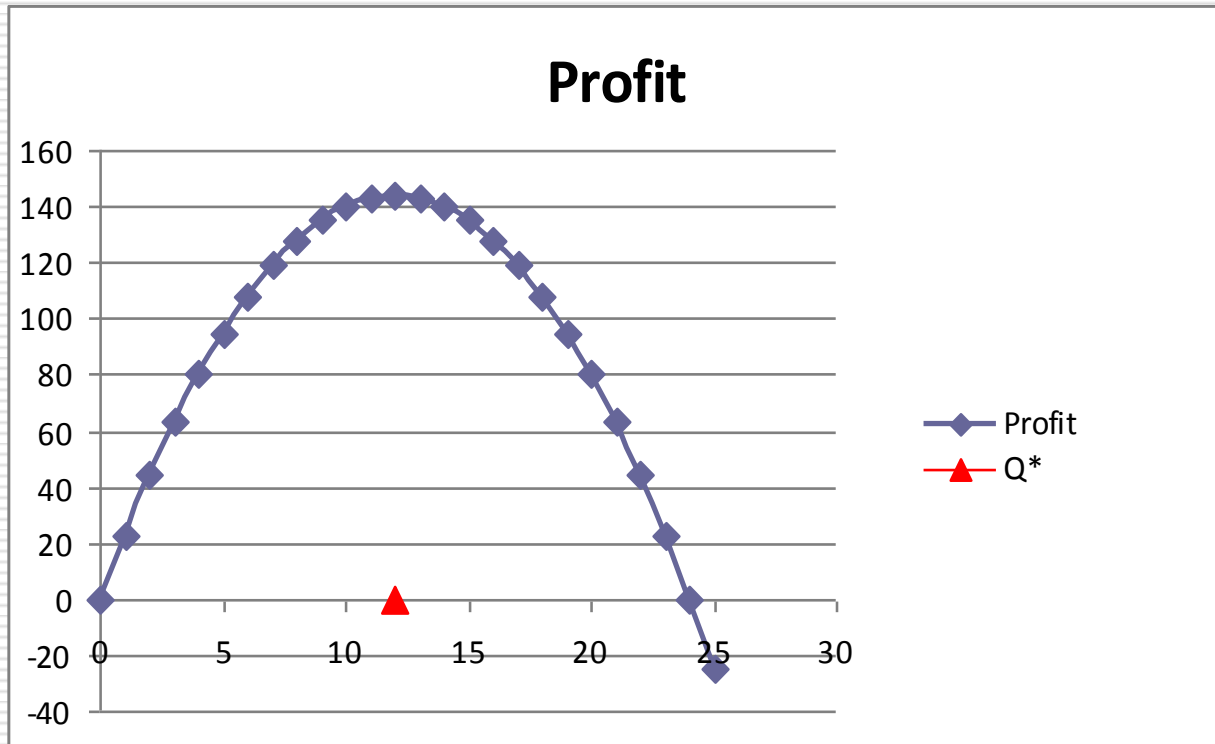
Total Revenue =  $pQ$ , where  $p$  is a constant, so TR is a straight line



