Econ 1101
Spring 2013
Week 3

Section 038

2/6/2013

Announcements

- Homework 2 due Friday night at 11:45pm, CST

Agenda for today

1. The concept of elasticity
2. Related case study
3. Income elasticity of demand
4. Econland
5. Pareto Efficiency

Elasticity

Last class: discussed direction of effects.

For example:
(1) own price ↑ then Q^D ↓
(2) substitute price ↑ then Q^D ↑

This class: beyond the direction, we are interested in the magnitude.

Sure Q^D ↓ when own price↑.
But by how much?

Sure Q^D ↑ when substitute price ↑. But by how much?

Elasticity, cont'd

Responsiveness of demand and supply to changes.

What kinds of changes? Three types we will look at:

1) Price
2) Income
3) Price of a related good

Perhaps we can just use the slope? $$\frac{\Delta Q^D}{\Delta P} = \frac{Q_2^D - Q_1^D}{P_2^D - P_1^D}$$

Nope, defective because of units issue. Cannot compare two goods this way.

Example:

- A $1 increase in price causes a decrease in quantity demanded of 5000 beads
- A $1 increase in price causes a decrease in quantity demanded of 1 can of spam

Elasticity, cont'd

Get units out by using percentages

e^D = Price elasticity of Demand (midpoint method: gives us same elasticity between two points)

$$-\frac{\%\Delta Q^D}{\%\Delta P} = -\frac{\frac{Q_2 - Q_1}{\frac{1}{2}(Q_2 + Q_1)}}{\frac{P_2 - P_1}{\frac{1}{2}(P_2 + P_1)}}$$

Elasticity, cont'd

Maybe this will help…

Think about a rubber band, you apply force to it to see how much it changes in its shape.

Similarly, the "force" is now price (for price elasticity of demand), income (for income elasticity of demand), or price of a related good (for cross price elasticity of demand) and the "shape" is now quantity demanded.

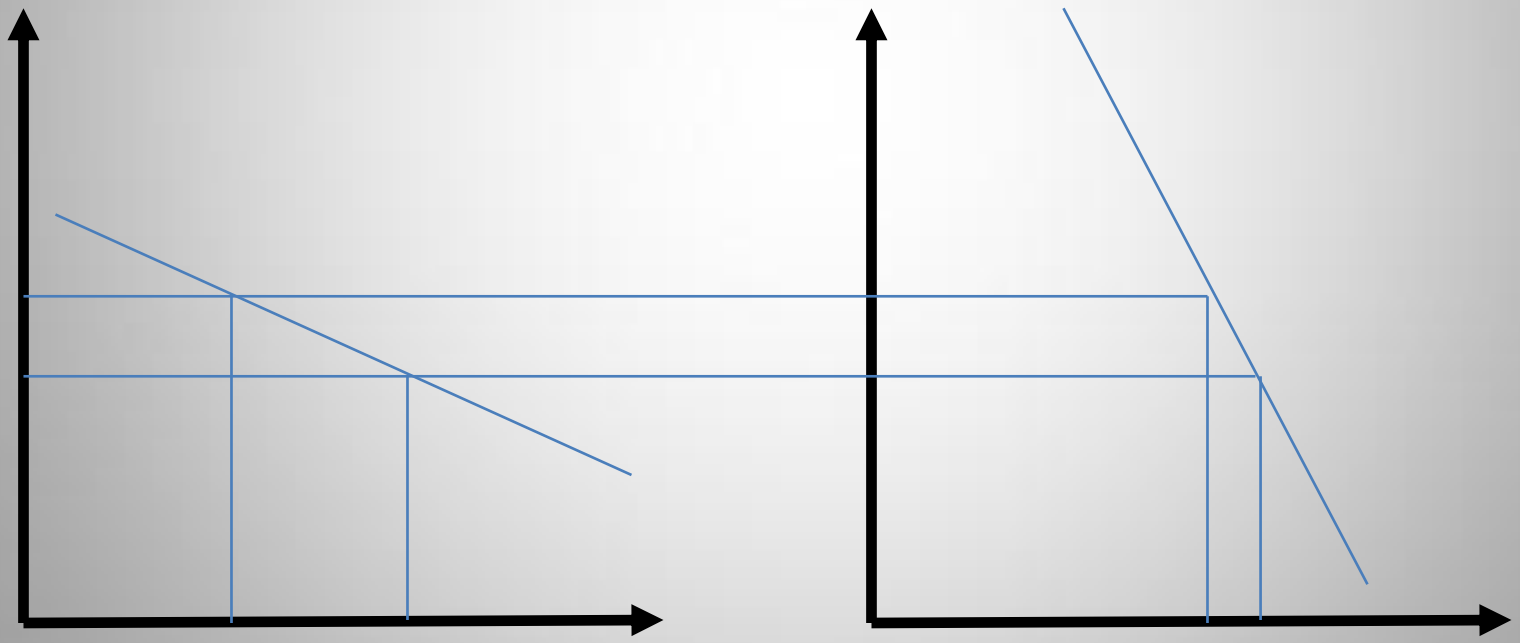
How responsive is quantity to price? Or income? Or the price of a related good?

