

I. The Essential Geometry of Net Benefit Maximizing (Rational) Choices

A. Nearly all economic models can be developed from one fairly simple model of rational decision making. It is the model that assumes that individuals **always attempt to maximize** their (private) **net benefits**.

- i. Consumers maximize consumer surplus: the difference between what a thing is worth to them and what they have to pay for it. $CS(Q) = TB(Q) - TC(Q)$
- ii. Firms maximize their profit, the difference in what they receive in revenue from selling a product and its cost of production: $\Pi = TR(Q) - TC(Q)$

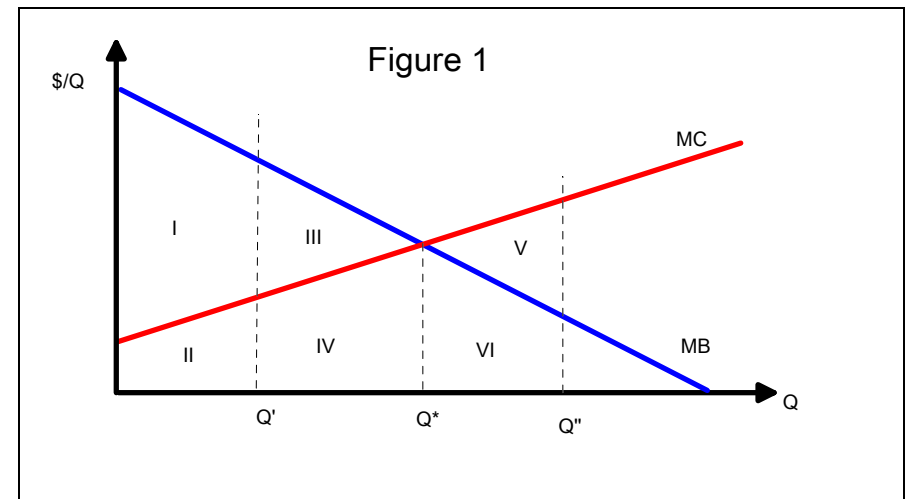
B. Most of you will have used these ideas before, but most of you will not have been shown exactly how the geometry works or how it fits together to produce an internally consistent model of markets grounded in individual decisionmaking.

- We will show how the net benefit maximizing model can be used as a basis for thinking about spatial voting models.
- We will also show how net benefit maximizing models can be used to thinking about voting behavior over taxes, public services, and public goods.
- We will also show how that geometry can be used to evaluate the relative merits of alternative public policies if we adopt the “maximize social net benefits” norm.
- We will also show that geometry can be used to think about the politics of democratic decision making.
- So, its very important to master these elementary looking tools!

C. The change in benefits, costs, etc. with respect to quantity consumed or produced is generally called Marginal benefit, or Marginal cost.

- i. DEF: **Marginal "X"** is the change in Total "X" caused by a one unit change in quantity. It is the slope of the Total "X" curve. "X" \in {cost, benefit, profit, product, utility, revenue, etc.}
- ii. *Important Geometric Property:*
 - Total "X" can be calculated from a Marginal "X" curve by finding the area under the Marginal "X" curve over the range of interest (often from 0 to some quantity Q).

This property allows us to determine consumer surplus and/or profit from a diagram of marginal cost and marginal revenue curves.



D. Examples:

- i. Given the marginal cost and marginal benefit curves in Figure 1, it is possible to calculate the total cost of Q' and the total benefit of Q' .
 - These can be represented geometrically as areas under the curves of interest. $TC(Q') = II$; $TB(Q') = I + II$.
- ii. Similarly, one **can calculate the net benefits** by finding total benefit and total cost for the quantity or activity level of interest, and subtracting them.
 - Thus the net benefit of output Q' is $TB(Q') - TC(Q') = [I + II] - [II] = I$.
- iii. Use Figure 1 to determine the areas that correspond to the total benefit, cost and net benefit at output Q^* and Q'' .
 - **Answers:**
 - $TB(Q^*) = I + II + III + IV$, $TC(Q^*) = II + IV$, $NB(Q^*) = I + III$
 - $TB(Q'') = I + II + III + IV + VI$, $TC(Q'') = II + IV + V + VI$, $NB(Q'') = I + III - V$

E. If one attempts to maximize net benefits, it turns out that generally he or she will want to consume or produce at the point where marginal cost equals marginal benefit (at least in cases where Q is very divisible).

- i. There is a nice geometric proof of this.
 - Note that the example above, C, nearly proves this.

