Principles of Economics

Public Economics

Types of Good

Excludable? \ Rival in consumption?	Yes	No
Yes	**Private Goods** • Ice-cream cones • Clothing • Congested toll roads	**Club Goods** • Fire protection • Cable TV • Uncongested toll roads
No	**Common Resources** • Fish in the ocean • The environment • Congested nontoll roads	**Public Goods** • Tornado siren • National defense • Uncongested nontoll roads

The Demand Curve

Consider the market for a good. There is are N buyers. The demand of individual i for the good is

$$q_i = \alpha_i - \beta_i p \tag{1}$$

, or equivalently:

$$p_i = \frac{\alpha_i}{\beta_i} - \frac{1}{\beta_i} q \tag{2}$$

- (1) says that if the price of the good is p, individual i is going to purchase q_i amount of the good.
- (2) says that individual i 's willingness to pay (WTP) for the q^{th} item of the good is p_i [1].

[1] Recall that a consumer's demand curve represents her willingness to pay for each additional item of the good. Or, equivalently, it represents the marginal benefit the consumer receives from the good.

The Demand Curve

If the good is a private good (excludable and rival in consumption), the total demand for the good – the market demand curve – is

$$Q = \sum_{i=1}^{N} q_i = \sum_{i=1}^{N} \alpha_i - (\sum_{i=1}^{N} \beta_i)P \tag{3}$$

, or equivalently:

$$P = \frac{\sum_{i=1}^{N} \alpha_i}{\sum_{i=1}^{N} \beta_i} - \frac{1}{\sum_{i=1}^{N} \beta_i} Q \tag{4}$$

, where we use P and Q to denote market price and quantity.

The Demand Curve

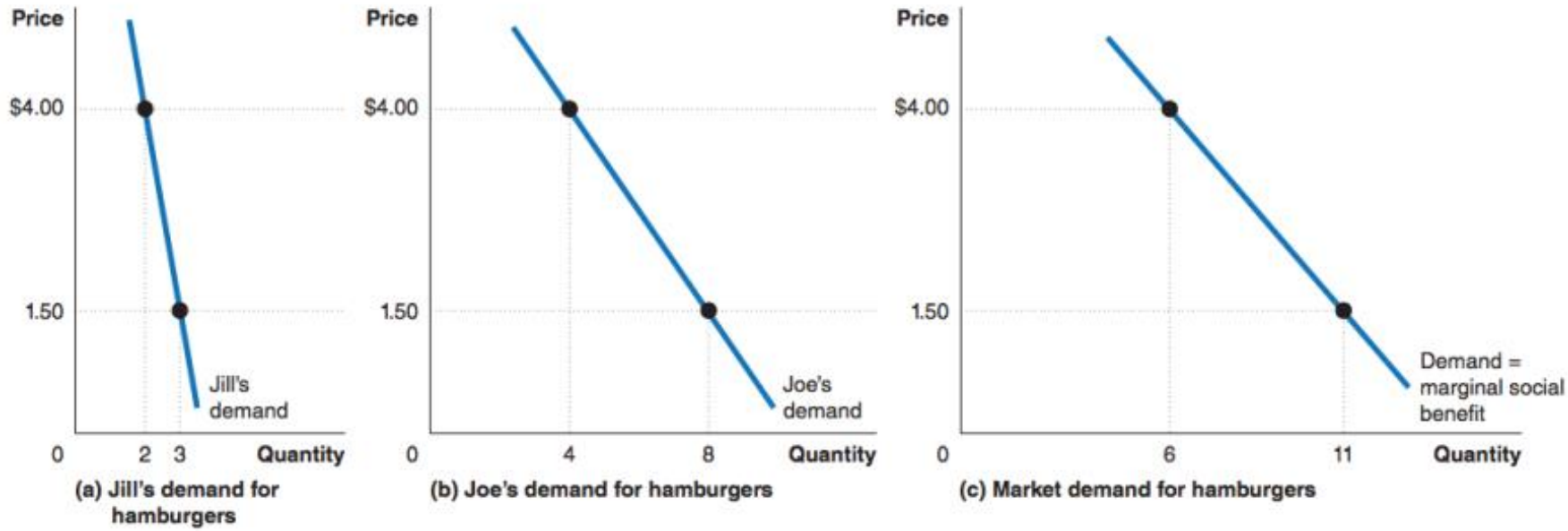
If the good is a public good, the total WTP for the good is

$$P = \sum_{i=1}^{N} p_i = \sum_{i=1}^{N} \frac{\alpha_i}{\beta_i} - (\sum_{i=1}^{N} \frac{1}{\beta_i})Q \tag{5}$$

