

# Lecture 2: Elasticity

September 5, 2023

# Overview

1. Supply and demand shifts
2. Non-linear demand curves
3. Defining elasticity
4. Useful elasticity terms
5. Why elasticity matters for policy
6. Many kinds of elasticity
7. Smoking in Spain

# Course Administration

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3. Problem Set 1 should be turned in
4. Problem Set 2 is posted
5. Questions on Use Numbers Assignment 1?
6. 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

Finder	Presenter
Annie	Trevor
Rebecca	Bridget



# Today's Ripped from the Headlines

Finder	Presenter
<hr/>	
Trevor	Marissa

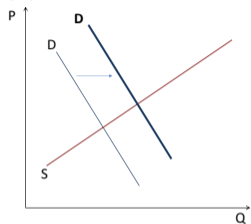
What Can You Conclude About Supply and Demand Changes from Changes in  $P^*$  and  $Q^*$ ?

## 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 prices for 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

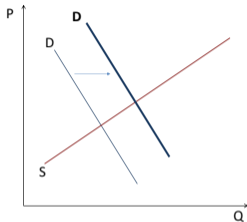
# All Four Different Cases: Want $P^* \downarrow$ and $Q^* \uparrow$

(a) Demand increases

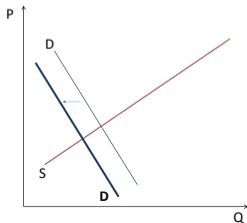


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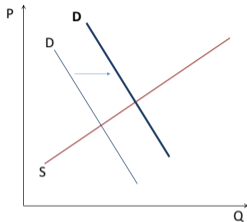


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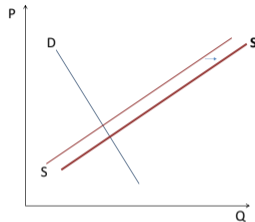


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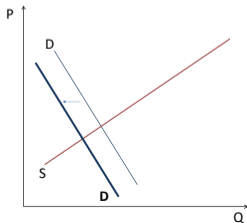
(a) Demand increases



(c) Supply increases

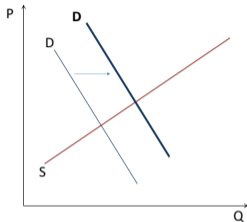


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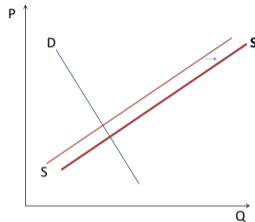


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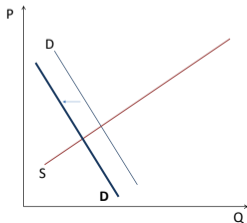
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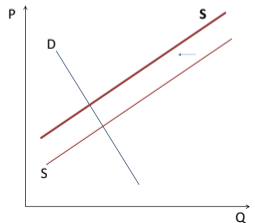
(c) Supply increases



(b) Demand decreases



(d) Supply decreases



## 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
- → Demand unchanged, supply increased.



# Vanilla and Supply and Demand

# Supply and Demand in the Market for Natural Vanilla

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  - no substitutes for natural vanilla
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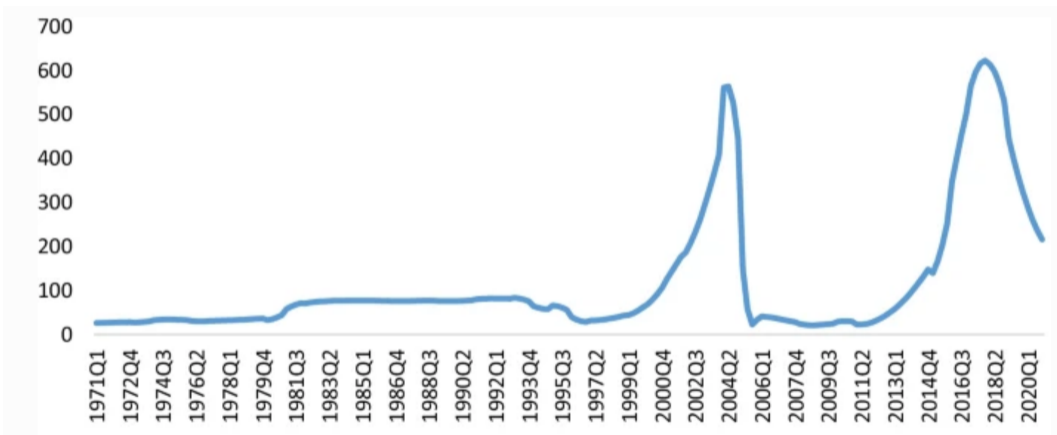
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  - see [here](#) (July 2020) and [here](#) (Dec 2019)

