Microeconomics

微观经济学

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Refresh: Time preference

Discounted utility model:

$$U^T(c_0, ..., c_t) = \sum_{t=0}^{T} D(t)u(c_t)$$

Constant discounting

$D(t) = \frac{1}{(1+r)^t} = \delta^t$

Quasi-hyperbolic discounting

$D(t) = 1$ if $t = 0$
$\beta\delta^t$ with $\beta < 1$ if t>0

Hyperbolic discounting implies that the discount factor between the current period and the next is lower than the discount factor in later periods.

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Time preference: Policy implications

Promote saving

What is the situation?

- Households are assumed to want to smooth consumption over the life cycle and are expected to solve the relevant optimization problem in each period before deciding how much to consume and how much to save.
- Defined-contribution plans: employees bear more responsibility for making decisions about how much to save.
- Low-saving households are making a mistake by saving too little.

Promote saving

What could be the problems?

- Financial educations: compound rate
- Self-control: would save more but lack the willpower
- Procrastination: postpone the action (35% express an intention to save more in the next few months, but 86% have made no change)
- A strong tendency toward inertia: **status quo bias**
  - the current status quo bias is not to save at all

Promote saving

What can we do about it?

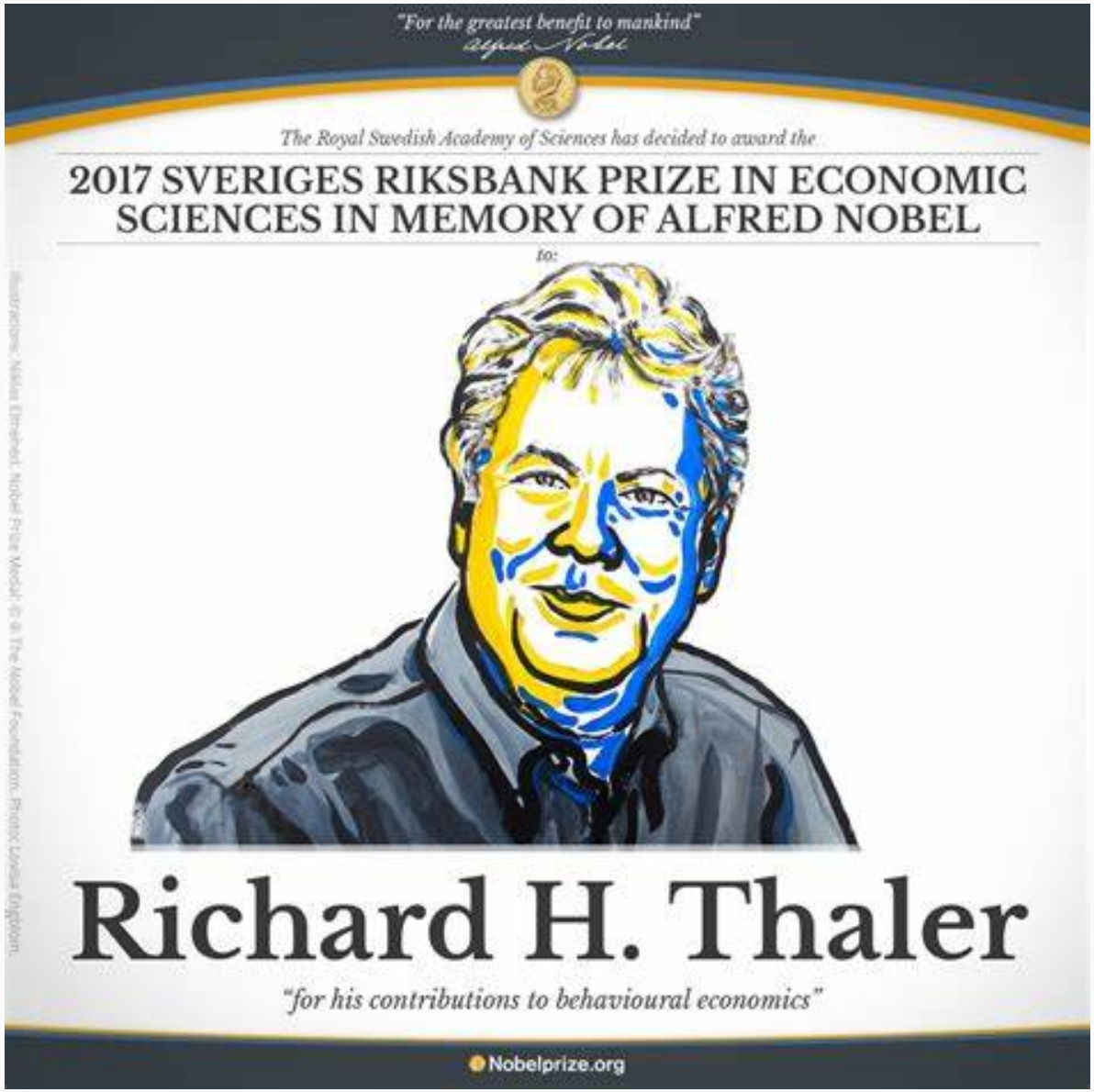
- To overcome status quo bias: changing the default by using an automatic enrollment plan
- However, the setting of the default saving rate is tricky. It may hurt those who would have saved more by making an active decision.
- It is also used on organ donations.

Promote saving

Thaler and Benartzi (2004): Save More Tomorrow

1. increasing the contribution rates before the scheduled pay increase to avoid a cut in take-home pay (loss in the future, and in another mental account)
2. the contribution rate continues to increase on each scheduled raise until the contribution rate reaches a pre-set maximum (so status quo bias is helping us)
3. employees can opt out of the plan at any time so they also feel comfortable to join

Promote saving



Promote saving

What is the consequence?

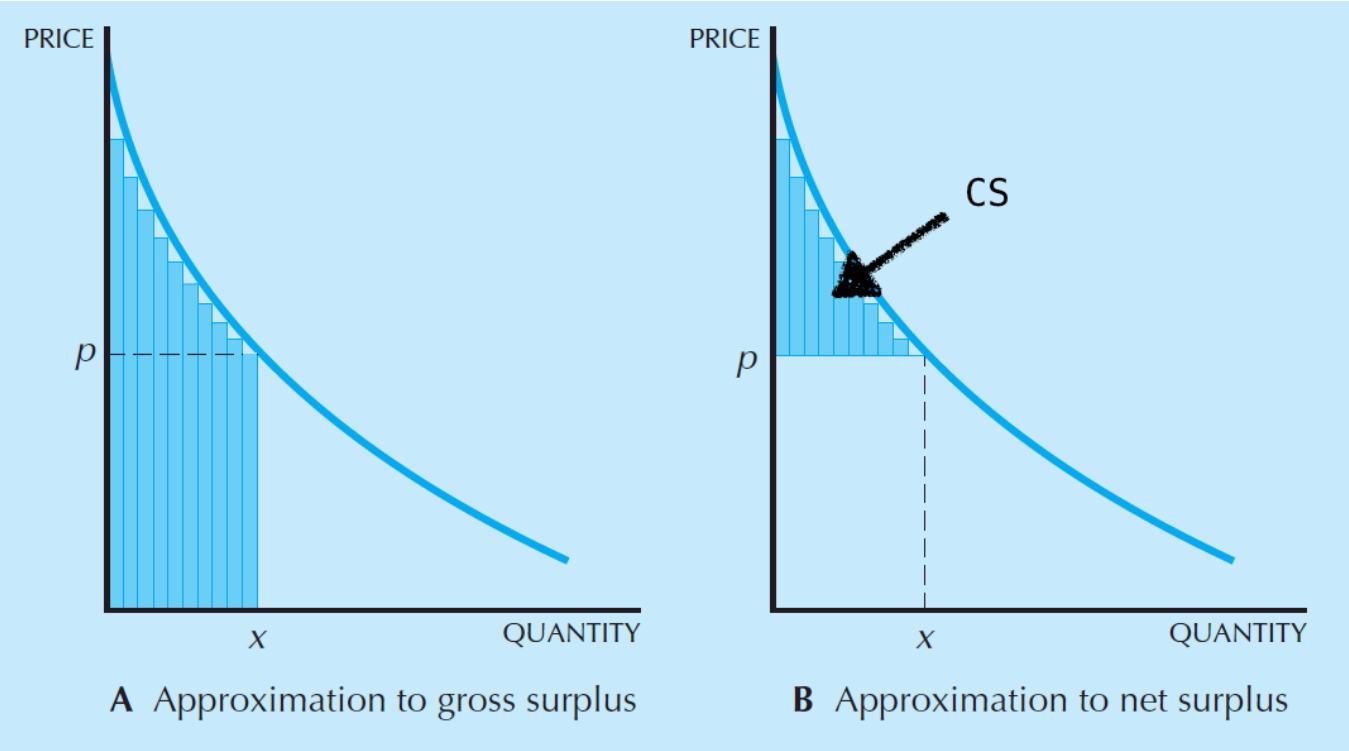
	Employees Who Were Already Saving on May 31, 2001		Employees Who Were Not Saving on May 31, 2001		All Eligible Employees
	Joined SMarT (N=615)	Did Not Join SMarT (N=3,197)	Joined SMarT (N=165)	Did Not Join SMarT (N=1,840)	(N=5,817)
Pre-SMarT (May 2001)	7.62	8.62	.00	.00	5.54
First pay raise (October 2001)	9.38	8.54	2.28	.26	5.83

