Nellis and Parket CH 2 - "The analysis of consumer demand

Demand (D) is the relationship between P and Q^D

The Law of Demand

Demand Curve

Factors that influence DEMAND = "demand shifters"

The IE and SE of a price change

Normal vs. Inferior goods (also Giffen goods and Veblen goods)

ELASTICITY

ELASTIC vs. INELASTIC Demand

Extreme elasticities

Determinants of elasticity of demand

Calculating the Price elasticity of demand using the "midpoint formula"

Δ in REVENUE from a price change depends on elasticity

Income elasticity of demand

Cross-price elasticity of demand

Go over case 1

The basic point of the next two chapters is to develop a model that shows how firms and households interact in markets.

In this chapter we're going to develop the consumer side of the market by looking at demand and consumer behavior.

In chapter 3 we look at Supply and firm decisions.

Notation:

D = demand
S = supply
P_x = the price of X
Q_x = the quantity of X
Q^D = quantity demanded
Q^S = quantity supplied
I = income

Demand for a good or service basically tells us how and why we want that item and how much we want at different prices.

⊗ Demand (D) is the relationship between the price of an item and how many units of that item are desired by a consumer or group of consumers.

⊗ Demand is not a number.

⊗ Demand tells us how many units of an item consumers are willing to purchase at all possible prices.

IOW: demand shows a series of possible alternative price and quantity combinations, all other things held equal.

We can construct a Demand Schedule (a list of alternative Price and Quantity combinations) by listing prices and the resulting quantities that are demanded.

A graphical illustration of a demand schedule is called a demand curve.
Example: the demand for cans of pinto beans by an individual per month

P	Q^D
1.00	2
0.75	3
0.50	4
0.25	5

- If price is $1.00 then this individual will purchase 2 cans of pinto beans per month.
- If price falls to $0.75, then he or she wants more → 3 cans per month.
- If price falls even more to $0.50 then she will demand 4 units.

We can get a couple of things from these numbers.

1st ➢ Price determines quantity demanded.

2nd ➢ Higher prices mean lower quantity demanded, and lower prices mean higher quantity demanded

⇒ There is an inverse relationship between price and quantity demanded.

⊗ This is known as "The Law of Demand" – all other things equal, as the price of an item increases the quantity demanded falls, and as the price of an item decreases the quantity demanded rises.

Demand curve can be read in both directions:

For a given price – how many units do consumers wish to purchase?
For a given quantity – what is the most consumers are willing to pay?

D = MB = max WTP

That much is pretty straightforward, but where does the exact nature of the relationship come from?

What factors influence the way price affect quantity demanded?

Factors that influence DEMAND (the relationship between P and Q^D) = "demand shifters"

- Income/wealth (generally, the more income you have, the more you will demand at any given price)
- Prices of substitute goods and services (if the price of a substitute good goes up, you will buy more of this other good)
- Prices of goods and services that are complements to the good in question (if the price of a complement good goes up, you will buy less of this other good)
- Current tastes/preferences/fashions (if you like something, you will buy more of it at any given price)
- Your expectations about future prices
- Your expectations about future income/wealth

⊗ the own price of the good is the most important determinant of quantity demanded, but each of these factors influence *HOW* price affects quantity.

That is, each of these things goes into determining the relationship between the price of an item and the number of units that are demanded.

SO we put all this stuff together (your income, prices of other goods, tastes and preferences, and expectations) and we can figure out the relationship between price and quantity for a particular good.

⊗ Given all these factors, we can determine the relationship called DEMAND.

But, if one of these things changes, then the relationship will change.

⊗ Change factor ⇒ change demand.

Show examples of shifts in Demand.

A change in the demand for the good means that the quantity demanded at any and all prices has changed.

⊗ When we change any of the other factors that influence demand we change the relationship between price and quantity demanded.

∴ We have to draw a new representation of that relationship. That is, we have to draw a new demand curve.