Graphically

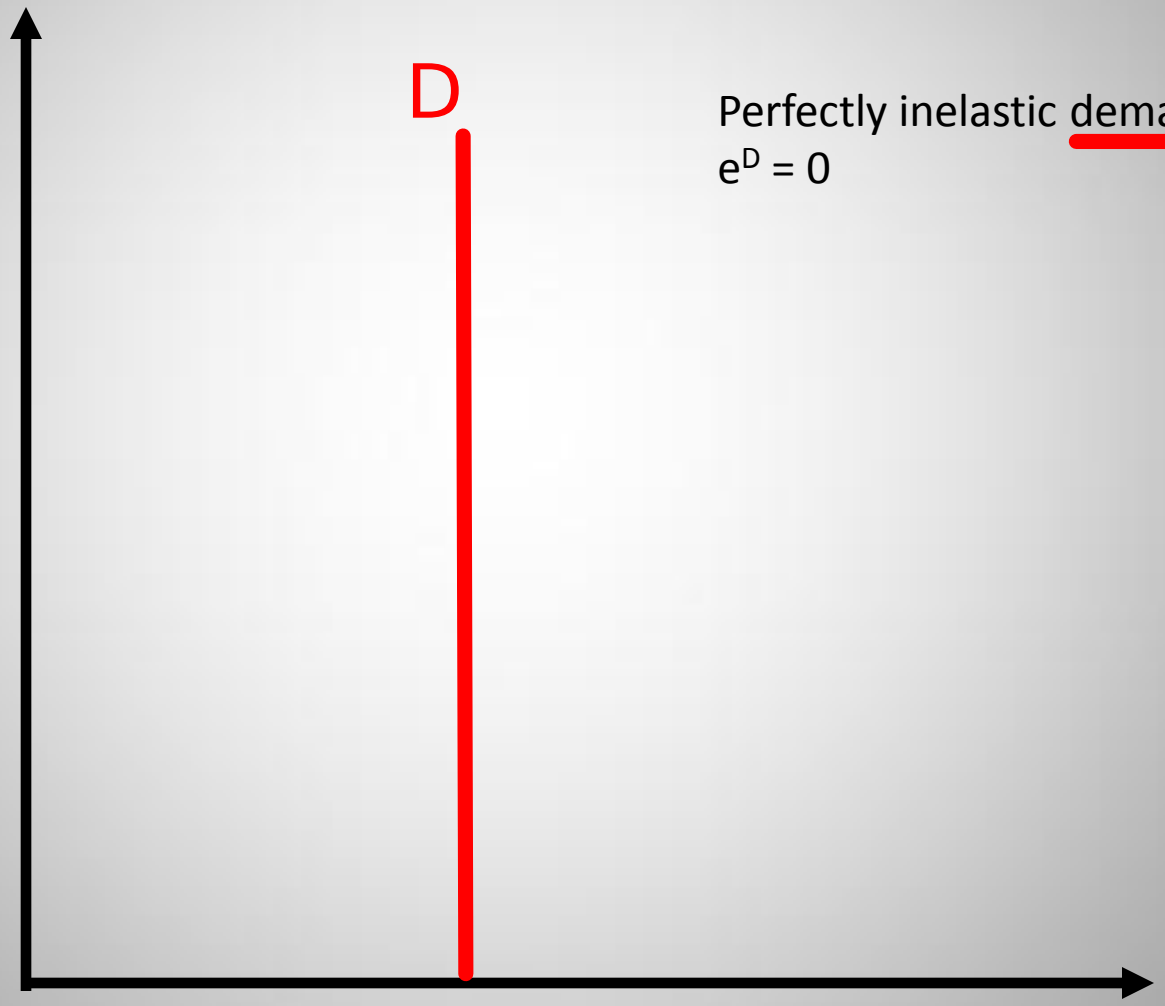
Which one is more responsive to a change in price?

Elastic

Inelastic



Elasticity, cont'd



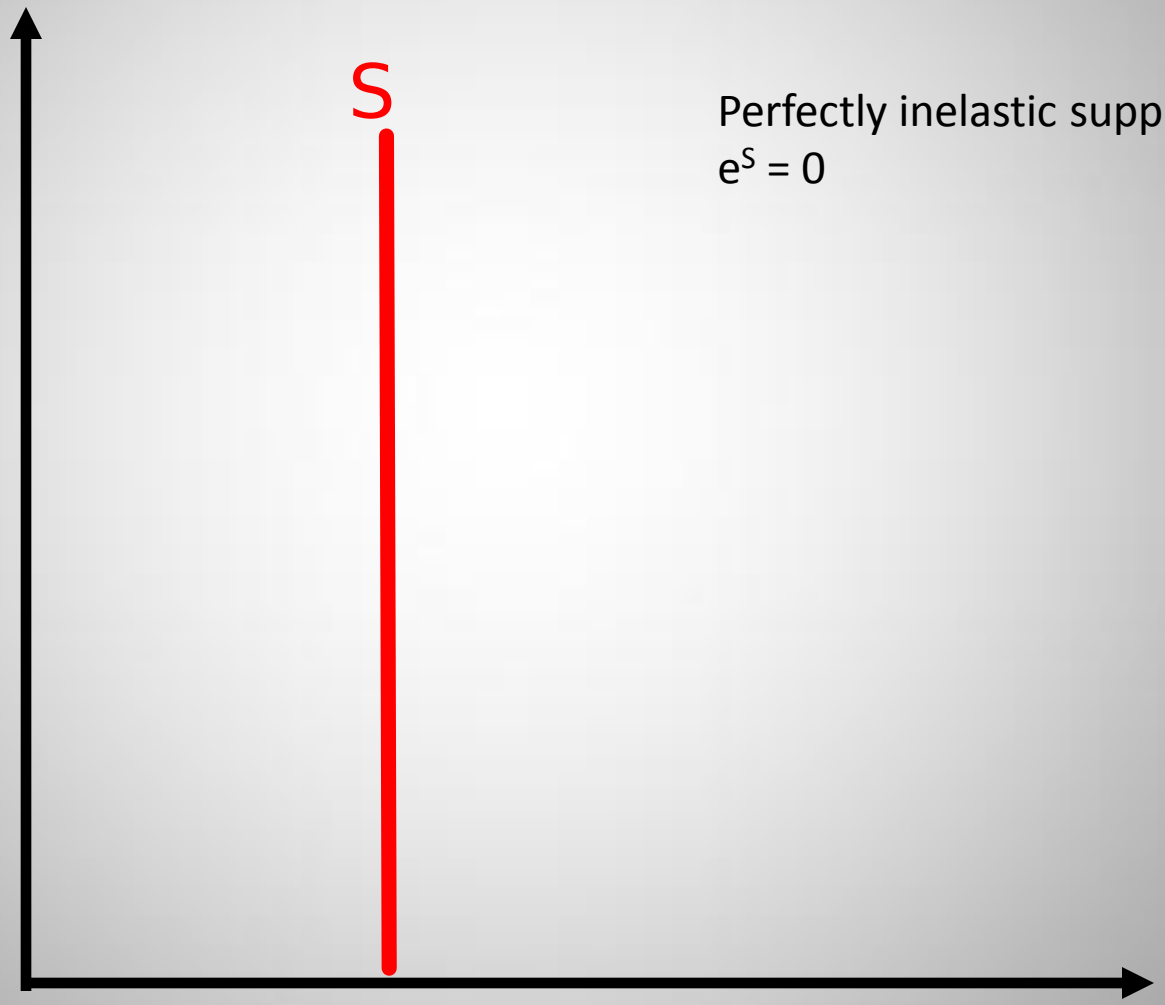
Perfectly inelastic demand

$e^D = 0$

Examples:

Insulin

Elasticity, cont'd



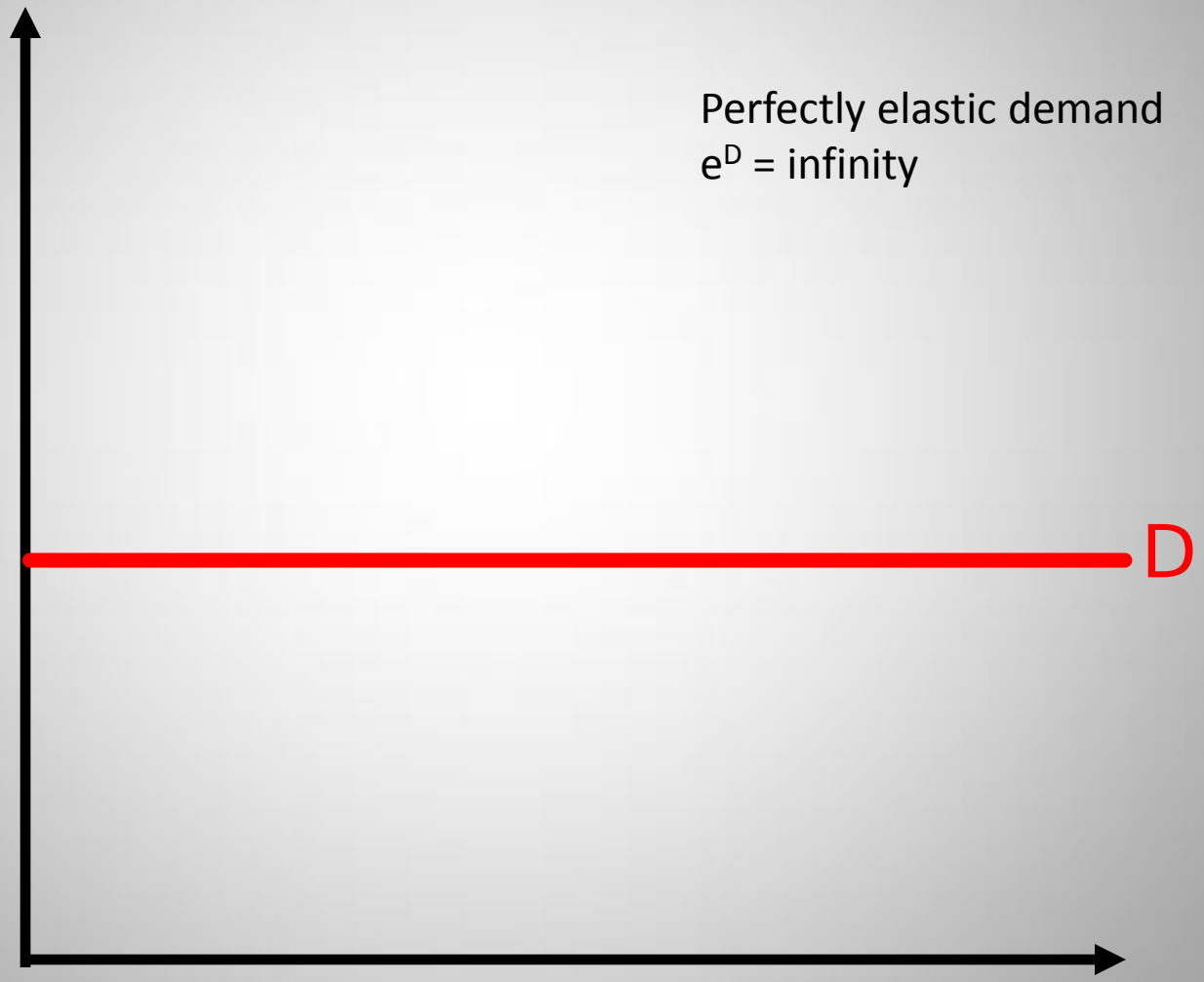
Perfectly inelastic supply

$e^S = 0$

Examples:

Properties at the beach, Rembrandt paintings

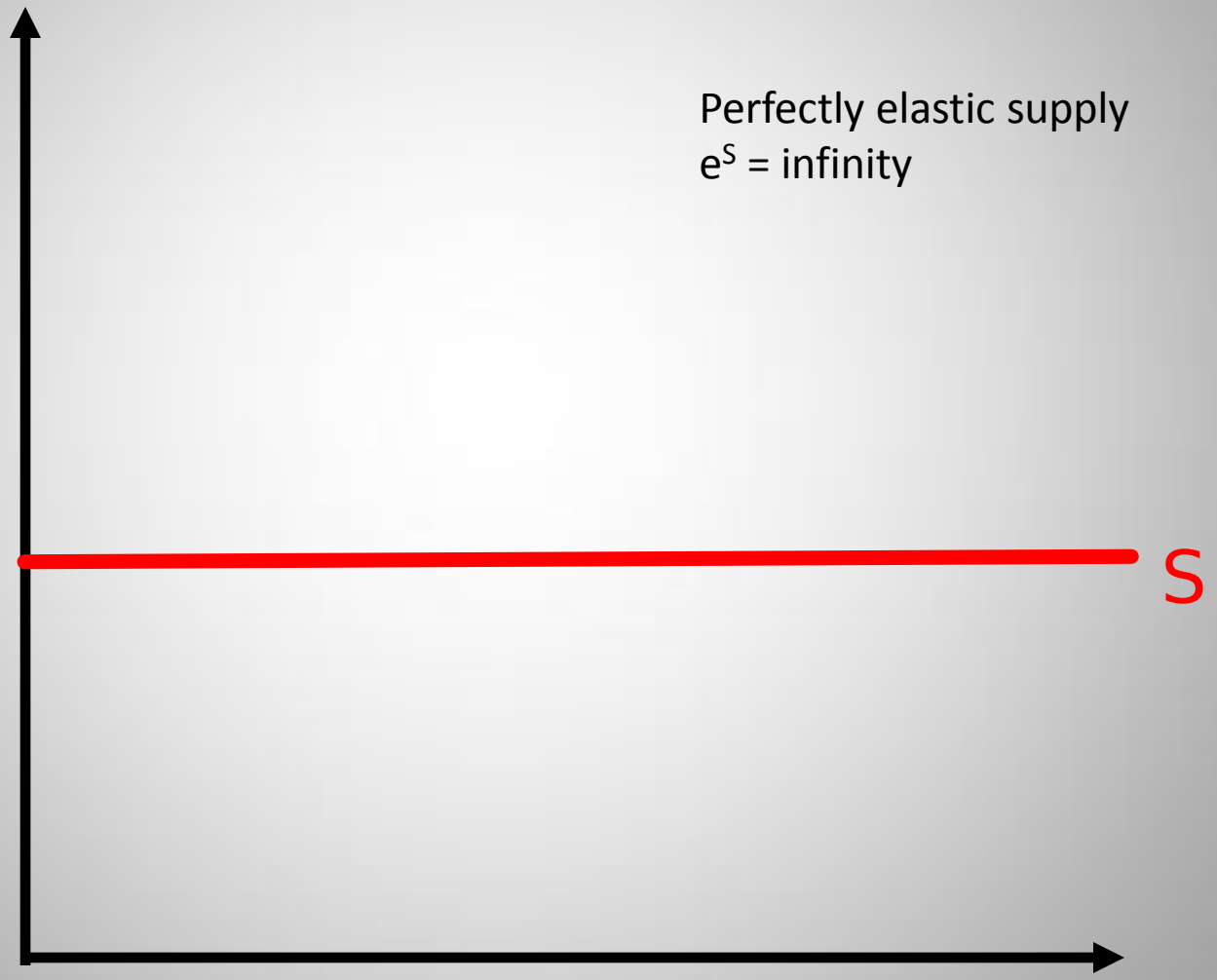
Elasticity, cont'd



Examples:

paper clips (very standard goods)