Figure 1: Average saving rate

Consumer's surplus and supplier's surplus

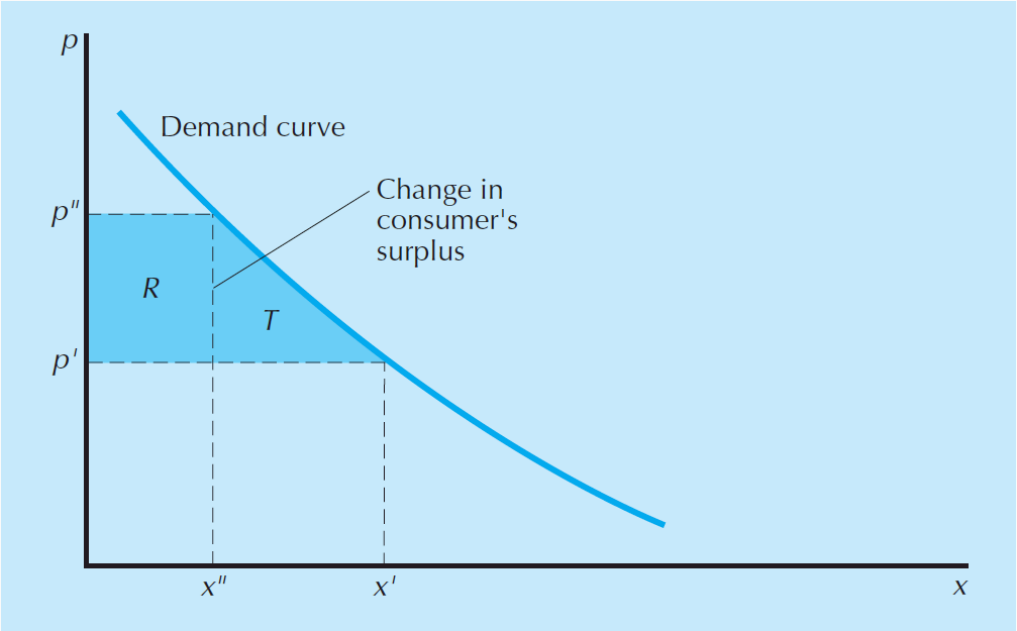
Consumer surplus (CS) 消费者剩余

We go from the consumer's problem to *individual* demand curves.



Consumer surplus is the difference between the willingness to pay and the price paid for the good.

How does CS change when price changes?

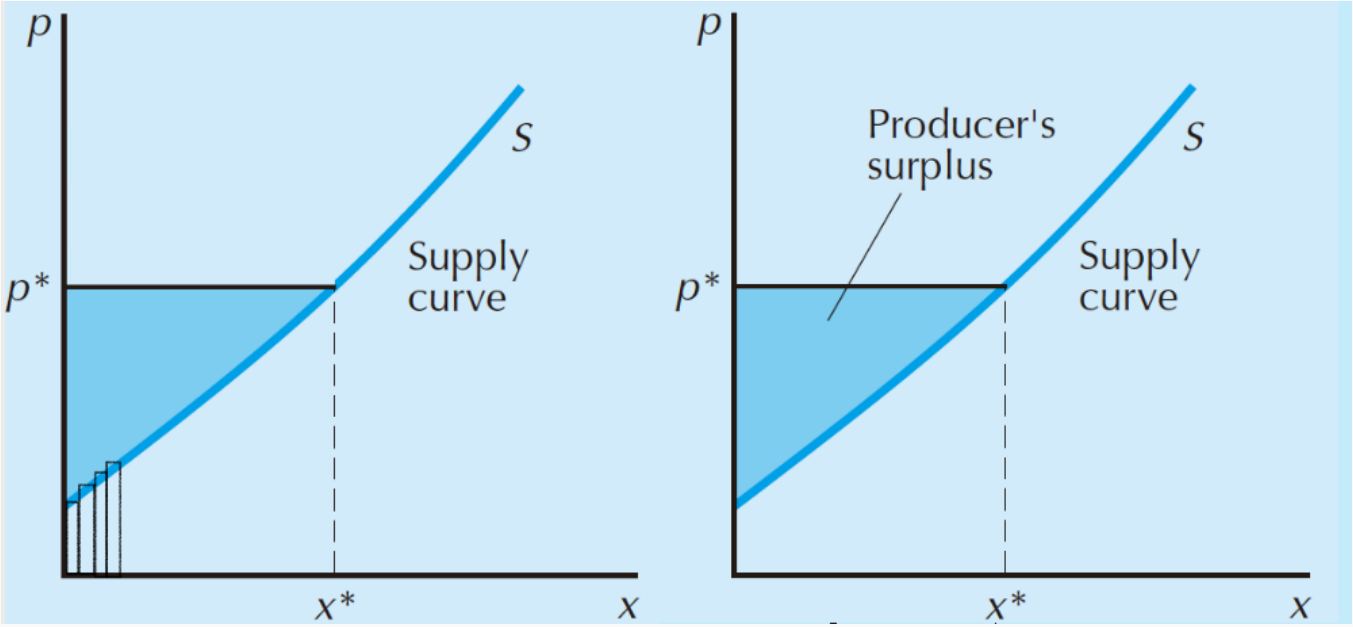


There are two areas in the changes in CS:

- Area R measures the loss in surplus due to the fact that the consumer is now paying more for all the units he continue to consume: $(p'' - p')x''$.
- Area T measures the lost in surplus due to the lost consumption of the x-good.

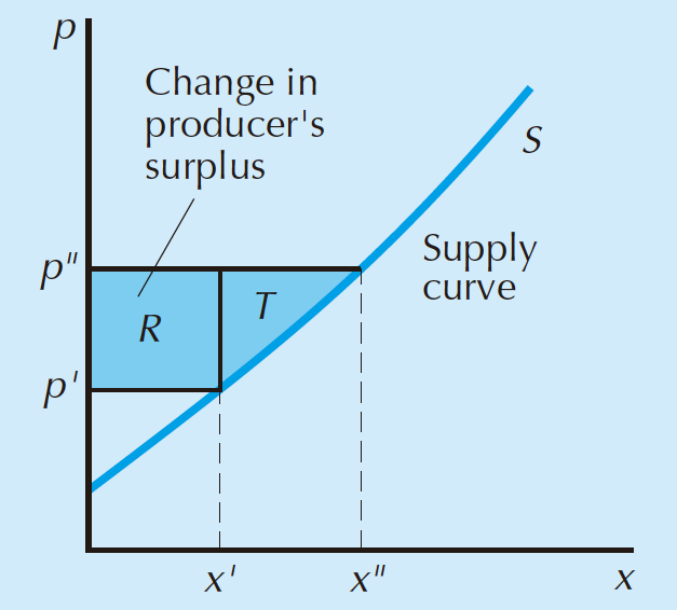
Producer's surplus (PS) 生产者剩余

The **supply curve** measures the amount that will be supplied at each price.



- The area *above* the supply curve measures the surplus enjoyed by the suppliers of a good.

