Lecture 2:
Elasticity

September 1, 2026

Overview

1. Administrative stuff
2. Supply or demand shifts
   - predicting equilibrium
   - knowing equilibrium and predicting shifts
3. Non-linear demand curves

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1. Administrative stuff
2. Supply or demand shifts
   - predicting equilibrium
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Elasticity

1. Defining supply and demand elasticity
2. Useful elasticity terms
3. Why elasticity matters for policy
4. Other kinds of elasticity

Course Administration

1. Ripped from Headlines sign-up cleaned up – please check

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2. Problem Set 1 should be turned in
3. Problem Set 2 is posted

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4. Quiz 1 is Lecture 4, Sept. 15

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2. Problem Set 1 should be turned in
3. Problem Set 2 is posted
4. Quiz 1 is Lecture 4, Sept. 15
   - focus is understanding supply and demand from data
5. Any other questions or outstanding issues?

How What You're Learning is Policy-Relevant

Ripped from Headlines presentation(s)

As a reminder, next week
Send the article by Wednesday midnight for approval

Afternoon

Finder	Presenter
Kordiea	Emily
Abby	Anders

Evening

Finder	Presenter
Kubra	Joshua
Shoshana	Nicole-Antoinette
Sydney	Ben

Today's Ripped from the Headlines

Afternoon

Finder	Presenter	Summarizer
Emily	Abby	Zoey
	Bora	

Evening

Finder	Presenter	Summarizer
Aryaa	Muriel	Jevel
Devan		Maria
Jevel	Emma	Sarah J.

Supply and Demand Reminder

Where We Left Off

Demand

1. Price
2. Number of consumers
3. Consumer income or wealth
4. Consumer tastes
5. Prices of other goods

Supply

1. Price
2. Suppliers' costs of production
3. Number of sellers
4. Sellers' outside options

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Defining Market Equilibrium

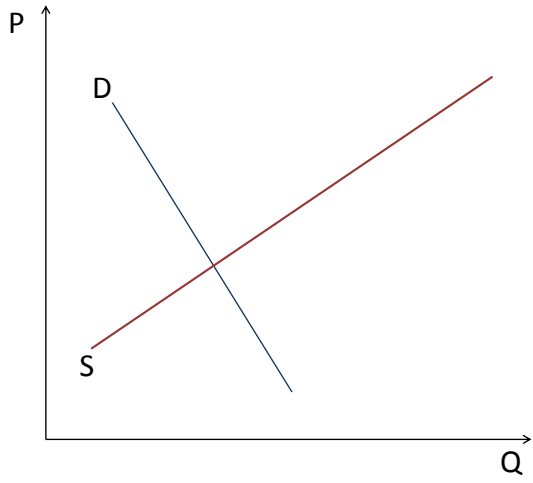
- Point at which consumers' quantity demanded equals producers' quantity supplied
  - $Q^D = Q^S$
- Equilibrium price $\equiv$ price at which quantity supplied equals quantity demanded
  - P such that $Q^D = Q^S$

Last class we discussed the impact of a shift in demand

Impact of Shift in Supply

- Suppose that the drought in California ends, and California can now produce more tomatoes
- What happens to the supply curve?

Where Does Supply Curve Go?



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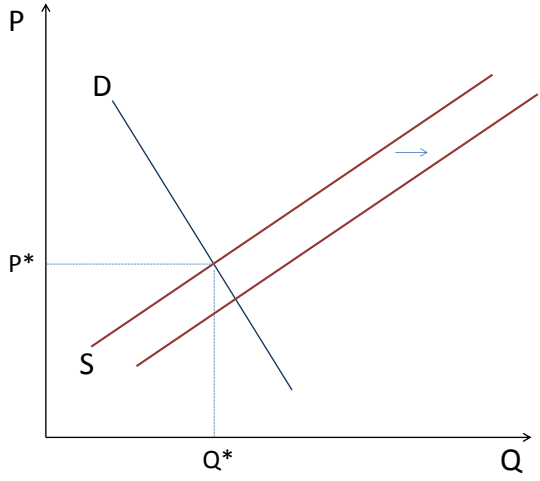

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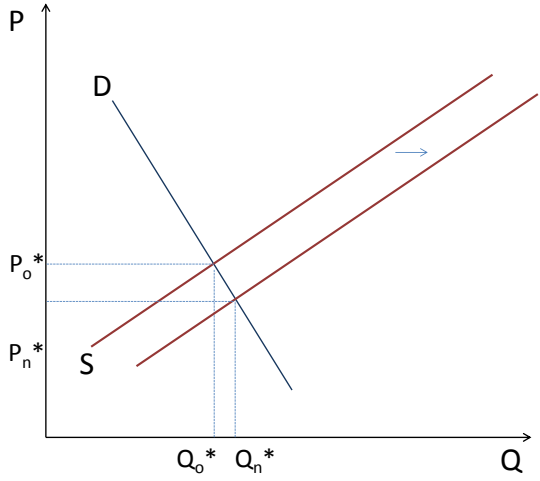

Algebra: Impact of Shift in Supply

- Suppose that we learn that ADM develops a tomato that ripens more quickly, increasing yields
- For any price, the quantity supplied of tomatoes increases by 400
- Recall $Q^{S,original} = 200P - 200$
- Then

$$Q^{S,new}$$

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Therefore

- Price falls
- Equilibrium quantity increases

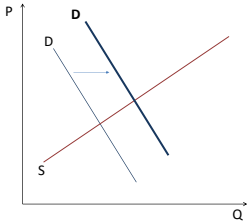
What Can You Conclude About Supply and Demand Changes from Changes in P^* and Q^*?