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With your neighbor, draw a set of supply and demand diagrams about what this means for equilibrium price and quantity

## “The Best Remedy for High Prices is High Prices”



Kahn et al, “Are there bubbles in the vanilla market?” *Agricultural and Food Economics*, 2022. [\[article\]](#)





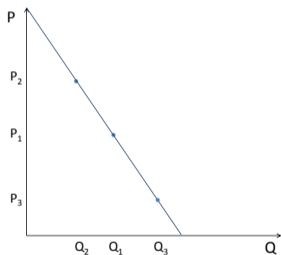
## Demand Curves are Not Linear

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

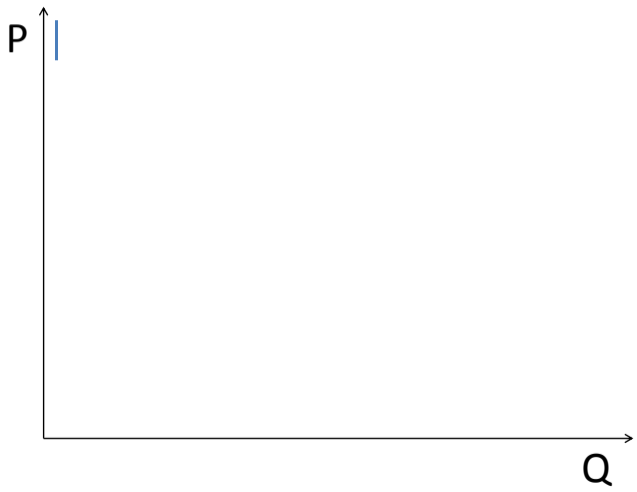
- there are two types of apartments: near and far from university
- near apartments are better
- if you don't get an apartment near, you can get one far at a known fixed price
- all apartments are identical
- each person wants only one apartment

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? → 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

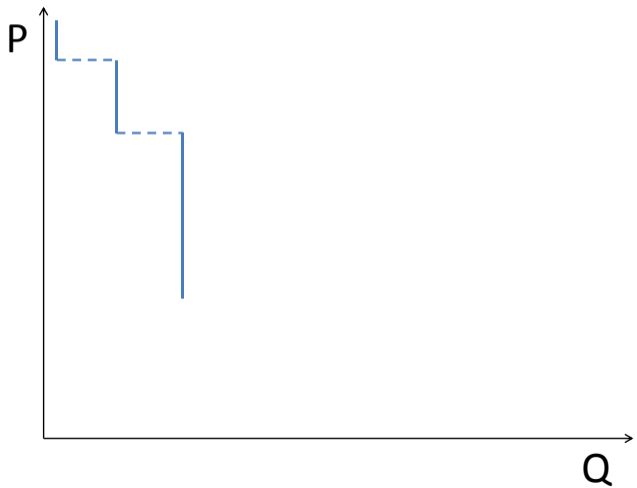


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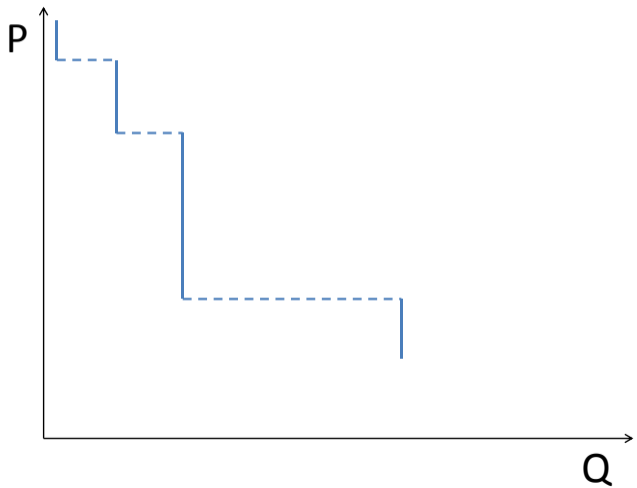