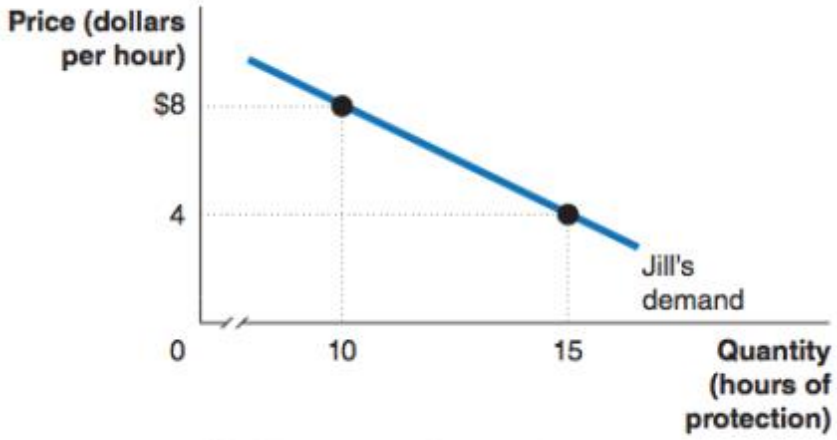
- (5) is the marginal social benefit curve for the public good[2].

[2]Since the curve is derived by adding individual marginal benefits together at each quantity of the public good provided. For private goods, the market demand curve = the marginal social benefit curve.