Deducing Changes to Supply and Demand from Changes in P and Q

- Assume only supply or demand changes
- Suppose that we observe a decrease in the price of coffee
- And suppose that we also observe an increase in the quantity of coffee consumed
- What can we assume happened to supply and demand?
- Work through problem step-by-step with your neighbor

All Four Different Cases: Want $P \downarrow$ and $Q \uparrow$

(a) Demand increases



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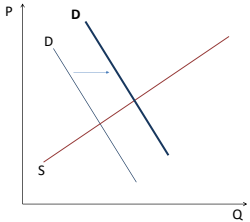
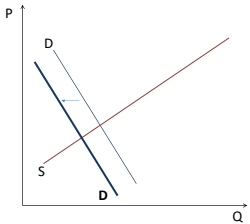


(b) Demand decreases



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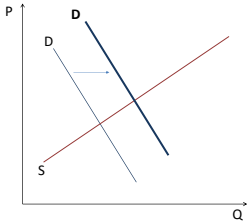

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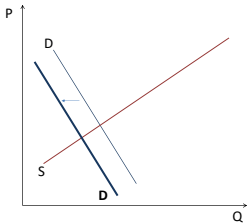

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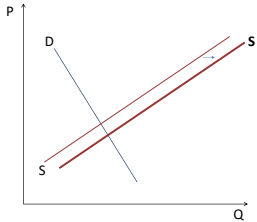

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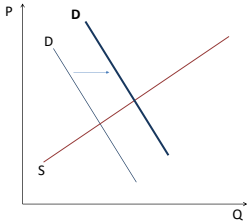

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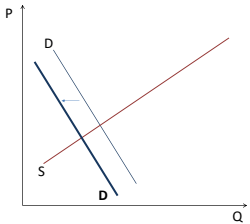

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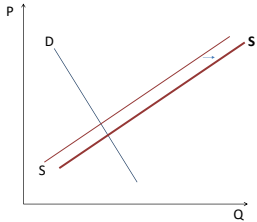

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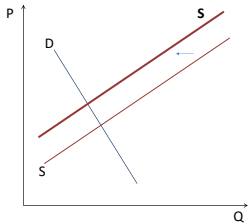

Deducing Changes to Supply and Demand from Changes in P and Q

Assume only supply or demand changes and that (1) prices decrease and (2) quantity of vanilla increases

- Prices decrease
  - Consistent with decrease in demand
  - Consistent with increase in supply
- Quantity increases
  - Consistent with increase in demand
  - Consistent with increase in supply
- $\rightarrow$ Demand constant, supply increased.

What if Both Supply and Demand Curves Shift?

You can predict the direction of only price OR quantity.

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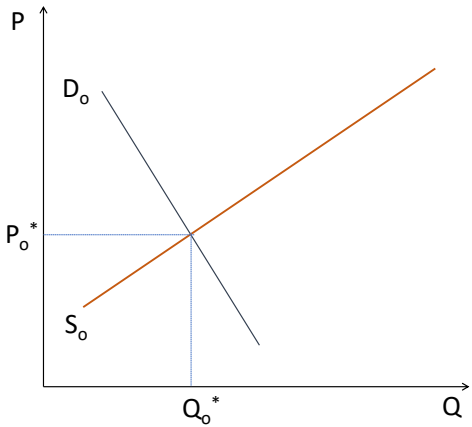

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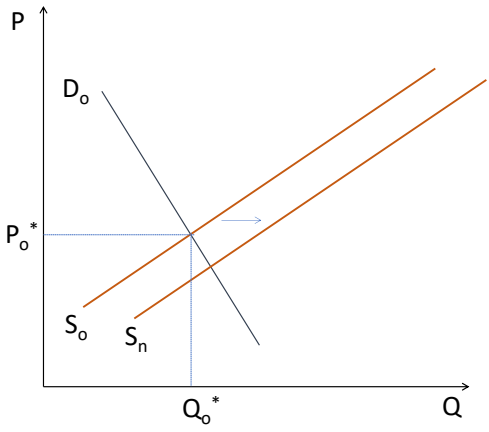

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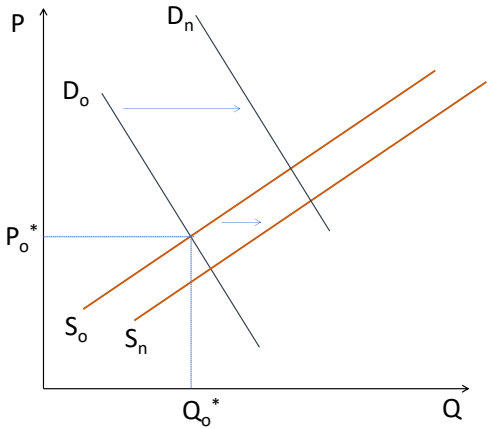