Producer's surplus (PS) 生产者剩余



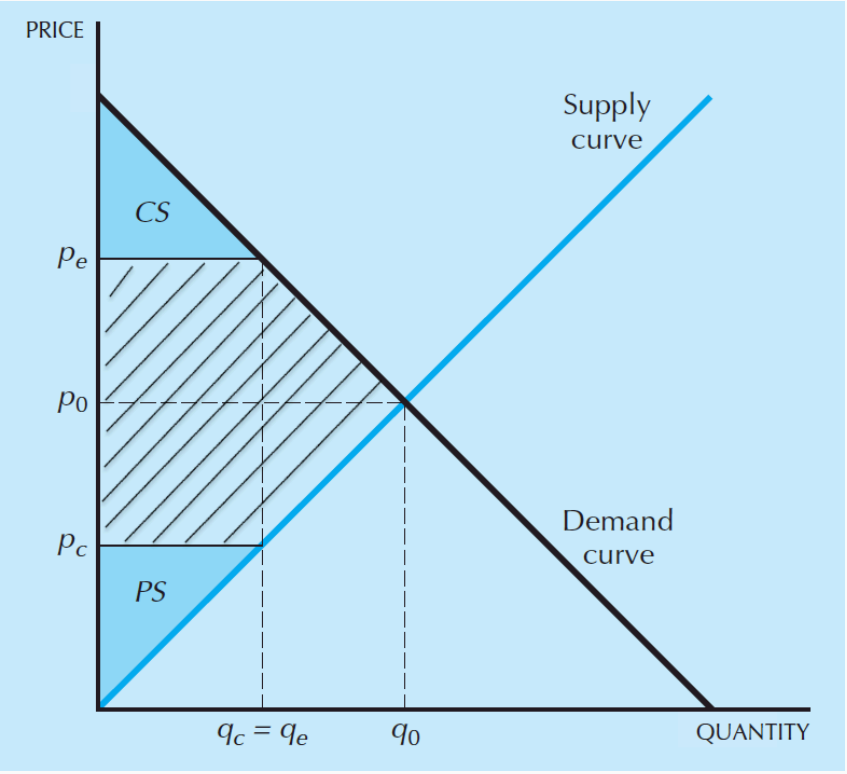
Price change from $p^{'}$ to $p^{''}$. There are two areas in the changes in PS:

- Area R measures the gain from selling the units previously sold anyway at $p^{'}$ at the higher price $p^{''}$.
- Area T measures the gain from selling the extra units at the price $p^{''}$.

Benefit-Cost analysis 收益-成本分析

We can calculate the benefits and costs of various economic policies. This is the case with price ceilings.

- With no intervention, the price would be p_0 and the quantity sold would be q_0.
- The authorities believe the price is too high and impose the price ceiling p_c.



Benefit-Cost analysis

- At the celing price p_c, the supply is q_c.
- At p_c, the demand is much larger than q_c. There is not enough products on the market.
- If we assume that we allocate by willingness to pay, then everyone who is willing to pay more than p_e gets the good.
- The lost consumer and producer suplus is given by the shade.
- We would generally expect that this shaded area is a lower bound on the lost of suplus in the case of a price ceiling.

Benefit-Cost analysis

The same analysis can be applied to rationing. 配给制

- Suppose that the authorities issue ration coupons 配给券 that allow for only q_c units to be purchased.
- If the ration coupons are marketable, then they would sell for a price of $p_e - p_c$.
- This would make the total price of the purchase equal to p_e.
- Whoever owns the ration coupons will benefit from the price difference.

Market demand

From individual to market demand

- We have seen in earlier lectures how to model individual consumer choice.
- Now we want to add up individual choices to get total market demand.

Assume there are n consumers. Let us use $x_i^1(p_1, p_2, m_i)$ to represent consumer $i's$ demand function for good 1. The **market demand** for good 1, also called the **aggregate demand** for good 1, is the sum of these individual demands over all consumers:

$$X^1(p_1, p_2, m_1, ..., m_n) = \sum_{i=1}^{n} x_i^1(p_1, p_2, m_i)$$

In general, the aggregate demand depend on the *distribution* of incomes.

Representative consumer: a simplification 代表性消费者

- It is convenient to assume that the aggregate demand is the demand of some "representative consumer" who has an income that is just the sum of all individual incomes.
  - The condition under which this can be done is beyond the scope of this course.
- An intuition: aggregate demand must be identical for any two distributions of the same total amount of wealth across consumers. That is, for any $(m_1, ..., m_n)$ and $(m'_1, ..., m'_n)$ such that $\sum_i m_i = \sum_i m'_i$, we must have $\sum_{i=1}^n x_i(p, m_i) = \sum_{i=1}^n x'_i(p, m'_i)$.

Aggregate demand

- For such condition to be satisfied, let's start with an initial distribution $(m_1, m_2, ..., m_n)$ and apply a differential change in wealth $(dm_1, dm_2, ..., dm_n)$ such that the aggregate wealth is unchanged:

$$\sum_{i=1}^{n} dm_i = 0$$

If aggregate demand is just a function of aggregate wealth (which has nothing to do with the distribtuion), then we must have that

$$\sum_{i=1}^{n} \frac{\partial x_i^k(p, m_i)}{\partial m_i} dm_i = 0 \text{ for every good k}$$

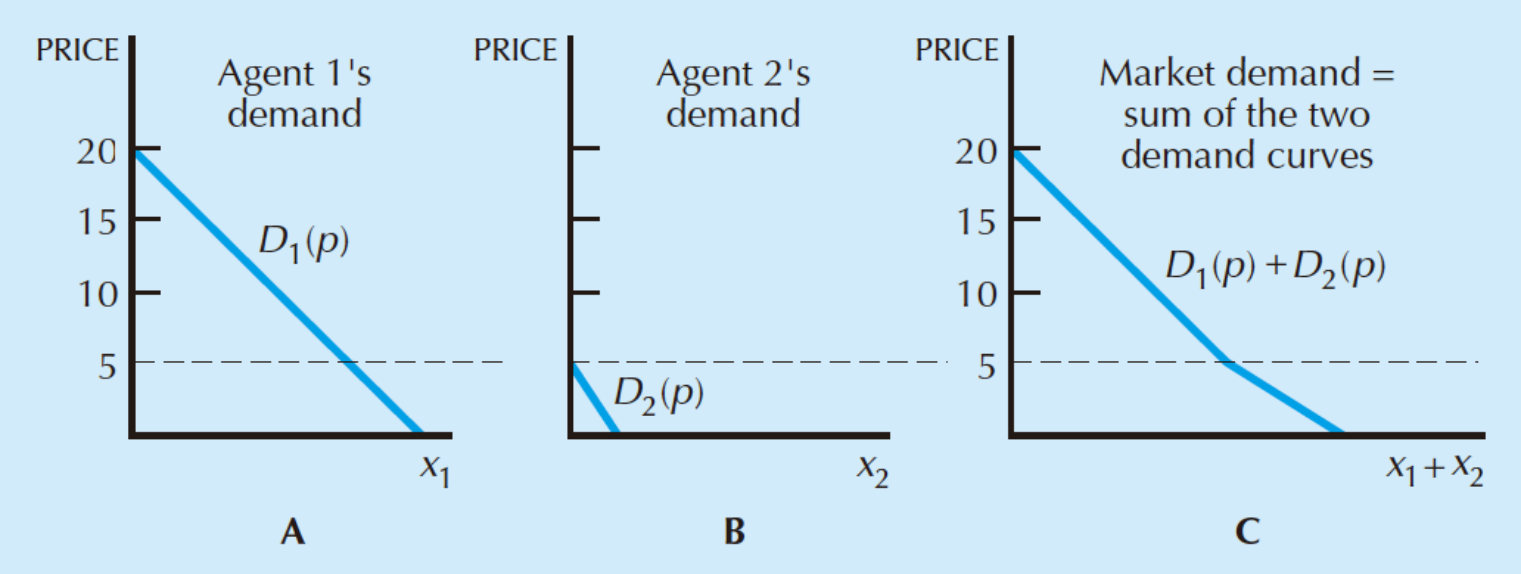
In words, the wealth effects of different individuals are compensated in the aggregate. That is, in the case of two individuals i and j,

$$\frac{\partial x_i^k(p, m_i)}{\partial m_i} = \frac{\partial x_j^k(p, m_j)}{\partial m_j}$$

for every good k.

Adding up demand curves

The (inverse) demand function: p(x)



- $D_1(p) = max\{20 - p, 0\}$
- $D_2(p) = max\{10 - 2p, 0\}$

Elasticity

Elasticity 弹性

Basic idea:
Elasticity is a measure of a variable's sensitivity to a change in another variable:

$$Elasticity(E) = \frac{\%\ change\ in\ one\ variable}{\%\ change\ in\ another\ variable}$$

- Why do we need the percentage change?
- Because we need a "unit free" measure.