Elasticity, cont'd



Examples:

goods with no economies of scale

Elasticity, cont'd

In between cases:

(1) When $e^D < 1$ we say: Demand is Inelastic
Total Spending = P*Q increases as P increases.
(Basically, if price goes up by 1%, quantity demanded goes down by less than 1%)

(2) When $e^D > 1$ we say: Demand is Elastic
Total Spending = P*Q decreases as P increases.
(Basically, if price goes up by 1%, quantity demanded goes down by more than 1%)

(3) When $e^D = 1$ we say: Demand is Unit Elastic
(Basically, if price goes up by 1%, quantity demanded goes down by exactly 1%)

Let's try to calculate e^D in an example.

Example

Time Period	Per Capita Daily Consumption of Motor Gasoline	Average Price Per Gallon in Dollars
June 2007	1.32	3.05
June 2008	1.26	4.07
Δ	–.06	1.02
Average of Both Years	1.29	3.56
%Δ	–.05	.28

Example, cont'd

So

$$e^D = -\frac{\%\Delta Q^D}{\%\Delta P} = \frac{.05}{.28} = .16$$

Short-Run Demand is Inelastic

As price goes up,

Total Spending = P*Q increases.

Example, cont'd

When estimating demand elasticity, we need to hold fixed other determinants of demand in order to isolate the impact of the change in price.

Why?

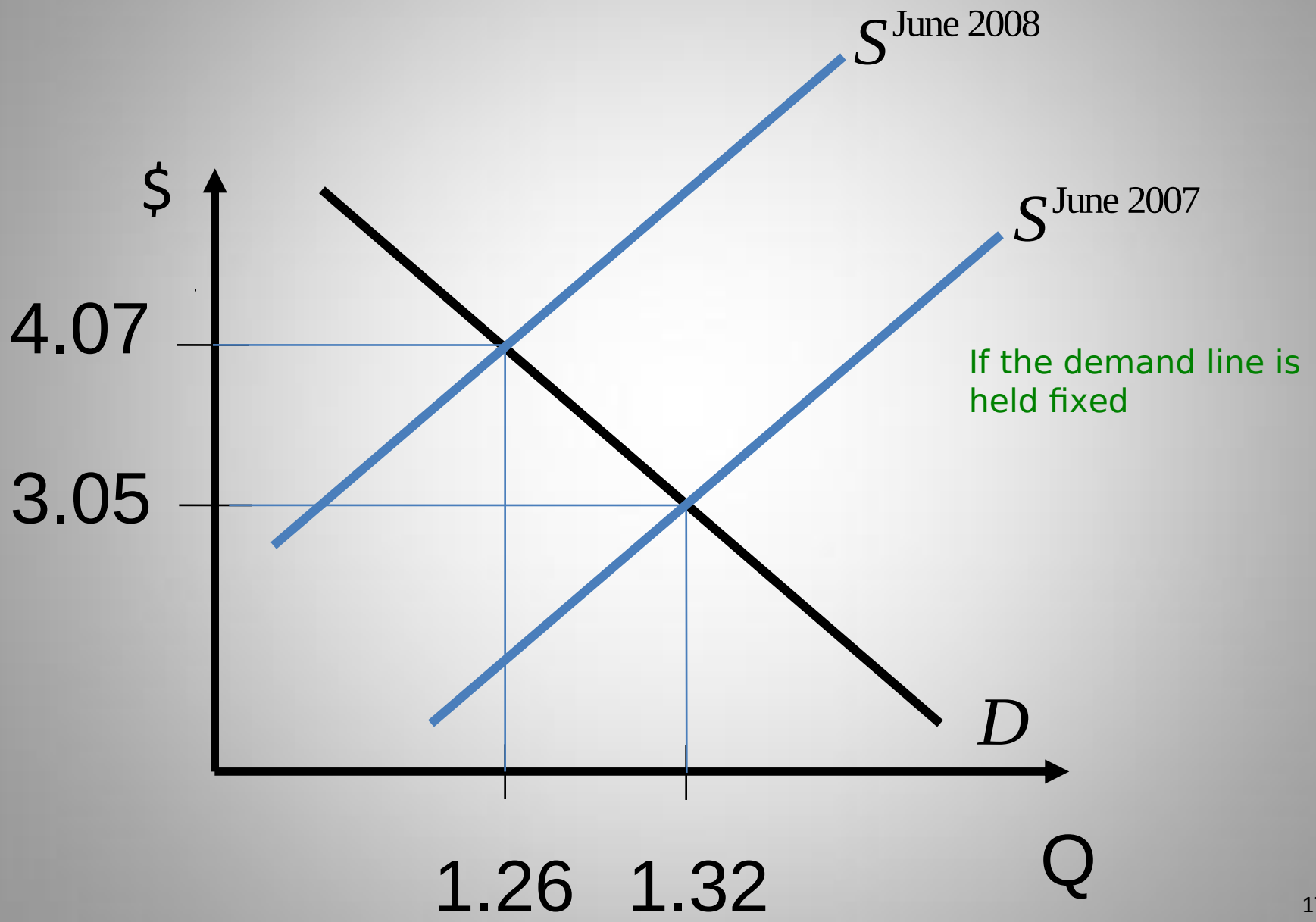
Ex: Price elasticity of demand

What are we trying to find?

What happens if we don't hold other factors fixed?

