Roadmap After Midterm

- Factors of Health Service Production:
  - Hospital Behavior
  - Physician's Practice
  - Labor Market
  - Pharmaceutical Industry
- Efficiency and Equity in Health Care Market
- Market Failure and Government Intervention
- Evaluation of Health Care Projects
- Health Care Systems
- Health Care Reform

Group Presentation

- Each group consists of 4-5 students.
- There are 12 topics in total, covering three four industries (hospital, physicians, nurses, and pharmaceutical companies) and three areas (structure, conduct, performance).
- You are asked to compile relevant data and related studies to analyze the structure, conduct, or performance of the assigned industry, and present it in class in the most creative way.

FACTORS OF HEALTH SERVICE PRODUCTION

EE 474 Health Economics

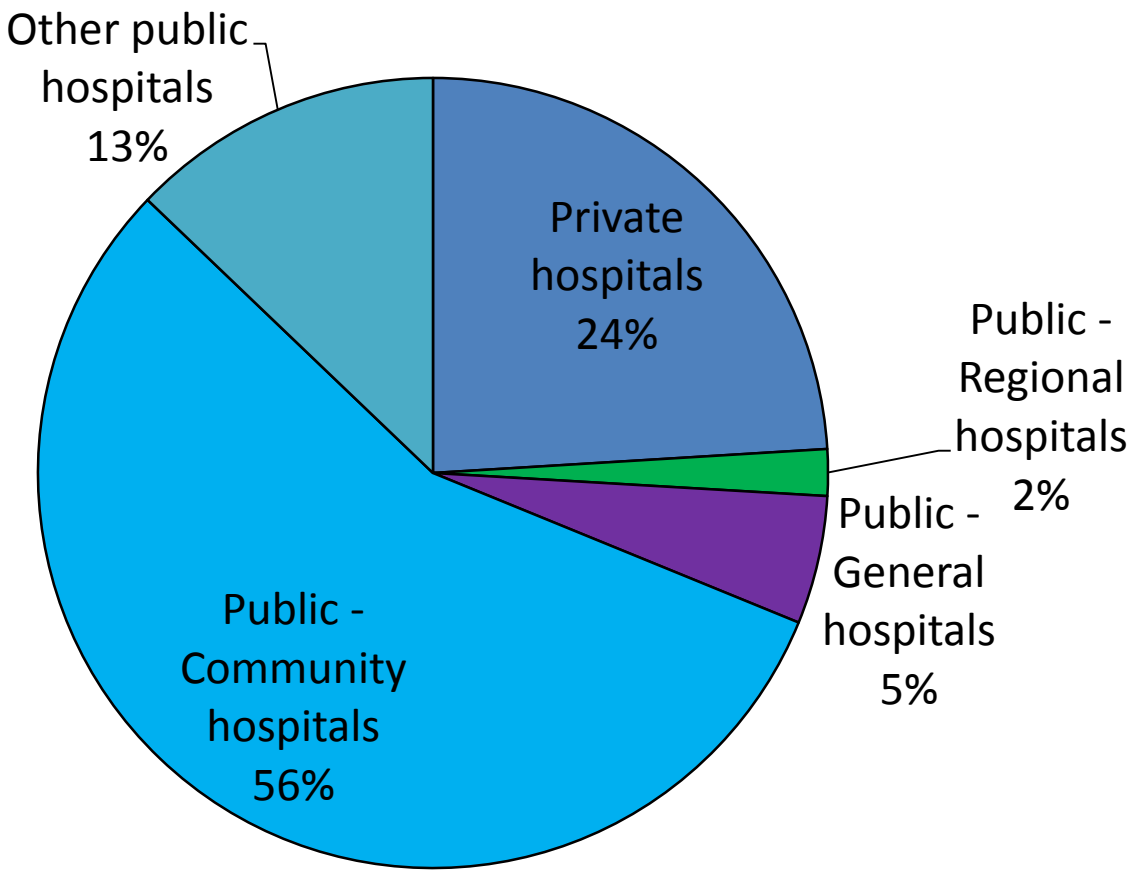
Semester 2/2017

HOSPITALS

Topics

- Some Statistics about Hospitals in Thailand
- Models of Non-Profit Hospital Behavior
  - The Quality-Quantity Nonprofit Theory
  - The Profit-Deviating Nonprofit Hospital
  - The Hospital as a Physicians' Cooperative
- Alternative: The Hospital as Two Firms

Hospitals in Thailand (2010)



Source: Bureau of Policy and Strategy, Ministry of Public Health

Hospitals as Non-Profits?

- The majority of hospitals in Thailand are public hospitals.
  - Largely subsidized by the government
  - Often receive a large amount of "donations"
  - Are they non-profits?
- Examples of hospitals operated by non-profit organizations in Thailand:
  - King Chulalongkorn Memorial Hospital (Thai Red Cross)
  - Hua Chiew Hospital (Poh Teck Tung Foundation)

What Exactly is a Nonprofit Firm?

- Criteria for a nonprofit firm is the nondistribution constraint.
  - No one has a legal claim on the nonprofit's residual (i.e. revenues – costs)
- Other distinctions between for profits and nonprofits:
  - Nonprofits are exempt from corporate income taxes and often from property and sales taxes.
  - Donations to nonprofits receive favorable tax treatment.

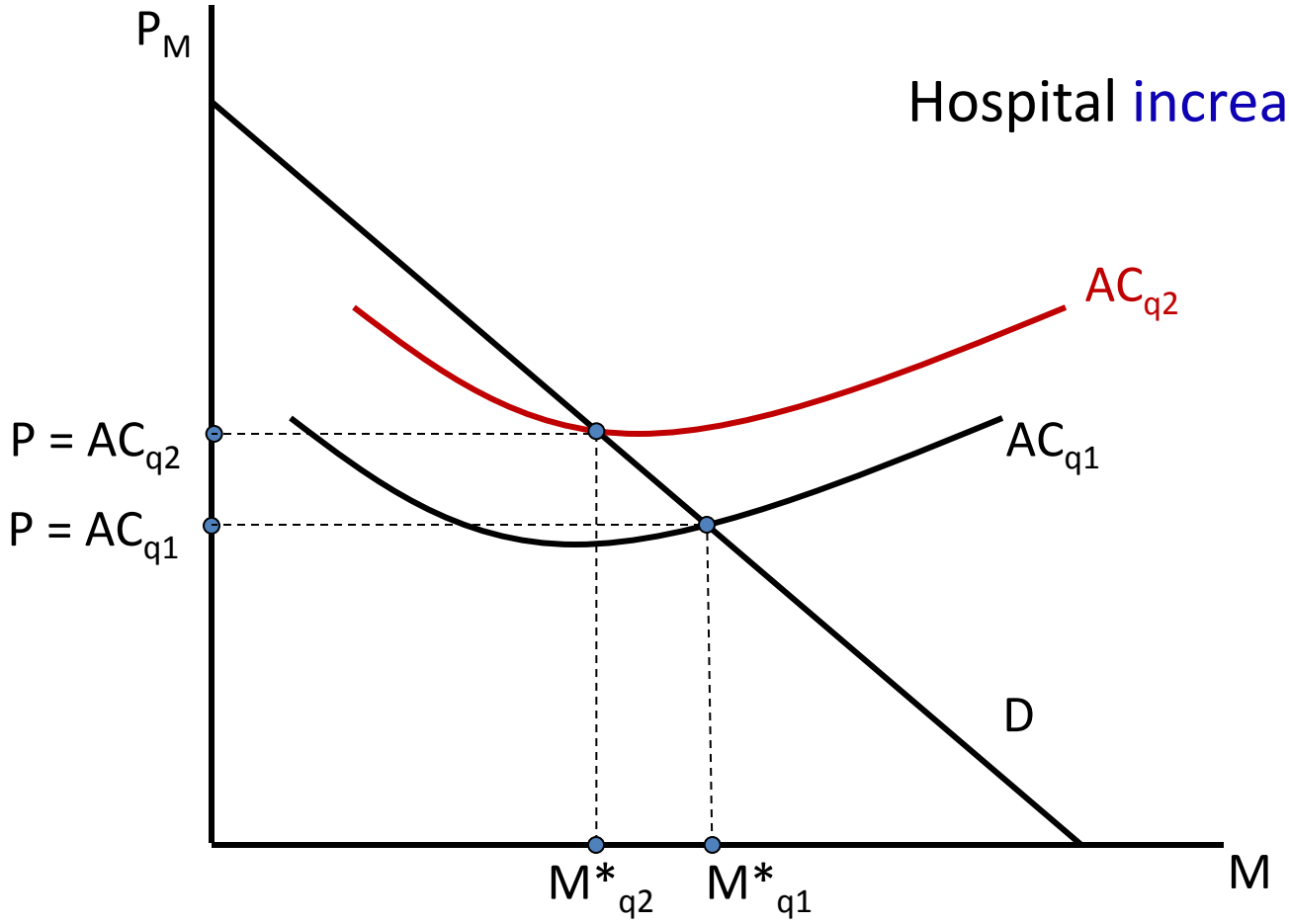
Why are Nonprofits Prevalent in Health Care?

- Weisbrod (1975):
  - Nonprofits arise to provide for unmet demands for public goods, most notably in cases where there are significant external benefits to the provision of a good.
- Hansmann (1980):
  - Nonprofit firms play a role in cases of contract failure (cases where it is difficult to observe the good's provision or quality).
  - For-profit firms tend to have a conflict of interest, and so nonprofit ownership is perceived as a signal of higher quality.

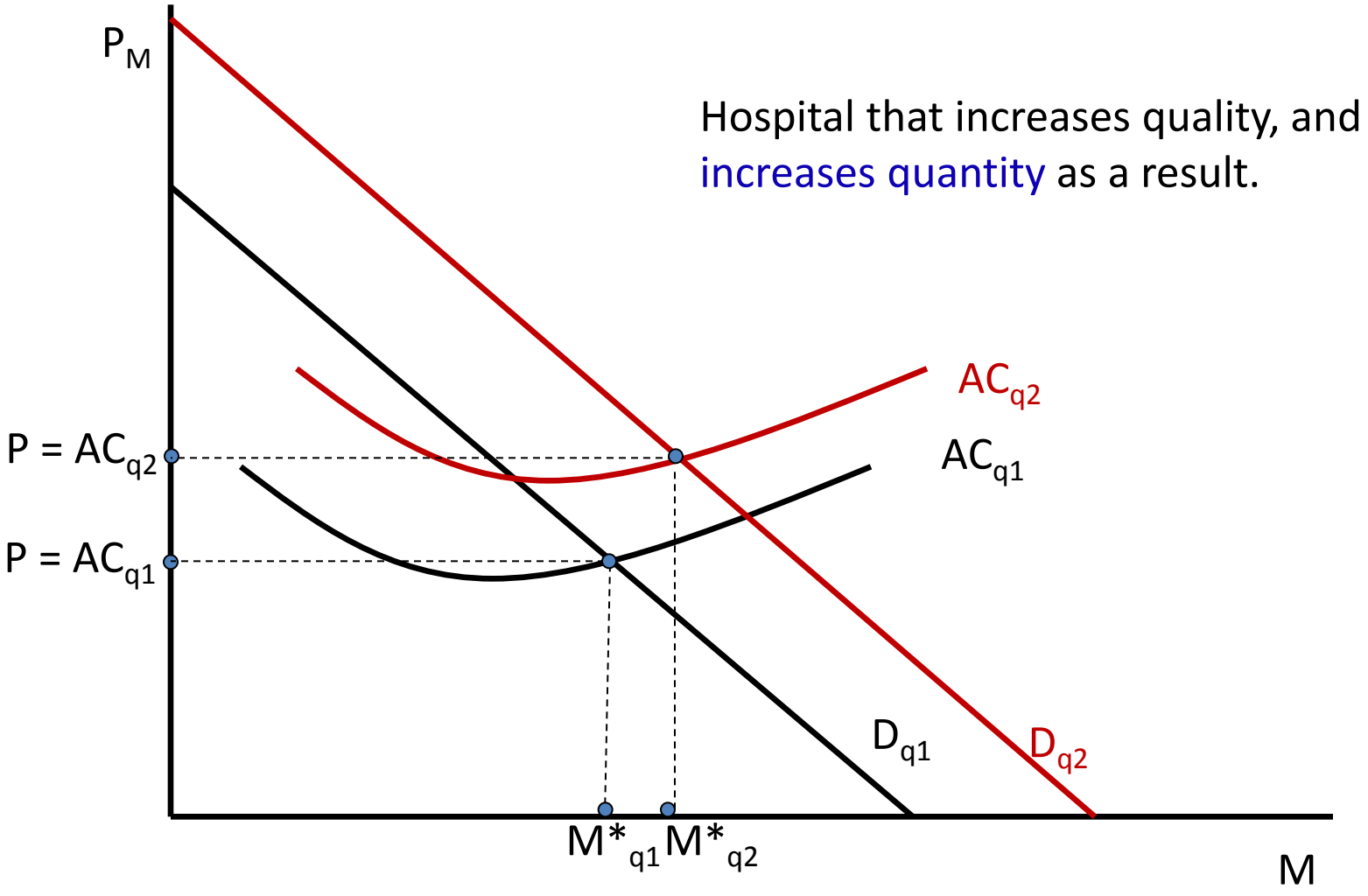
I. The Quality-Quantity Nonprofit Theory

- Economists start the analysis with the objective of the hospital decision makers.
- Newhouse (1970) proposed a utility maximizing model that approximate the *altruistic firm*.
  - The hospital decision makers have altruistically internalized the community benefit in providing quantity of care.
  - An increase in quality might increase demand.
- The hospital administrator chooses the combination of quality and quantity that maximizes his or her utility.