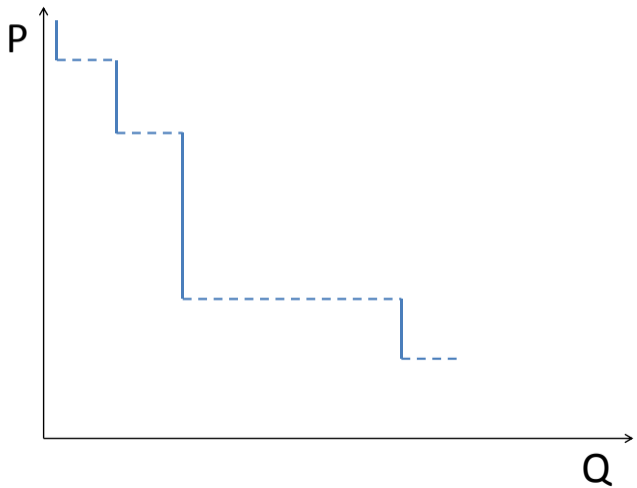
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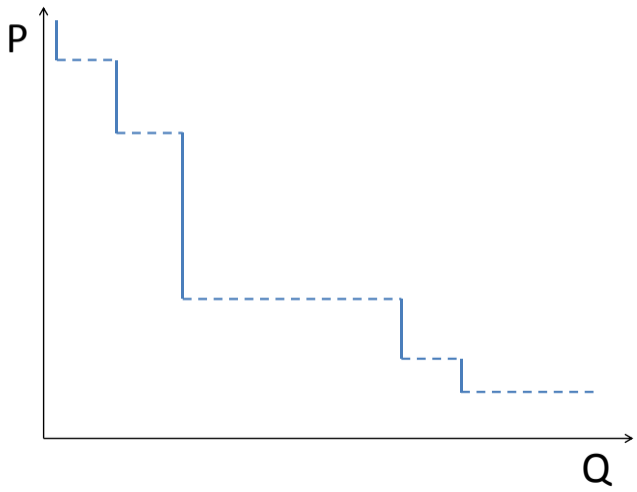
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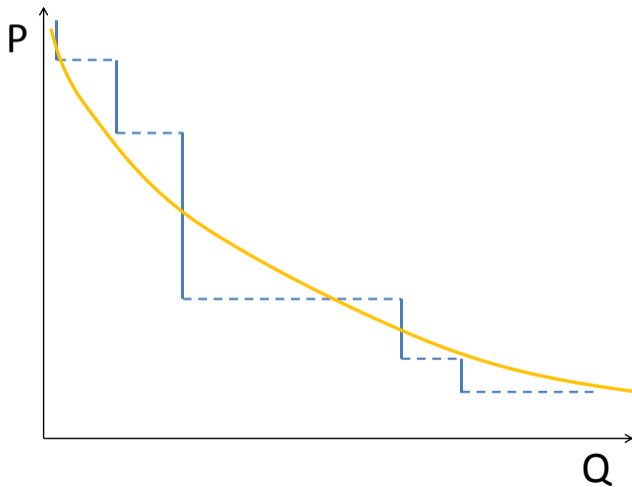
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# With Many Steps, Imagine a Curve



## Why the Shape of the Curve Matters: Avocados!

- 1914 US puts limits on imports of Mexican avocados
- 1994 North American Free Trade Agreement (NAFTA) passes
- 2004 USDA agrees to year-round avocado imports from Mexico
- Domestic producers of avocados
  - form expectations from part of demand curve they observe
  - except that increase in  $Q$  will lead to decline in  $P$
- What happens?

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- What happens? Almost no change in  $P$ , big increase in  $Q$

# Three (Not Mutually Exclusive) Explanations

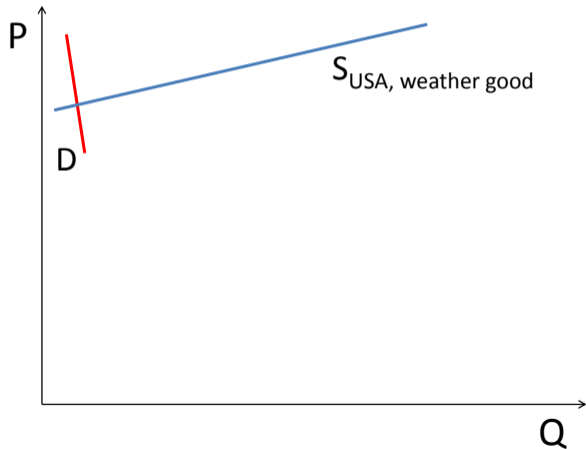
Or, Is Everything We've Learned Wrong?