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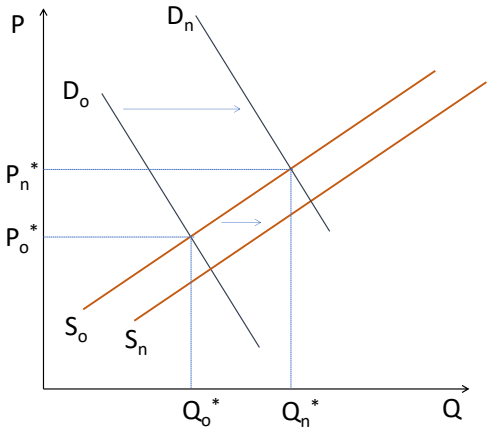

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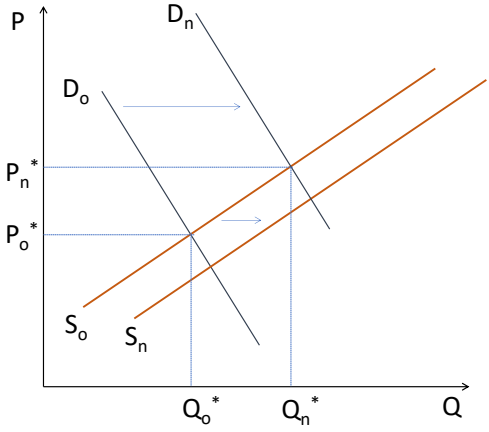

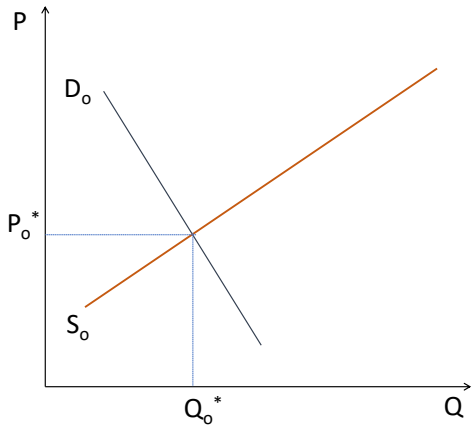

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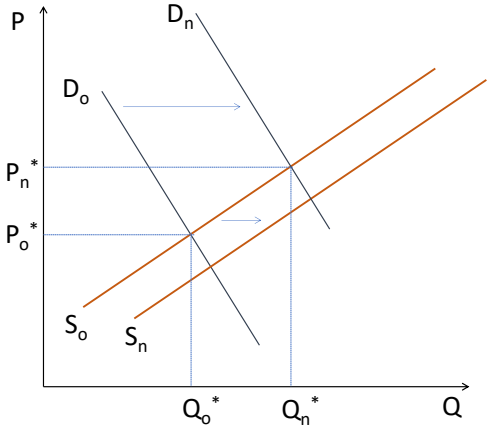

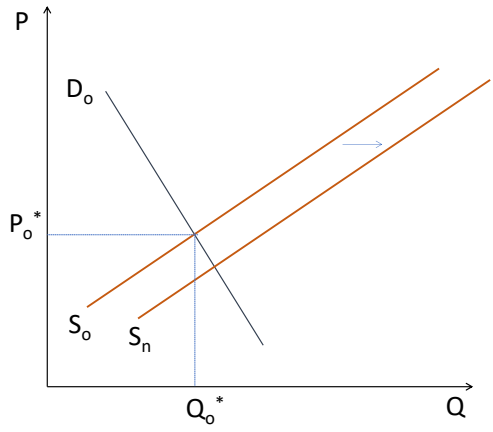

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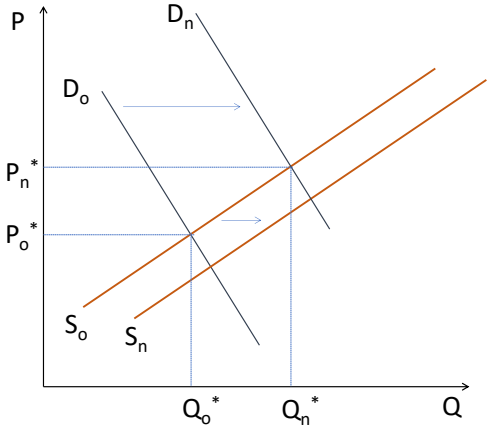

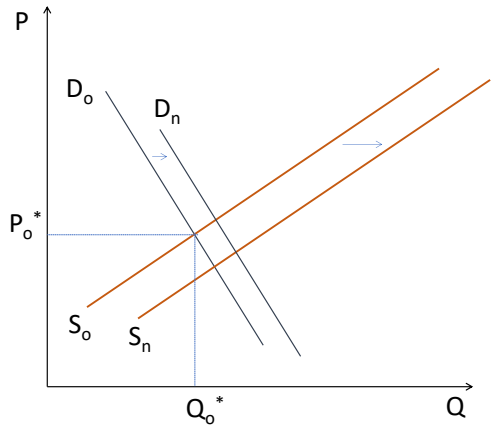

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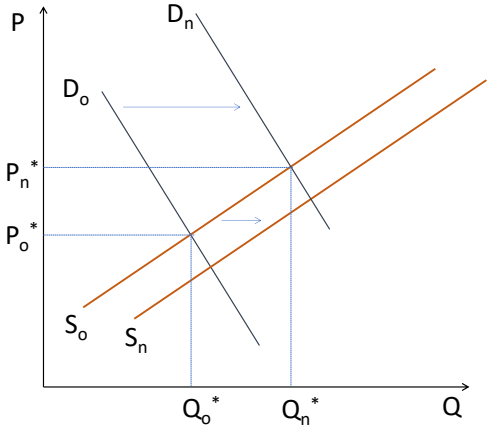