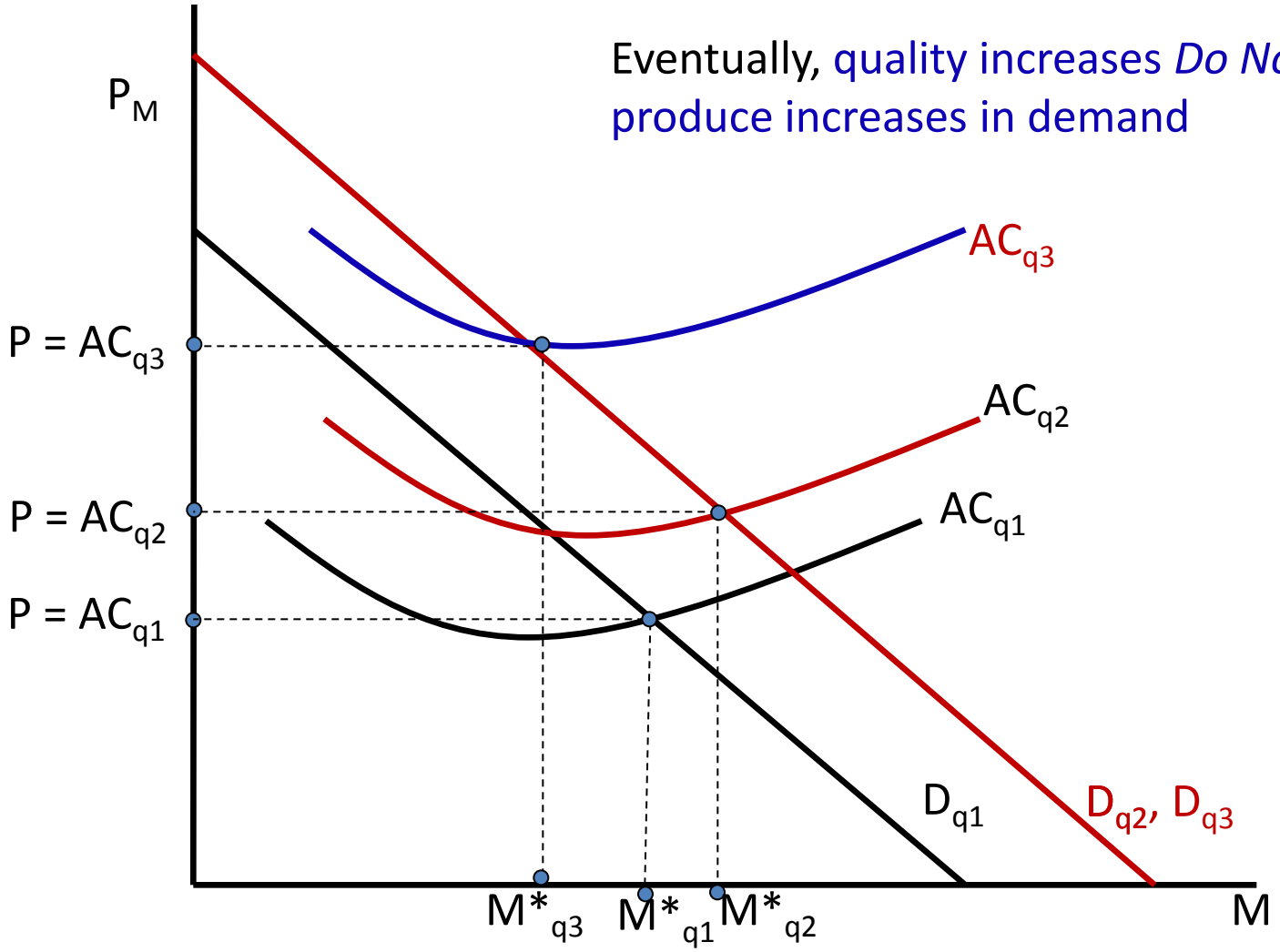
The Quality-Quantity Nonprofit Theory



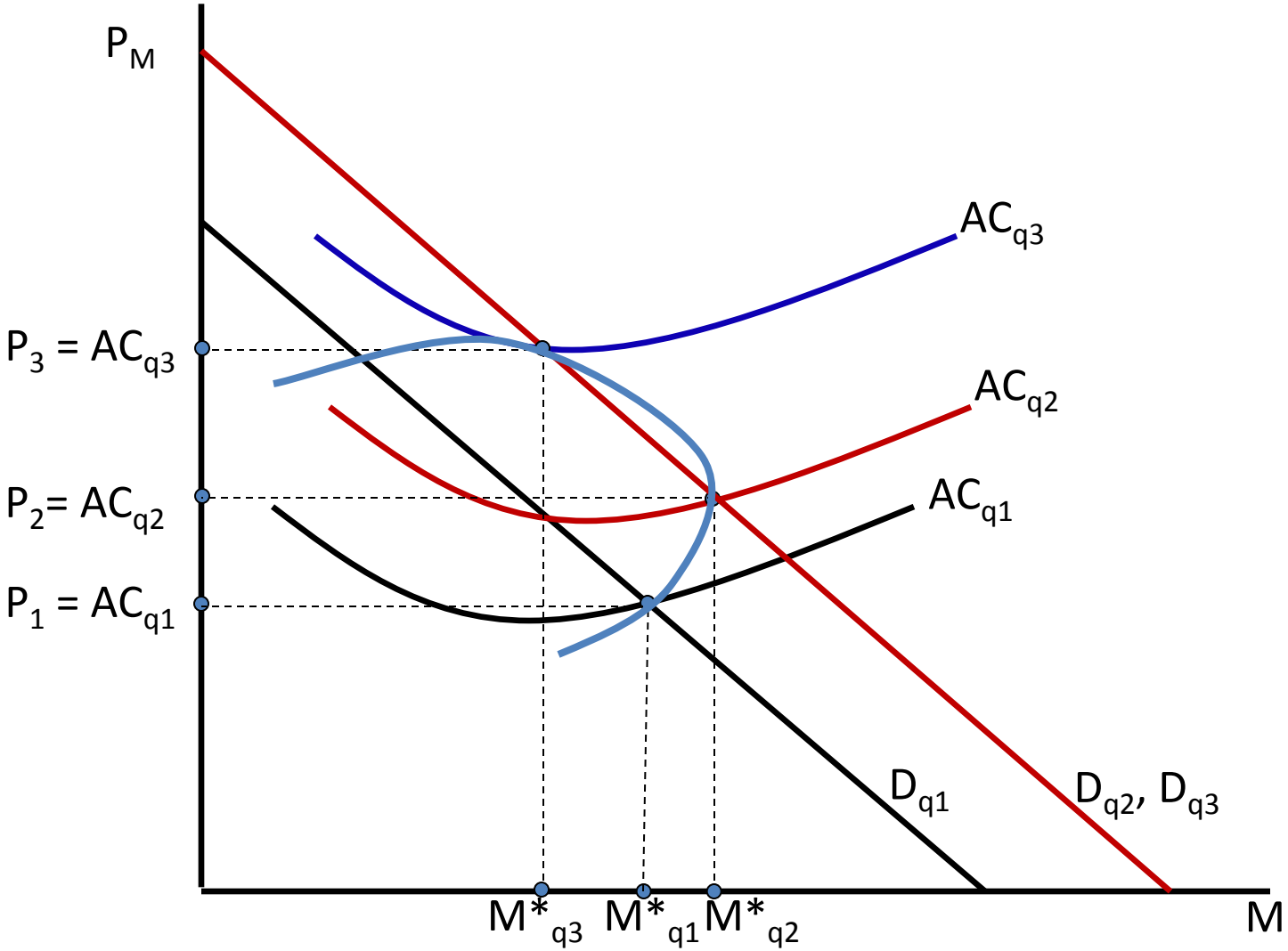
The Quality-Quantity Nonprofit Theory



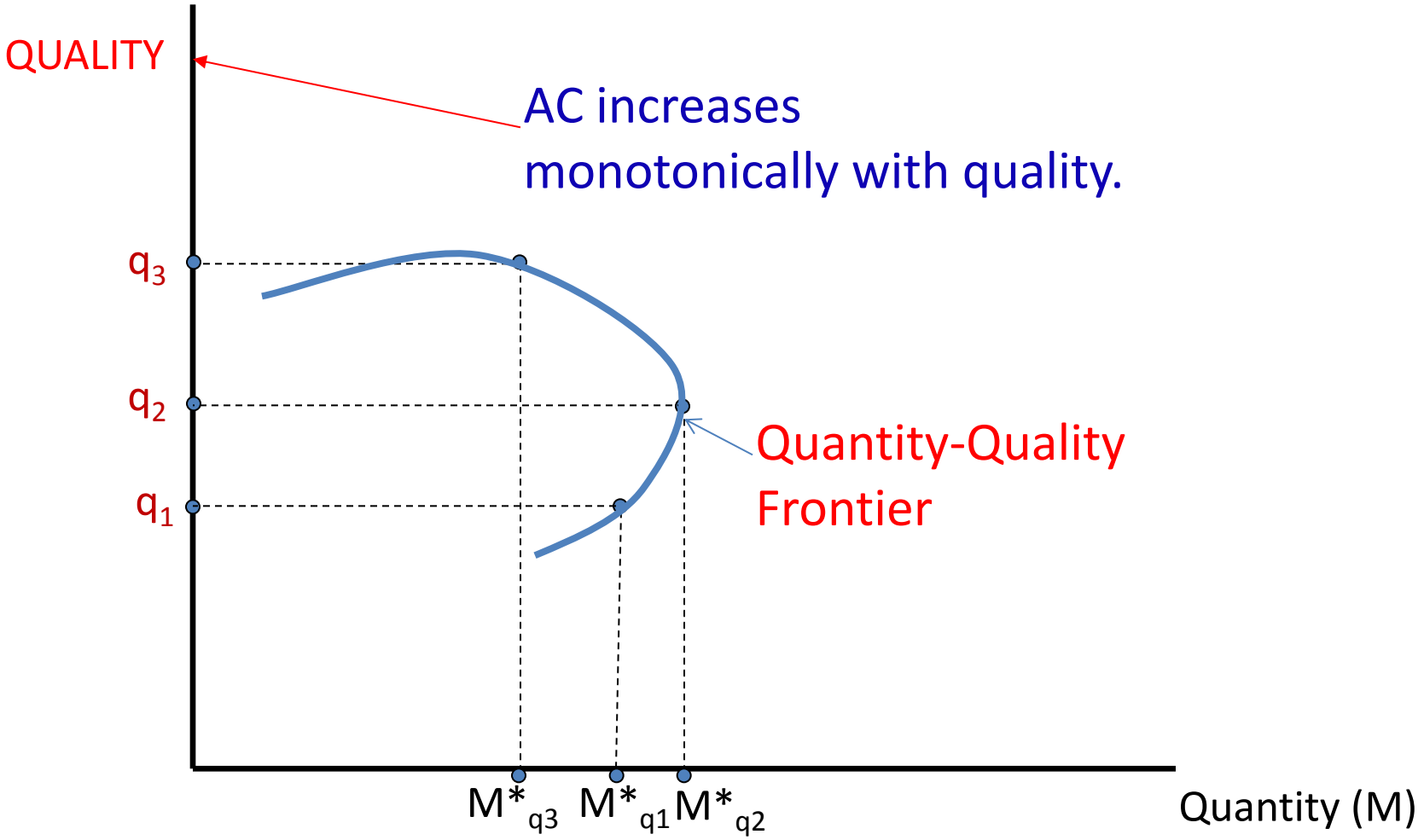
The Quality-Quantity Nonprofit Theory



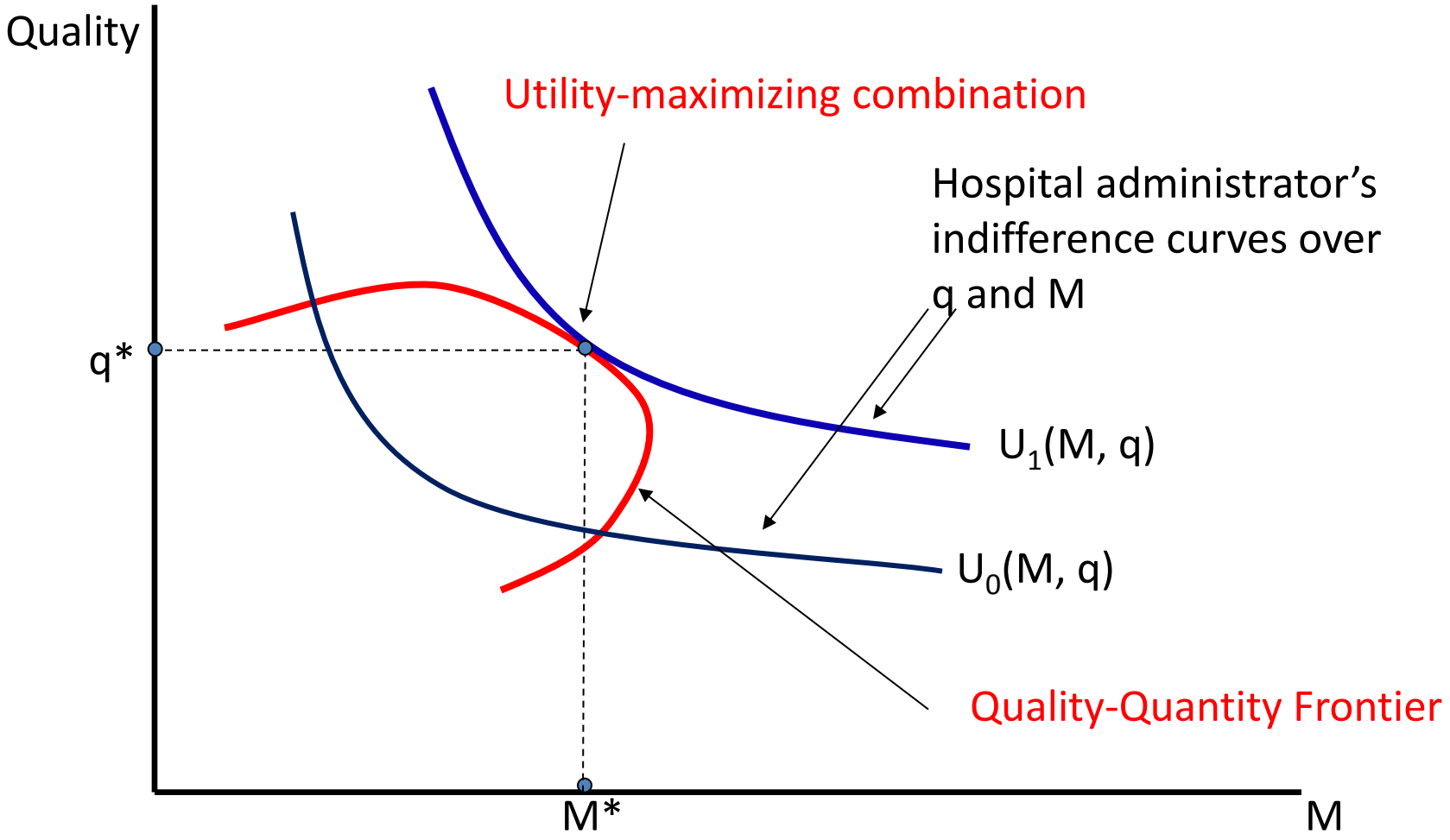
Hospital Administrator's Options



Hospital Administrator's Options in Terms of Quality and Quantity



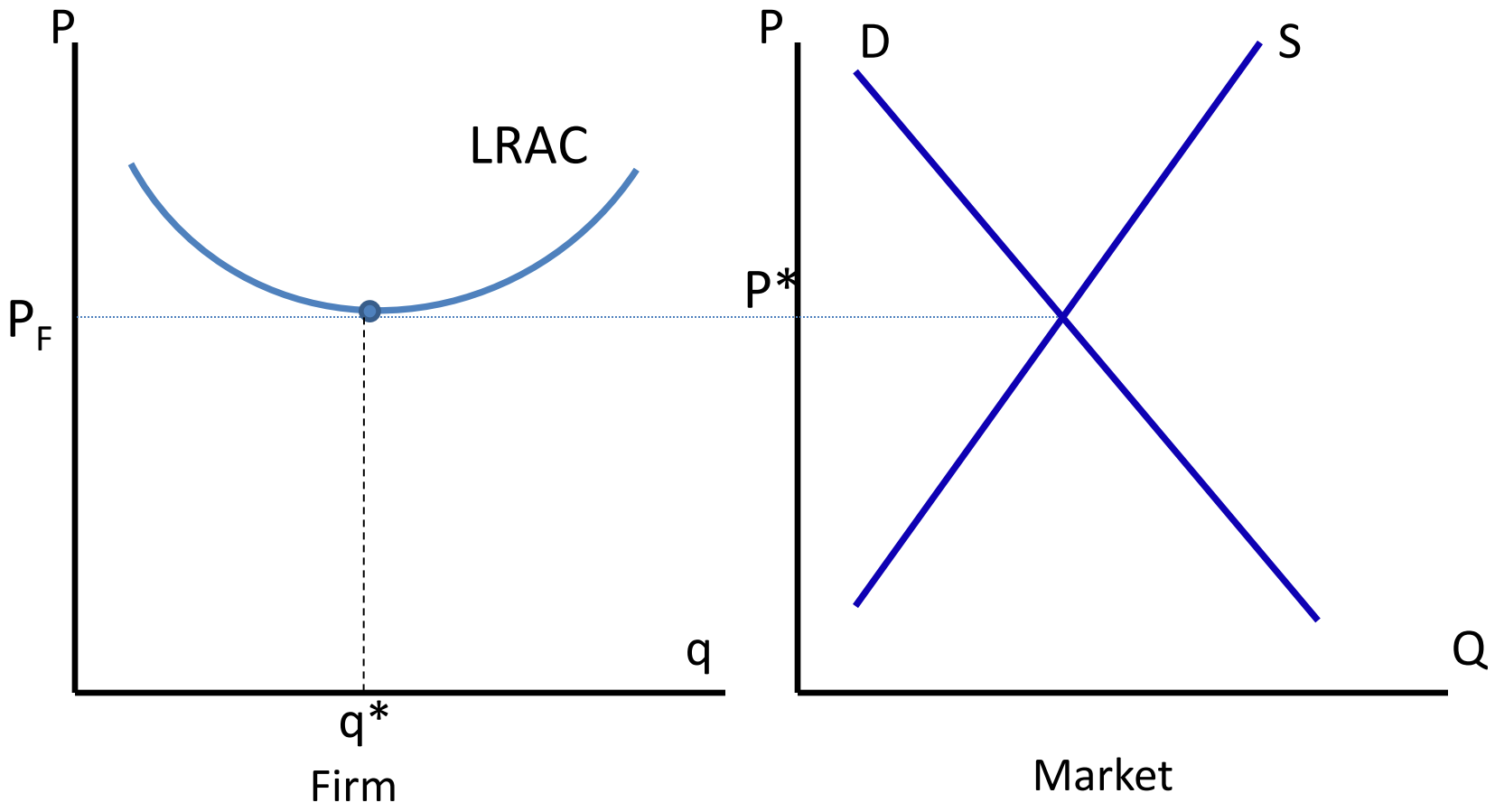
Hospital Administrator's Utility Maximization



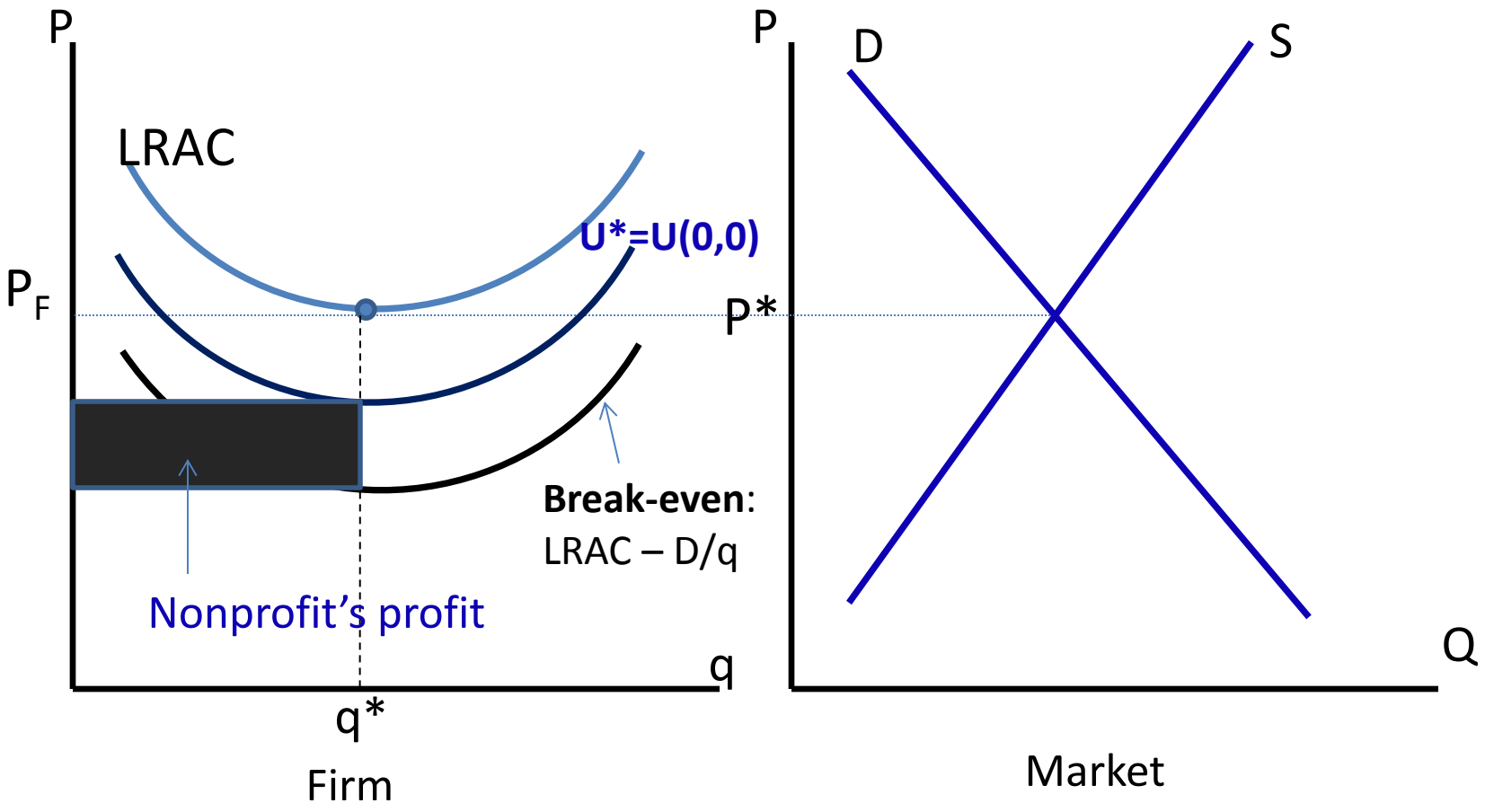
II. The Profit-Deviating Nonprofit Hospital

- Lakdawalla and Philipson (2006) view the nonprofit as a mix of altruism and profit motives:
  - Altruistic firms can be analyzed as if they were *pure profit-maximizers with a cost advantage*.
  - For-profit firms are the "marginal ones" responding to changes in regulatory and market conditions.
- Hospital's objective: Max $U = U(q, \pi)$
  - Nonprofit's profit: $\pi^N = \pi_S + D$ (D = donations)
  - For-profit's profit: π^F
- Reservation utility (minimum required utility): $U^* = U(q, \pi) = U(0,0)$.
- Operating constraints:
  - For-profit: $\pi^F \geq 0$
  - Profit-deviating nonprofit: $\pi^N = \pi_S + D \geq 0$

"Traditional" Market Model:
For-Profit's Entry Condition



Profit Deviating Model



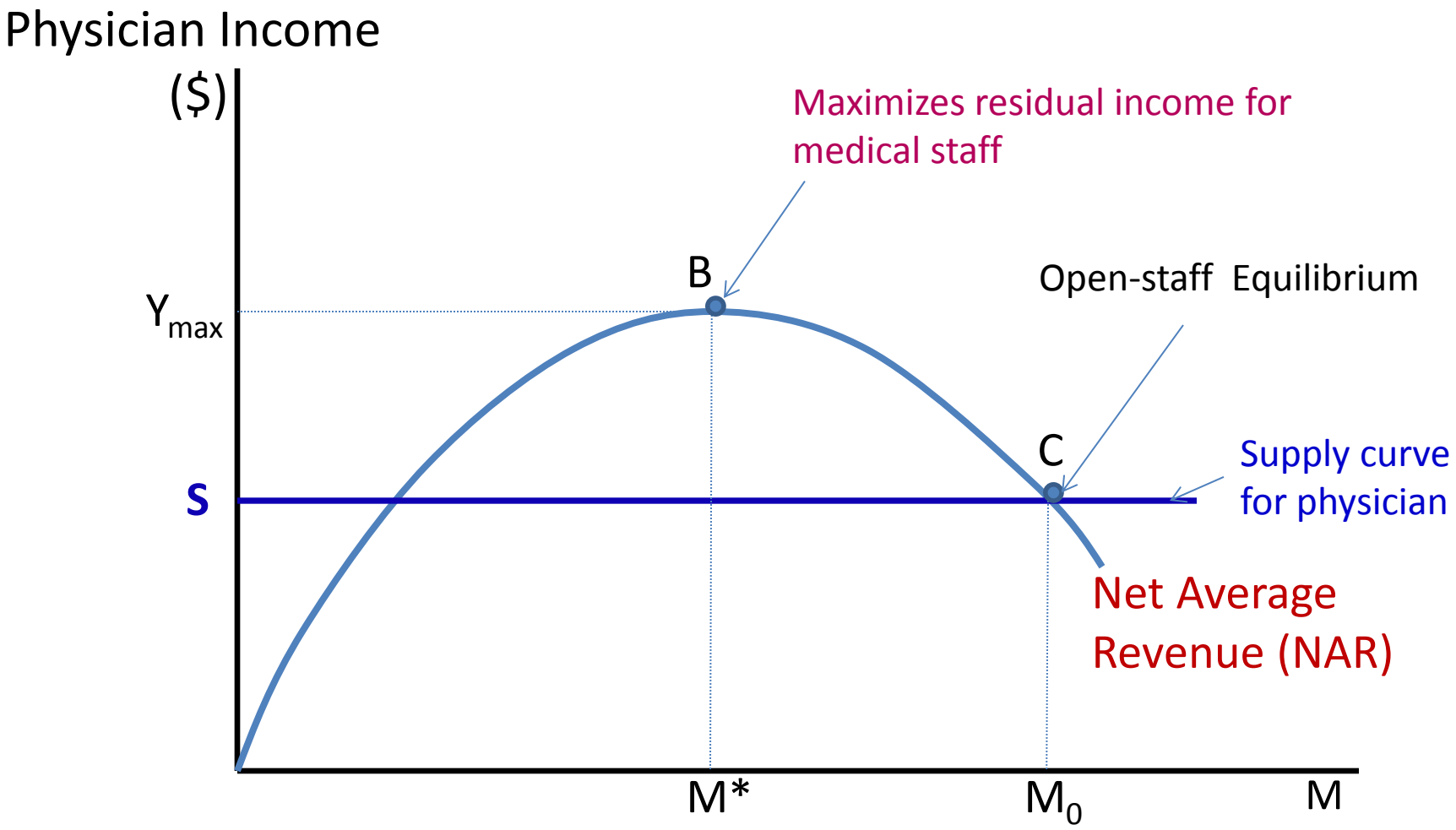
III. The Hospital as a Physicians' Cooperative

- Mark Pauly and Michael Redisch (1973) describe the nonprofit hospital as a "physicians' cooperative".
  - The hospital is controlled by a physician staff who operate the hospital so as to maximize their net incomes.
- Hospital objective: Max (NR/M)

  where NR = Net revenue = total revue – all factor payments

  M = Number of physicians
- Two types of staff:
  - "Close" staff hospitals: Physicians can limit the size of the staff.
  - "Open" staff hospitals: Physicians are free to enter.