# Profit Maximization

## Perfectly Competitive Firm

$$\text{Profit} = \text{TR} - \text{TC}$$

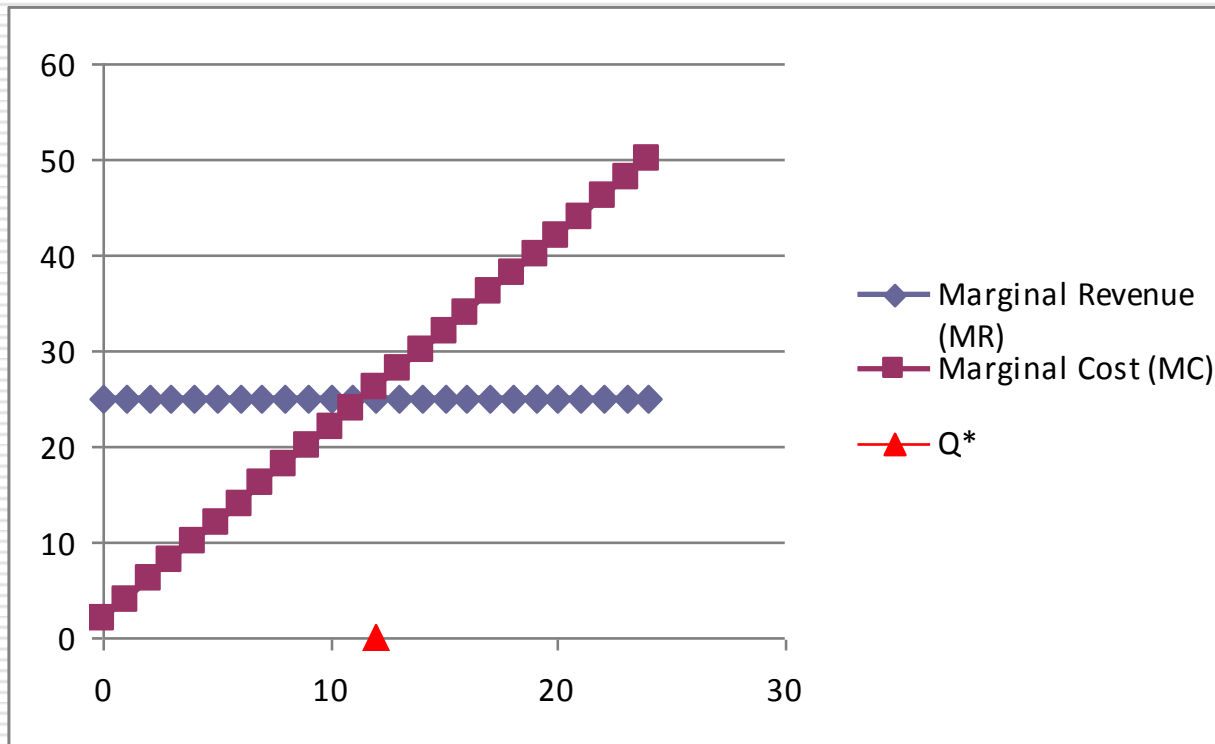


# Profit Maximization

## Perfectly Competitive Firm

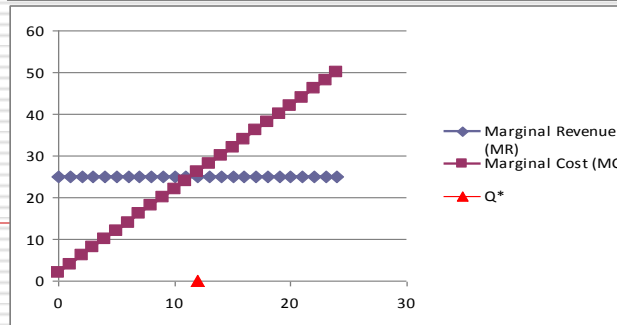
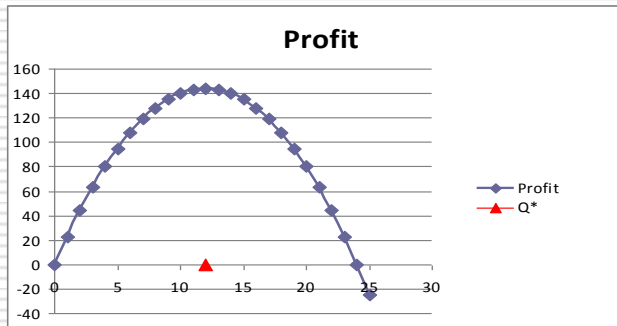
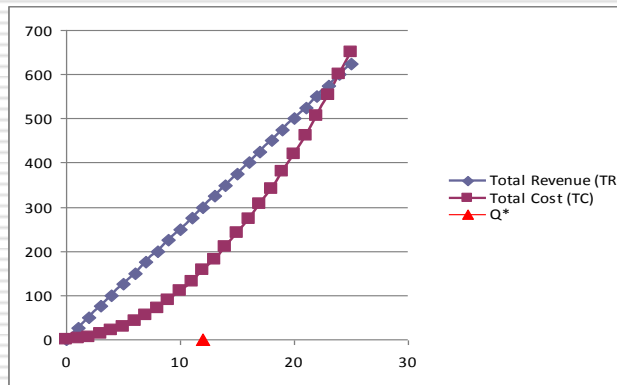
Marginal Revenue (MR) = Marginal Cost (MC)