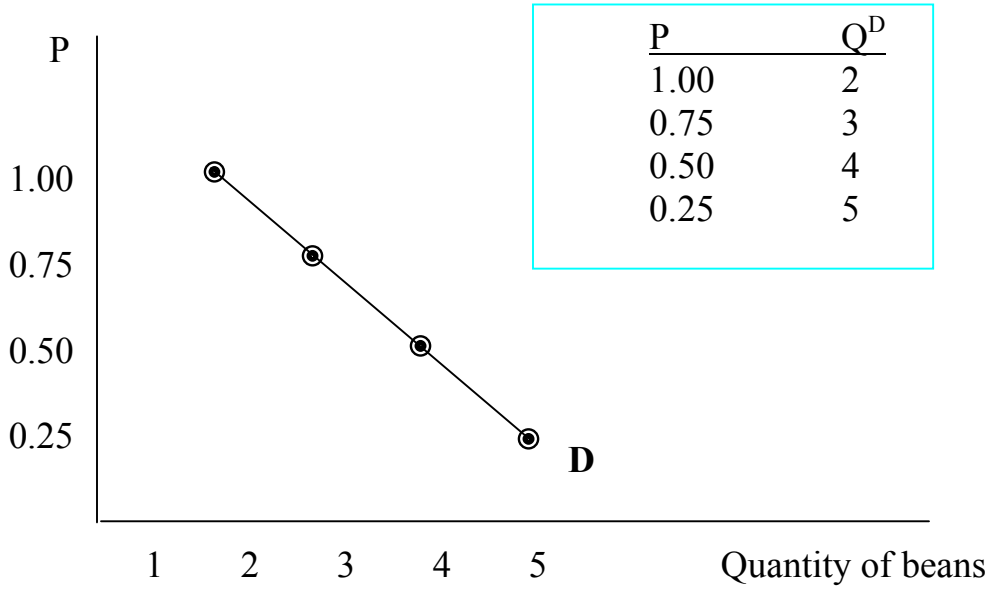
⊗ "CHANGE IN DEMAND" ➢ caused by a change in a factor other than the price of the good.

➢ Shown by <u>SHIFTING THE DEMAND CURVE</u>.

We use a DEMAND CURVE to illustrate the relationship between price and quantity for a particular good.

A demand curve is simply a graphical representation of a demand schedule.

➢ and what does this say about the nature of the relationship between price and quantity demanded?



P	Q^D
1.00	2
0.75	3
0.50	4
0.25	5

⊗ The law of demand implies that <u>demand curves are always downward sloping</u>.

2 factors that enforce the law of demand are…
The INCOME EFFECT (IE) of a price change and
The SUBSTITUTION EFFECT (SE) of a price change.

IE = change in Q^D for a good due to the effect of the price change on the purchasing power of your income.

Not an explicit change in income, but a change in what your income will purchase due to a price change.

✪ ↓ price of good that is regularly purchased = ↑ available income

OK now let's think about how consumers react to income changes…

When income increases, consumers will purchase more NORMAL GOODS.

Price decrease
IE: ↓ P ⇒ ↑ purchasing power of income ⇒ ↑ Q of all normal goods purchased

Price increase
IE: ↑P ⇒ ↓ purchasing power of income ⇒ ↓ Q of all normal goods purchased

✪ The substitution effect from a price change is the change in the quantity of the good demanded because its price changes relative to the prices of other goods.

When the price of good A goes down, that good is now relatively cheaper than an alternative good B, so you substitute away from alternative B, and toward the now relatively cheaper good A.

→ so, the substitution effect is all about substitution between goods.