Physician Cooperative Model



Comparing the Quantity-Quality and the Physicians' Cooperative Theories

- Hospital and physician' revenues:

$$R = R(K,L,M_0)$$

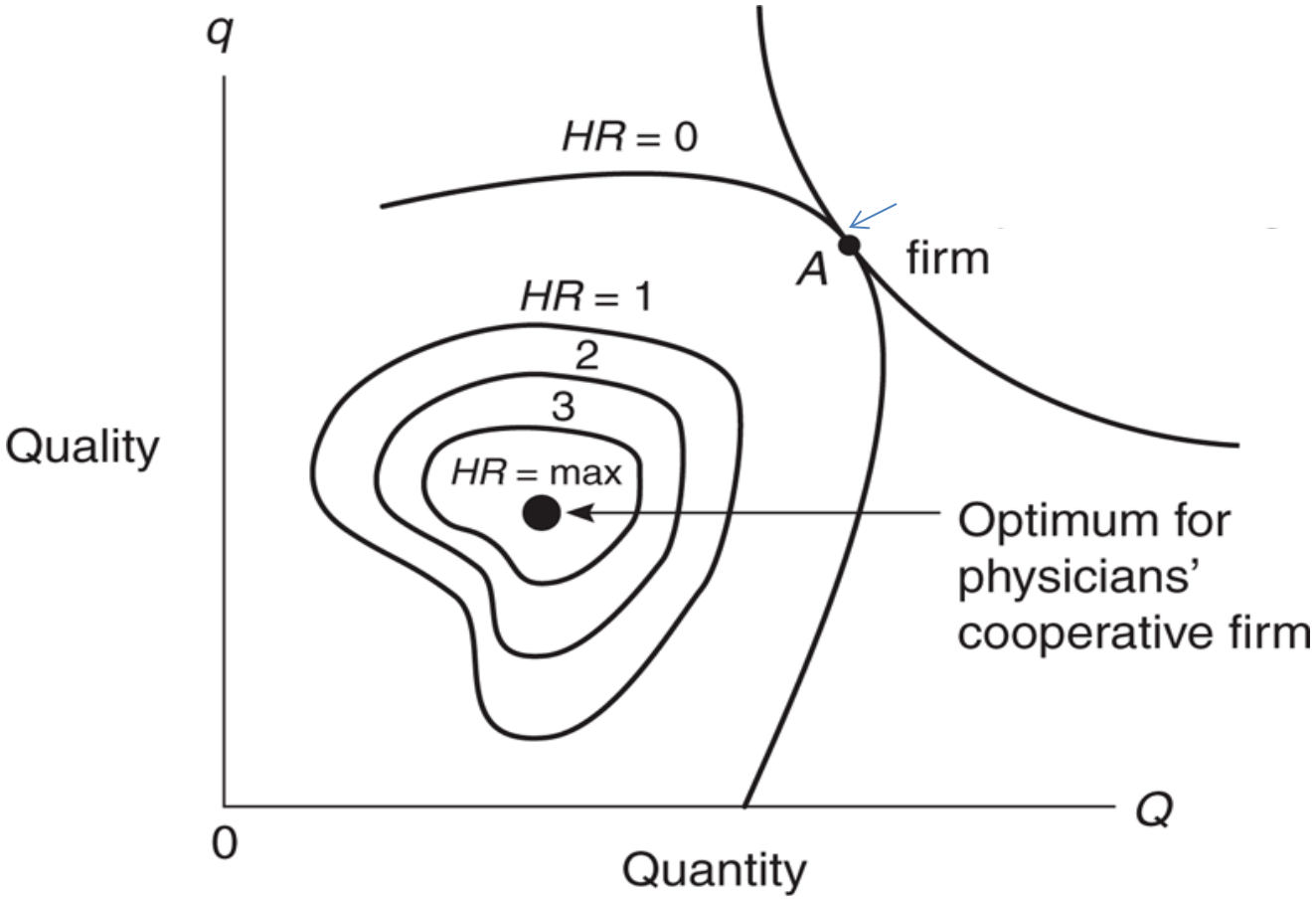
- Hospital residual revenue:

$$HR = R(K,L,M_0) - wL - rK - sM_0 + D_0 + G_0$$

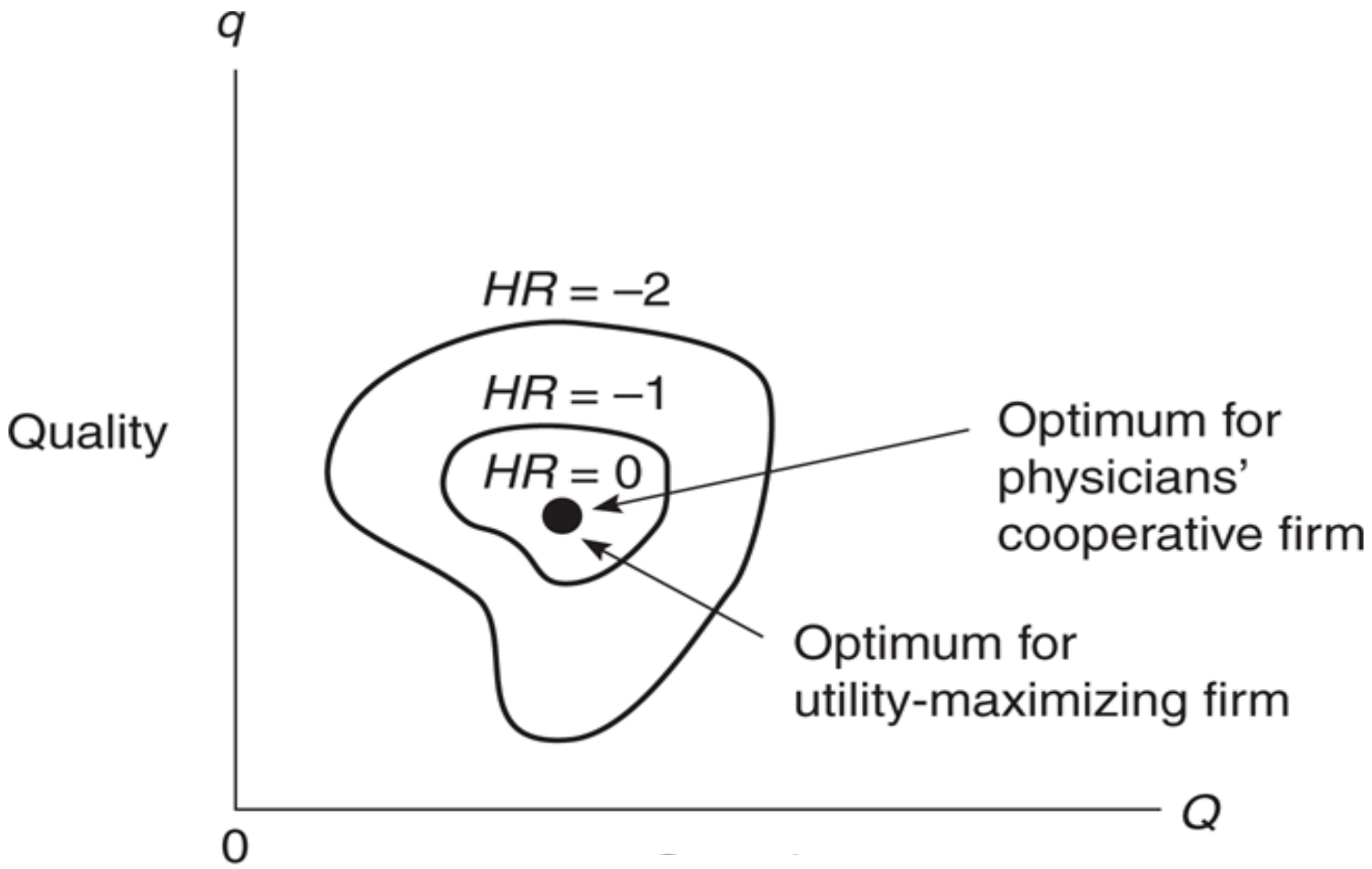
where D_0 = donation, G_0 = government subsidies, and physician supply price = s.

- Pauly-Redisch model ➔ Max HR
- Newhouse's model ➔ Max U(q, M) s.t. HR = 0.

The Quantity–Quality vs. The Physicians' Cooperative Theories



Effects of Increased Competition



Summary of Hospital Behavior Model

- *Newhouse*: The hospital administrator chooses the best combination of quantity and quality of care. (Utility maximization model)
- *Lakdawalla-Phillipson*: Nonprofit preferences include altruism and profit maximization.
- *Pauly-Redisch*: Optimal physician staff size maximizes the pecuniary gain to physicians. (Profit maximizing model)

Question: Which model do you think apply to hospitals in Thailand?

PHYSICIAN'S PRACTICE

Topics

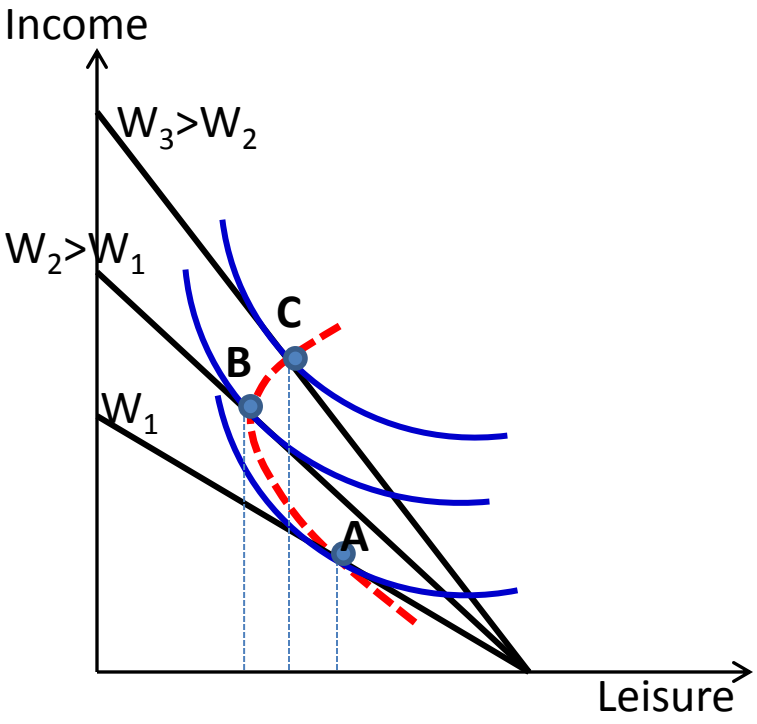
- Benchmark Model of The Physician's Practice
- Physician Agency and Supplier-Induced Demand
- The Target Income Hypothesis
- Diffusion of Information and Small Area Variations
- Malpractice

I. Benchmark Model of The Physician's Practice

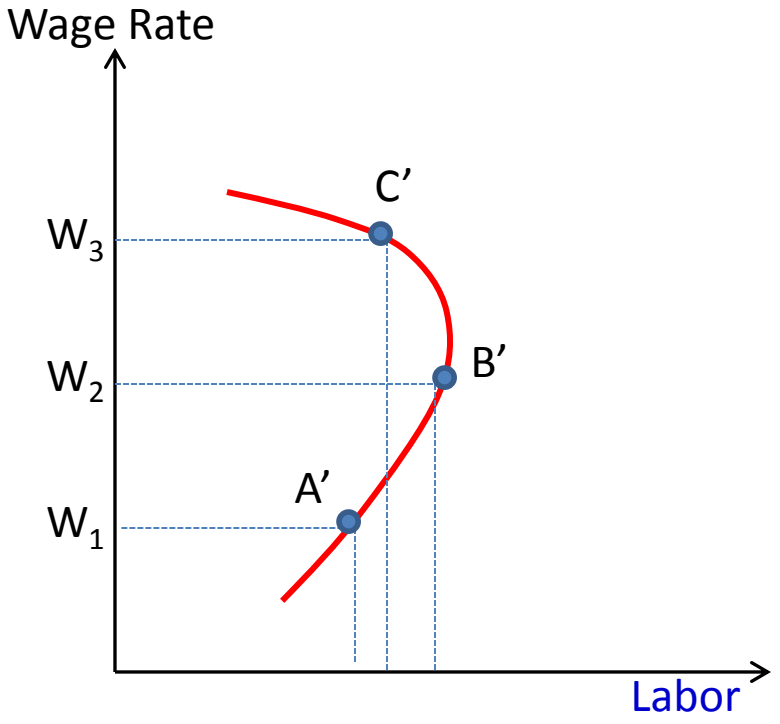
- McGuire and Pauly (1991) describe physicians as utility maximizers.
- Physician's utility depends:
  - Net income (π)
  - Leisure (L)
  - The degree of inducement (I): Physician's own efforts to induce patients to buy more care than appears medically necessary.
- Physician's Utility function:

$$U = U(\pi, L, I)$$

Supply of Physician Labor

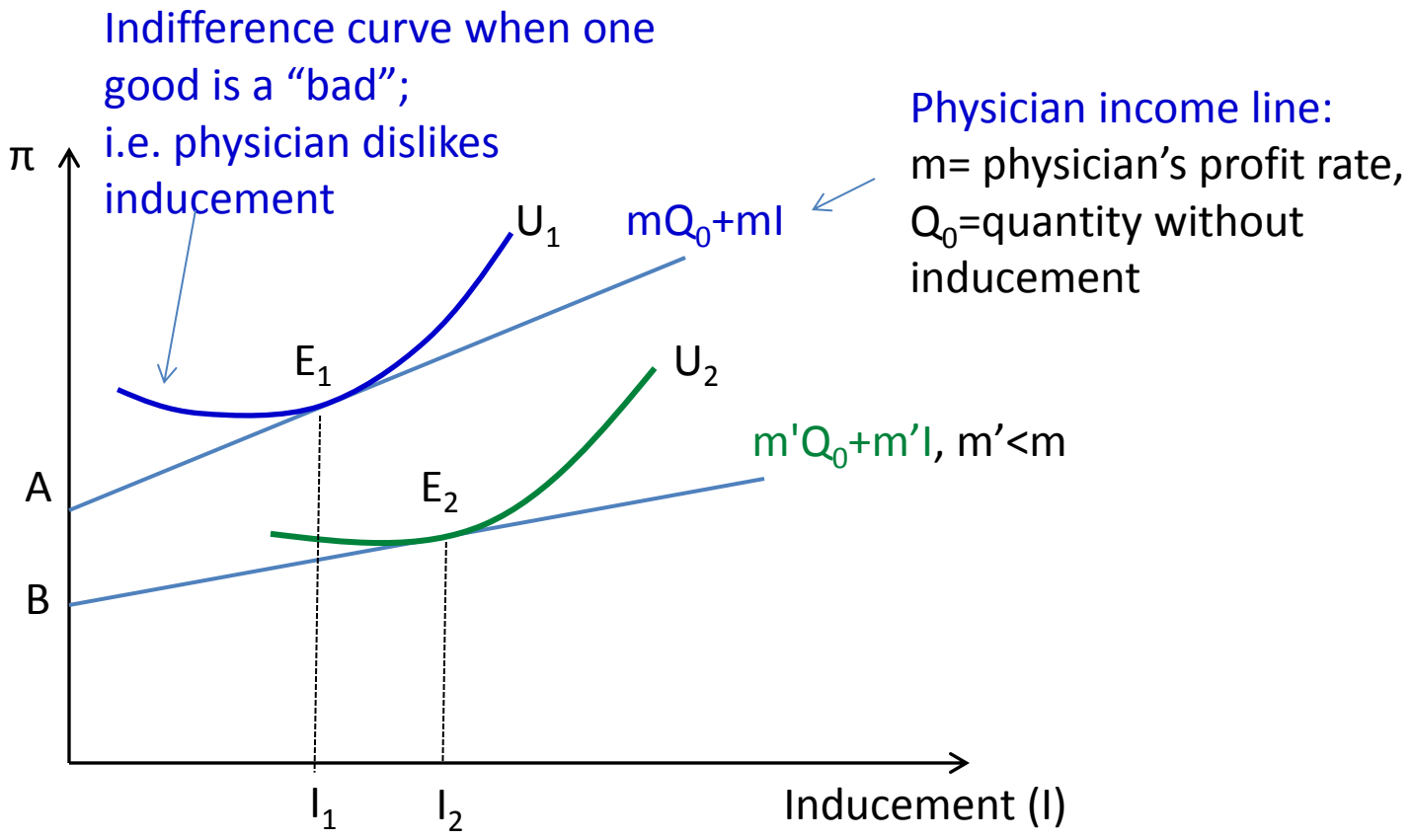


Labor-Leisure Tradeoff



Backward-Bending Supply Curve

Physician's Response to Reduced Rate of Profit

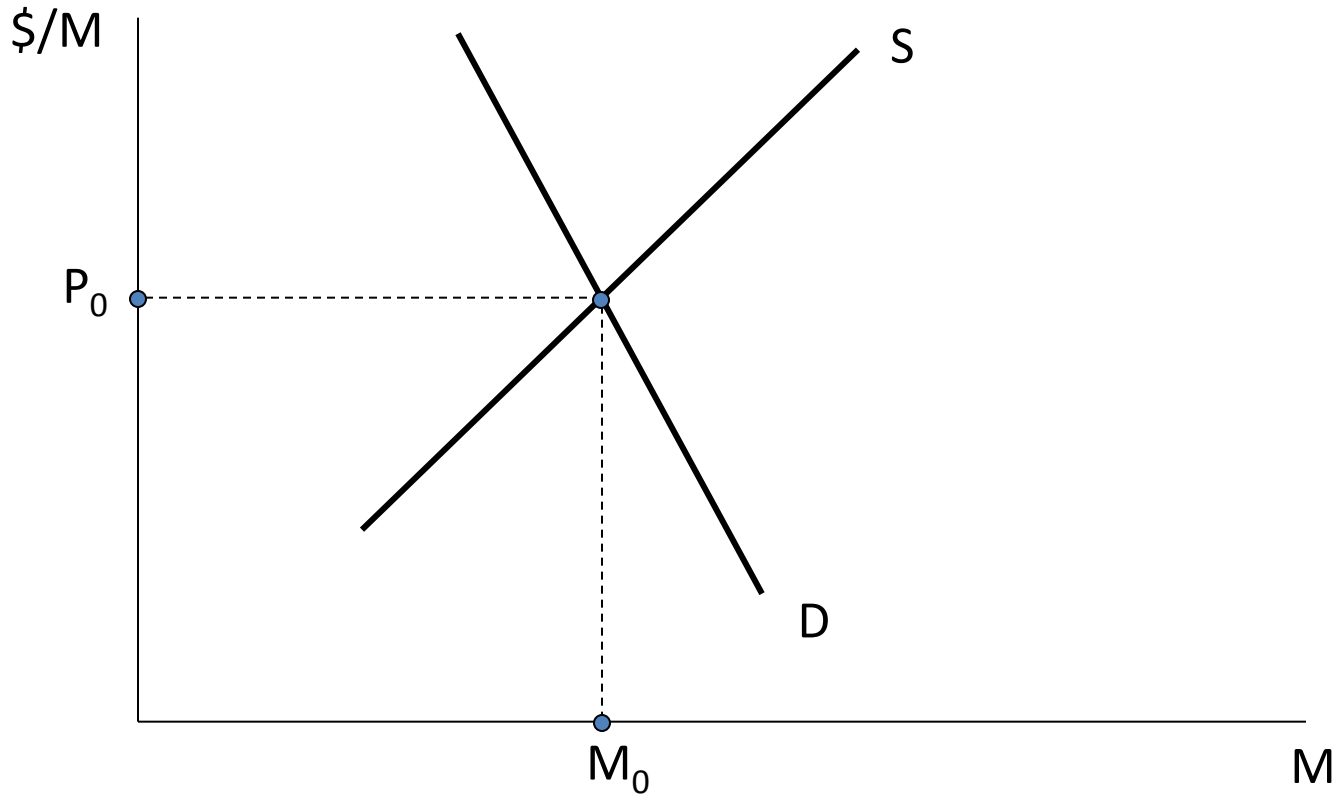


m'<m: A lower profit rate results in higher level of inducement.