Marginal Revenue is constant (horizontal line); Marginal Cost is increasing



# Profit Maximization

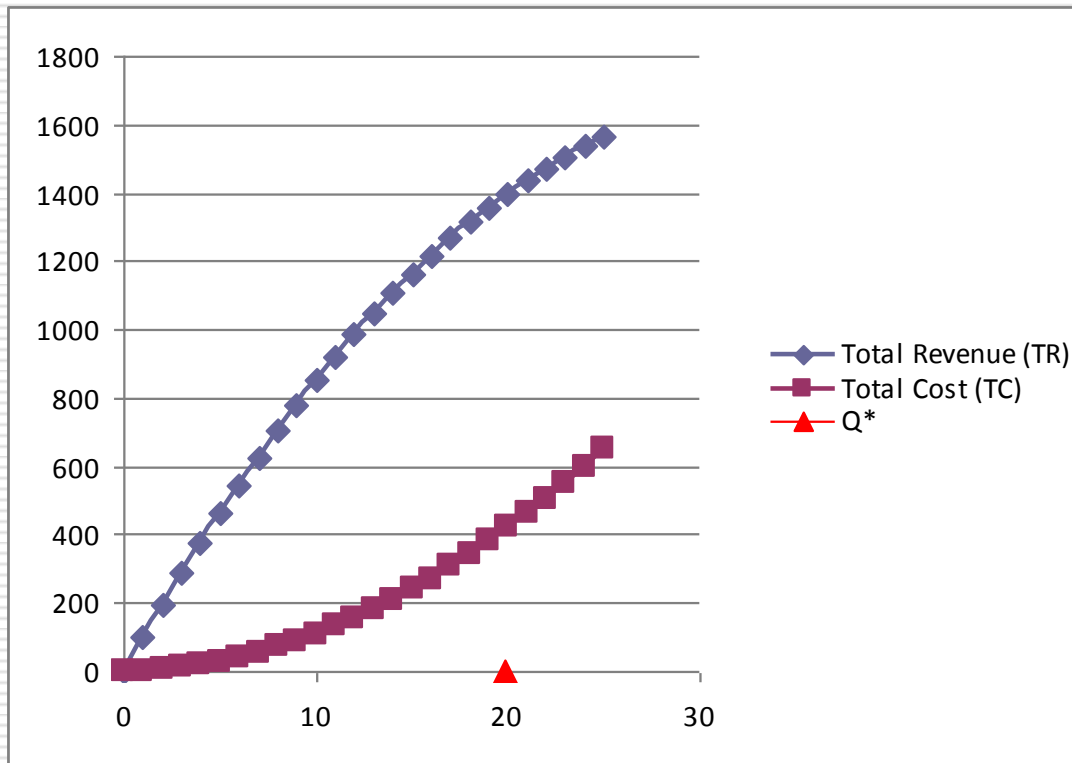
## Perfectly Competitive Firm



# Profit Maximization

Market-Powerful (e.g., Monopolistically Competitive) Firm – see [ue\\_lecture\\_4.xls](#)