Imagine your demand for fruits per week increase from 1 *kg* to 2 *kg*. The change is 1 *kg*. However, if you measure by *jin* 斤, the change becomes 2 *jin*s.

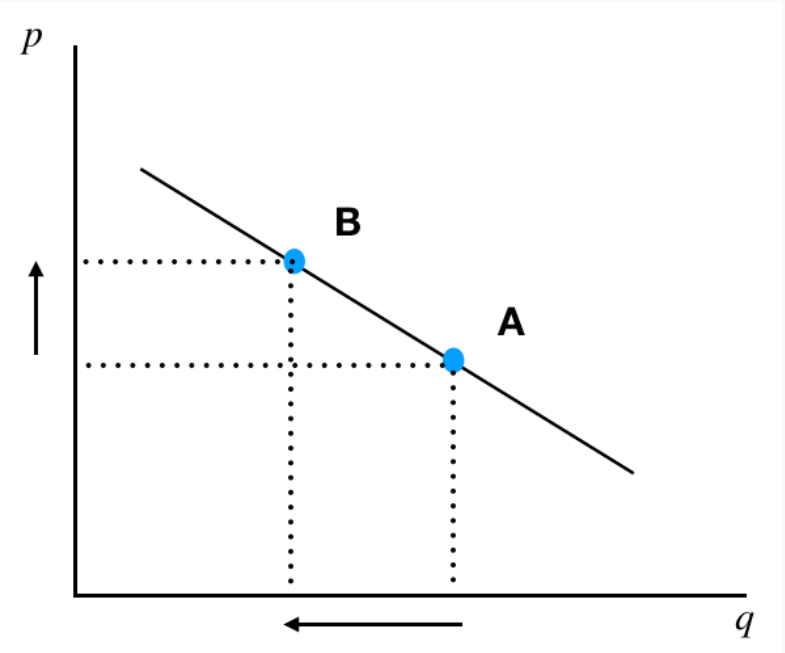
Price elasticity of demand

In consumer theory, the price elasticity of demand 需求价格弹性 is the change in consumer demand as a result of a change in a good's price:

$$\varepsilon = \frac{\Delta q/q}{\Delta p/p} = \frac{p}{q}\frac{\Delta q}{\Delta p}$$

.

- Along the same demand curve, if p and q move in opposite directions, which would make price elasticity negative. This is inconvenient!
- So we usually take its absolute value.



What determines price elasticity?

To learn the determinants of price elasticity, we look at a series of examples.
In each example:

- Suppose the prices of both goods rise by 20%.
- The good for which q falls the most (in percentage) has the highest price elasticity of demand.
- What lesson does the example teach us about the determinants of the price elasticity of demand?

Example 1

Breakfast cereal vs. Sunscreen

- The prices of both of these goods rise by 20%. For which good does q drop the most? Why?
  - Breakfast cereal has close substitutes (e.g., bread, pancakes, eggs, noodles, etc.), so buyers can easily switch if the price rises.
  - Sunscreen has no close substitutes, so consumers would probably not buy much less if its price rises.
- **Lesson:** price elasticity is higher when close substitutes are available.

Example 2

Blue jeans vs. Clothing

- The prices of both of these goods rise by 20%. For which good does q drop the most? Why?
  - For a narrowly defined good such as blue jeans, there are many substitutes (black jeans, sports pants, shorts, etc.).
  - There are fewer substitutes available for broadly defined goods (not too many substitutes for clothing... maybe leaves?)
- **Lesson:** price elasticity is higher for narrowly defined goods than broadly defined ones.

Example 3

Insulin 胰岛素 vs. Caribbean Cruises

- The prices of both of these goods rise by 20%. For which good does q drop the most? Why?
  - For millions of diabetics, insulin is a necessity. A rise in its price would cause little or no decrease in demand.
  - A cruise is a luxury. If the price rises, some people will forgo it.
- **Lesson:** price elasticity is higher for luxuries than for necessities.

Example 4

Gasoline in the short run vs. in the long run

- The prices of both of gasoline rise by 20%. Does q drop more in the short run or the long run? Why?
  - There is not much people can do in the short run, other than ride the public transport.
  - In the long run, people can buy energy efficient cars or live closer to where they work.
- **Lesson:** price elasticity is higher in the long run than the short run.

The determinants of price elasticity: A summary

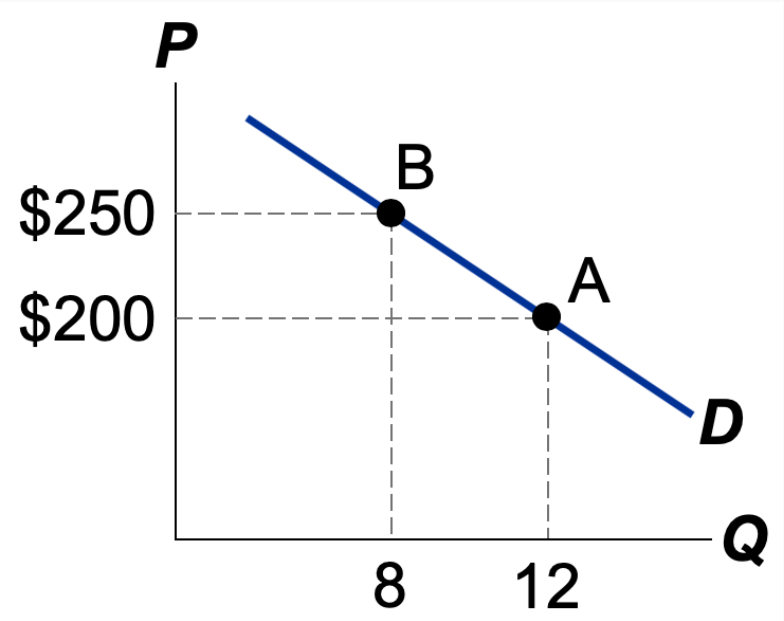
The price elasticity of demand depends on:

- The extent to which close substitutes are available
- whether the good is a necessity or a luxury
- how broadly or narrowly the good is defined
- the time horizon - elasticity is higher in the long run than the short run

Calculating percentage changes

Standard method of computing the percentage (%) change:

$$\frac{\textit{end value} - \textit{start value}}{\textit{start value}} \times 100\%$$



Problem: The standard method gives different answers depending on where you start

- Going from A to B, the % change in P equals $\frac{250-200}{200} = 25\%$, Q falls 33%, elasticity=33/25=1.33
- Going from B to A, P falls 20%, Q rises 50%. elasticity=50/20=2.5

Calculating percentage changes

So, we can instead use the midpoint method (中点法):

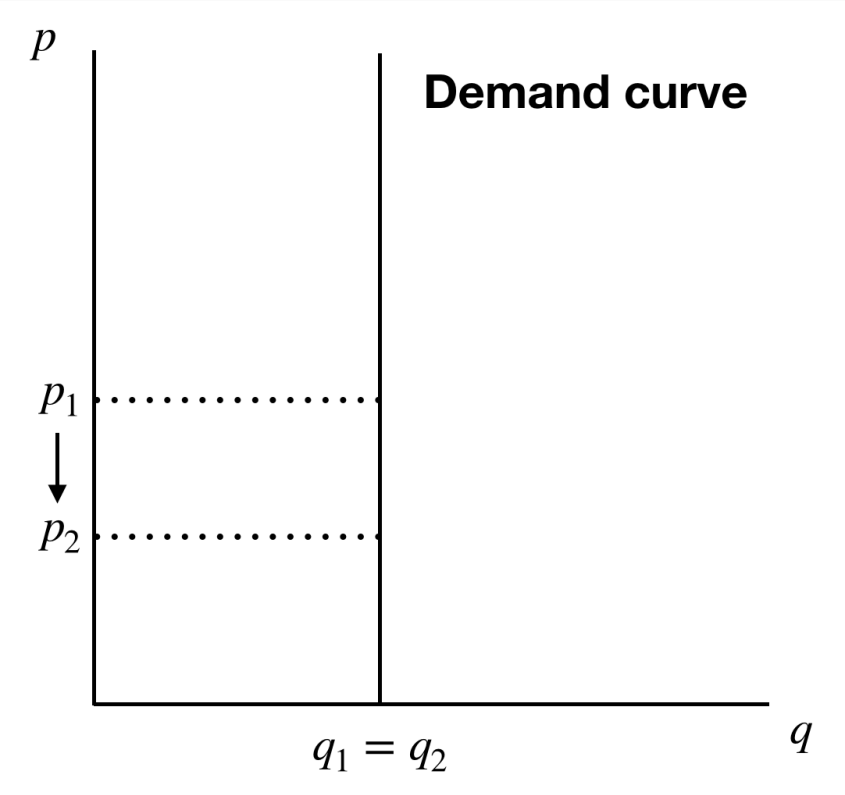
$$\frac{\textit{end value} - \textit{start value}}{\textit{midpoint}} \times 100\%$$

- The midpoint is the number halfway between the start and end values, the average of those values.
- It doesn't matter which value you use as the "start" and which as the "end" – you get the same answer any way.