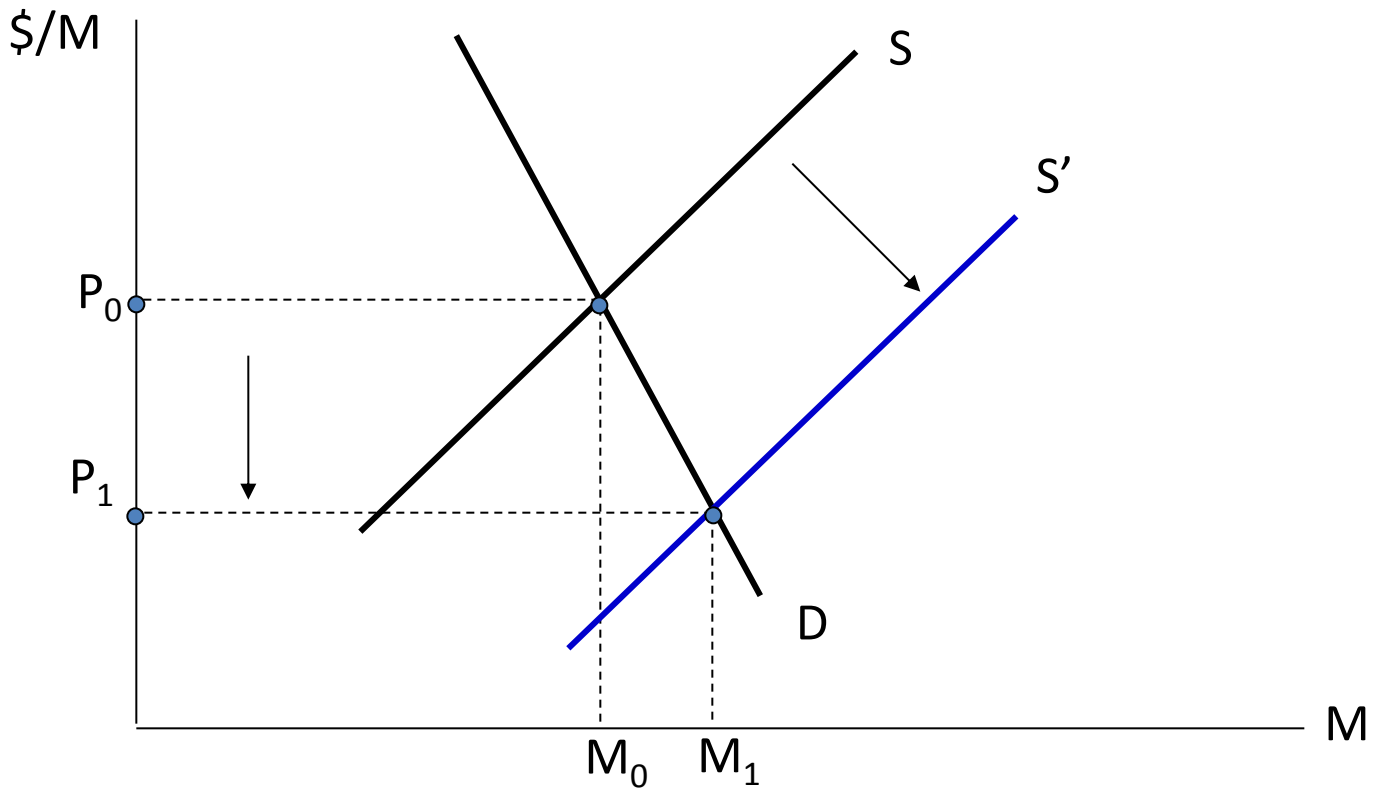
II. Physician Agency and Supply-Induced Demand

- In medicine, we identify the physician as the *agent,* and the patient as the *principal.*
- When two parties have *unequal* knowledge, the problem in called 'asymmetric information.'
- Policy concern is when self-interest physicians may violate their role as agents.
  - "Perfect agents" are the agents who make choices and recommendations on the behalf of principals that the principals themselves would have made if they had the same information.

Original Situation

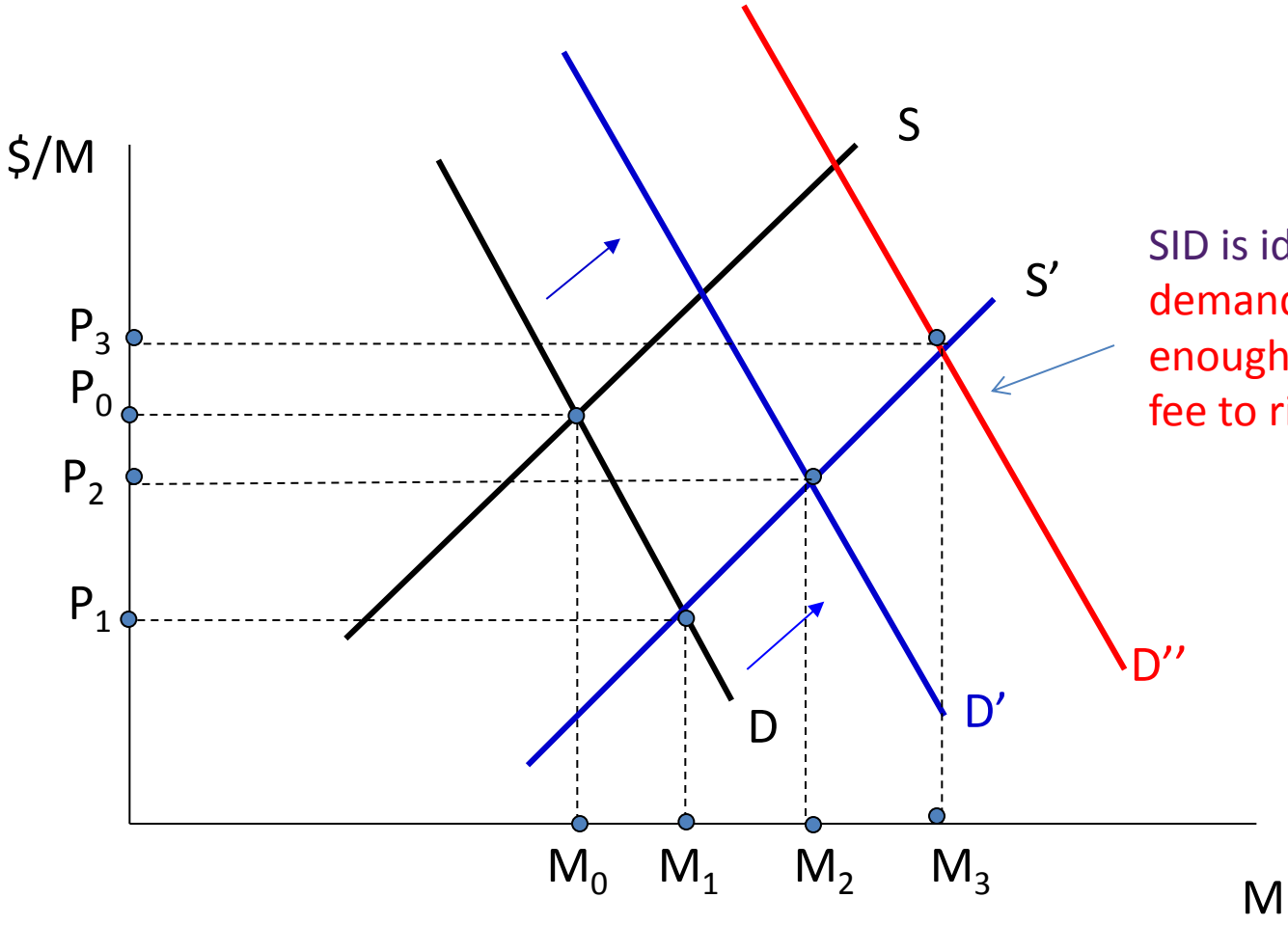


Some Exogenous Change in the Supply of Physicians Occurs (S increases)



Increase in S caused by an increase in the supply of physicians per person in the market.

Supply Induced Demand (SID)



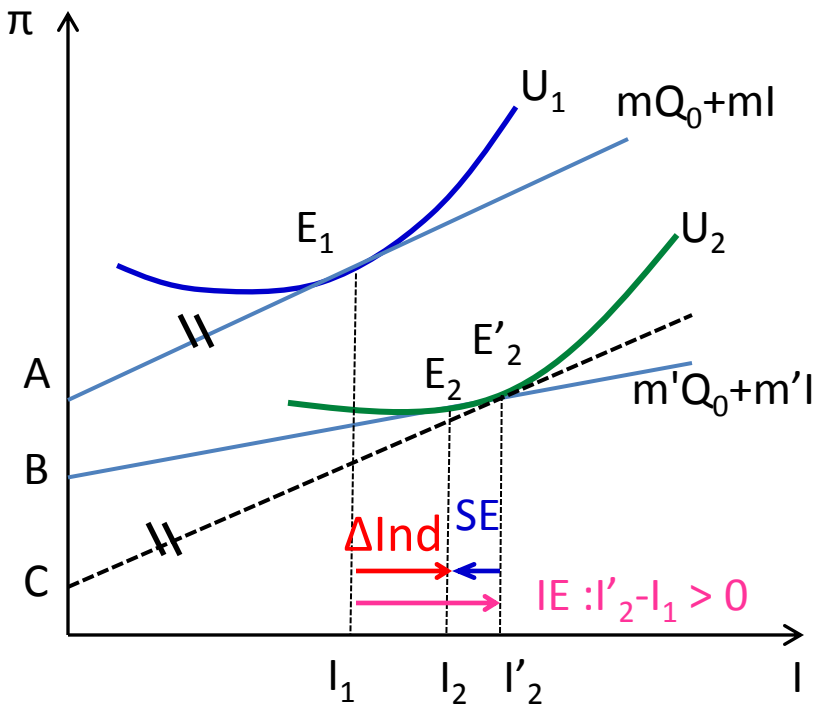
SID is identified when demand increases enough to cause the fee to rise.

III. The Target Income Hypothesis

- Economists *expect* physicians to respond to the financial incentives, but the theoretical puzzle is why physicians would wait until supply had increased to induce demand.
  - We need some theory other than profit maximization to explain the behavior
- Target income hypothesis suggests that they have a certain level of income that they do not want to fall below.
  - This is an extreme case of the benchmark model.

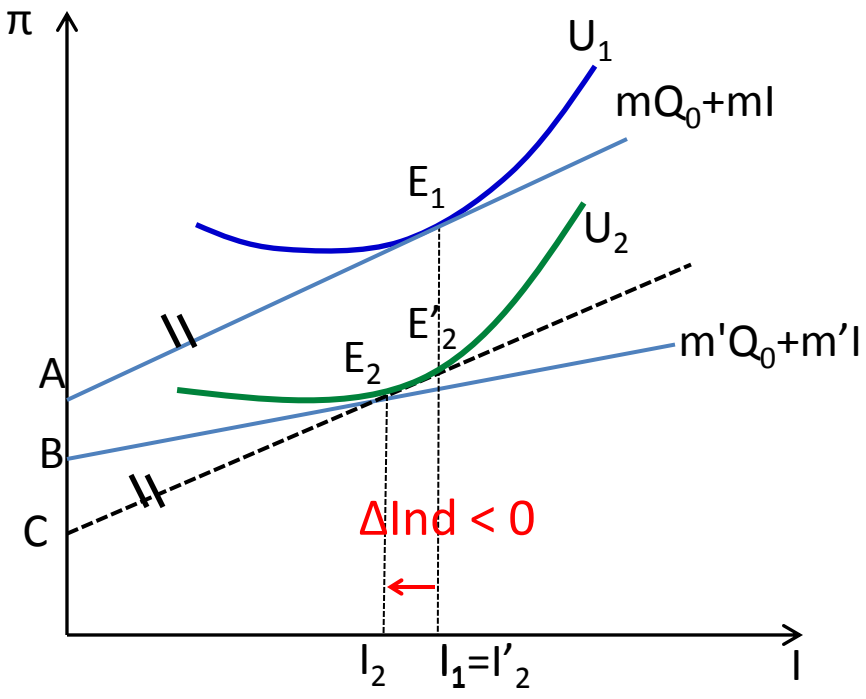
The McGuire-Pauly Synthesis of SID Benchmark Models

Target Income Behavior



Income Effect

Profit-maximizing Behavior



No income effect

The Benchmark Model as a Synthesis

- The McGuire-Pauly synthesis tells us that the size of the income effect is critical to understanding and identifying SID behavior.
- A lower profit rate, *m,* has two offsetting effects on inducement:
  - *Income effect:* Decreased income would make inducement more desirable.
  - *Substitution effect:* If inducement is less profitable (smaller m), providers would do less inducement, that is, substitute away from it.

IV. Small Area Variation (SAV)

- Another type of information problem related to physician's practice is where neither the physician nor the patient know the best treatment.
- Patient assumes that the physician knows and is giving good information. But the physician may not know either.
- This leads to an area of inquiry known as small area variation or small area analysis.
  - There are substantial variations in medical and surgical utilization rates across and within small geographic areas (e.g. zipcodes, hospital markets, etc.).

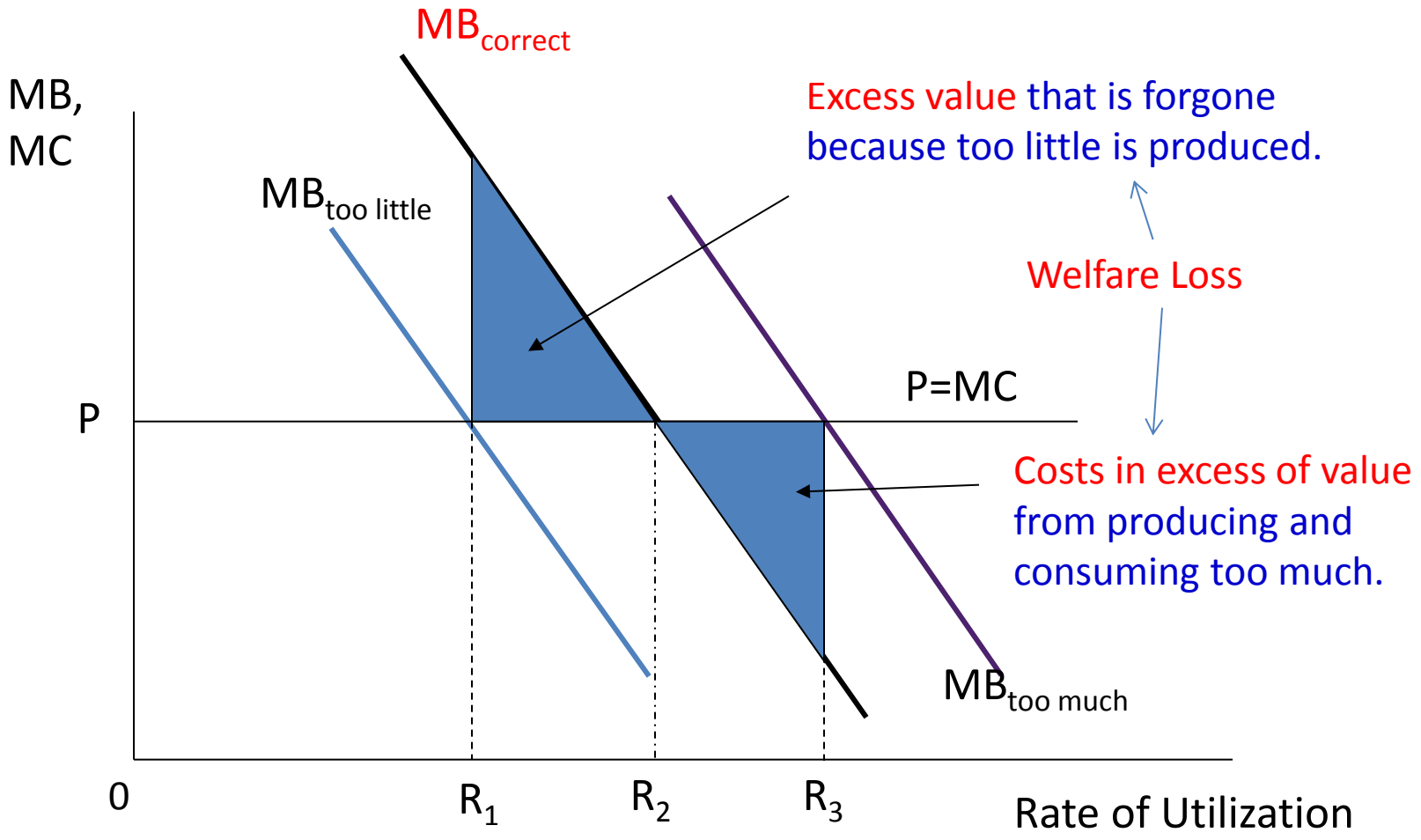
Different Views on the Variability

- The Physician Practice Style Hypothesis:
  - Practice style probably varies among physicians due to an *incomplete diffusion of information* on medical technologies (Wennberg, 1984).
- Formulation of Practice Style:
  - Physician's practice style are more influenced by *his peers* in the same hospitals and in other hospitals in his region (Epstein and Nicholson, 2009).
- Education, Feedback, and Surveillance:
  - *Information programs* directed at physicians can alter their behaviors and thus presumably their practice styles (Wennberg & Fowler, 1977).

Small Area Variation and the Social Cost of Inappropriate Utilization

- The most important issue in the SAV literature is the proposition that substantial variation in utilization rates is an indication of *inappropriate care*.
- It is necessary to determine the variability due to economic, social, demographic and chance reasons, in order to determine the residual portion that is due to physician decisions
- What is the economic cost of this variability (i.e. physician misinformation)?

Variation Causes Welfare Loss



V. Malpractice

- Medical malpractice occurs when a negligent act or omission by a physician or medical professional results in a damage or harm to a patient.
- Many malpractice judgments are very large and malpractice insurance premiums can be very high (at least in developed countries).
- The high likelihood of malpractice suits lead to what is called "negative defensive medicine" which occurs where physicians refuse to perform risky procedures to avoid lawsuits.

LABOR MARKETS

Topics

- The Demand for and Supply of Health Care Labor
- Factor Productivity and Substitution Among Factors
- Shortages of Health Professionals
- Licensure and Monopoly Rents

I. Demand for and Supply of Labor

- Health care labor is an important input in the production of health care. But how many of each labor input should the firm (e.g. hospital) demand?
- The firm hires workers as long as the cost of the additional worker is less than what the firm is able to sell the output that the input produces for.
- Example:
  - It costs the firm $100 to hire another worker (L) for a day
  - The worker produced 10 more units of output: $MP_L = 10$
  - Marginal product the firm was able to sell for $20 each: MR = $20
  - Additional profits: (10*$20) - $100 = $200 - $100 = $100.

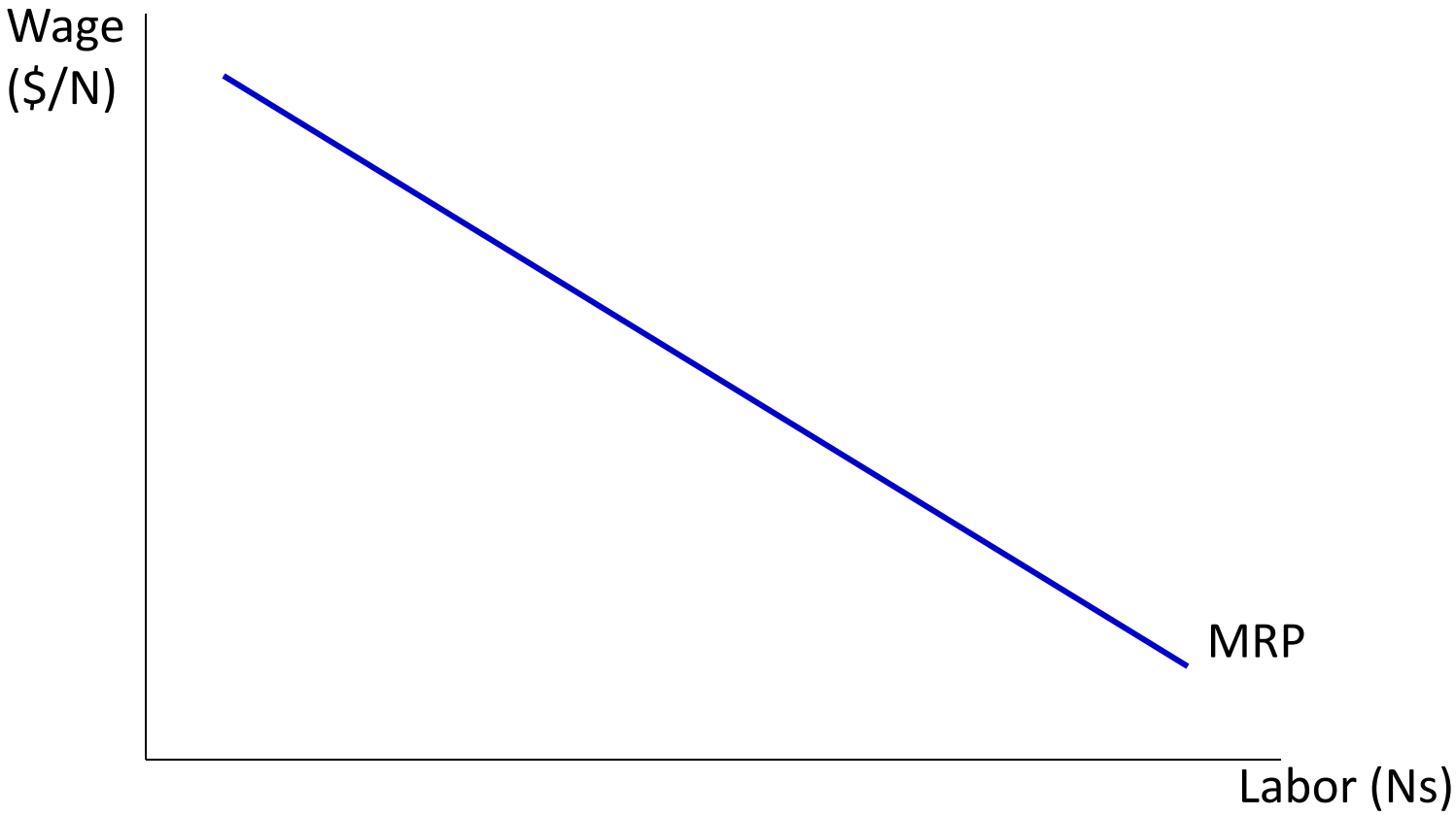
Demand for Labor

- Thus, the firm's demand for labor (or any other input) is related to:
  - The input's marginal product (what output the input can produce)
  - The output's marginal revenue (what the firm can sell the additional output for on the market)
- Specifically, the firm's demand for an input is its marginal revenue product (MRP) curve, where MRP is the additional revenue that results from employing one additional worker.

$$MRP = MP_L * MR$$

- It is assumed that the MP_L is decreasing with labor, so the MRP curve is also decreasing with labor.