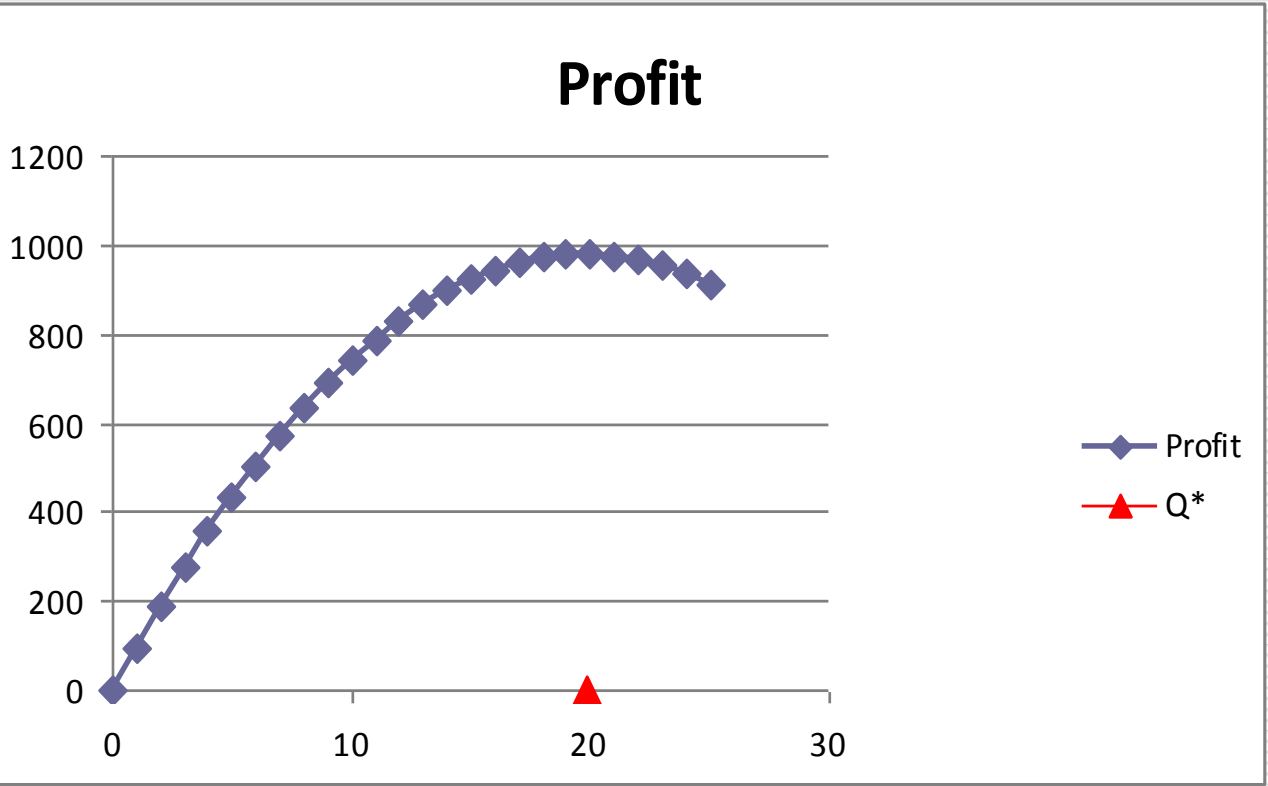
Total Revenue =  $pQ$ , where  $p$  depends on  $Q$  (the inverse demand curve), so TR is not a straight line