1. Demand curve is not linear
2. Demand increases
3. “Price” for big customers includes reliability of supply, so true “price” fell  $\rightarrow Q \uparrow$



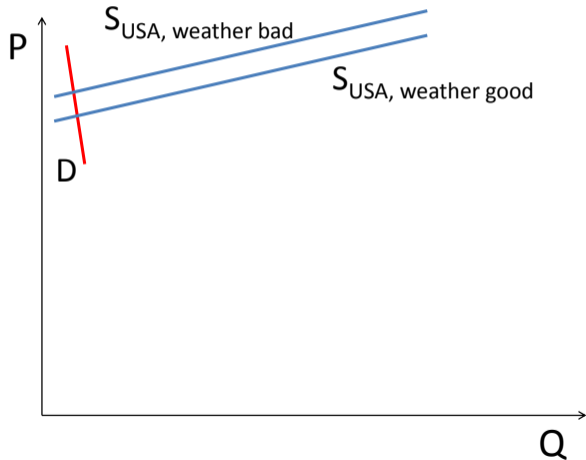
# E.1.: Demand Curve is Not Linear

The World Before NAFTA



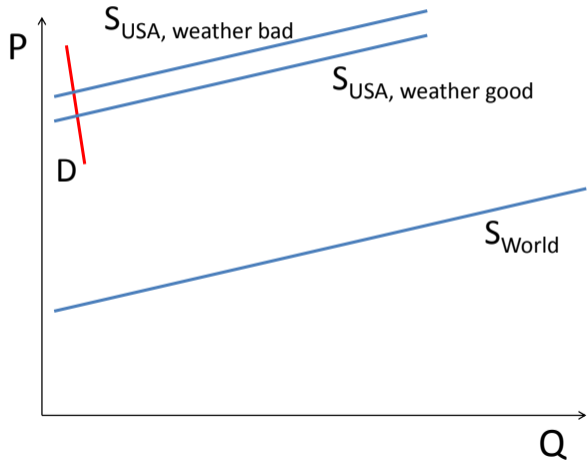
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Where Is World Supply?



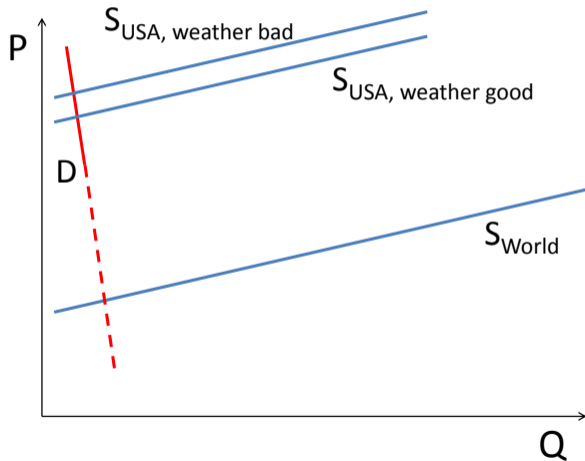
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If You Think Demand is Linear, What Happens?



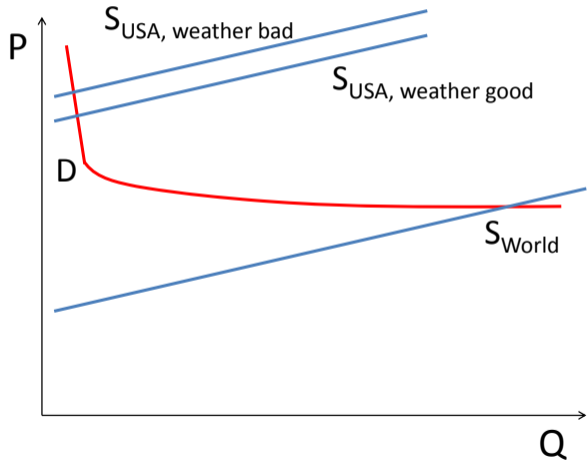
## E.1.: Demand Curve is Not Linear

Why Is This Unlikely to Have Been the Case?



# E.1.: Demand Curve is Not Linear

## Curved Demand Is One Explanation



## E.3.: “Price” for big customers falls

- Elsewhere, I learned that after the introduction of Mexican avocados, big chains considered putting them in menus
- Major cost component for big chain input is reliability
  - Mexican supply guarantees year-round supply
  - And more reliable supply
- Thus, for big firms, maybe this is now a different market
  - Not a niche product
  - More of a commodity
  - Think of Chipotle as the consumer here
  - What happens to Chipotle consumer surplus with addition of this market?