The Firm's Marginal Revenue Product (MRP) Curve for Labor



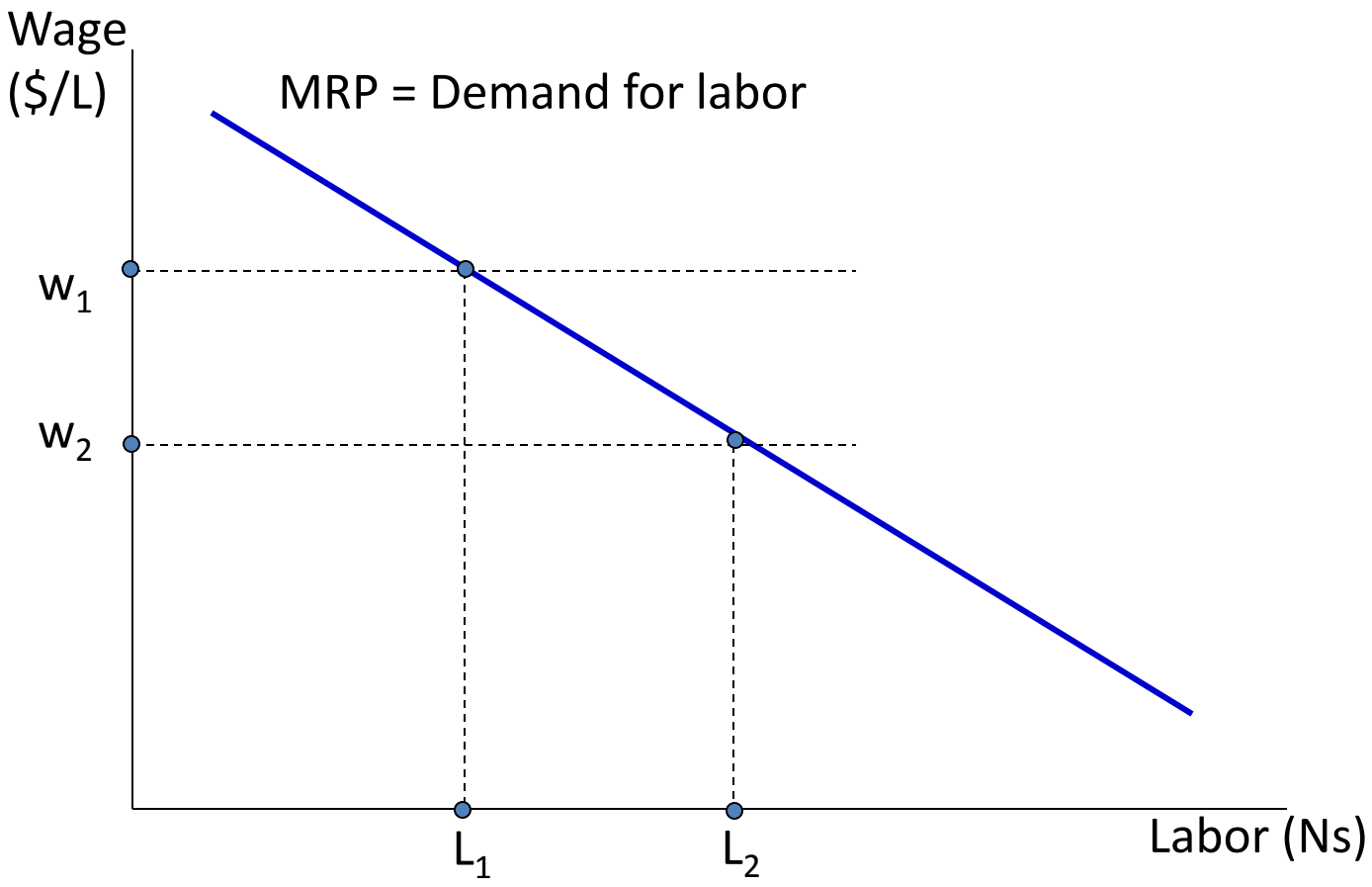
MRP as the Firm's Demand for Labor

- The firm's demand for labor is the relationship between the wage rate and the quantity of labor demanded.
- The wage rate represents the cost to the firm of purchasing a unit of labor.
- As long as the wage rate is less than the MRP, the firm will continue to hire workers.
- The firm will hire workers up to the point where:

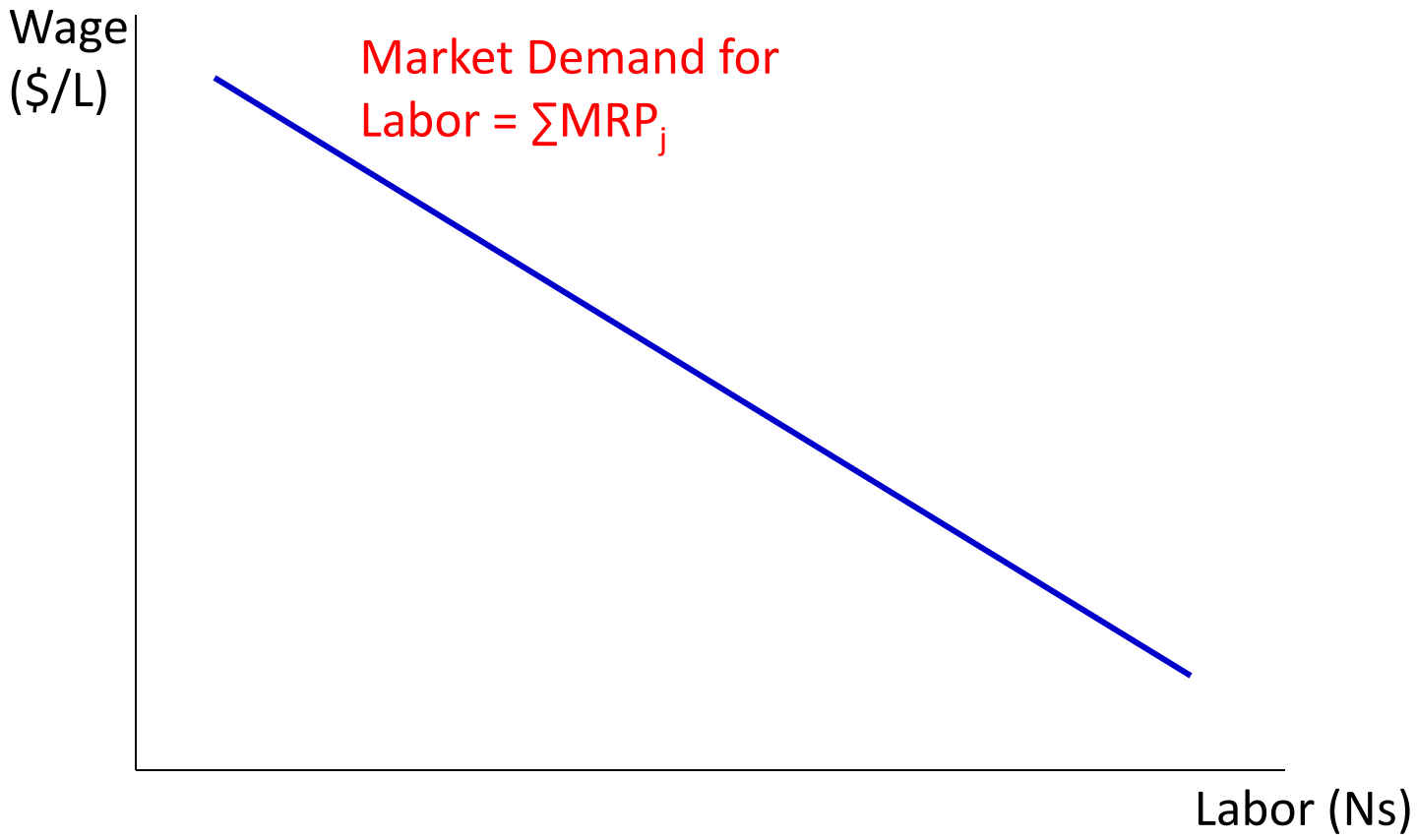
$$MRP = w.$$

- The relationship between wages and quantity of labor is therefore the MRP curve.

Firm Demand for Labor



Market Demand for Labor With Many Firms



The Supply of Labor

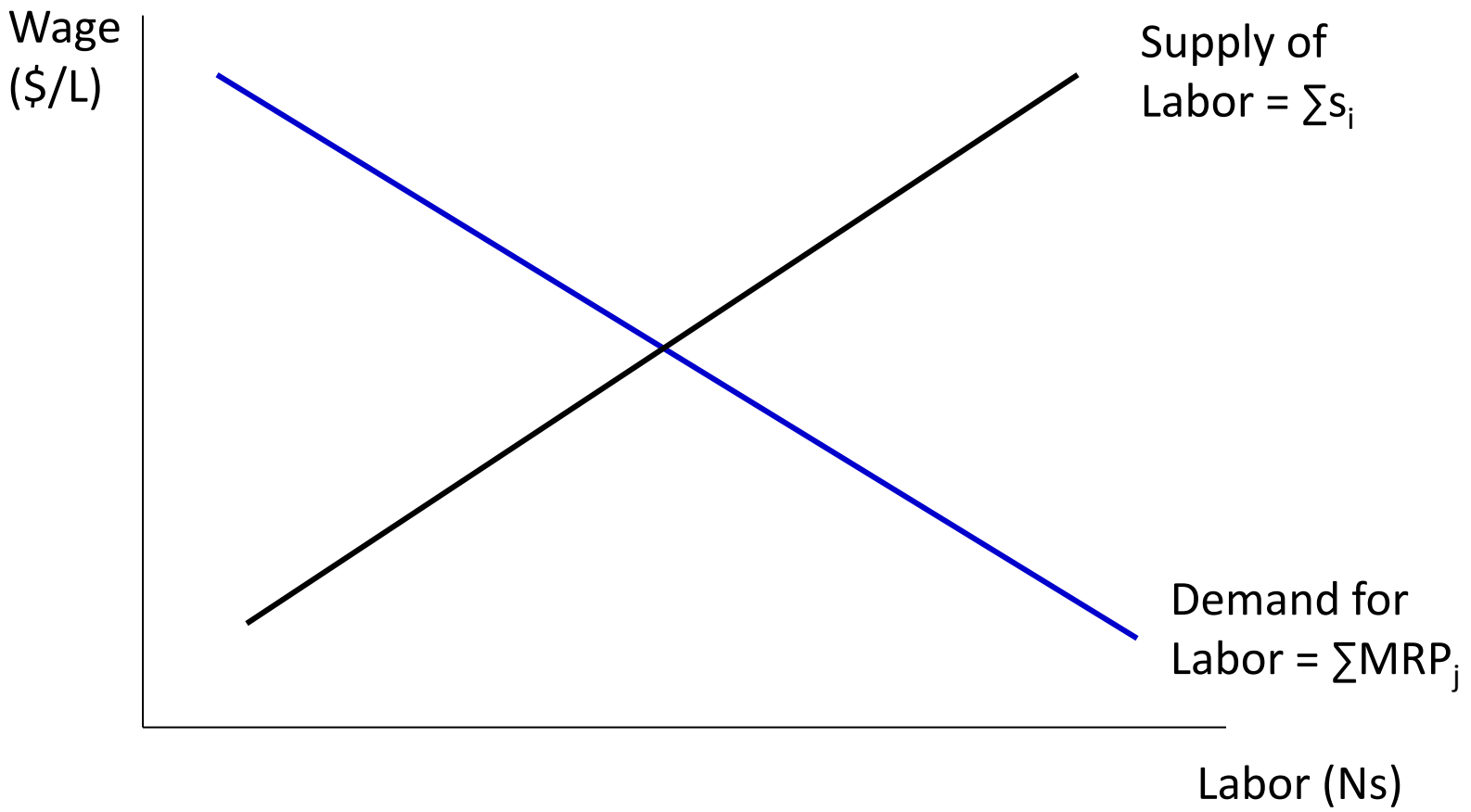
- The higher the wage rate, the greater the quantity of work that will be supplied by the existing workers in the labor force. (ie. Upward-sloping curve)
  - Some workers who are already working will work longer hours.
  - Similar workers maybe attracted into the market from elsewhere.

    ➢Movement along labor supply curve

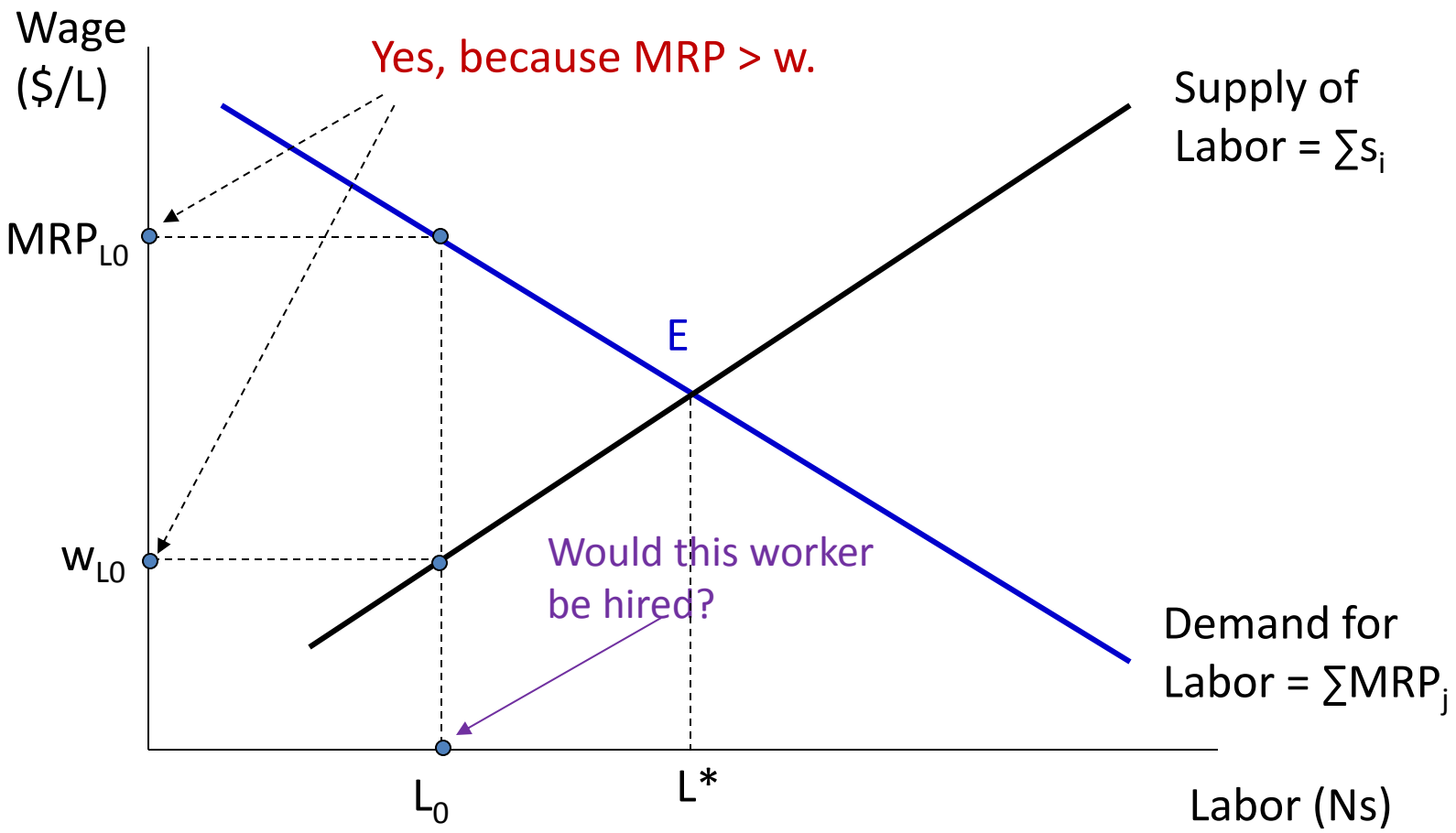
- New workers that have recently joined the labor force would add more workers at each wage rate (add another s_i to the Σ).

  ➢Labor supply curve shift

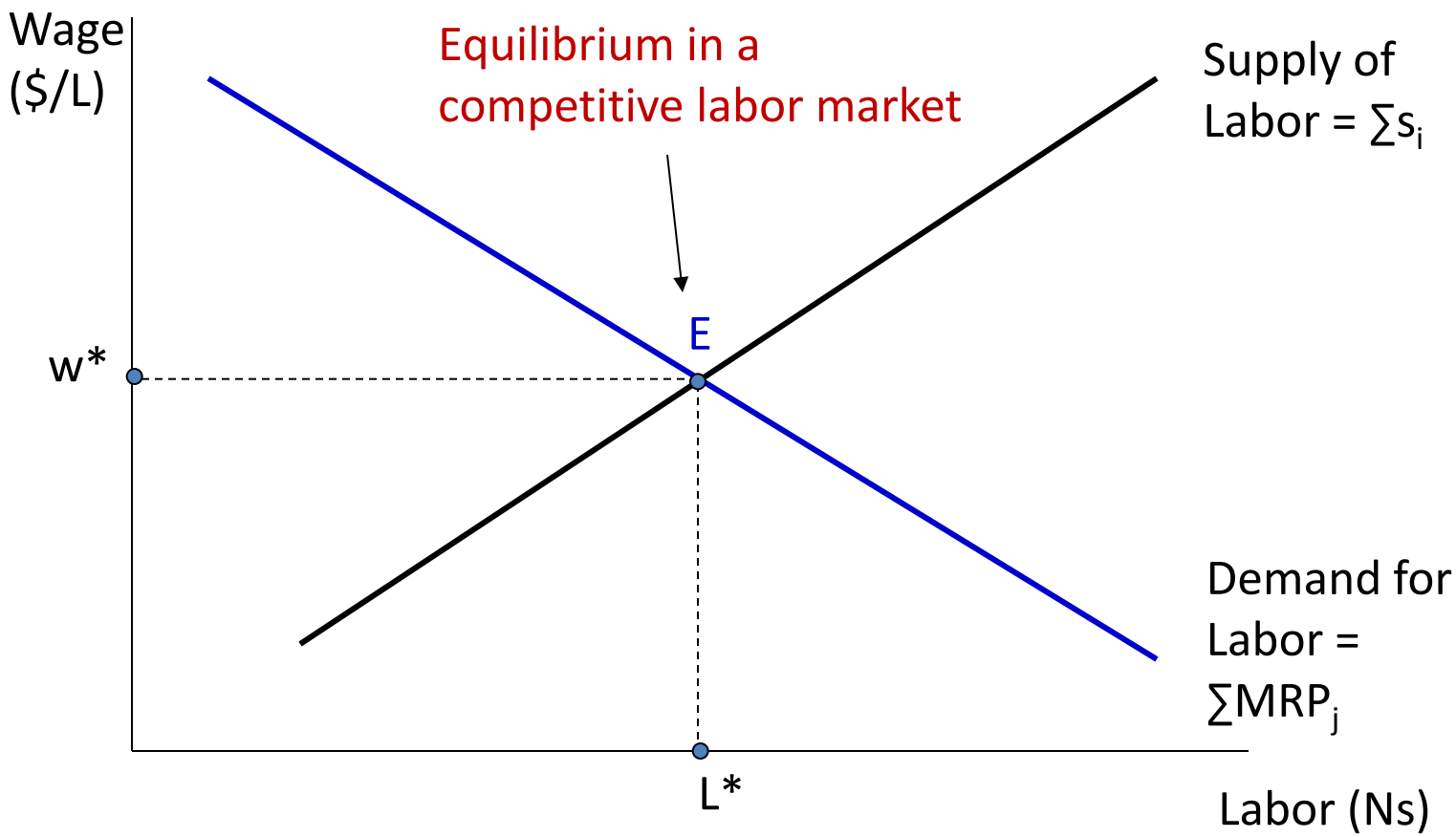
Market for Labor With Many Buyers and Sellers