The variety of demand curve

Special case 1: perfectly inelastic demand

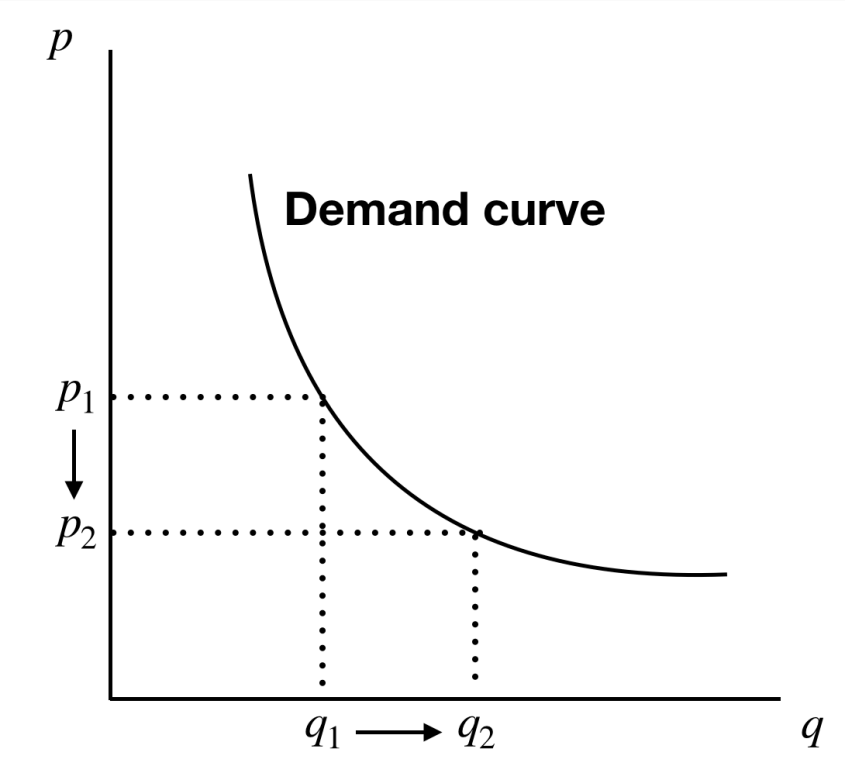
- demand curve: vertical
- consumer' price sensitivity: none
- elasticity: 0



The variety of demand curve

Special case 2: unit elastic demand

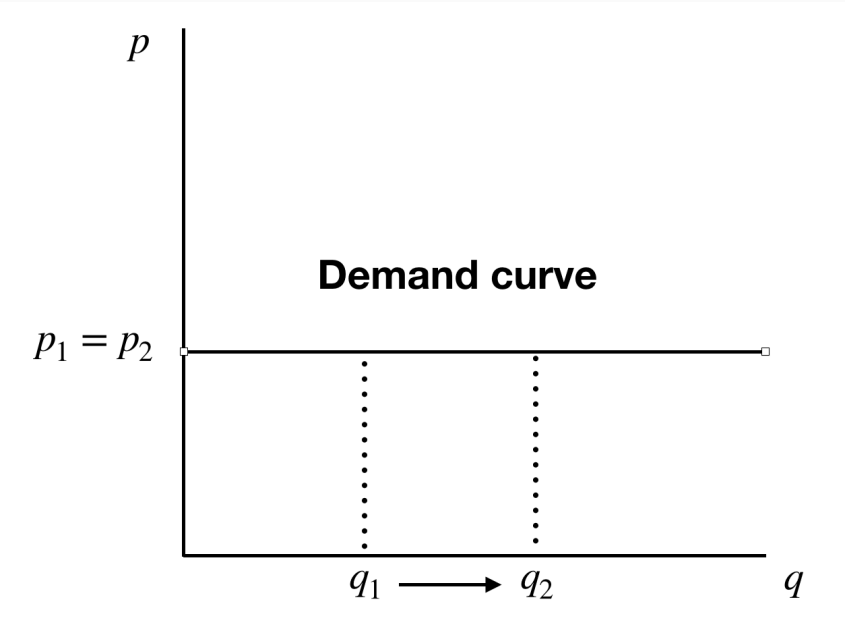
- demand curve: intermediate slope
- consumer' price sensitivity: intermediate
- elasticity: 1



The variety of demand curve

Special case 3: perfectly elastic demand

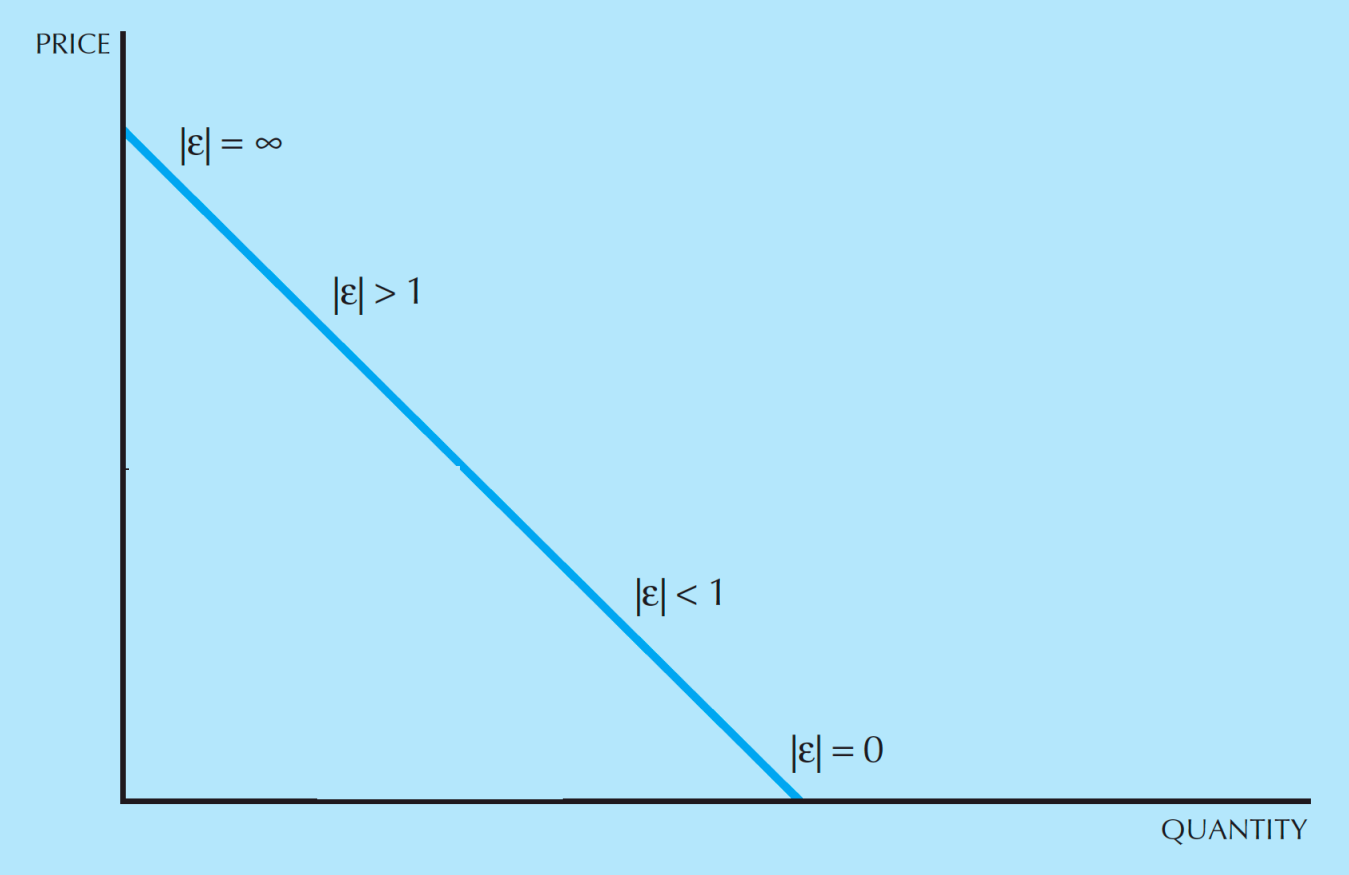
- demand curve: horizontal
- consumer' price sensitivity: extreme
- elasticity: infinity



Can you think of an example that fits this case?