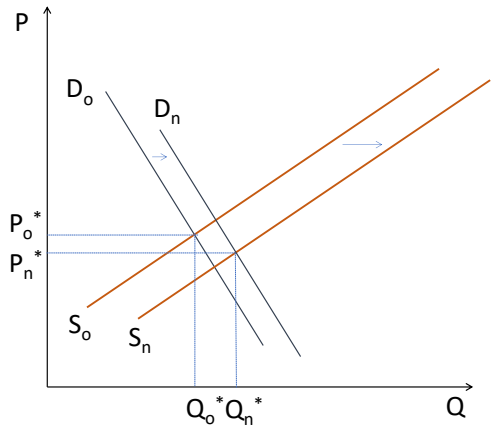

Vanilla: Supply and Demand

Supply and Demand in the Market for Natural Vanilla

1. In the "beginning"
   - no substitutes for natural vanilla
   - creating vanilla is incredibly labor-intensive

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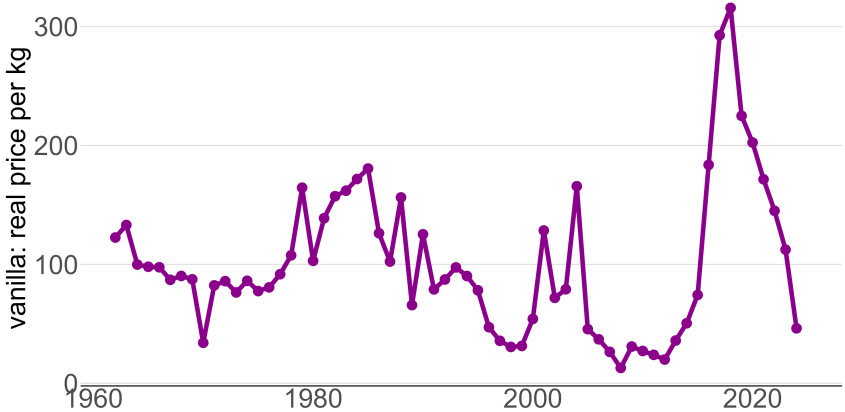
   - it takes a farmer three years to get a vanilla bean after he decides you want one
5. Finally, more beans arrive
   - farmers are finally able to make more
   - see here (July 2020) and here (Dec 2019)

"The Best Remedy for High Prices is High Prices"



Kahn et al, "Are there bubbles in the vanilla market?" *Agricultural and Food Economics*, 2022. [article]

Demand Curves Are Not Linear

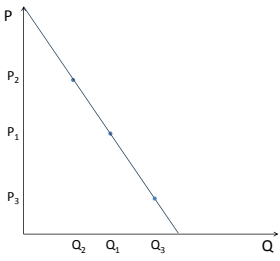
Demand Curves are Not Linear

1. What do we mean by linear?
2. Implications of linear curve
3. Building a non-linear curve
4. Example of why the shape matters

What Do We Mean By Linear?

- A linear function can be written as $y = mx + b$
- If b is zero ($y = mx$), then a 5-unit change in $x \rightarrow 5*m$-unit change in y
- If b is not zero, this isn't exactly true. However, the slope is always the same everywhere

Implications of a Linear Demand Curve



- There is a price sufficiently high that no one wants to consume the good
- At a price of zero, there is a finite quantity demanded
- Implies that many small changes in price always have the same impact as an equivalent large change in price
- This may be quite wrong

Where a Demand Curve Comes From

Thanks to Hal Varian's textbook

Let's assume we're interested in the market for apartments in a medium-sized college town. Further assume that

- there are two types of apartments: near and far from university
- near apartments are better
- if you don't get an apartment near, you can get one far at a known fixed price
- all apartments are identical
- each person wants only one apartment

We are interested in the price of the near apartments.

Putting Together a Demand Curve

- Reservation price is the "maximum willingness to pay for something"
- What is the highest reservation price of anyone in this market? $\rightarrow$ this is the top of the demand curve
- As we lower the price one dollar, how many additional people want an apartment? This is Q
- Another dollar? This is the next (Q, P) on the curve

Putting Together a Demand Curve: In Pictures

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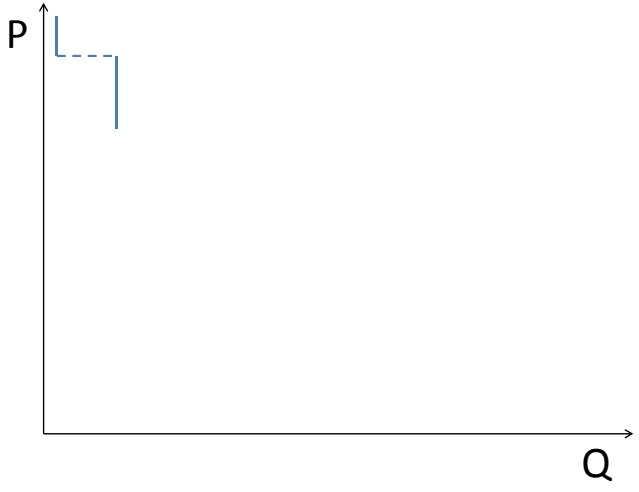
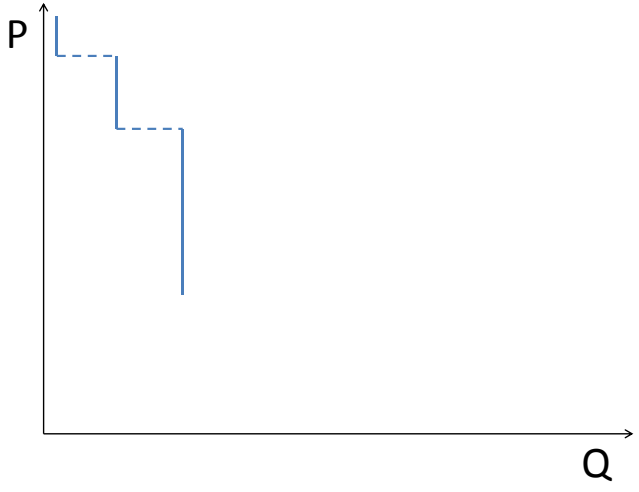