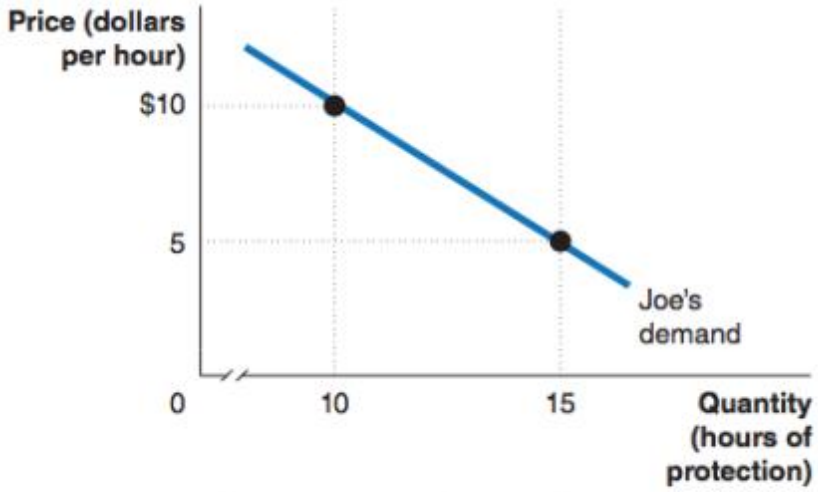
Demand for Private Good



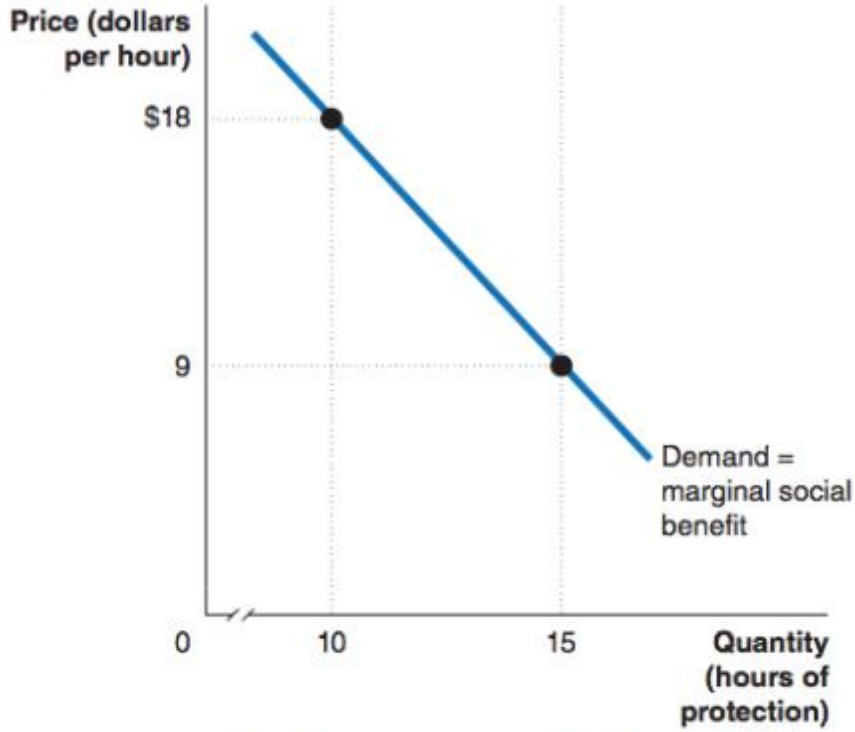
Demand for Public Good



(a) Jill's demand for security guard services

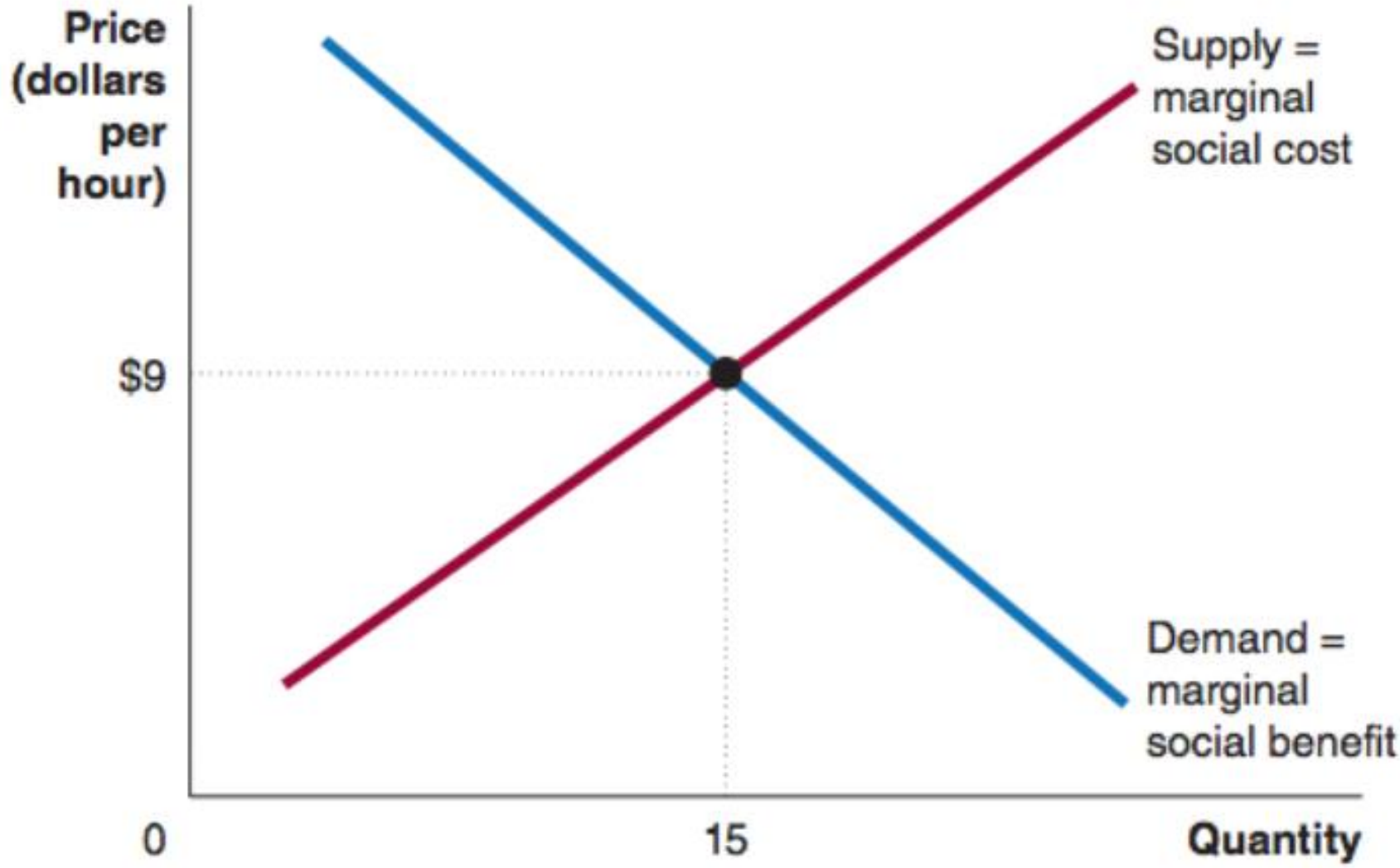


(b) Joe's demand for security guard services



(c) Total demand for security guard services

The Optimal Quantity of a Public Good



Club Good

Because club goods are non-rival in consumption, their marginal social benefit curve is the same as that of public goods.

Because club goods are excludable, there exists a market demand curve for club goods, which is

$$Q = max\{q_1, ..., q_N\}$$

, where the maximum of individual quantity demanded is taken since club goods are non-rival in consumption.

Example 1

John and Mary live in a community. The 2022 World cup live stream in the community is a public good. John and Mary's WTP for the live stream are, respectively [3].

$$P_J = 200 - 2Q$$

$$P_M = 200 - Q$$

The marginal cost of providing the live stream is: $P = 100$.

Then the total WTP for world cup live stream is:

$$P = 400 - 3Q$$

The sociall optimal level of world cup live stream in the community is: $Q^* = 100$.

[3] As their respective demand curves show, Mary appreciates an exciting football game more than John.

Example 2

John and Mary live in the Xiamen University campus. Professor Liu teaches a course called **Mathmatical Analysis** in the Xiamen University. The course is a club good: one must pay a tuition to attend Prof. Liu's lectures. John and Mary's WTP for Prof. Liu's lectures are, respectively [4].

$$P_J = 200 - 2Q$$

$$P_M = 200 - Q$$