Elasticity of a linear demand curve

The slope of a linear demand curve is constant, but its elasticity is not.



Price elasticity and total revenue

Elasticity and revenue

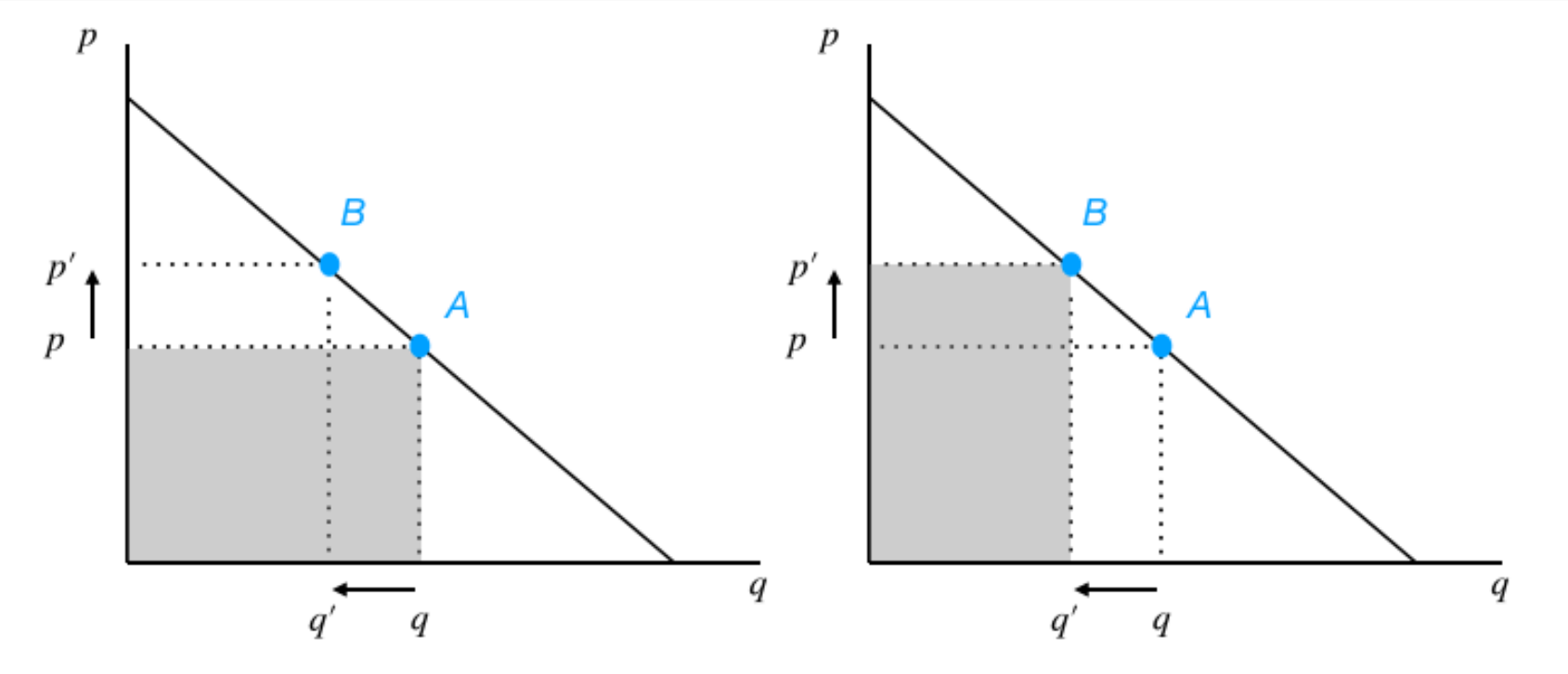
A price increase has two effects on revenue (R) 收益:

- Higher p means more revenue on each unit you sell.
- But you sell fewer units (lower q).

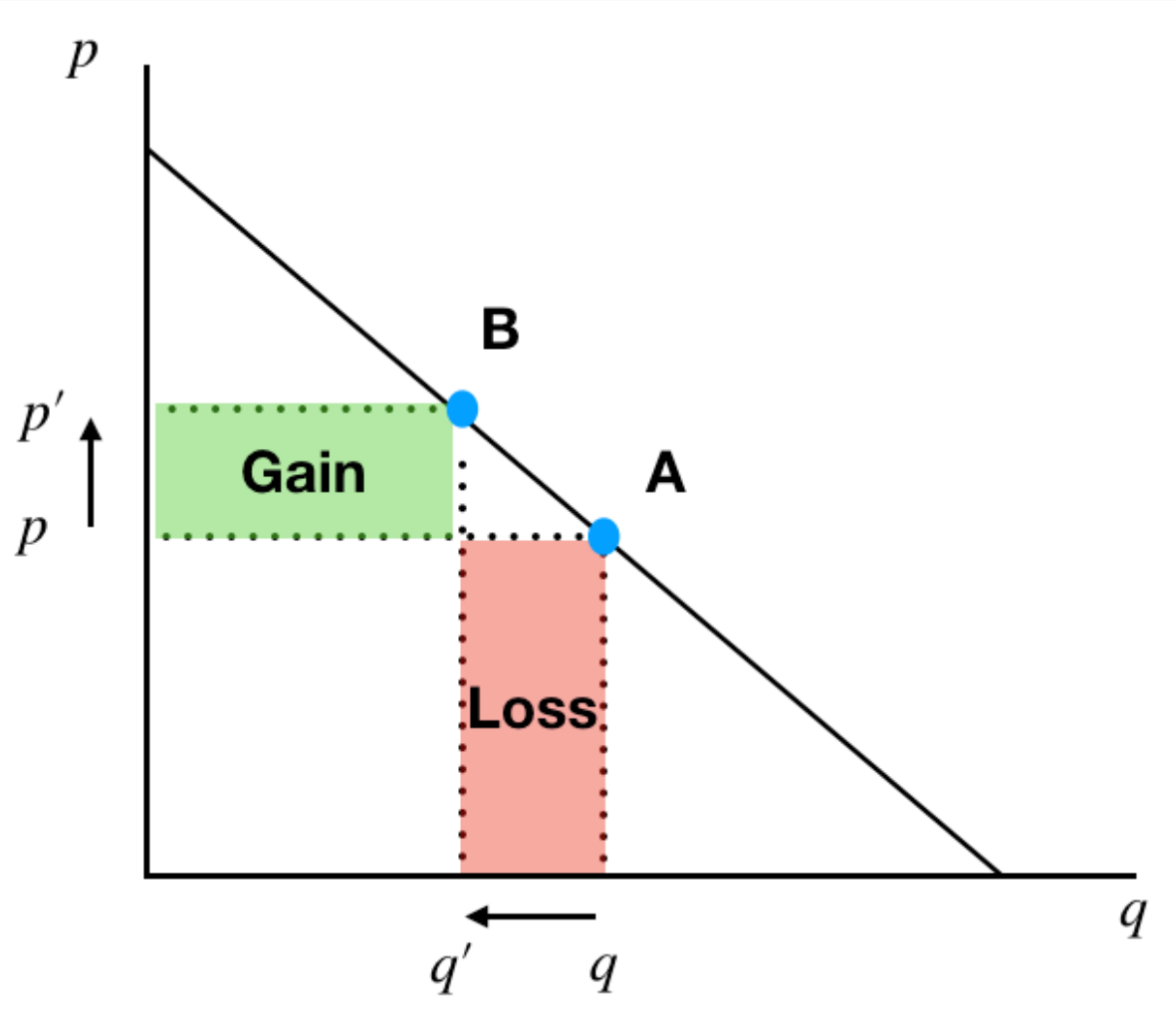
Which of these two effects is bigger?