## 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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- Formally, percentage change in one value relative to percentage change in another
- In math, elasticity is

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

- $\Delta$  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  $\leq 0$ ?

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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  $|E_D|$



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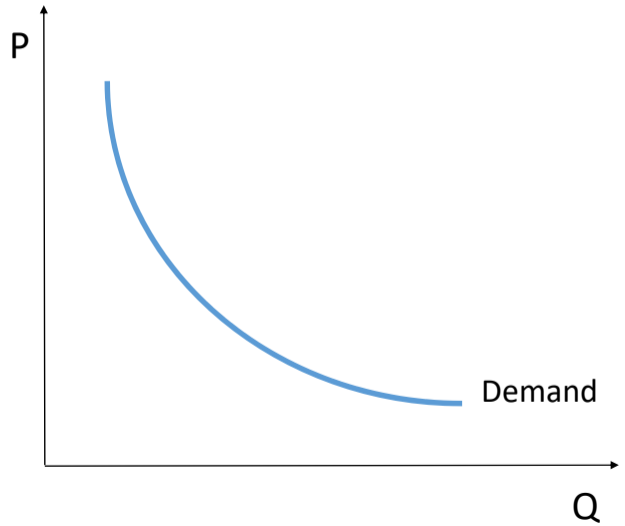
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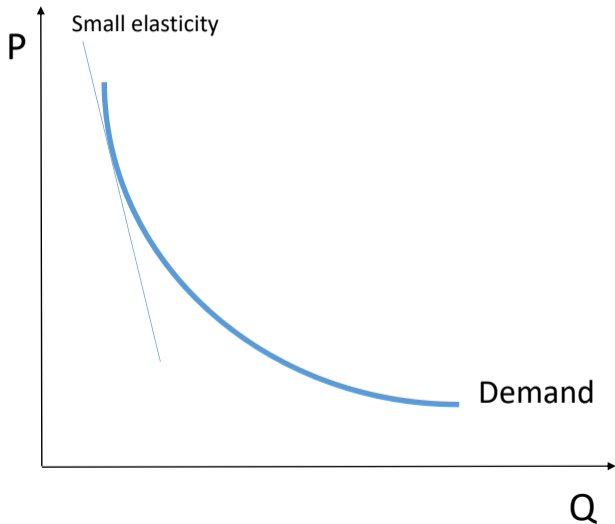
- Is  $E_S > 0$ ? or  $< 0$ ?  $E_S > 0$
- If producer can easily decrease production, what does this mean for  $|E_S|$ ?
- The more easily the producer can decrease production, the larger  $|E_S|$

# Elasticity with Non-Linear Demand Curves



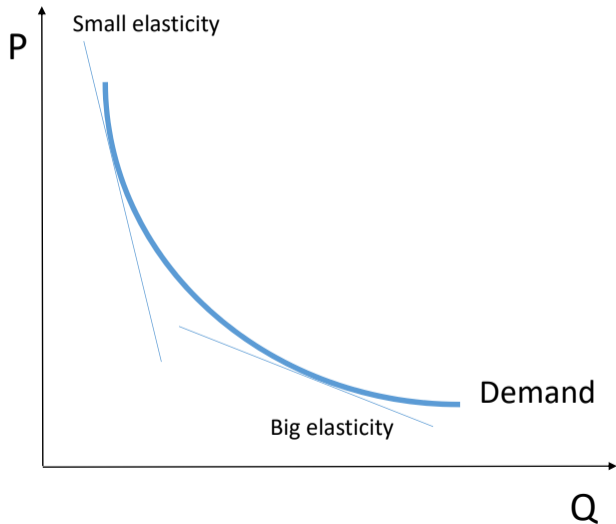
A non-linear demand curve

## For Non-Linear Demand Curves, Elasticity is the Slope



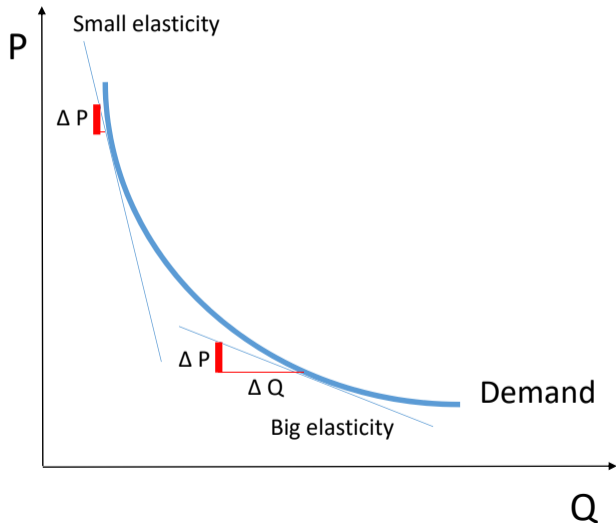
When prices are high, demand is relatively inelastic, or smaller in absolute value