# Profit Maximization

Market-Powerful (e.g., Monopolistically Competitive) Firm

$$\text{Profit} = \text{TR} - \text{TC}$$

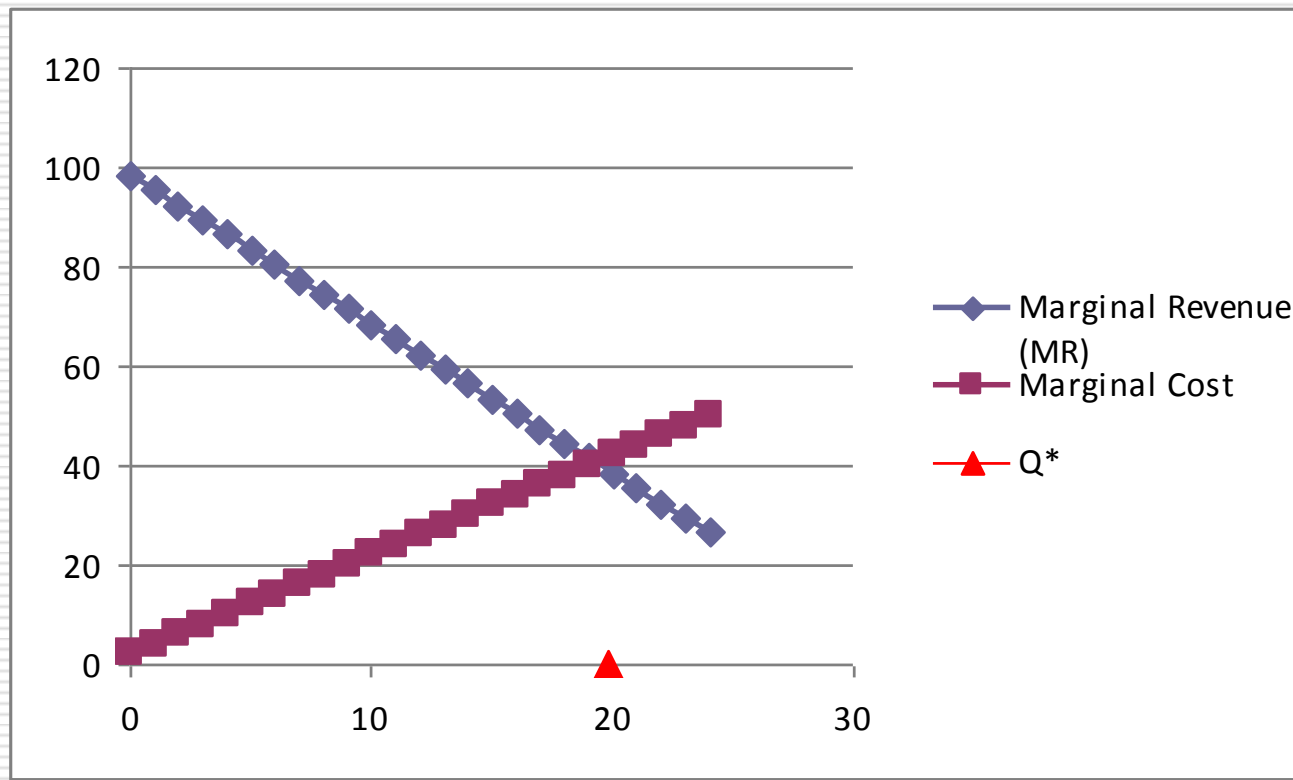


# Profit Maximization

Market-Powerful (e.g., Monopolistically Competitive) Firm

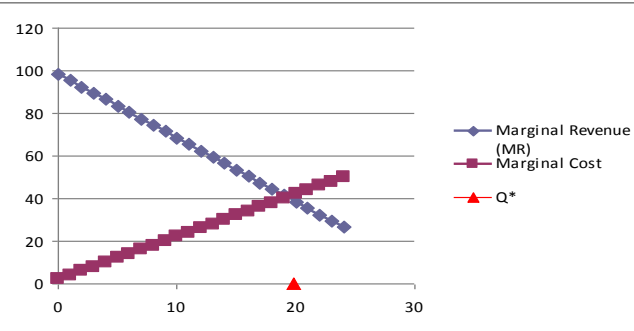
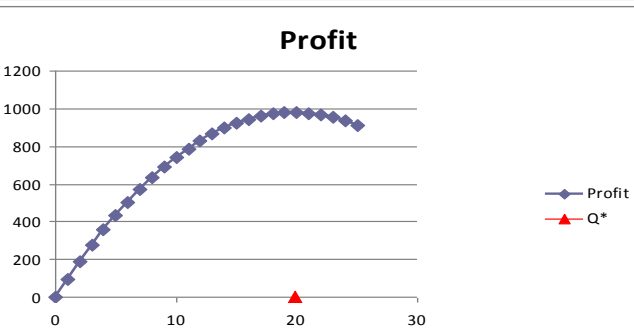
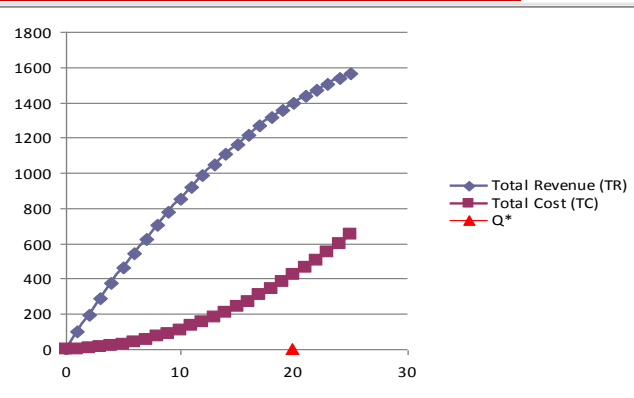
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Maximum Profit occurs where  $MR = MC$ ; MR is not constant



# Profit Maximization

Market-Powerful (e.g., Monopolistically Competitive) Firm



# Long-run Equilibrium of the Firm

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Long-run is that period of time when two conditions\* are satisfied:

- *All* inputs are variable; in the short-run only *some* inputs are variable. This implies that in the long-run there is zero fixed cost.
- In the long-run entry has taken place; positive economic profits in the short-run are the signal for entry, so in the long-run there are zero economic profits (the Zero Profit Condition)

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\* It is possible to conceptually distinguish these two conditions, so some people talk about the long-run as the period in which one or the other but not both conditions are satisfied.

# Long-run Equilibrium of the Firm

continued

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- Nature of “economic profits” as opposed to “accounting profits”
- How does *Zero Profit Condition* Work?

$$\text{Profit}(Q) = \text{TR}(Q) - \text{TC}(Q) = 0$$

basically,  $p$  in TR expression adjusts downward with entry until economic profits are reduced to zero

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# Firms that distribute output to customers at various locations

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- Assumptions: input and production costs do not vary by location
- Customers located along straight line (see illustration)

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**A B C D**                      **E**                      **F**                      **G**                      **G'**

- Firm must choose *one* location for production
  - One delivery per trip
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# Principle of Median Location

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- Transportation costs are minimized when the firm is located at the median location (ignoring  $G'$  this is  $D$ )