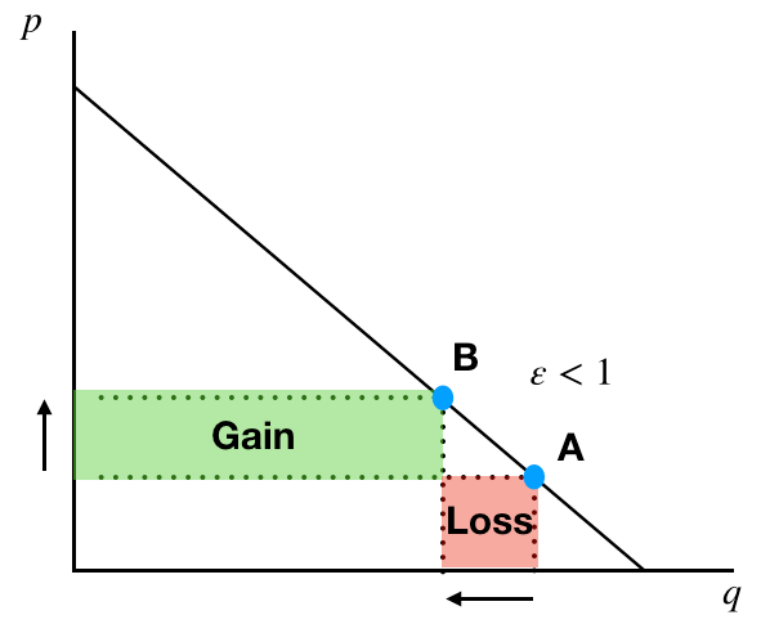
- It depends on the price elasticity of demand.

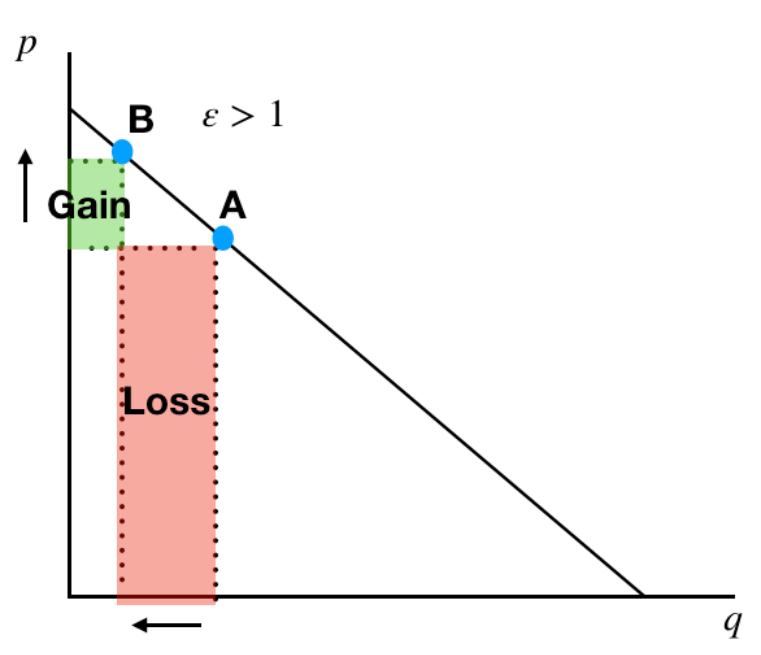
Revenues



Changes in revenue: a graphic demonstration

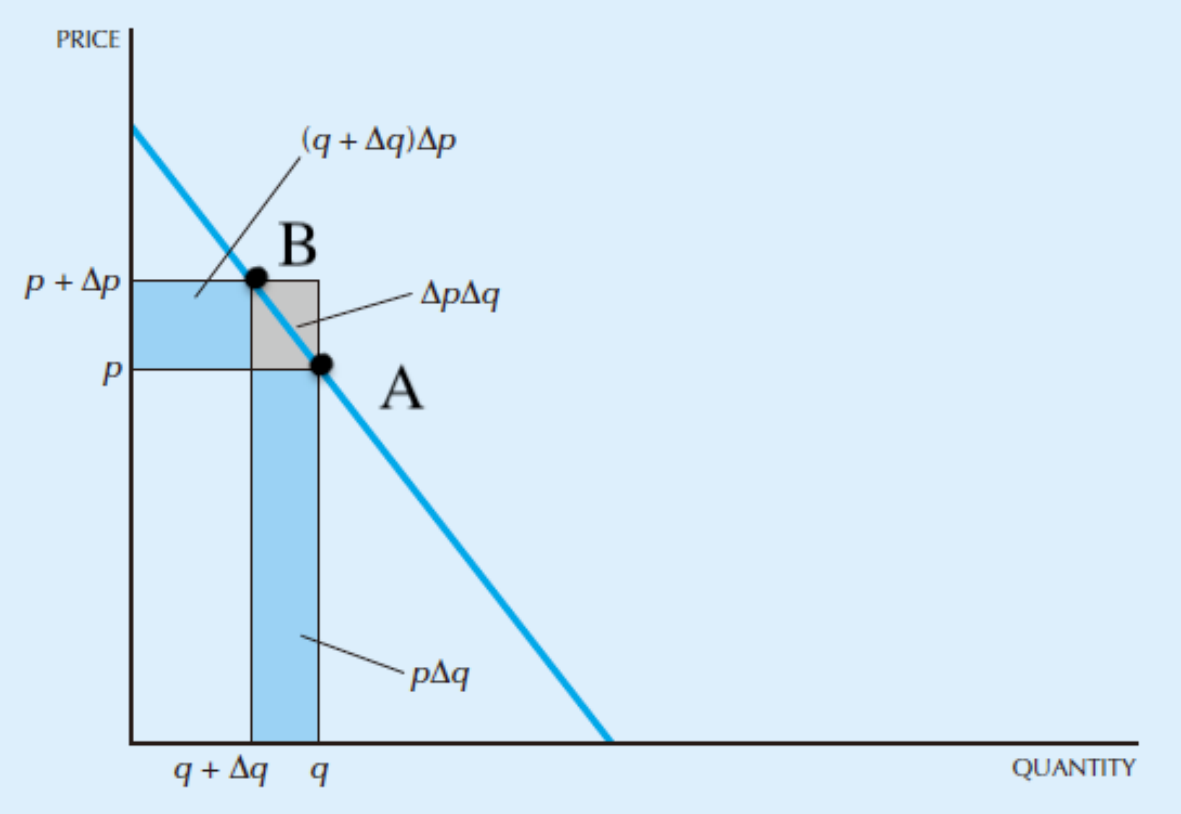






It seems that the net revenue of a price change depends on the elasticity of demand.

Changes in revenue: an algebra demonstration



Revenue at A: $R = pq$

Revenue at B: $R' = (p + \Delta p)(q + \Delta q)$

Changes from A to B: $\Delta R = R' - R = q\Delta p + p\Delta q + \Delta p \Delta q \approx q\Delta p + p\Delta q$

How does revenue change when you change the price of a good?

$$\Delta R \approx p\Delta q + q\Delta p$$

$$\frac{\Delta R}{\Delta p} = q[1 + \frac{p}{q}\frac{\Delta q}{\Delta p}] = q[1 + \varepsilon(p)] = q[1 - |\varepsilon(p)|]$$

Intuitions:

- If $|\varepsilon(p)| > 1$, which means that the demand is very responsive to price changes, then an increase in price will reduce demand so much that revenue will fall.
- If $|\varepsilon(p)| < 1$, which means that the demand is very unresponsive to price (inelastic), then an increase in price will not change demand very much, and overall revenue will increase.

Marginal revenue curves

How revenue changes when you change the quantity of a good?

$$\Delta R \approx p\Delta q + q\Delta p$$

$$MR = \frac{\Delta R}{\Delta q} = p + q\frac{\Delta p}{\Delta q} = p[1 + \frac{q}{p}\frac{\Delta p}{\Delta q}]$$

$$= p[1 + \frac{1}{\varepsilon}] = p(q)[1 - \frac{1}{|\varepsilon(q)|}]$$

(We've written $p(q)$ and $\varepsilon(q)$ to remind ourselves that both price and elasticity will typically depend on the level of output.)
Remark: strikes may help the employers to gain more profits (in the short-run)!

- strikes 罢工 decrease quantity $\rightarrow$ increase price too much (depending on the elasticity) $\rightarrow$ may increase revenue in the short-run

Tax

Tax

When tax is present in a market, there are *two* pieces of interest

- the price the demander pays
- the price the supplier gets

These two prices differ by the amount of the tax.