Market for Labor with Many Buyers and Sellers



Equilibrium in Competitive Market for Labor



II. Factor Productivity and Substitution among Factors

- Productivity of labor input is a major determinant of supply.
  - Productivity improvements increase output (i.e. same level of output can be produced with fewer inputs).
- The productivity of an input factor can be measured as the average product (AP) of the factor: $AP_L = Q/L$.
- In measuring factor productivity labor, one needs to estimate the incremental output resulting from the additional unit of that labor in the production process. This is the marginal product (MP) of the factor:

$$MP_L = \Delta Q/\Delta L$$

Marginal Products and Efficiency of Input Use

	All Physicians		Solo Physicians		Group Physicians	
Input	***MP***	***MP/W***	***MP***	***MP/W***	***MP***	***MP/W***
Physician	2.967	0.114	2.686	0.102	2.793	0.110
Secretary	0.192	0.043	0.253	0.058	0.105	0.023
Registered nurse	0.585	0.104	0.628	0.109	0.625	0.114
Practical nurse	0.542	0.129	0.533	0.132	0.485	0.109
Technician	0.320	0.067	0.321	0.059	0.278	0.057
Physician assistant	0.231	0.040	−0.014	−0.003	1.082	0.192

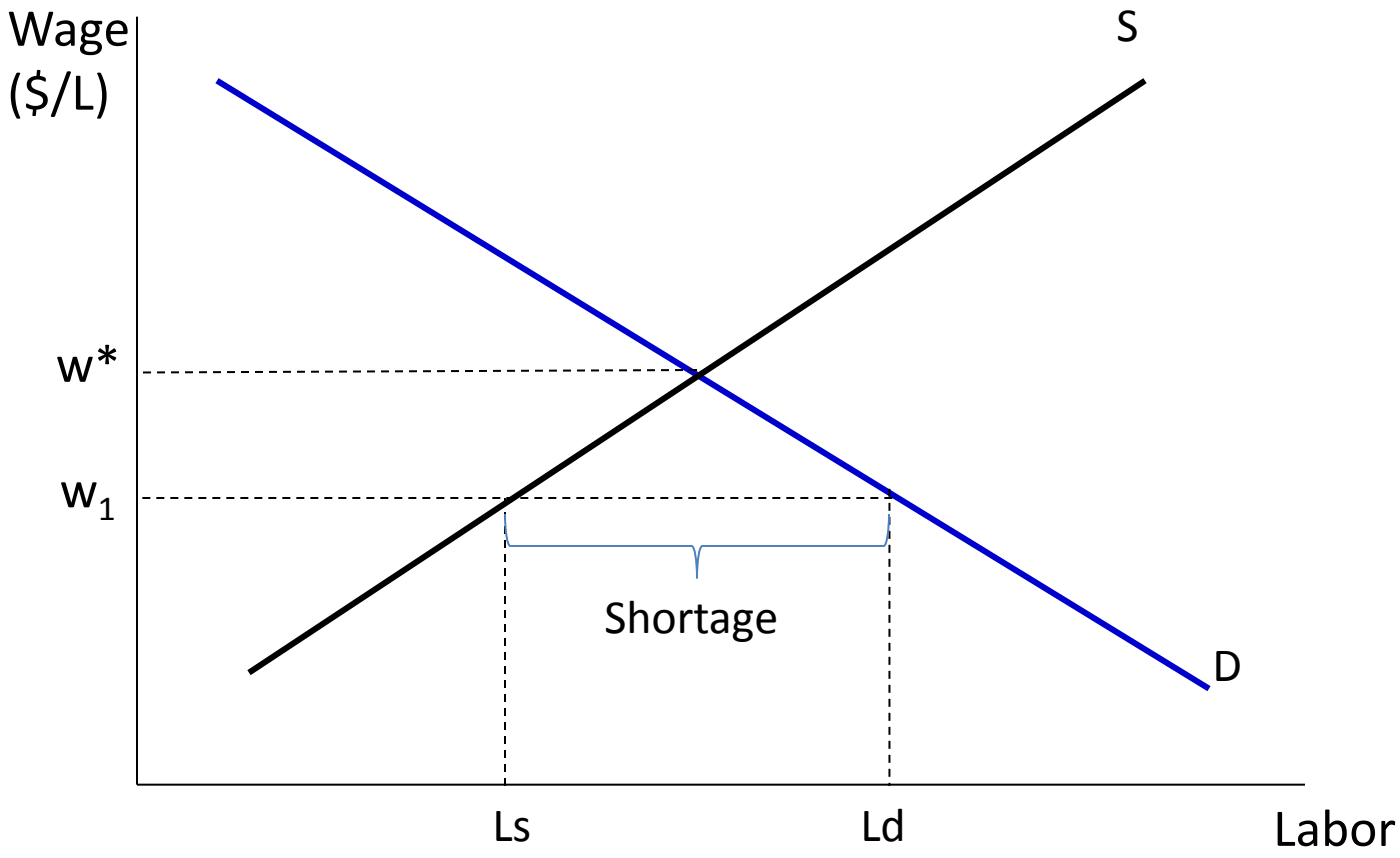
Note: MP = Marginal product

MP/W = Marginal product per dollar wages spent on input

Nurses were Underutilized.

Source: Reprinted from the *Journal of Human Resources.* Douglas M. Brown, "Do Physicians Underutilize Aides?" Originally published in the *Journal of Human Resources* 23 (1988): 342–55. © 1998 by the Board of Regents of the University of Wisconsin System. Reproduced by the permission of the University of Wisconsin Press.

III. Shortages of Health Professionals



Rate of Return and Shortage

- The internal rate of return is the discount rate that equates the present value of the stream of costs to the stream of revenues from education.
- Let *R* = internal rate of return, then *R* satisfies:

$$0 = (B_0 - C_0) + \frac{(B_1 - C_1)}{1+R} + \frac{(B_2 - C_2)}{(1+R)^2} + \ldots + \frac{(B_n - C_n)}{(1+R)^n} = \sum_{t=0}^{n} \frac{(B_t - C_t)}{(1+R)^t}$$

when B_t = Revenue at time *t* and C_t = Cost at time *t*.

- High rates of return may occur whenever the supply of labor fails to responds quickly to changes in demand. In some cases, this is a result of barriers to entry faced by potential health professionals.
  - Ex: Licensure Law

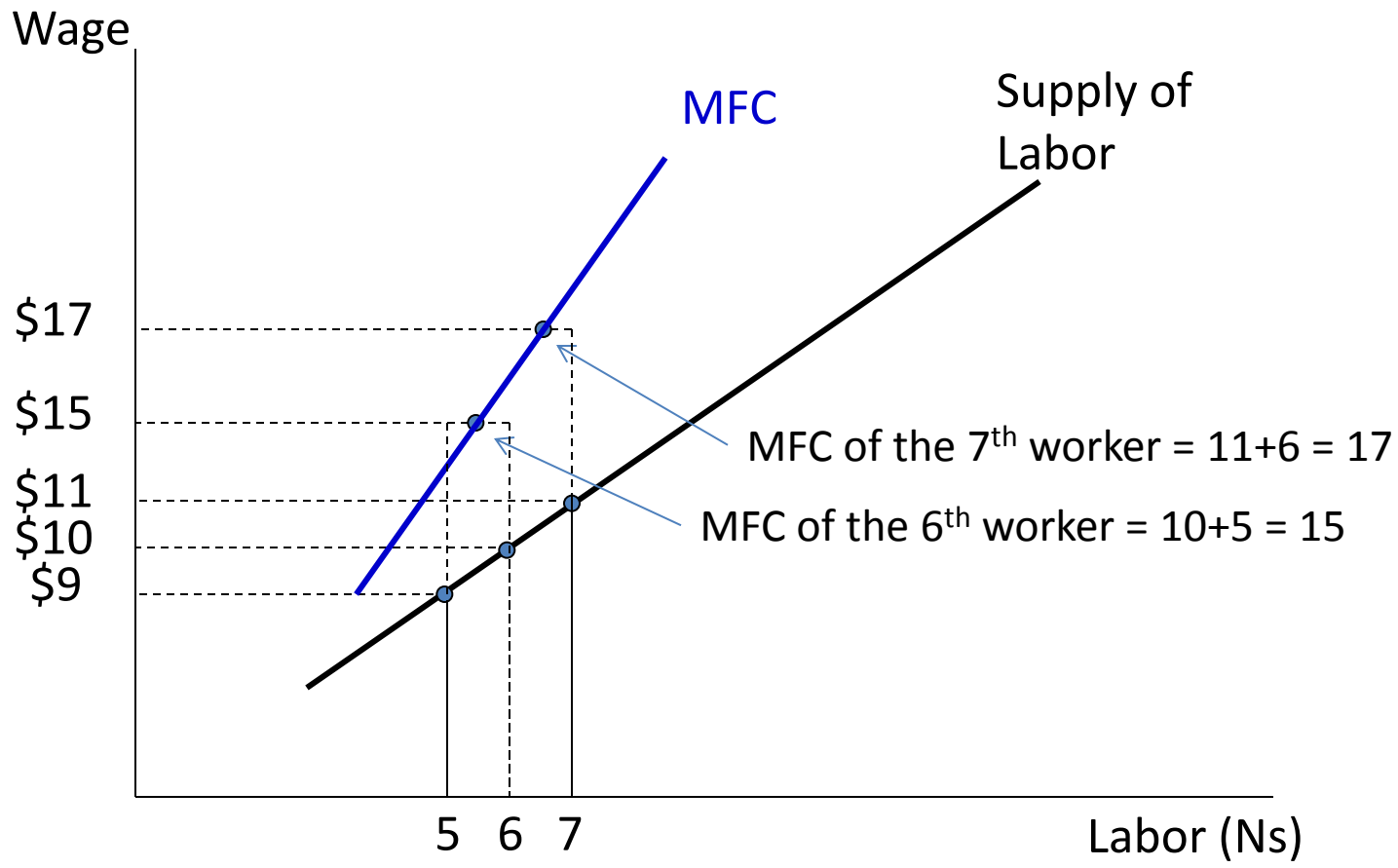
Role of Monopsony Power: Shortages of Labor

- A monopolist is a single seller of a product in a market.
- A monopsonist is a single buyer of an input in the market.
- The monopsonist is able to use its market power to reduce the prices it pays for inputs.
- Examples:
  - Hospitals are monopsonists in the market for nurses.
  - Health plans are monopsonists in the market for physicians and hospitals – e.g. Canada's single-payer health system

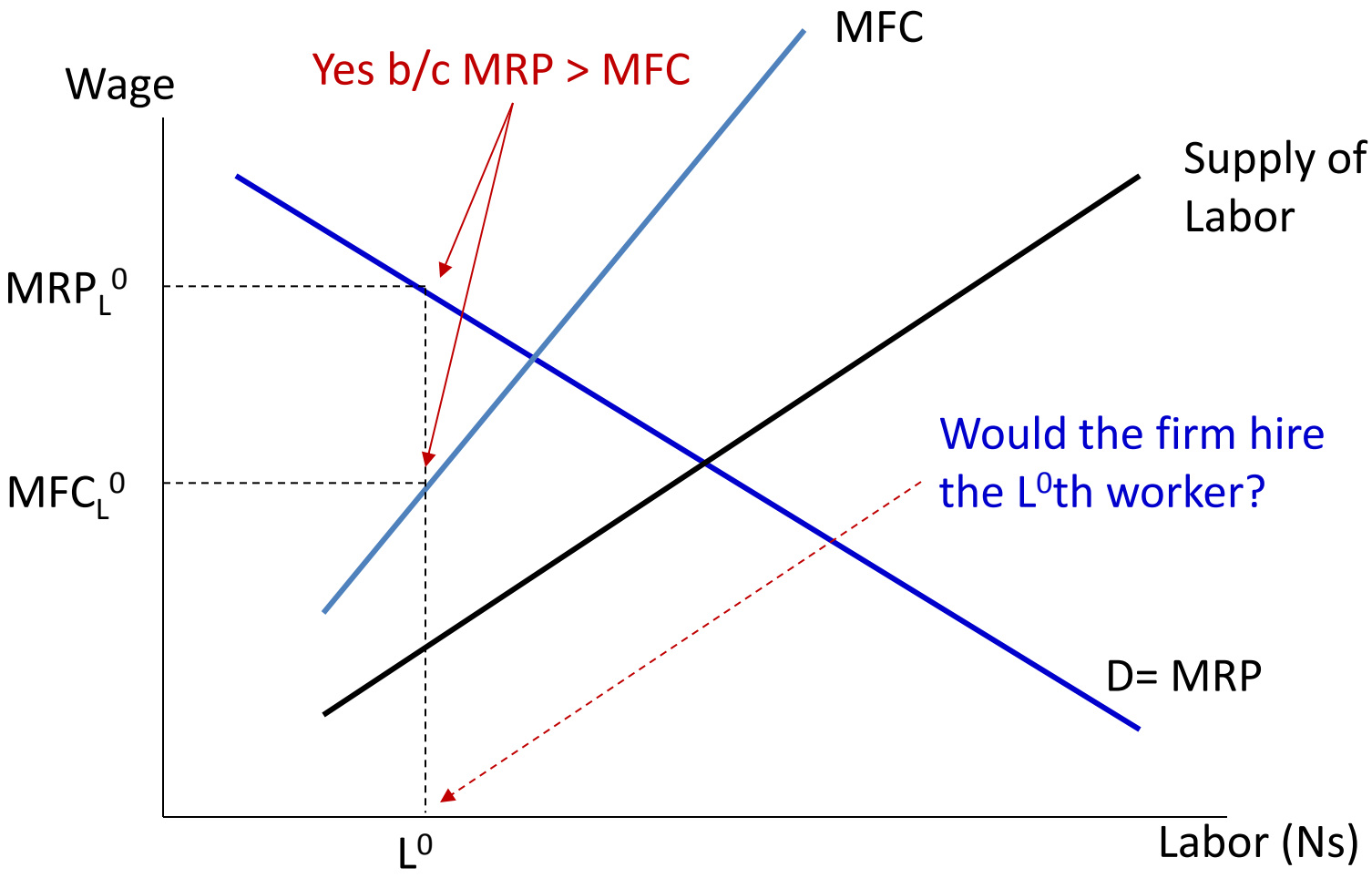
Monopsonistic Labor Market

- A monopsony exists if there is a single purchaser of an input in the market.
- The market then has a single MRP curve that represents the demand for a factor or input.
- The monopsonist faces the entire supply of labor.
  - Just like the monopolist faces the entire demand for its output
- Because the monopsonist faces the entire supply curve, it recognizes that if it wants to hire another worker, it must pay that worker a higher wage rate and also a higher wage rate to all those who would have worked for less.