The marginal cost of teaching for prof. Liu is: P = 100. The price Prof. Liu charges for attending his lectures is P = 80[5].

[4] As their respective demand curves show, Mary enjoys Mathematical Analysis more than John.

[5] Because he can.

Example 2(Cont.)

The total WTP for Prof. Liu's lectures is:

$$P = 400 - 3Q$$

The sociall optimal level of lecturing Prof. Liu should provide is: $Q^{social} = 100$.

Example 2(Cont.)

The market demand for Prof. Liu's lectures is:

$$P = 200 - Q$$

At P = 80,

- The number of lectures John will purchase is $q_J = 60$.
- The number of lectures Mary will purchase is $q_M = 120$.

Therefore the market quantity of lectures that will be produced is $Q^{market} = 120$[6].
Prof. Liu's profit is $80 \times 180 - 100 \times 120 = 2400$.

[6] i.e., Prof. Liu will produce 120 lectures. John will attend 60. Mary will attend 120.

Example 2(Cont.)

What is the optimal price Prof. Liu should charge?

$$P^* = arg\max_P \left\{ P \times \left[(200 - P) + \left(100 - \frac{1}{2}P \right) \right] - 100 \times (200 - P) \right.$$

$$= \frac{400}{3}$$

Example 3

John and Mary live in the community. The apples in community are a private good. John and Mary's WTP for apples are, respectively [7].

$$P_J = 200 - 2Q$$

$$P_M = 200 - Q$$

The marginal cost of apples is: P = 100. There are many apple sellers so that seller-side of the market is competitive. As a result, each seller sells at her marginal cost, i.e. P = 100.

Then the market demand curve is:

$$Q = 300 - 1.5P$$

The equilibrium number of apples sold is: $Q^* = 150$.

[7] As their respective demand curves show, Mary likes apples more than John.