**A B C D E F G G'**

- Why does the principle of median location hold?\*
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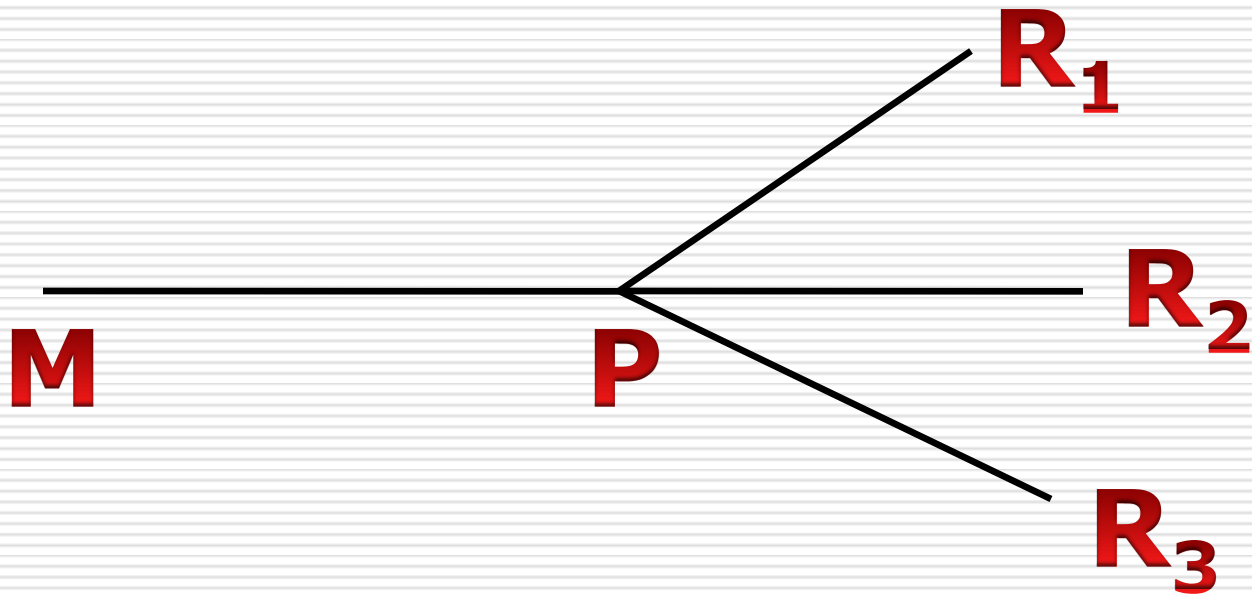
# Lessons from the Principle of Median Location

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- ❑ Location of the most distant customer does not alter the optimal location (if  $G$  moves to  $G'$ )
  - ❑ Median location is indeterminate if there are an *even* number of customers
  - ❑ Principle of median location can be reconciled with One Input, One Market Model
  - ❑ Principle of median location gives rationale for growth of cities
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# Port Cities

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# Other Factors in Location Decisions\*

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- Labor Costs
  - Other inputs: energy, capital, land
  - Intermediate inputs
  - The knowledge input
  - Taxes and public services
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# Agglomeration Economies

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- Agglomeration economies (traditional definition and categorization)
    - Economies of scale within the firm
    - Localization economies
    - Urbanization economies
    - Interindustry linkages
  
  - Rosenthal and Strange (2003)
    - Industry (continuum)
    - Geographic (distance)
    - Temporal
    - Organization (structure) of industry
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# Economies of Scale within the Firm

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- Average cost declines when output increases at a given location
  - What would an economy without scale economies be like?
  - Implications of extent of scale economies for size of cities
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# Localization Economies

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- ❑ External to firm, related to size of local industry
  - ❑ Definition of “industry”
  - ❑ Specific to particular industries
  - ❑ Shopping effects
  - ❑ Economies of scale in the provision of inputs (labor, capital, services)
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# Urbanization Economies of Scale

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- Shopping economies
    - Diversity of goods and services
  - Provision of inputs not specific to an industry
    - Diversity of goods and services
    - Urban infrastructure
      - Transportation facilities
      - WiFi network?
      - Cultural and recreational amenities
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# Empirical Evidence

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- Henderson (1986)
  - Rosenthal & Strange (2001)
  - Henderson (2003)
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# Static Theory of External Economies and Diseconomies

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- Distinction between private costs/benefits and social costs/benefits
  
  - Examples:
    - Pollution
    - congestion
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# Localization Economies

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- $TC = n(tc)$ , where  $n$  is the number of firms and  $tc$  is the total cost of each firm
  - $tc = q(ac)$ , where  $q$  is the output of each firm and  $ac$  is the average cost of each firm
  - $AC = TC/n = tc(n)/nq = tc/q = ac$
  - $\Delta TC = \Delta nq(ac) + \Delta ac(nq) + \Delta qn(ac)$
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# Localization Economies **continued**

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$$\begin{aligned}\square MC &= (\Delta TC / \Delta n) / q \\ &= q(ac) / q + (\Delta ac / \Delta n)(nq) / q \\ &= AC + n(\Delta ac / \Delta n)\end{aligned}$$

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# Localization Economies Figure 3.7



# End of Lecture 4

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