Putting Together a Demand Curve: In Pictures



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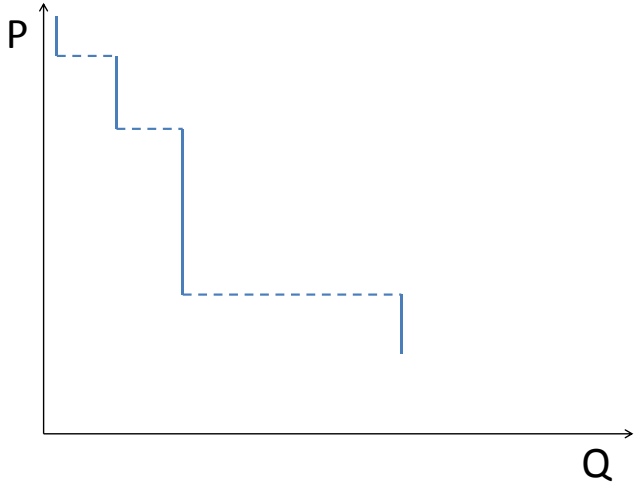

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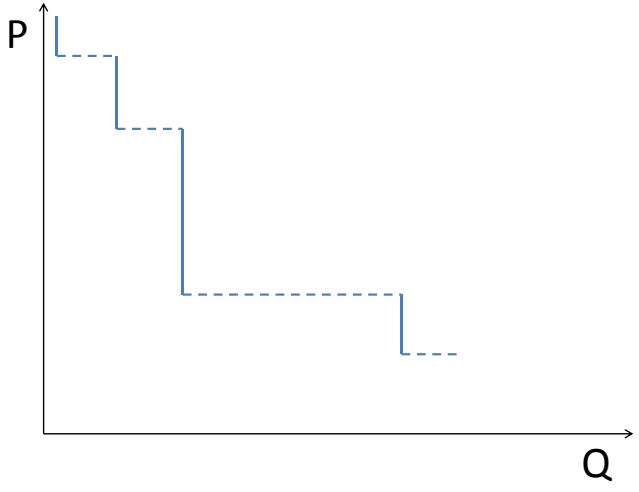

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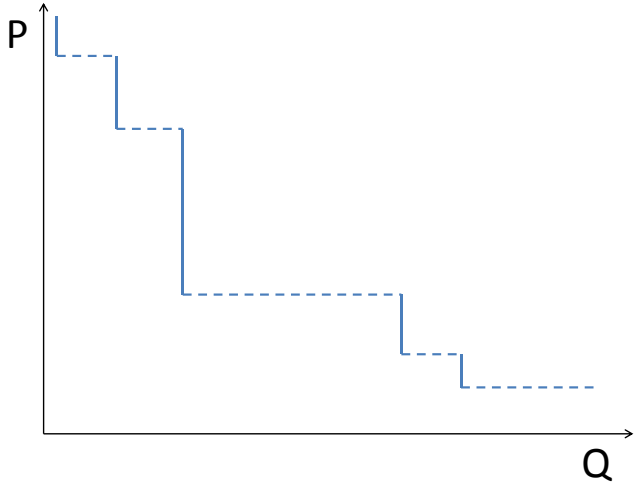
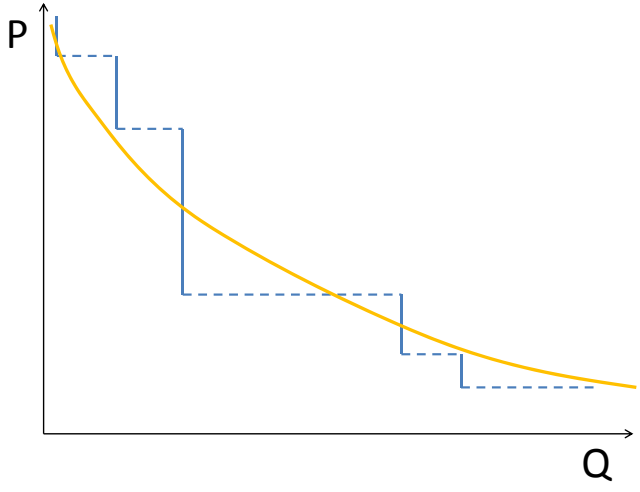


With Many Steps, Imagine a Curve



Why Do We Care About the Shape of This Curve?