- Note that $NB(Q^*) > NB(Q')$ and $NB(Q^*) > NB(Q'')$, so choosing the quantity at which marginal benefit equals marginal cost tends to maximize net benefits.
 - ii. In the usual case, a net-benefit maximizing decision maker chooses consumption levels (Q) such that their own marginal costs equal their own marginal benefits. They do this not because they care about "margins" but because **this is how they maximizes net benefits** in most common choice settings of interest to economists. (Another common choice that maximizes net benefits is $Q^* = 0$. Why?)
 - iii. This characterization of net benefit maximizing decisions is quite general, and can be used to model the behavior of both firms and consumers in a wide range of circumstances.
 - iv. Moreover, the same geometry can be used to characterize ideal policies if "all" relevant costs and benefits can be computed, and one wants to maximize *Social Net Benefits*.
- F. That each person maximizes their own net benefits does not imply that every person will agree about what the ideal level or output of a particular good or service might be.
- i. Most individuals will have different marginal benefit or marginal cost curves, and so will differ about ideal service levels.
 - ii. To the extent that these differences can be predicted, they can be used to model both private and political behavior:
 - (What types of persons will be most likely to lobby for subsidies for higher education?)
 - What types of persons will prefer progressive taxation to regressive taxation?
 - What industries will prefer a carbon tax to a corporate income tax?)
- G. One can **use the consumer-surplus maximizing model to derive a consumer's demand curve** for any good or service (given their marginal benefit curves) by: (i) choosing a price, (ii) finding the implied marginal cost curve for a consumer, (iii) use MC and MB to find the CS maximizing quantity of the good or service, (iv) plot the price and the CS maximizing Q^* , and (v) repeat with other prices to trace out the individual's demand curve.
- Hint: to learn how to do this, draw a few MB curves and derive the demand curves associated with them.
- It will turn out that when MB is downward sloping over the whole range of interest, the Demand curve and MB curve will go through the same points. However, if the MB rises and falls, there will be places on the MB curve that are not on the demand curve.

- H. Similarly, one can use a profit maximizing model (another measure of net benefit) to derive a competitive firm's **short run** supply curve, given its marginal cost curve. Again, one (i) chooses a price (which is a price taking firm's MR curve), (ii) finds the profit maximizing output, (iii) plot P and Q^* , (iv) repeat to trace out a supply curve.
- I. Given individual demand curves and individual firm supply curves, ideas about market equilibria can be derived.

II. Markets, Externalities, and Social Net Benefits

- A. Market Demand can be determined by varying price and adding up the amounts that consumers want to buy at each price.
- i. **Market Demand** curves for ordinary private goods, thus, can be shown to be "horizontal" sums of individual demand curves
 - ii. Similarly, **Market Supply** (for an industry with a fixed number of firms) can be derived by varying price and adding up the amounts that each firm in the industry is willing to sell at each price.
 - iii. **Market Supply** curves for ordinary private goods can be shown to be "horizontal" sums of individual firm supply curves.
 - iv. In the short and medium run, the number of firms in the industry can be taken as fixed. However, supply in the "Marshallian" long run reflects entry and exit of firms from the industry.
 - v. (The process of entry and exit can also be analyzed. Incentives for exit and entry end when profits fall to zero. This fact allows the equilibrium numbers of firms to be found in Marshallian industries using long run average cost curves of firms. "Zero" profit output levels for a typical firm in the industry can be computed using MR and MC and/or AR and AR curves. In the long run, such firms and outputs are simply replicated until market demand is satisfied.)
- B. Note that derived in this way, it is clear that:
- i. Every market **demand curve is the sum of the marginal benefit** curves of the individual consumers, because each consumer's demand curve is essentially his or her MB curve.
 - ii. Every short and middle run **market supply curve is the sum of the marginal cost** curves of the individual firms in the market, because each firm's supply curve is essentially its MC curve.
 - iii. Consequently, market demand and supply curves can be used as social marginal benefit and marginal cost curves to estimate the net benefits realized by all firms and consumers in an industry.

- C. In competitive markets, prices tend to move to "market clearing levels," that is to prices that set the total quantity supplied by all firms equal to the total amount demanded by consumers. (This defines equilibrium market P^* , and Q^* .)
- In competitive markets, this occurs where the supply and demand curve cross.
 - At any other price, there will either be surpluses (which tend to cause prices to fall) or shortages (which tend to cause prices to rise).
 - Note that this is, in principle, an entirely decentralized process requiring governments to do nothing more than enforce property rights and contracts.