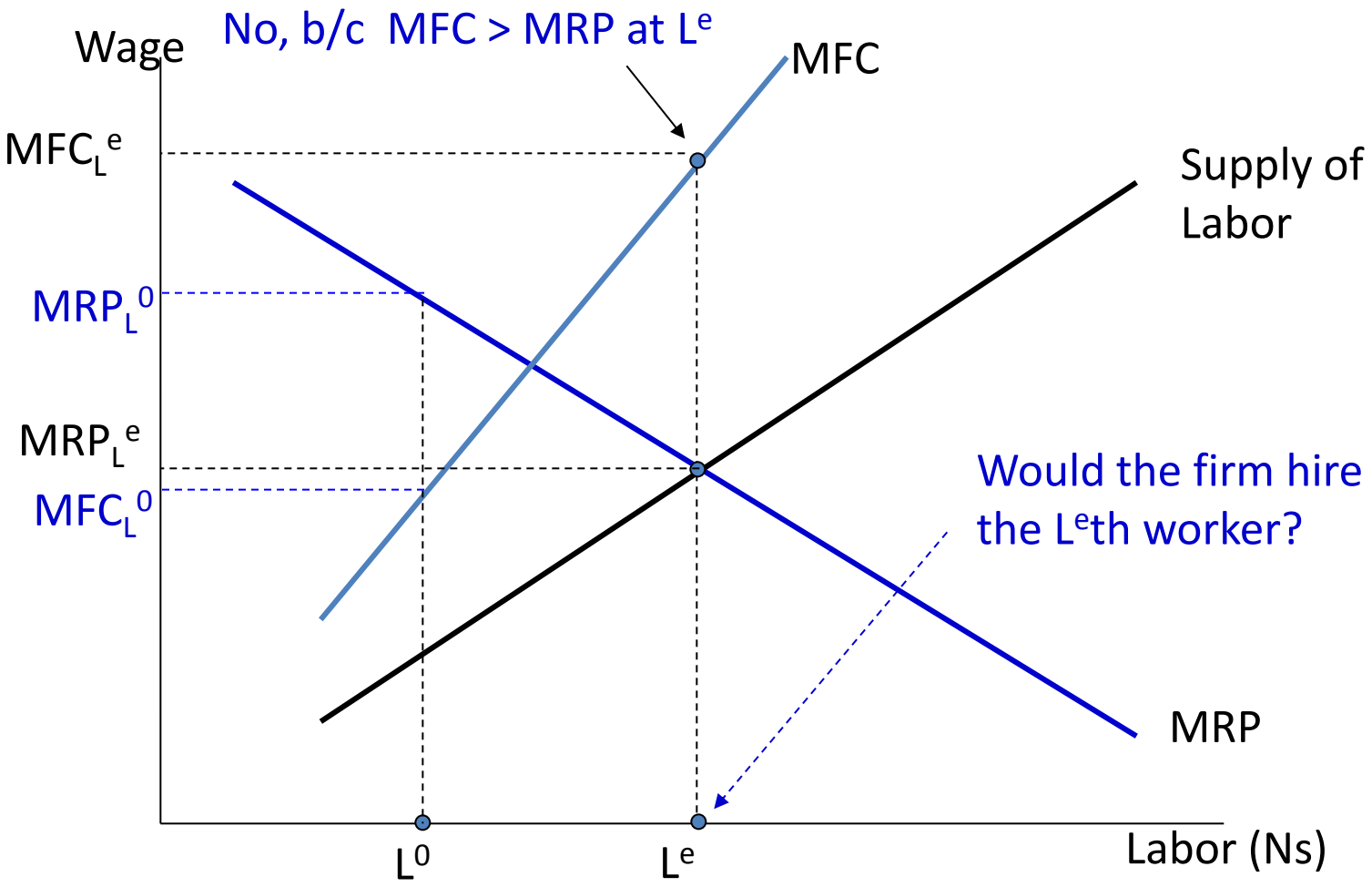
Monopsony Model



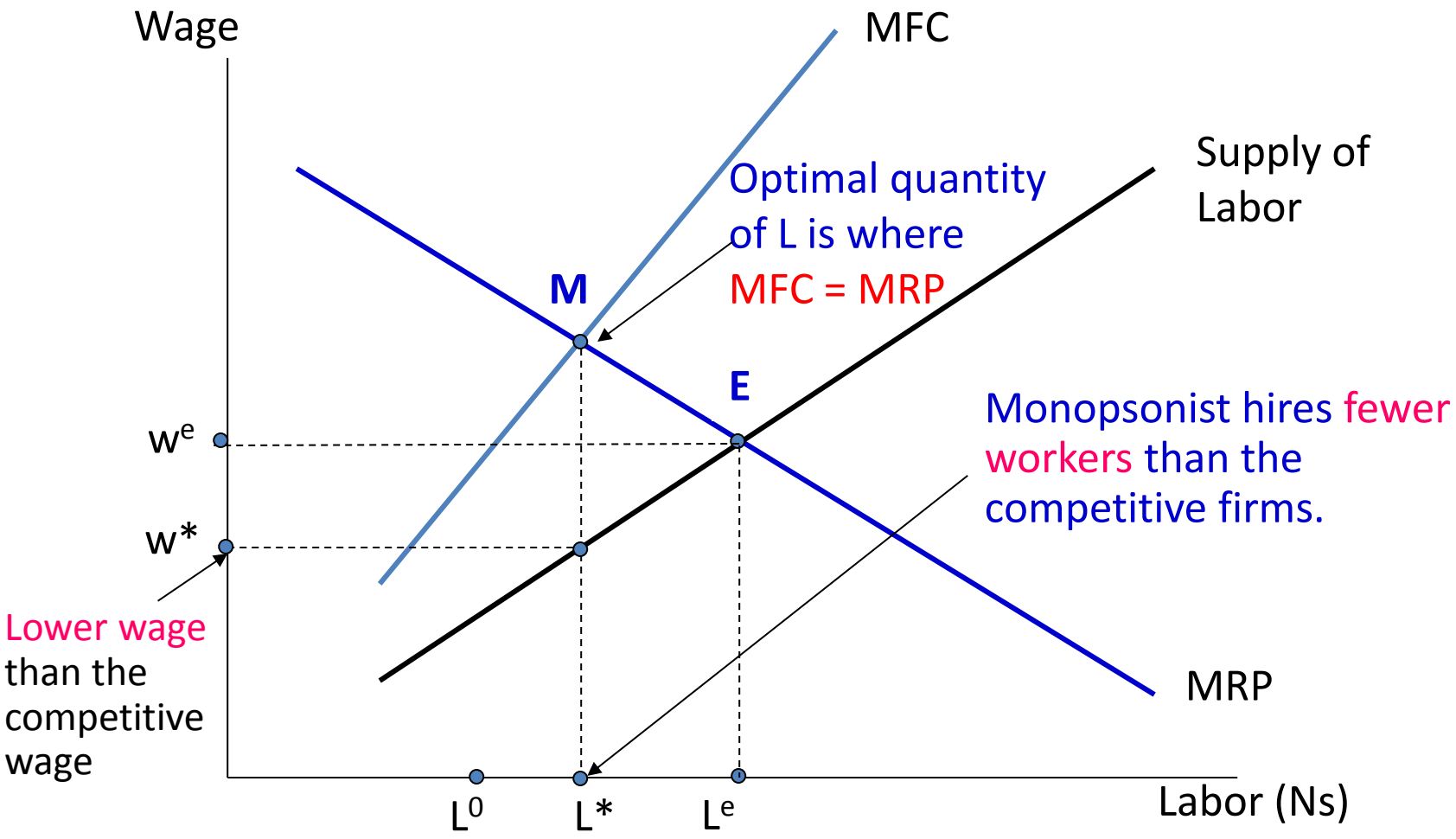
Monopsony Model



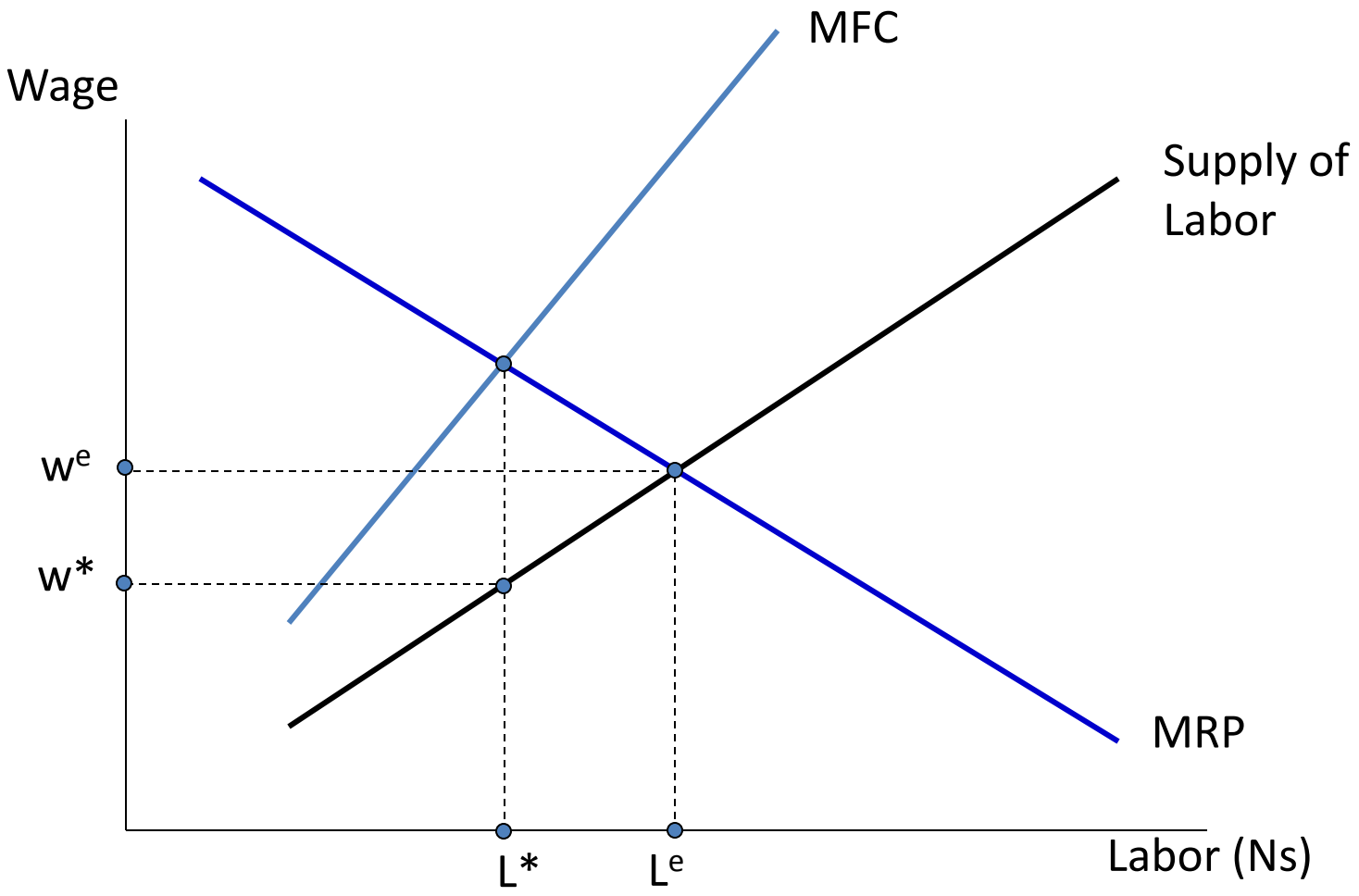
Monopsony Model



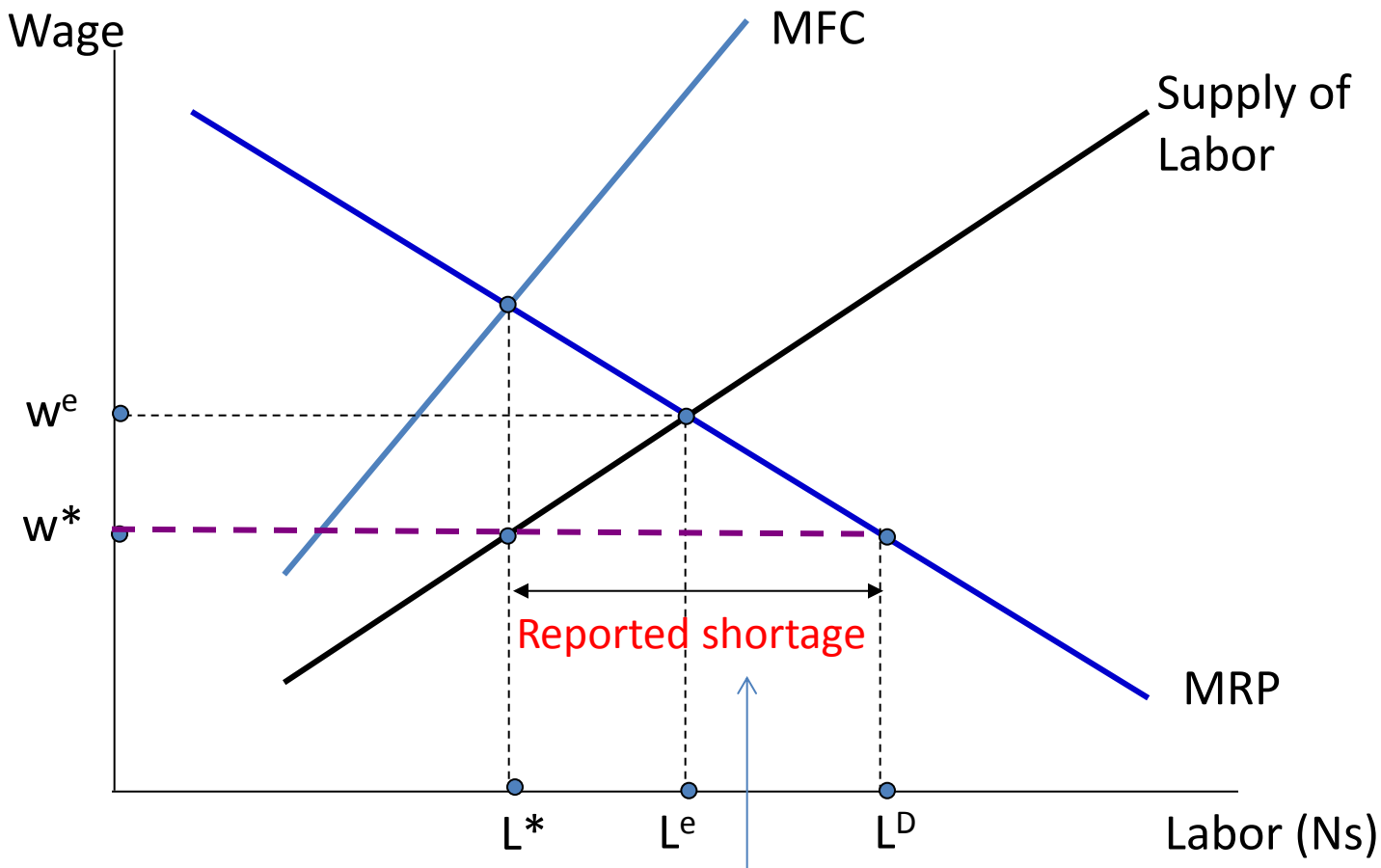
Monopsony Model



Monopsony Model



Monopsony Model: Reported Shortages



There is not enough nurses willing to at the low wage rate that monopsonist hospitals are willing to pay.

IV. Licensure and Monopoly Rent

- Controversies on the role of health professional licensure:
  - Self-interest theory: Organized medicine has used control of licensure for self-interest by limiting entry.
  - Public-interest theory: Regulatory measures, such as licensure, are demanded as a result of the limited information patients have about quality and the relatively high costs of obtaining information.
- Some economists argue that licensure and professional control over medical education creates "economic rents" for physicians.
  - Payment to factors over and above those necessary to induce them to provide their services.

PHARMACEUTICAL INDUSTRY

Topics

- The Production of Health and Substitutability
- Structure and Regulations in Pharmaceutical Industry
- Drug Pricing and Profits
  - Monopoly pricing
  - Price discrimination
- R&D and Innovation
- Cost Containment

Overview

- Types of drugs:
  - Over-the-counter (OTC) drugs vs. prescription drugs
  - Original drugs vs. generic drugs
- Main characteristics of the pharmaceutical industry:
  - Significant barriers to entry and regulations
  - Substantial opportunities for price discrimination
  - Higher-than-normal profits for pharmaceutical firms
  - Large research and development spending
  - Large spending on drugs requires 'cost containment' strategies

I. The Production of Health and Substitutability

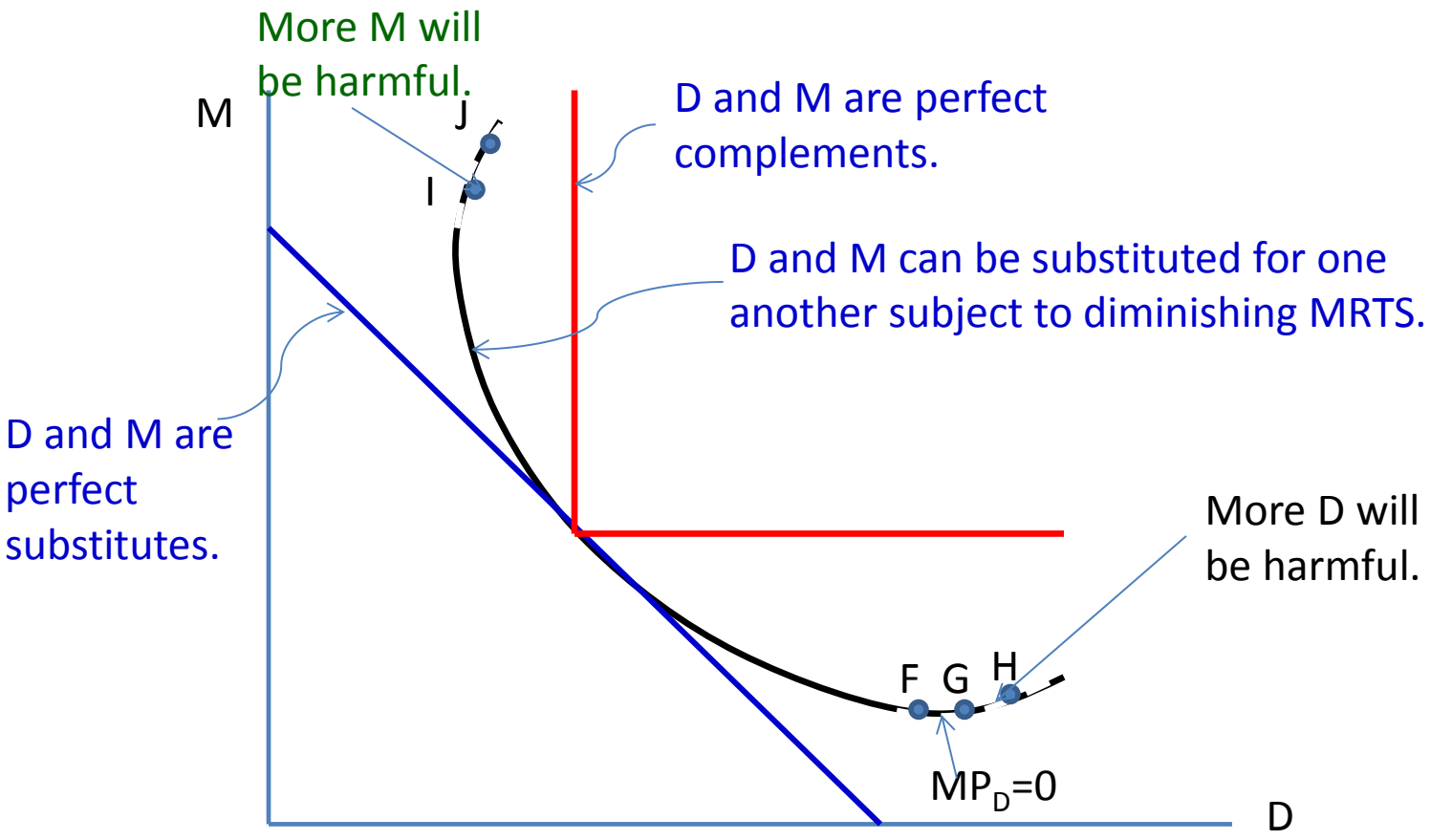
- Consider the following health production function:

$$HS = f(D,M)$$

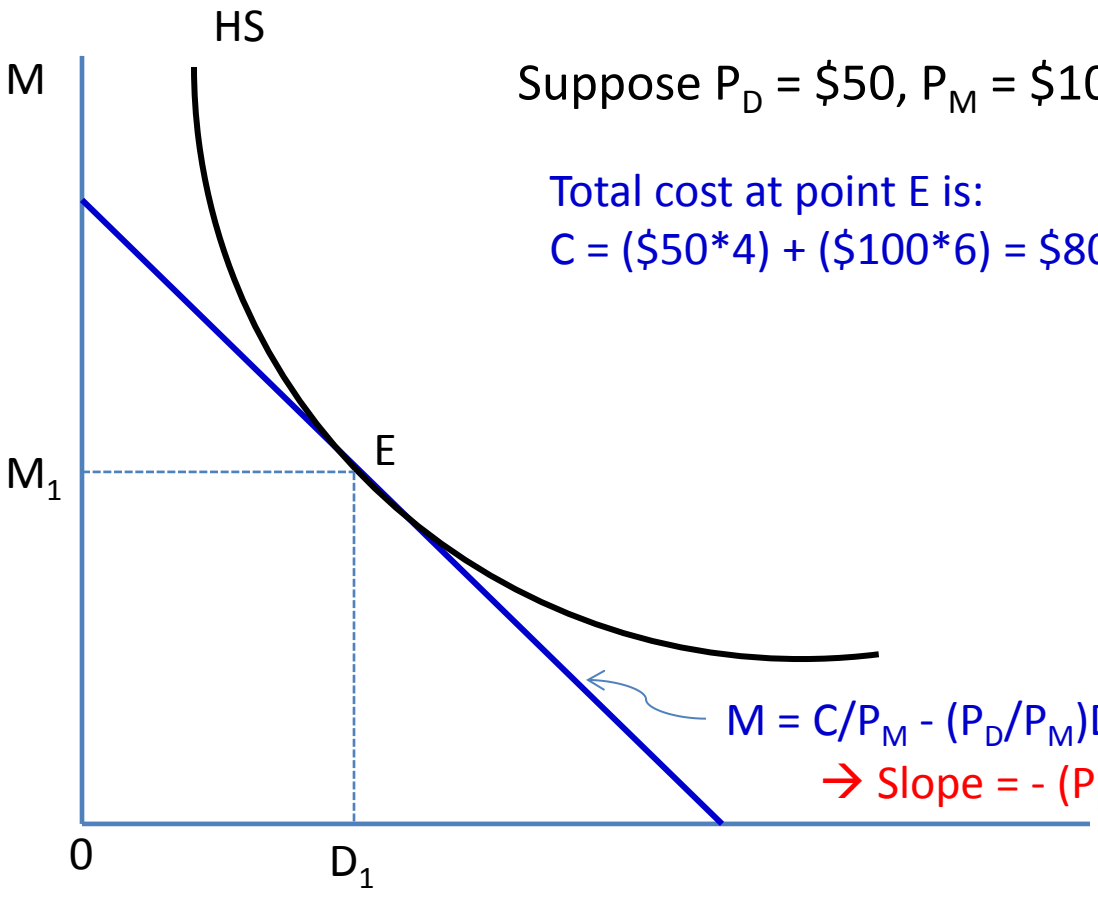
where HS is health status, D is drugs and M is other health inputs.

- Three possibilities of the relationship between drugs and other medical inputs:
  - They may have to be used in fixed proportions.
  - They may be perfect substitutes for one another.
  - They may be able to be substituted for one another but subject to diminishing marginal rate of technical substitution (MRTS).

Substitution Between Drugs (D)and Other Medical Inputs (M)



Least-Cost Production



Suppose P_D = \$50, P_M = \$100, D_1= 4, M_1 = 6.

Total cost at point E is:
C = (\$50*4) + (\$100*6) = \$800.

$M = C/P_M - (P_D/P_M)D$

→ Slope = $- (P_D/P_M)$=-0.5

Insurance and Substitutability

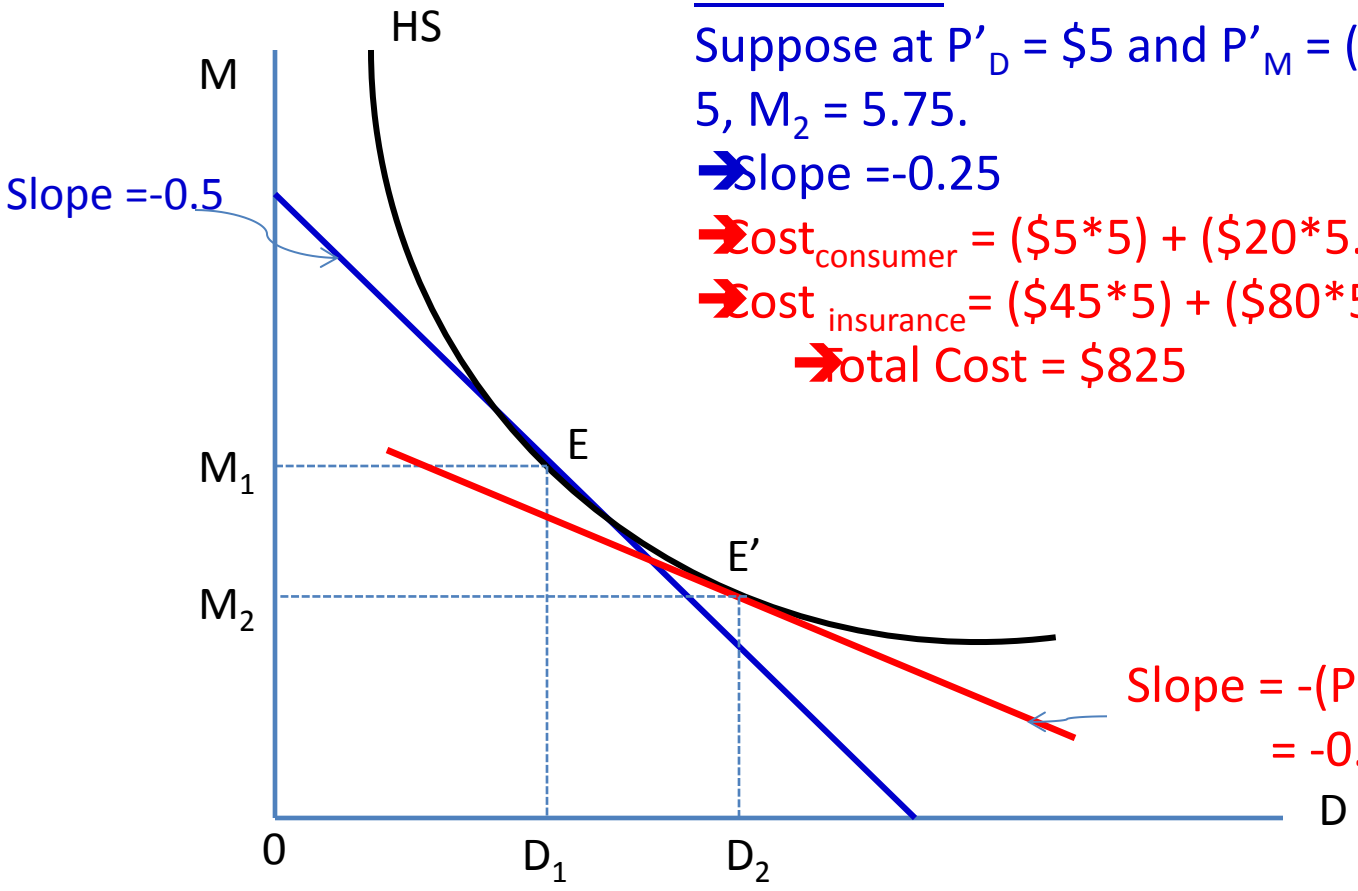
- Consider 2 different insurance policies:

1. 20% coinsurance on both D and M
   - Out-of-pocket payment for 1 unit of D = 0.2*$50 = $10
   - Out-of-pocket payment for 1 unit of M = 0.2*$100 = $20
   - Slope of the new budget line = -(10/20)=-0.5 → same D* and M*

2. 20% coinsurance on M only and a deductible of $5 (fixed copayment) for each D
   - Out-of-pocket payment for 1 unit of D = $5
   - Out-of-pocket payment for 1 unit of M = 0.2*$100 = $20
   - Slope of the new budget line = -(5/20) = -0.25

- If insurance policies more generously cover D than they do for M, consumers will replace D for M in the production process.