Tax

It doesn't matter which way the tax is levied.

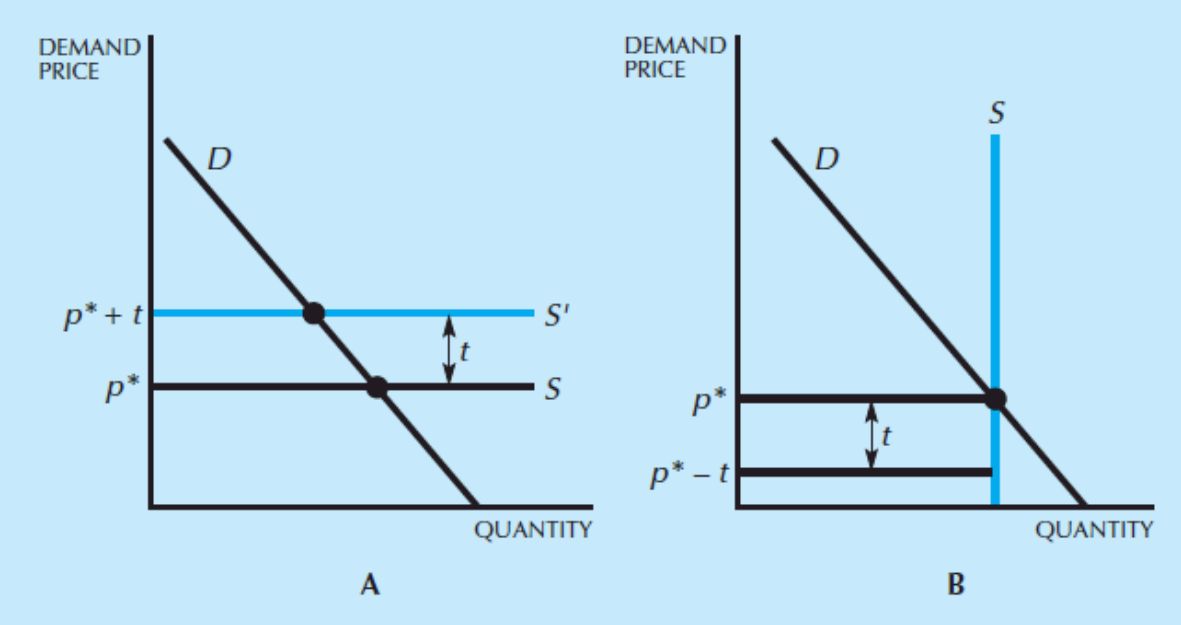
- If the tax is being imposed on the demanders, the equilibrium quantity traded is that quantity q^* such that the demand price at q^* *minus the tax being paid* is just equal to the supply price at q^*.

$$P_D(q^*) - t = P_S(q^*)$$

- If the tax is being imposed on the suppliers, then the condition is that the supply price *plus the amount of the tax* must equal the demand price.

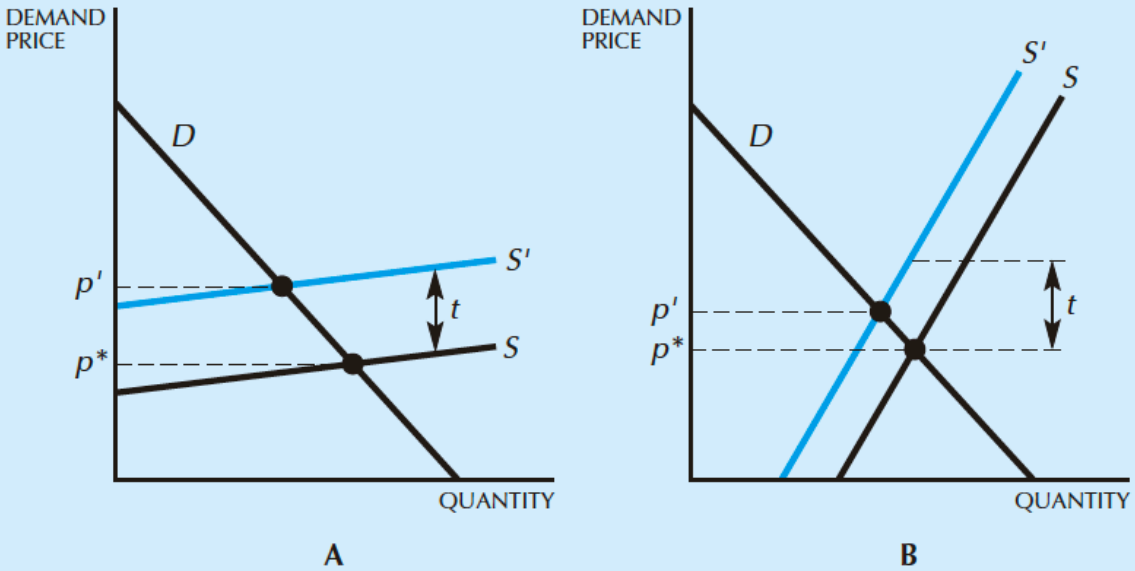
$$P_D(q^*) = P_S(q^*) + t$$

An example of passing along a tax: two extreme cases:



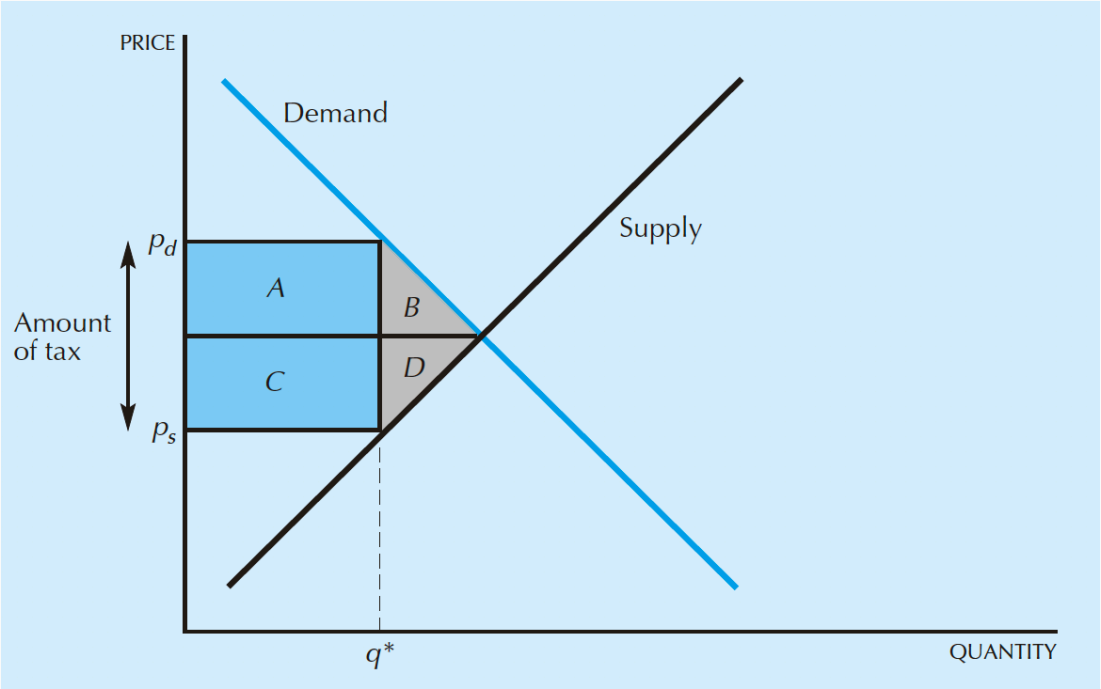
- Figure A: the ideal world of the **suppliers** with perfectly elastic supply curve. The tax gets completely passed along to the consumers.
- Figure B: the ideal world of the **consumers** with perfectly inelastic supply. None of the tax gets passed along.

General example of passing along a tax



Passing along a tax. (A) If the supply curve is nearly horizontal, much of the tax can be passed along. (B) If it is nearly vertical, very little of the tax can be passed along.

The deadweight loss 无谓损失 of a tax



- The government gains A+C from the tax.
- The deadweight loss (excess burden) is measured by the area B+D. It is the social cost of the tax.

What is the source of this excess burden? Basically it is the lost value to the consumers and producers due to the reduction in the sales of the good.

Questions?