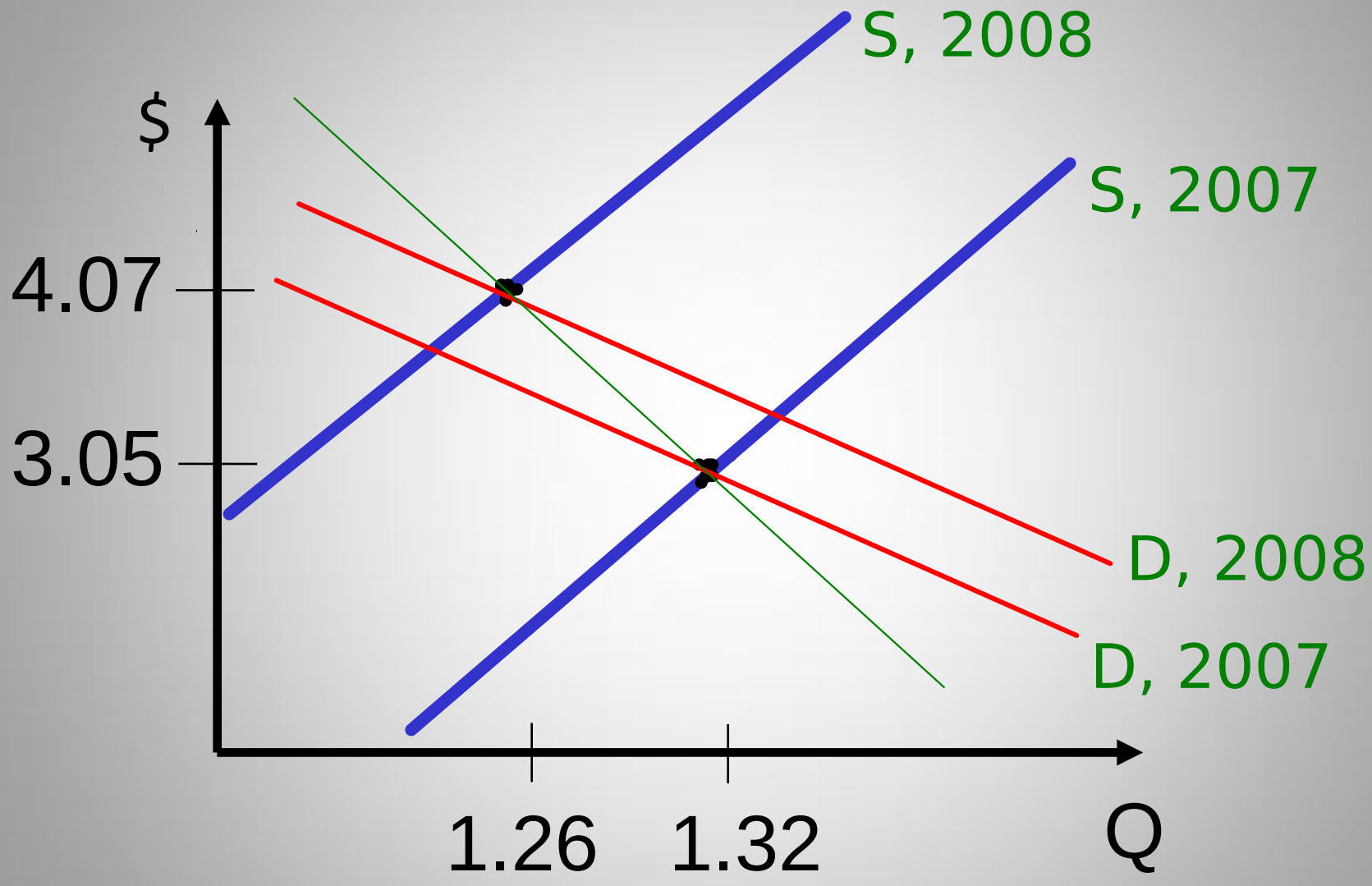
Also need to take into account supply. Some of you might be thinking: "Why is what we calculated the elasticity of demand and not the elasticity of supply?"

Example, cont'd



If the demand line is held fixed

Example, cont'd



The elasticity we calculated before refers to the thin green line, rather than the (true) red demand lines.

Example, cont'd

We show that it is the demand elasticity by seeing that:

- The supply curve did shift:

Price of barrel of oil increased from $65 to $121. Oil is an input in making gasoline. An increase in input prices shifts the supply curve up and to left.

- Demand Curve Did Not Shift (So movement along Demand)
  - Have to argue that the determinants of demand (the things that make it shift) remained unchanged.

Example, cont'd

Let's go through the determinants of demand

1) Tastes of consumers
   - Seasonality in Demand (drive more in summer than spring). Hold this fixed here by comparing June to June.

2) Number of consumers
   - Population grows over time. Hold fixed here by using per capita numbers.

Example, cont'd

3) Income

- Gas is a normal good. So in order for demand not to shift, income can't change. Income not that much different June 2007 to June 2008. (But things started looking different later in 2008, as the economy started falling off a cliff on account of the economic crisis.)

4) Prices of substitutes and complements

- Didn't change much over this one year period.

Long Run Elasticity

Elasticity we have estimated is a short-run elasticity.

Consumers have not had much time to make a response.

Over a long period of time, if gas is significantly higher in price:

- Consumers will buy different cars
- Might live in different places
- Society might change the laws, like lower the speed limit.

For the long-run elasticity, we need to compare cases where prices have been different for a long time.

Case Study

Let's take a look at Reading 2:

"Fuel Consumption in Europe and the U.S."

Europe has long taxed gasoline. What we pay here at the pump for gas wouldn't pay the tax in the Europe.

The tax here is (per gallon):

Federal	18.4 cents
State (MN)	40.4
Total (MN)	58.8

(23 cents more in CA)

Case Study, cont'd

Country	Average Price $US per Gallon	Consumption Per Capita Gallons Per Day	Per Capita GDP ($1,000)
United States	2.80	1.29	45.5
Selected Countries in Europe			
Norway	7.00*	.30	51.9
United Kingdom	6.90	.28	35.7
Germany	6.88	.25	34.3
France	6.37	.15	32.7
Spain	5.13	.15	31.6
Italy	6.50	.21	30.4
Some Other Countries			
Japan	4.49	.33	33.6
Mexico	2.45	.29	14.0
China	2.29	.04	5.3

Case Study, cont'd

Price and Per Capita Quantity Consumed of Gasoline
The United States and Norway in 2007

Time Period	Per Capita Daily Consumption of Motor Gasoline	Average Price Per Gallon in Dollars
United States (the "now")	1.29	2.80
Norway (the "future")	.30	7.00
Δ	-.99	4.20
Average of Both Periods	.80	4.90
%Δ	-1.24	.86

So: Elasticity(long run)
= %ΔQ/%ΔP
= 1.24/.86= 1.44

Case Study, cont'd

Is this valid?

1) Is Supply Curve is shifting between these two countries?

Yes. Because the tax on gas in Norway shifts the supply curve up and to the left.

2) Is Demand Curve staying fixed?

Have to analyze this step by step:

A) Income

We picked Norway because income is approximately the same as US. Note gas is a normal good so we need to be careful to hold fixed income in the comparison. Look in the table at China's consumption of gas. It is small because China is still a poor country.

What about price of substitutes? (i.e. what are some substitutes?)

Case Study, cont'd

B) Price of Substitutes

Oops. Public transit is more convenient in Norway, it is a better option. The availability of a substitute shifts the demand for gas down and to the left. So our simple analysis gives the higher price too much of the credit for the lower consumption in Norway. Demand for gas in Norway is lower both because the price of gas is higher and because public transit is better.