## 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?

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



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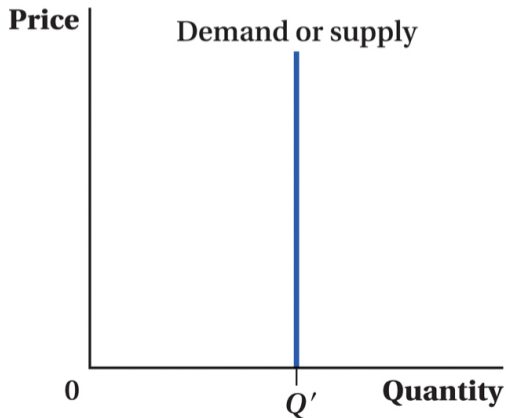
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- Perfectly elastic,  $|E| = \infty$ 
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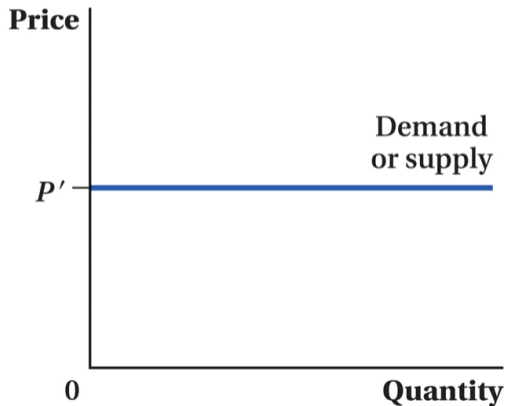
# Drawing Perfectly Inelastic and Perfectly Elastic Demand and Supply

# Drawing Perfectly Inelastic and Perfectly Elastic Demand and Supply

**(a) Perfectly inelastic**



**(b) Perfectly elastic**





## 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

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- policy makers can change the “price” that workers receive by changing tax rates
- if you want to know how much revenue taxes yield, you need to know how responsive workers are to changes in wages
- Or, if you want to know how many people will take up Obamacare, you need to know how responsive the uninsured are to changes in the price of insurance

# 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

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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 Dollars	Number of families number	Average consumption per family pounds	Median income dollars	Consumption per \$100 income 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

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- How can we characterize income elasticity of demand for peaches?

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- 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

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- If  $E_{XY}^D$  is positive, are  $X$  and  $Y$  substitutes or complements?



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Policy examples, please!

# Smoking in Spain: Or, Policy Relevance

# Smoking in Spain



# Smoking Elasticities

Study	Country or countries	Data source or data sources	Methodology	Price elasticity	Income elasticity
Yeh et al. <sup>44</sup> Chávez <sup>45</sup>	EU Ecuador	Euromonitor International Encuesta Nacional de Ingresos y Gastos de Hogares Urbanos y Rurales	Threshold regression method Deaton approach	[-0.503, -1.227] -0.87	[0.282, 0.576] N/A
Ramos-Carbajales et al. <sup>46</sup>	El Salvador	Dirección General de Estadística y Censos	Cointegration	-0.93	0.99
Guindon et al. <sup>47</sup> Liu et al. <sup>48</sup>	Latin America China	Multidata Global Market Information Database and China Tobacco Year Book	Pooled data OLS	-0.31 -0.49	N/A N/A

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→ Pay attention to interaction of income and prices

Time permitting: What kind of cross-price elasticity could matter here?

## What We Did This Class

1. Non-linear demand curves
2. Defining elasticity
3. Useful elasticity terms
4. Why elasticity matters for policy
5. Many kinds of elasticity
6. Smoking in Spain

## Next Class

- GLS, Chapter 3, but not 3.4 or 3.5
- Problem Set 2 is due
- Use Numbers 1 of 3 is due
- Bring your Use Numbers 1 of 3 answers for class discussion
- Send Ripped from Headlines by Wed. midnight