- Hold on a few minutes
- Elasticity determines shape of the curve
- Elasticity determines how consumers respond to policy movements

Defining Elasticity

Small Math Aside: Absolute Value

- "How far a number is from zero"
- We write $|a|$ – the vertical bars are the absolute value sign

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- Absolutely crucial for policy decisions
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- Absolutely crucial for policy decisions
- Formally, percentage change in one value relative to percentage change in another
- In math, elasticity is

$$E = \frac{\%\Delta Q}{\%\Delta P}$$

- Δ is capital Greek letter delta, denoting change

Price Elasticity of Demand

- How responsive are consumers to a change in price?

$$E_D = \frac{\%\Delta Q_D}{\%\Delta P}$$

- Is $E_D > 0$? or ≤ 0?

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- The larger the number of substitutes,

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- If the number of substitutes for this product is large, what does this mean for $|E_D|$?
- The larger the number of substitutes, the more consumers can choose a different product when price increase
- More substitutes $\rightarrow$ bigger $|E_D|$

Price Elasticity of Supply

- How responsive are producers to a change in price?

$$E_S = \frac{\%\Delta Q_S}{\%\Delta P}$$

- Is $E_S > 0$? or < 0?

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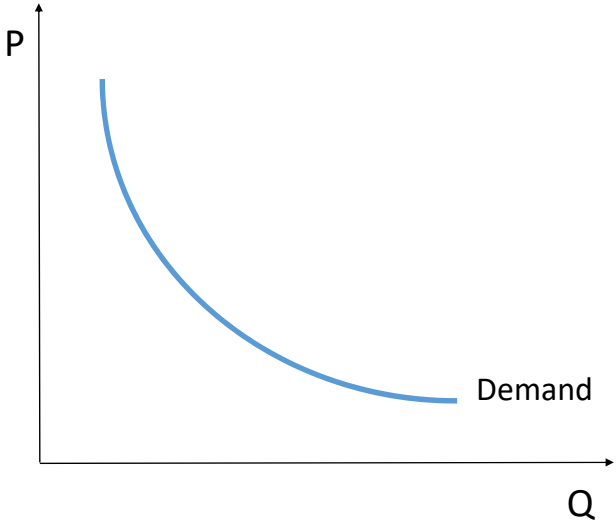
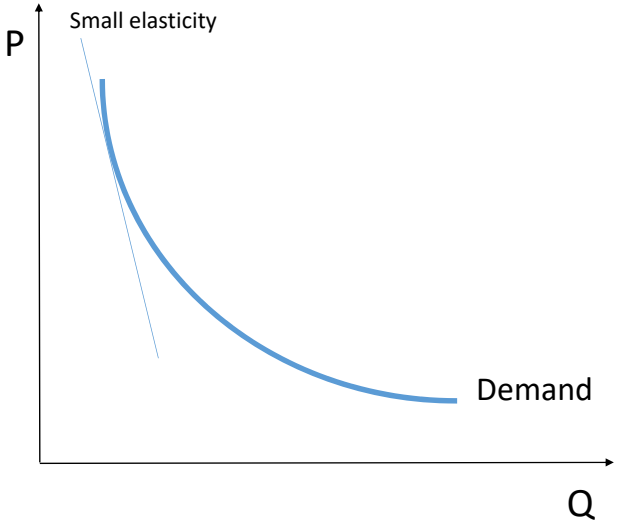
- If producer can easily decrease production, what does this mean for $|E_S|$?
- The more easily the producer can decrease production, the larger $|E_S|$

Elasticity with Non-Linear Demand Curves



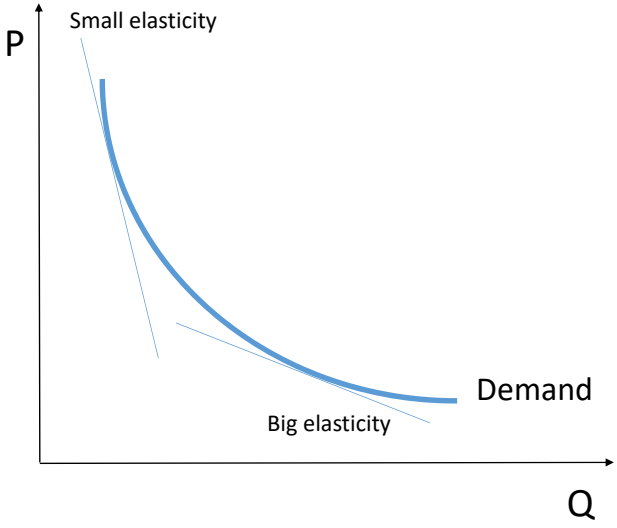
A non-linear demand curve

For Non-Linear Demand Curves, Elasticity is the Slope



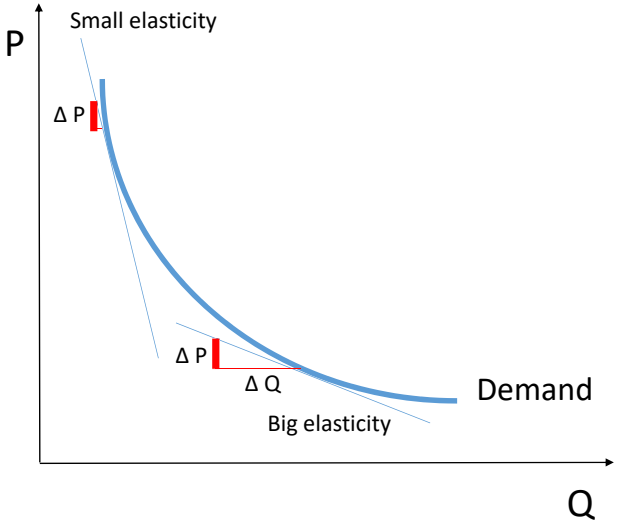
When prices are high, demand is relatively inelastic, or smaller in absolute value