So the actual elasticity is lower than the 1.44 estimate above. (i.e. instead of saying a 1% increase in price causes a 1.44% decrease in quantity, some of that decrease in quantity is due to availability of substitutes and not just because of the 1% price increase)

Case Study, cont'd

C) Other Factors

Population Density?

Population density is lower in the US than Europe and that is one reason demand for gas is higher in US. (But Norway is less dense than most European countries, so Norway and U.S. comparison is not as bad)

Summary

What Makes Demand More Elastic?

1. Long time horizon

2. Luxury, not a necessity.

3. When products are defined more narrowly so there are better substitutes.

Look at Food

A) Price elasticity of food as a group is low (inelastic). So if all prices increase by 10%, quantity falls less than 10% (so spending on food goes up).

Price of food goes up overall, you still need to eat.

Summary

B) But now suppose look at one kind of food, meat. Raise price of meat, price of other foods fixed...

Some possibilities for substitution: fish, bread, etc.

C) Now look at raising price of Johnsonville Brats 10%

- Can easily substitute a different brand of brat, so very responsive to changes in price.

Income Elasticity of Demand

$$e^{Income} = \frac{\%\Delta Q^{D}}{\%\Delta Income}$$

If Income Elasticity of Demand (IED) > 0, the good is…..

NORMAL

If Income Elasticity of Demand (IED) < 0, the good is….

INFERIOR

Income Elasticity of Demand

For Normal Goods:

Two kinds:

Necessity <1

(Or income inelastic. Spending share falls as income rises)

toilet paper…

Luxury >1

(Or income elastic: Sending share rises as income rises)

vacation homes... and

Income Elasticity of Demand

Health Care

(At country level)

Look at this data on health care spending as percent of GDP (gross domestic product) for various countries

Data from, Uwe E. Reinhardt, Peter S. Hussey and Gerard F. Anderson, "U.S. Health Care Spending In An International Context," Health Affairs, 23, no. 3 (2004): 10-25 http://content.healthaffairs.org/cgi/content/full/23/3/10

Income Elasticity of Demand

County	GDP per Capita	Health Spending Share
US	35.2	13.9
Switzerland	29.9	11.1
Norway	36.4	9.0
Germany	26.2	10.7
Canada	28.8	9.7
Average Rich	31.3	10.9
Hungary	13.4	6.8
Slovak Rep	12.0	5.7
Mexico	8.9	6.0
Turkey	5.7	4.8
Average Poor	10.0	5.8

So health care at the country level is clearly an income elastic good.

Richer countries tend to spend a higher share of income on health care.

Introducing Econland

Now, let's look at something different: let's introduce a model that we will use to study how markets work.

As is standard practice in economics, the model will be fully specified. We will be explicit about all the agents in the economy and how they behave.

Econland

- Our toy economy that follows some explicit assumptions. Like the map example from the first day of class, what happens in Econland can tell us something useful about the real world.
- Useful because we can use Econland to examine the efficiency of competitive markets and the impacts of government policies.
- Inhabitants: D1, D2, D3,….D10 and S1, S2, S3, ….,S10
- Only “D” (Demand) people eat Widgets, and each D person can eat at most one widget.
- Each D person has a reservation value for one widget. Amount of dollars he would be exactly willing to give up to get one.

Table of Reservation Values

Name	Reservation price for one widget
D1	9
D2	8
D3	7
D4	6
D5	5
D6	4
D7	3
D8	2
D9	1
D10	0

Suppose D1 has $20 to start with.

D1 indifferent between:

$20 and 0 widget

Or

$11 and 1 widget (he values a widget a $9, so $20-$9 = $11)

Suppliers

S people:

- Don’t eat widgets
- But know how to make them
- However, they get hungry from widget work (so they won’t do it for free!)

Cost to an S person to make one widget can be interpreted as the amount of dollars we have to give her so she is just willing to do it.

Table of Costs

Cost of one widget (dollars)	Name
1	S1
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10

Suppose S3 has $20 to start with.

S3 indifferent between:

$20 and making 0 widget

Or

$23 and making 1 widget (She must get $3 from selling a widget to be still indifferent)

Putting it together

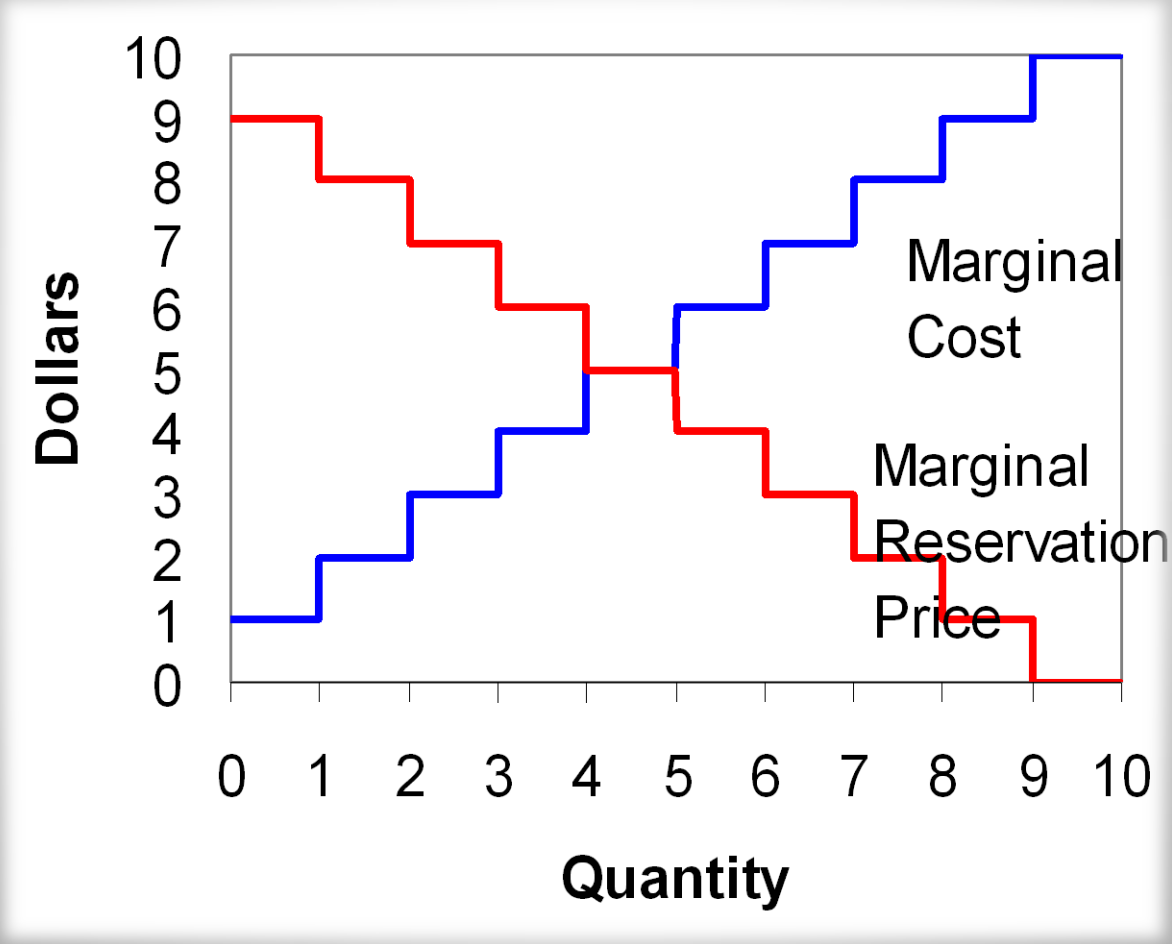
Name	Res. Price	Cost	Name
D1	9	1	S1
D2	8	2	S2
D3	7	3	S3
D4	6	4	S4
D5	5	5	S5
D6	4	6	S6
D7	3	7	S7
D8	2	8	S8
D9	1	9	S9
D10	0	10	S10