III. Using Net Benefits Maximization as a Normative Framework

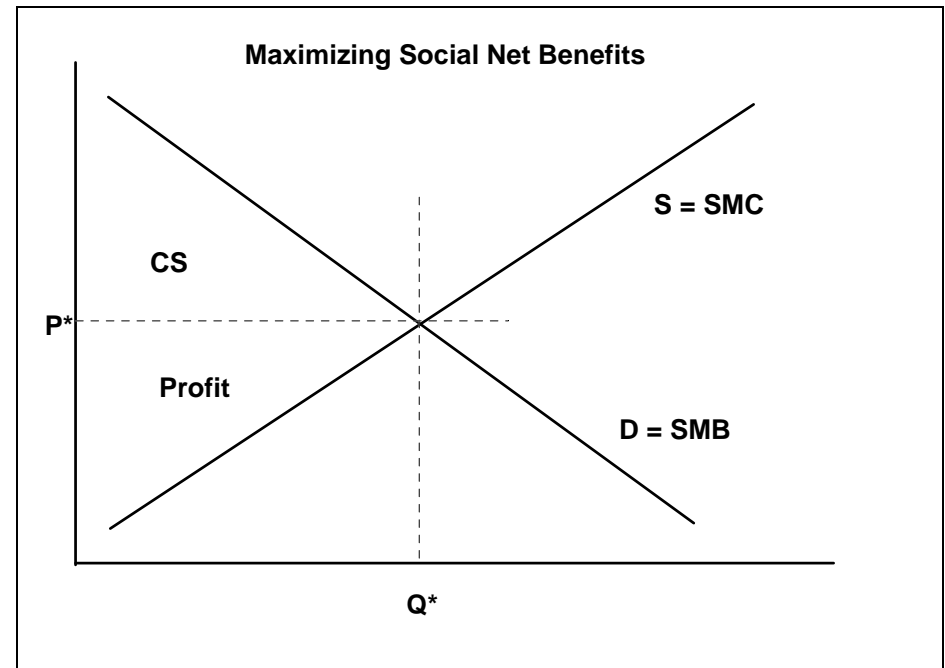
- A. One can also use the net-benefit maximizing approach as the basis for a normative theory of behavior:
- B. Namely, it may be argued that "society" should maximize social net benefits.
- C. The social net benefits of an action or outcome is the sum of all the (total) benefits associated with the action or outcome minus the sum of all the (total costs) associated with that action or outcome.

$$SNB(Q) = \sum TBi(Q) - \sum TCi(Q) = \sum [TBi(Q) - TCi(Q)]$$

for all individuals $I = 1, 2, 3 \dots N$ in the market or society of interest

- D. Note that there are cases in which one can use a market demand curve to derive total benefits for consumers and the supply curve to calculate the total cost of producing the services purchased by consumers.
- In the absence of externalities, the area under the demand curve from 0 to Q is the total benefits from producing a good.
 - In the absence of externalities, the area under the supply curve from 0 to Q is the total cost of producing the good.
 - The difference in these two areas is the Social Net Benefit of producing Q .
 - Note that this social net benefit is usually divided between firms and consumers, and can also be measured as the sum of all consumer surplus and all profits.
- E. In the absence of externalities or market concentration, **markets tend to produce social net benefit maximizing outcomes!**
- Note that the "market clearing" price causes markets to produce the **social net benefit maximizing** level of output (in cases where there are not externalities, e.g. relevant costs or benefits).

- Q^* sets social marginal benefit (the demand curve) equal to social marginal cost (the supply curve).
- This is one very widely used **normative** argument favoring markets as a method of social organization.



- F. In cases where **external costs** exist, however, market outcomes will (often) fail to maximize social net benefits, because those costs will not be fully accounted for in the calculations of economic agents.
- In this case, either demand or supply will not include all marginal benefits or all marginal costs.
 - The existence of externality problems provides a **normative** basis for government policy (if one wants to maximize social net benefits).
 - In cases where significant external costs exist at the margin (at Q^*), markets will tend to **over produce** the output of interest relative to that which maximizes social net benefits.
 - In cases where significant external benefits exist at the margin (at Q^*), markets will **under produce** the service of interest relative to that which maximizes social net benefits.

- v. Governments might adopt policies to discourage production in the first case (perhaps with taxes) or encourage it (perhaps with subsidies) in the second case.
- vi. The steps that governments will actually take to address externality problems will be analyzed in this class.
- vii. (Other tools for analyzing externality and public goods problems may be developed after the midterm.)