For Non-Linear Demand Curves, Elasticity is the Slope



When prices are low, demand is more elastic, or larger in absolute value

For Non-Linear Demand Curves, Elasticity is the Slope



The more vertical line gives a smaller change in quantity for the same change in price

For Linear Demand Curves, Elasticity is **Not Exactly** the Slope

- But we won't pay too much attention to this oddity
- And we won't worry about the particular formula for linear demand curves

Calculating Changes from Elasticity

A problem to work on with your neighbor

- Suppose that the price elasticity of demand for peaches is -0.82
- Recall that

$$E = \frac{\%\Delta Q}{\%\Delta P}$$

- If the price of peaches increases by 5%, how much does the quantity of peaches consumed change?
- If the quantity of peaches consumed increases by 5%, by how much has the price of peaches changed?

Working Through an Elasticity Calculation

If the price of peaches increases by 5%, how much does total peach consumption change?

$$E_D = -0.82$$

$$E_D = \frac{\%\Delta Q}{\%\Delta P}$$

Working Through an Elasticity Calculation

If the price of peaches increases by 5%, how much does total peach consumption change?

$$
\begin{aligned}
E_D &= -0.82 \\
E_D &= \frac{\%\Delta Q}{\%\Delta P} \\
-0.82 &= \frac{\%\Delta Q}{5}
\end{aligned}
$$

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Therefore

$$\%\Delta Q = -0.82 * 5 = -4.1$$

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Therefore

$$\%\Delta P = \frac{5}{-0.82} = -6$$

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Drawing Perfectly Inelastic and Perfectly Elastic Demand and Supply

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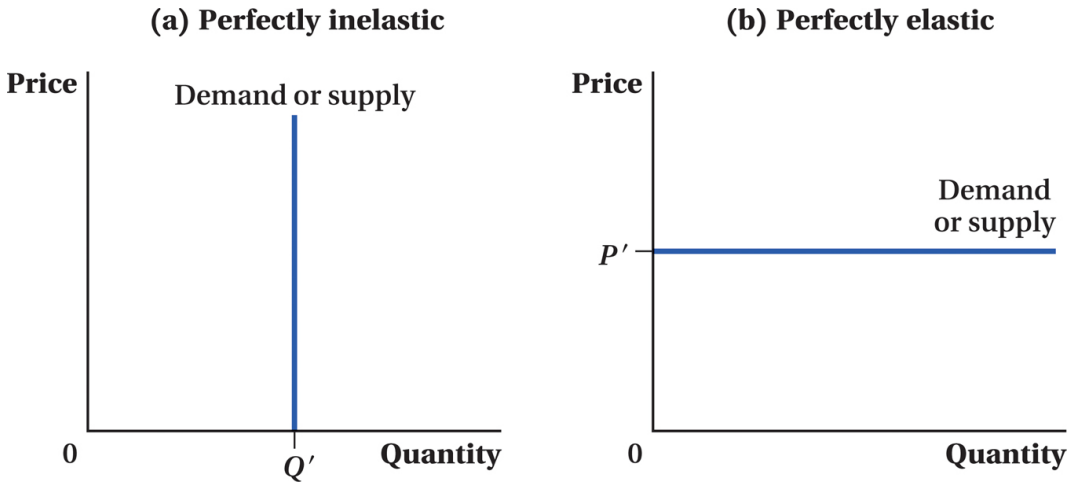

Time Horizon Matters for Elasticity

- Over short time horizons, the behavior of people and firms can be pretty inelastic
- In the long run, everything is elastic

Elasticity and Policy

Impacts from Demand-Side Incentives

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$25k to first-time homebuyers

- From Harris campaign
- (paired with subsidies to housing suppliers)

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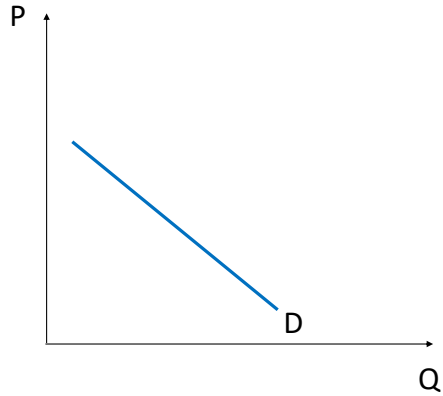

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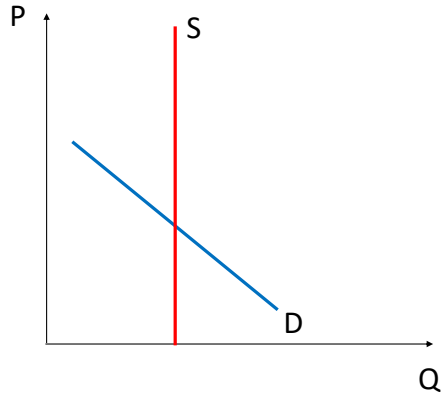