From the society's point of view

- Marginal Cost: the cost of the next one in (think of the additional cost to sellers as a group due to the next unit)

- Marginal Reservation Price: The value of the next one in (or additional value to buyers as a group that the next unit provides)
  - Often referred to as marginal benefit

Plotting it on a graph



Econland

Suppose we set up a market economy in Econland

At P=3, who is willing to sell?

So Q^S is 3

So from Marginal Cost curve, we get supply curve

At P=7, who is willing to buy?

So Q^D is 3

So from Marginal Reservation Price curve, we get demand curve (at each price, how much quantity is demanded)

Name	Res. Price	Cost	Name
D1	9	1	S1
D2	8	2	S2
D3	7	3	S3
D4	6	4	S4
D5	5	5	S5
D6	4	6	S6
D7	3	7	S7
D8	2	8	S8
D9	1	9	S9
D10	0	10	S10

Econland

What happens when Econland is a Market Economy?

P: Price of a widget
MRP is demand curve
MC is supply curve

Equilibrium:
Q = 5
P = $5

S1, S2, S3, S4, S5 produce
D1, D2, D3, D4, D5 consume

Gains from trade

What are the gains from trade (being in the market)?

Consumer Surplus (CS) of particular buyer

= reservation price – price paid

Producer surplus (PS) of seller profit

= price received – cost

Surplus in Econland

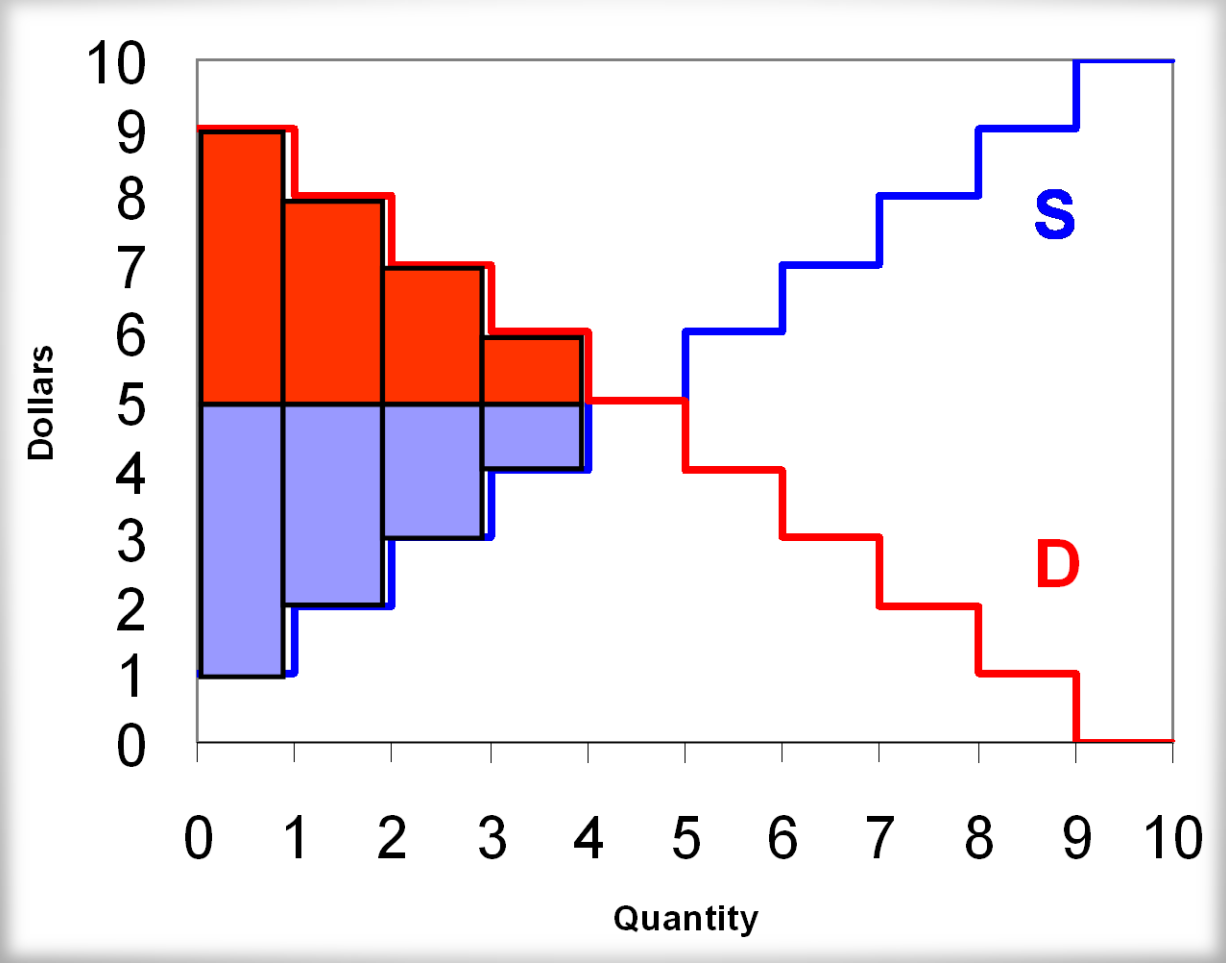
Q	Res. Price	price paid	CS	Price rec.	Cost	PS
1	9	5	4	5	1	4
2	8	5	3	5	2	3
3	7	5	2	5	3	2
4	6	5	1	5	4	1
5	5	5	0	5	5	0
6	4	-	0	-	6	0
7	3	-	0	-	7	0
8	2	-	0	-	8	0
9	1	-	0	-	9	0
10	0	-	0	-	10	0
Total			10			10