Insurance and Substitutability



Insurance II:

Suppose at P'_D = \$5 and P'_M = (0.2*\$100)=\$20, D_2= 5, M_2 = 5.75.

➔Slope =-0.25

➔$Cost_{consumer}$ = (\$5*5) + (\$20*5.75) = \$140.

➔$Cost_{insurance}$= (\$45*5) + (\$80*5.75) = \$685.

➔Total Cost = \$825

II. Structure and Regulation

- Pharmaceutical industry is dominated by significant *barriers to entry*.
- A barrier to entry is any factor that impedes the entry of new firms into an industry or product market.
- 3 major types of barriers to entry:
  1. Patent protection:
     - Patent gives firm exclusive rights to produce a drug for up to 20 years
  2. Brand loyalty (or first mover) advantage:
     - Patent creates name recognition and prescribing.
     - This makes it harder for a generic to penetrate a market.
  3. Drug regulation:
     - FDA approval process for a new drug is costly and time consuming.

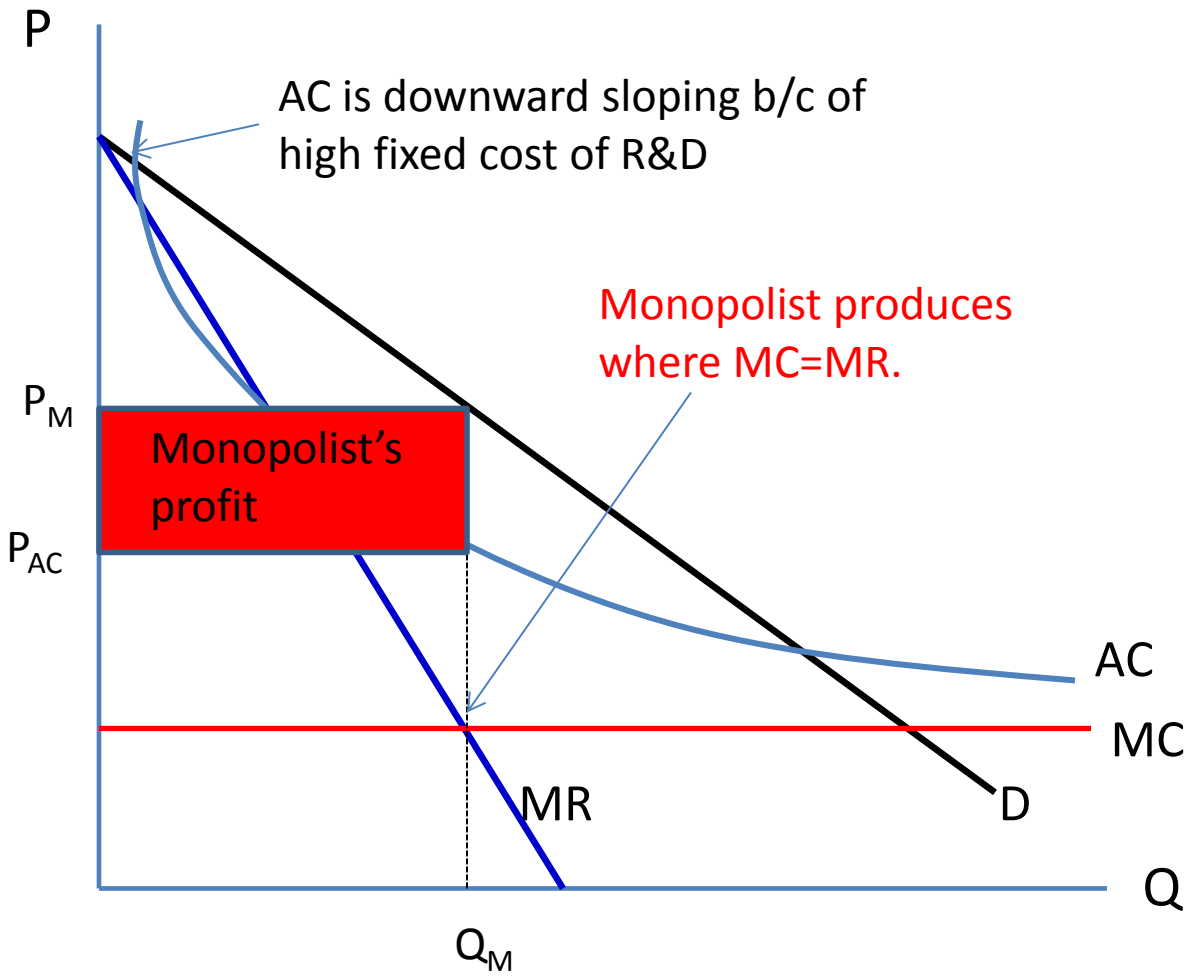
Drug Regulation

- The pharmaceutical industry is one of the most heavily regulated of all industries.
- The Thai Food and Drug Administration (FDA) was originated to control the widespread counterfeit and contaminated products.
- In other countries, e.g. USA, the FDA plays a very important role in the pharmaceutical industry, as it is responsible for the approvals of new drugs (which could take ~14 years). This process involves trade-offs:
  - Consumer protection: Gain in safety and efficacy
  - Rapid innovation: Cost of delaying patients from utilizing useful drugs.

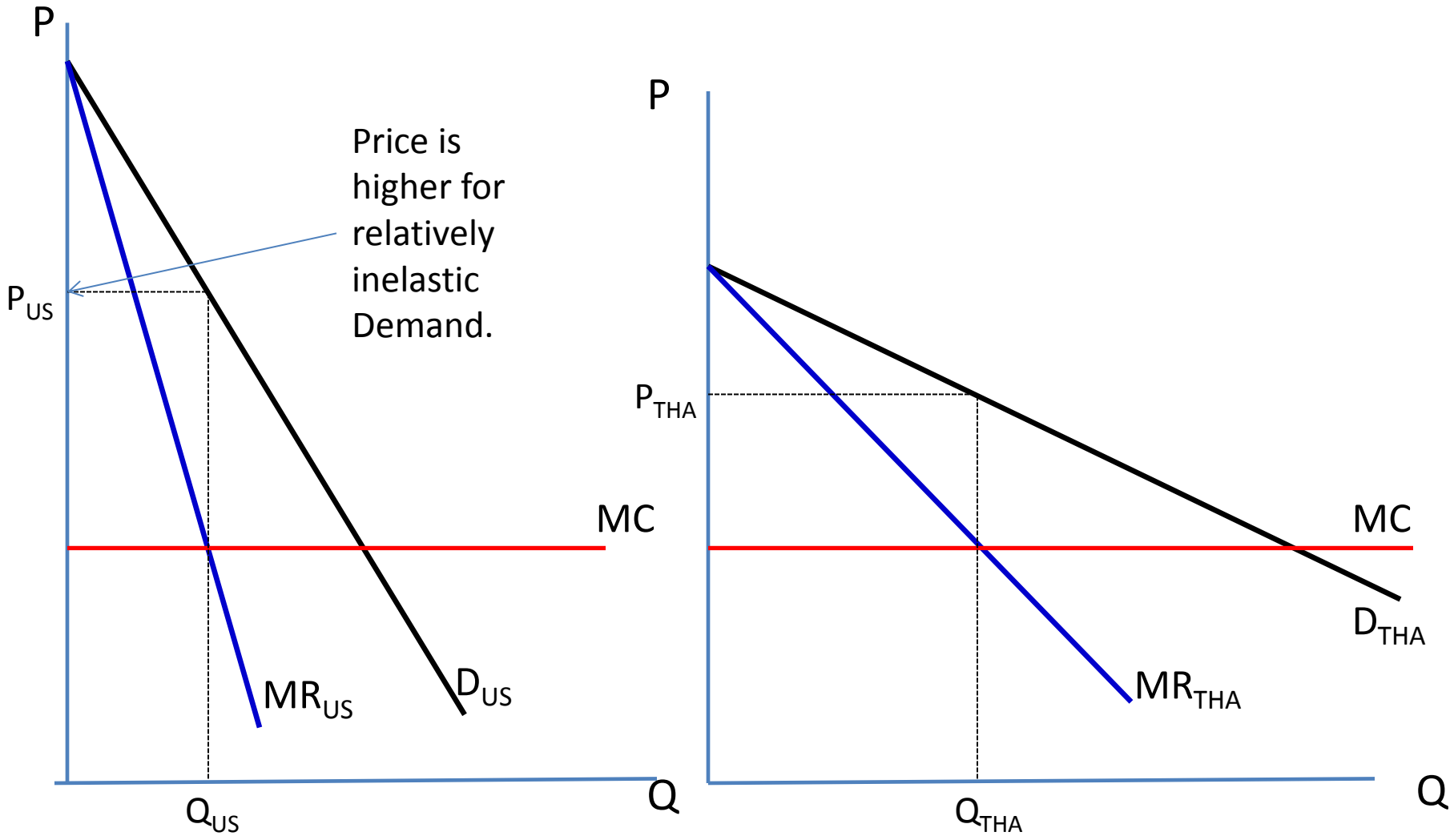
Drug Regulation

- Two types of drug approval errors:
  - Type I errors: FDA rejects drug that is actually safe and effective
  - Type II errors: FDA approves unsafe, ineffective drug
- What are the incentives?
  - FDA has incentive to commit Type I error because all costs are external to the FDA from a Type I error.
  - Pharmaceutical firms may have had an incentive to commit Type II error, as long as the costs remain external to the firm.
- So, the major unanswered question is whether the government (FDA) side or the private side (pharmaceutical firms) make the fewest and least costly errors.

III. Monopoly Pricing



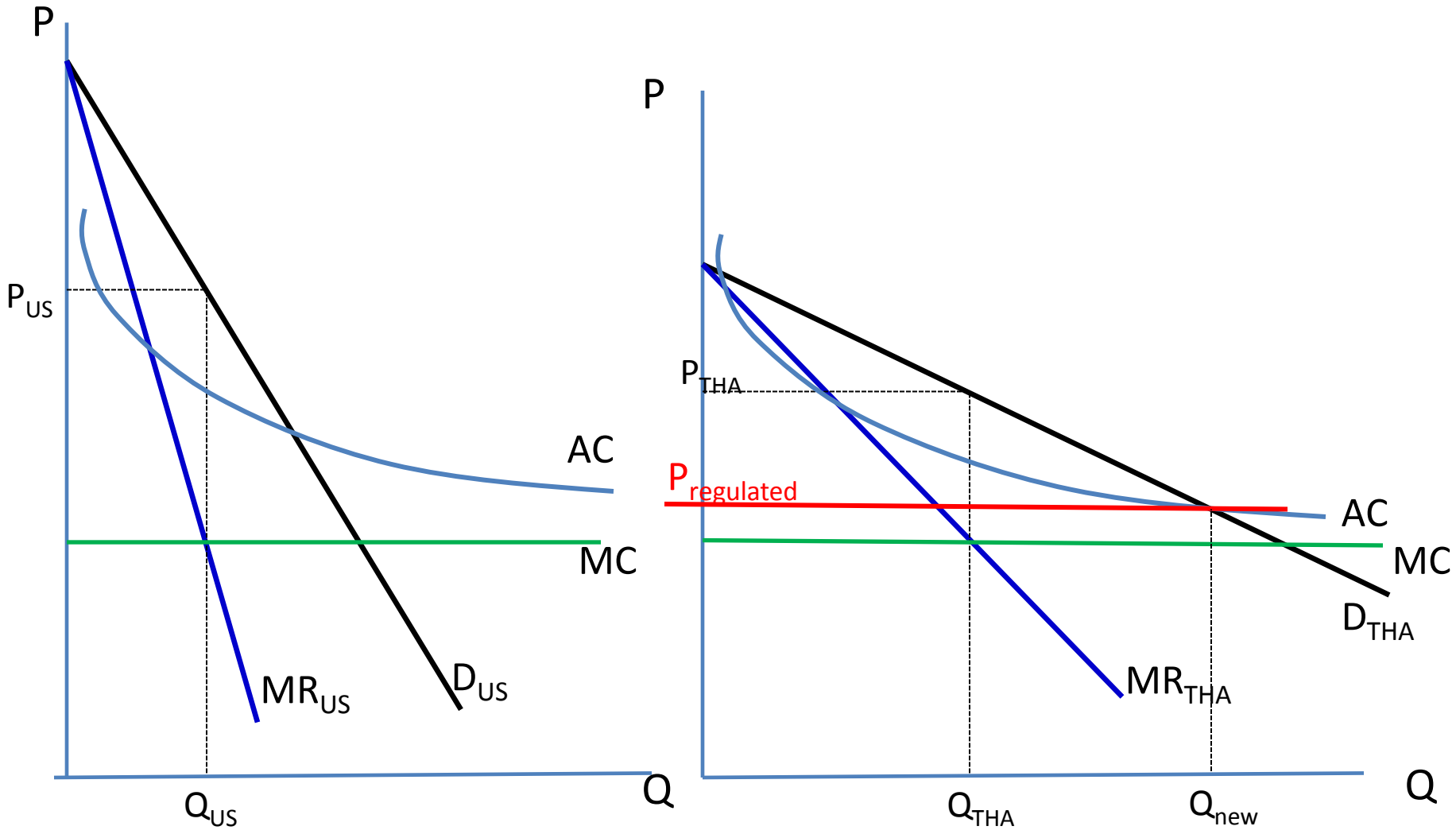
3rd Degree Price Discrimination



Monopsony Pricing and Price Controls

- Price discrimination is not the only possible explanation for price differentials.
- Prices in some countries can be lower because their governments regulate prices or their national health plan serves as a monopsony buyer.
- In the previous example, if the Thai government imposes price controls but the US government fails to do so, consumers in the US will be worse off.

Price Discrimination & Price Regulation



Competition and Generic Entry

- Once a patent expires, other firms (generic drug companies) can enter the market.
- We would expect to see lower prices and smaller market share for the branded-drug companies after generic entry. But this is often not the case. Why?
- Branded producers can still retain some monopoly power by taking advantage of the market segmentation between the brand-loyalty customers and other customers.
  - Brand-loyalty customers don't see generic drugs as close substitutes of branded drugs.
    - Relatively inelastic demand.

IV. R&D and Innovation

- Product innovation is an important issue in the pharmaceutical industry.
  - New drugs can be very effective in improving quality of life and extending lives→ improve society's welfare
  - Drug companies use the costs of innovation (R&D) to justify the large profits that pharmaceutical firms have earned.
- Patents provide protection for pharmaceutical companies so they are able to recover these R&D expenditures.
- The decision to develop a new drug depends on the expected revenues of the drug minus the expected costs of the drug innovation process.

Investment Decisions

- Net present value is:

$$NPV = \sum_{t=1}^{T} \frac{(R_t - C_t)}{(1+r)^t}$$ ➡ Invest if NPV > 0

where R_t and C_t represent the revenue and costs in time t, r is the cost of capital and T is the life of the project

- Pharmaceutical R&D projects can be broken into 3 parts:

a. The research, testing, and review period

➔ No revenue & large costs

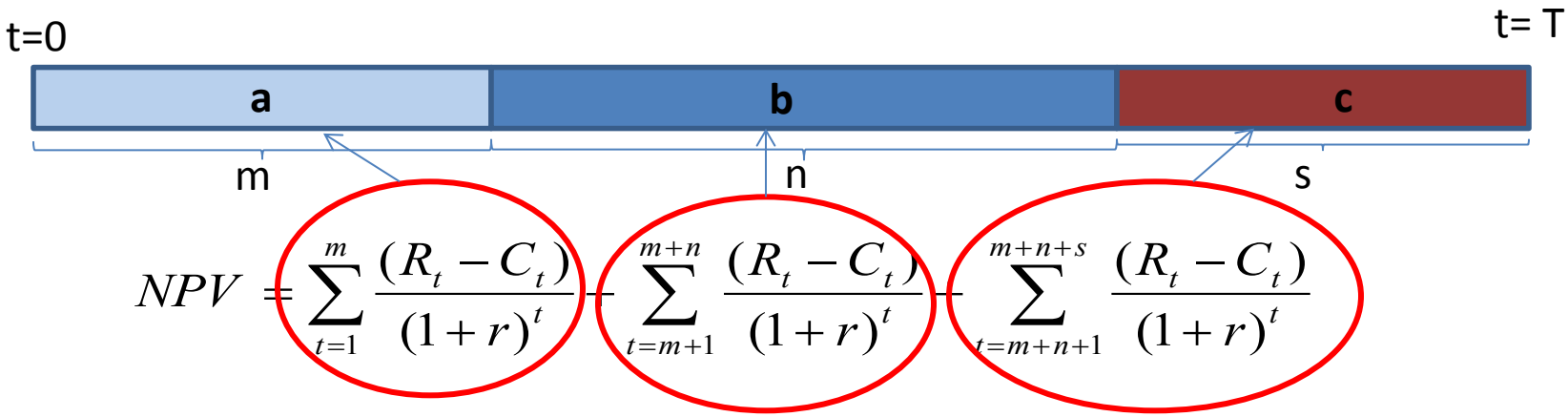
b. The effective period of patent protection

➔ Highest revenue & moderate cost

c. The post-patent period

➔ Diminishing revenue & increasing costs

Investment Decisions



- Firms' decision to investment in R&D depends on:
  - Regulations and testing procedures
  - The length of the research, testing, and review period
  - Firms' ability to charge high price in period b
  - Firms' ability to create 'brand recognition' after patent expiration → First-mover advantage!
  - Risk of the projects

Prices, Price Regulation, and Innovation

- Most important issue related to drug policy is the effects of prices on innovation.
  - Higher drug prices and potential markets encourage more R&D and innovation.
  - But if prices are too high, there's a need for regulation.
- Drug price regulation effects innovation and the availability of drugs.
  - Price regulations reduces investment in R&D, the rate of innovation, and the number of new drugs.
- Thus, drug policy maker needs to address the trade-offs between controlling price and stimulating innovation.

V. Cost Containment

- The rapid growth in drug expenditures has led to great policy interest in cost containment (i.e. to restrain expenditure).
- One solution is to exercise monopsony power.
- Three cost-containment strategies:
  - Higher copayments: Shift a larger share of the cost burden to the patient and to decrease consumption of marginally beneficial drugs.
  - Use of generic drugs: Lower prices for the equivalent therapeutic components.
  - Adoption of drug formularies: Use drug-utilization review program, or develop a list of approved drugs.

Thai Pharmaceutical Industry

- Is there any monopoly?
  - Government Pharmaceutical Organization (GPO)
    - Gov't requires public hospitals to use to give GPO preferences in purchasing medicine.
- Cost-containment strategies?
  - Encourage the use of generic drugs
  - Use of drug formularies: Under certain health schemes (UCS and SSS), hospitals are required to prescribe drugs based on the National List of Essential Drugs (NLED)