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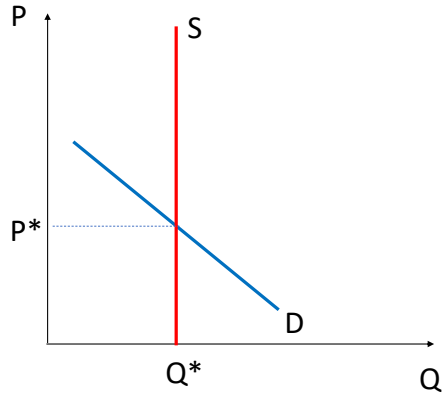

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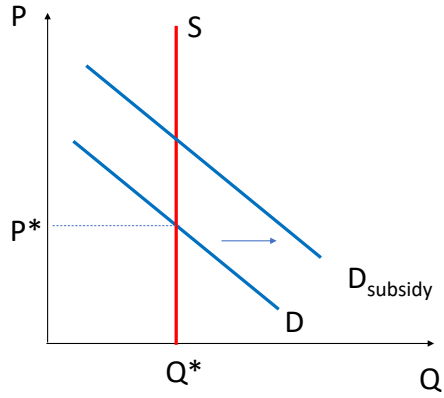

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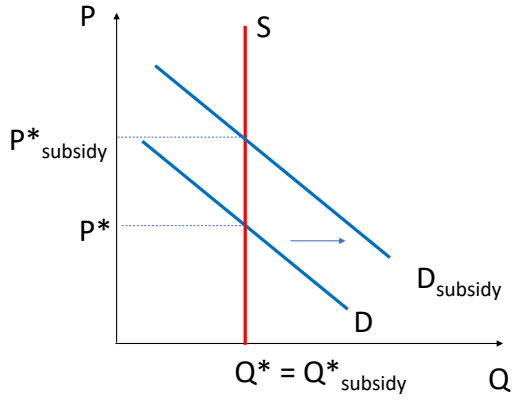

Many Types of Elasticity

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- Price elasticity of demand and supply
- Income elasticity of demand
- Cross-price elasticity of demand

Income Elasticity of Demand

- We are interested in the income elasticity of demand

$$E_I^D = \frac{\%\Delta Q^D}{\%\Delta I}$$

- What do you consume more of as your income increases?

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- What does it mean if $E_I^D > 1$? Your consumption increases more than your income $\rightarrow$ luxury good

Income Elasticity of Demand for Fresh Peaches

Table 10. Quantity of peaches eaten fresh per $100 of income
444 families, Salt Lake City, Utah, 1947

Income range	Number of families	Average consumption per family	Median income	Consumption per $100 income
Dollars	number	pounds	dollars	pounds
Less than 1,376	34	20	920	2.2
1,376–2,300	40	26	1,990	1.3
2,301–2,476	46	22	2,400	0.9
2,476–2,975	41	24	2,740	0.9
2,976–3,275	41	26	3,000	0.9
3,276–3,600	50	32	3,500	0.9
3,601–4,575	40	27	3,980	0.7
4,576–6,075	54	38	5,000	0.8
6,076–9,975	49	38	7,500	0.5
9,976 and over	49	40	12,000	0.3

- From a 1947 thesis about the peach market
- How can we characterize income elasticity of demand for peaches?

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- From a 1947 thesis about the peach market
- How can we characterize income elasticity of demand for peaches?
- Compare change in peach consumption to change in income

Contemplate Yourself!

Think of some examples

- What is the sign of the income elasticity of demand for fresh fruit and vegetable consumption?
- Give an example of a normal good and an inferior good

Cross-Price Elasticity of Demand

How much does your demand for pluots change when the price of apricots increases?

Cross-Price Elasticity of Demand

How much does your demand for pluots change when the price of apricots increases?

$$E_{XY}^{D} = \frac{\%\Delta Q_X^D}{\%\Delta P_Y}$$

- The responsiveness of quantity demanded of good X to price of good Y
- If E_{XY}^{D} is positive, are X and Y substitutes or complements?

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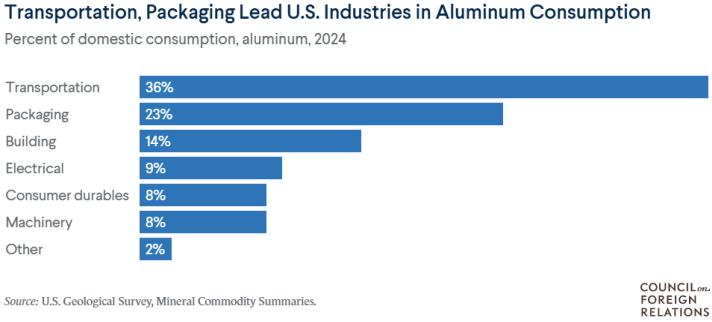
Policy examples, please!

How Does Cross-Price Elasticity Explain Impacts of Tariffs?

As of June 4, US charges 50% tariff on aluminum



From Council on Foreign Relations

If soda and aluminum are complements, do we expect to happen to the price of Coke?
How does this relate to cross-price elasticity?

What We Did This Class

1. Equilibrium
2. Deducing supply and demand shifts from equilibrium outcomes
3. Non-linear demand curves

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Elasticity

1. Defining elasticity
2. Useful elasticity terms
3. Why elasticity matters for policy
4. Many kinds of elasticity

Next Class

- GLS, Chapter 3, but not 3.4 or 3.5
- Problem Set 2 is due
- Send Ripped from Headlines by Wed. midnight