Surplus in Econland

- Consumer Surplus is $10
- Producer Surplus is $10

- Total Surplus is just Consumer Surplus + Producer Surplus
  - So Total Surplus = $20 in this example

Graphically



Surplus in Econland

Consumer Surplus

- Area between demand curve and price line

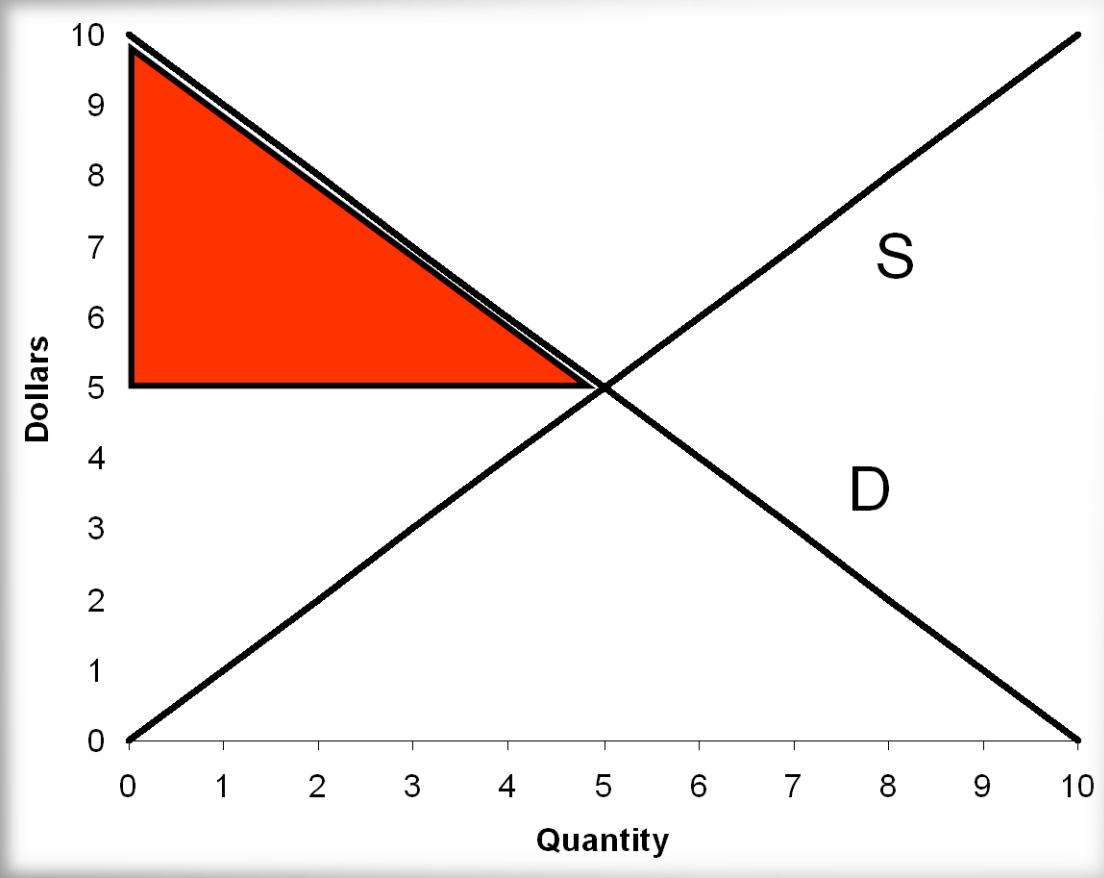
Producer Surplus

- Area between price line and supply curve

In Econland, demand and supply curves look like steps

- In economy with lots of people, we won't notice the steps, things will smooth out (this example had 10 people, but think about an economy with 1000 people, the steps will become smaller. Now think about an economy with infinitely many people)

General Case



CS = Area of Triangle
= ½×5 ×5 = 12.5

PS = ½×5 ×5 = 12.5

TS = CS + PS = 25

Efficiency

We just have the same supply and demand diagram that we've always been looking at. This is the case when the allocation is a **market allocation** (P, Q, and Who are determined competitively)

How should we interpret this new "Total Surplus" idea? Look at it like a "Social surplus"… or if it helps, a "Social pie"

Consumers get part of the social pie, producers get part of the social pie.

But can we say that the market allocation is efficient?

What does it mean for an allocation to be efficient? We need a concept of efficiency.

The standard concept in Economics is **Pareto Efficiency**

Pareto Efficiency

- Vilfredo Pareto 1848-1923

- An allocation is Pareto Efficient if it is feasible and there is no way to make someone better off without making someone worse off.
- Alternatively: The Pie is big as it can be. (If someone is to get a bigger slice, it can only come from someone else getting a smaller slice.)

Example

There are 6 pieces of a cake.
Are the following allocations Pareto efficient?

2 pieces to the student, 2 pieces to me, and 2 pieces in the trash

No, I can take those pieces from the trash and be better off

4 pieces to me, 2 pieces to the student

Pareto Efficient

6 pieces to me, none for the student

Pareto Efficient

8 pieces to me, none for the student

No, because not feasible

Where does equity show up in the definition of efficiency?

Pareto Efficiency

Name	Res. Price	Cost	Name
D1	9	1	S1
D2	8	2	S2
D3	7	3	S3
D4	6	4	S4
D5	5	5	S5
D6	4	6	S6
D7	3	7	S7
D8	2	8	S8
D9	1	9	S9
D10	0	10	S10

Let's go back to the Econland numbers Reservation Prices and Costs for Widgets

Pareto Efficiency

1. Suppose we have an allocation where D8 consumes a widget but D2 does not. Is this Pareto efficient?

Name	Res. Price	Cost	Name
D1	9	1	S1
D2	8	2	S2
D3	7	3	S3
D4	6	4	S4
D5	5	5	S5
D6	4	6	S6
D7	3	7	S7
D8	2	8	S8
D9	1	9	S9
D10	0	10	S10

No, because D2 could have bought it from D8 and both would have been better off

Pareto Efficiency

2. Suppose we have an allocation where S7 produces a widget but S1 does not. Is this Pareto efficient?

Name	Res. Price	Cost	Name
D1	9	1	S1
D2	8	2	S2
D3	7	3	S3
D4	6	4	S4
D5	5	5	S5
D6	4	6	S6
D7	3	7	S7
D8	2	8	S8
D9	1	9	S9
D10	0	10	S10

No, because S1 could have produced it and both could have been better off

Something to think about

- Then what is a Pareto Efficient allocation in Econland?