OK so lets define the substitution effect from a price change:

Price decrease
SE: $\downarrow P_A \Rightarrow$ good A is now relatively cheaper than alternatives $\Rightarrow \uparrow$ Q of all good A and $\downarrow$ Q of alternatives (substitute TOWARD the cheaper good)

Price increase
SE: $\uparrow P_A \Rightarrow$ good A is now relatively more expensive than alternatives $\Rightarrow \downarrow$ Q of all good A and $\uparrow$ Q of alternatives (substitute TOWARD the cheaper goods ~ in this case the alternatives)
For NORMAL GOODS, the IE and SE work in the same direction:

NORMAL GOODS

IE: $\downarrow$ P $\Rightarrow \uparrow$ purchasing power of income $\Rightarrow \uparrow$ Q of the good (and other normal goods)

SE: $\downarrow$ P $\Rightarrow$ substitute towards this now relatively cheaper good $\Rightarrow \uparrow$ Q

But for INFERIOR GOODS, the IE and SE work in opposite directions:

INFERIOR GOODS

IE: $\downarrow$ P $\Rightarrow \uparrow$ purchasing power of income $\Rightarrow \downarrow$ Q of the good (because its an inferior good)

SE: $\downarrow$ P $\Rightarrow$ substitute towards this now relatively cheaper good $\Rightarrow \uparrow$ Q

Another factor enforcing the law of demand is the principle of diminishing marginal utility – the satisfaction (utility) that we derive from a particular good as we purchase more and more units of it goes down.

$\Rightarrow$ since we're getting less satisfaction from the next unit, the amount we are willing to pay decreases as well.

ELASTICITY

"Elastic" = flexible $\Rightarrow$ "elasticity" = flexibility

We're now going to look at the flexibility or elasticity of demand.

Elasticity = the flexibility of one variable with respect to changes in another variable.

-or-

by how much (what percent) does one variable change when we change another variable?

To put this in context the law of demand says:

$$\Delta P \Rightarrow \Delta Q^D$$

The price elasticity of demand (E^D_P) tells us by how much quantity demanded will change for a given change in price.

$$E^D_P = \frac{\%\Delta Q^D}{\%\Delta P}$$

$\Rightarrow$ By how much does Q^D decrease when price increases?
$\Rightarrow$ By how much does Q^D increase when price decreases?

Q: who would need to know this information? $\rightarrow$ Firms.

✪ Knowing the price elasticity of demand allows firms to:

(1) predict the change in Q^D (sales) from a given price change
(2) determine the price change necessary to achieve some desired change in sales

Question: can the price elasticity of demand ever be a positive number?

$\rightarrow$ NO. $E^D_P > 0$ would violate the law of demand $\Rightarrow E^D_P$ is always < 0

For some goods quantity demanded will be very sensitive to price changes, and for others it will not be so sensitive.

✪ If Q^D changes a lot for a given price change, we say demand is elastic (flexible).

ELASTIC D ⇒ big change in Q^D for a given change in P.

✪ If Q^D changes only a little for a given price change, we say demand is inelastic (not flexible).

INELASTIC D ⇒ small change in Q^D for a given change in P.

Also, people have different preferences. Its unlikely that the way I react to a price change – in terms of the quantity I purchase – will be the same as the way YOU react to a price change.

my demand for coffee is not very flexible with respect to price changes = "inelastic demand" => E^D_P is a low number

You on the other hand, like coffee, but you're not a freak about it the way I am. In fact, you like tea just as well. So if the price of coffee goes up just a little, you're going to switch to tea almost entirely.

✪ You: small ↑ P_{COFFEE} ⇒ very large change in Q^D

your demand for coffee is very flexible with respect to price changes = "elastic demand" E^D_P is a high number

In general, we state that if:

$\left|\%\Delta Q^D\right| > \left|\%\Delta P\right| \Rightarrow$ Demand is "ELASTIC" $\Rightarrow \left|E_p^d\right| > 1$

$\rightarrow$ The quantity change is large relative to the price change

IF:

$\left|\%\Delta Q^D\right| < \left|\%\Delta P\right| \Rightarrow$ Demand is "INELASTIC" $\Rightarrow \left|E_p^d\right| < 1$

$\rightarrow$ The quantity change is small relative to the price change

IF:

$\left|\%\Delta Q^D\right| = \left|\%\Delta P\right| \Rightarrow$ Demand is "UNIT ELASTIC" $\Rightarrow \left|E_p^d\right| = 1$

$\rightarrow$ The quantity change is equal to the price change

Consider the two extreme cases:

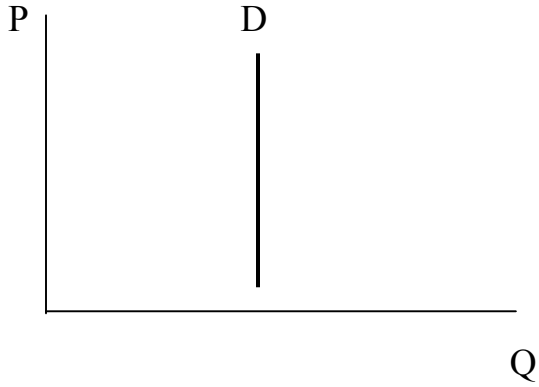
(1) <u>Perfectly Inelastic Demand</u> $\Rightarrow E^D_P = 0$

$\Rightarrow$ Quantity demanded of the good is <u>completely insensitive</u> to price changes.

$\Rightarrow$ no matter what the price (or price change) your quantity demanded is always the same.

$\Rightarrow \frac{\%\Delta Q^D}{\%\Delta P} = 0$

Q: how would we draw a demand curve that fits this description?



A perfectly inelastic demand curve is vertical ⇒ No matter what happens to price, quantity demanded remains the same.

Q: Do goods like this exist? Are there goods that you will buy the same amount no matter what the price?

A: probably not. Maybe the anti-venom for a snakebite victim, or insulin for a diabetic. Water in the desert.

So, there probably aren't any goods for which demand is perfectly inelastic, but we can certainly think of goods for which demand is very inelastic.

The other extreme elasticity…

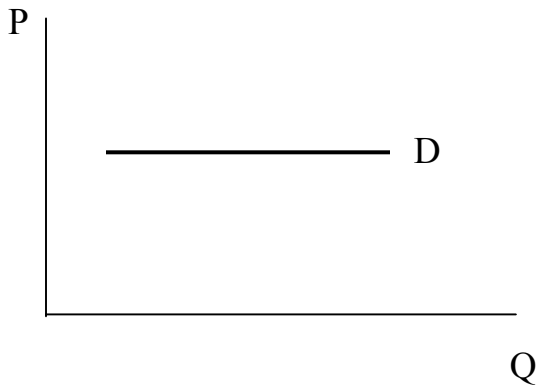
(2)Perfectly Elastic Demand⇒ $E^D_P = \infty$

⇒ Any price change causes an infinite change in quantity demanded.

⇒ No matter what the price (or price change) your quantity demanded is always the same.

$$\Rightarrow \frac{\%\Delta Q^D}{\%\Delta P} = \infty$$

Q: how would we draw a demand curve that fits this description?



A perfectly elastic demand curve is horizontal ⇒ Just a tiny change in price, and quantity demanded changes infinitely.

Q: Do goods like this exist? Are there goods that you will instantly stop buying if the price goes up by a penny (or even a fraction of a penny)?

A: Probably not. The classic example is an agricultural product from a particular producer → the good is exactly the same no matter who produces it, so if Farmer number 1's price goes up just a little, everyone will purchase from the other farmers.

Ok so these perfectly elastic demand goods are going to be hard to find too – but we can think of goods for which demand will be very elastic.

This brings up an interesting question:

✪ What determines the price elasticity of demand for a particular good?

→ what determines how quantity demanded will react to price changes?

- Think about it in terms of your own preferences:

? What goods will you continue to buy even if price gets high?

→ Things you can't do without. Things that DO NOT HAVE SUBSTITUTES.

? What types of goods are you going to stop buying if price goes up a little?

→ Things that you can do without. Things that DO HAVE SUBSTITUTES.

✪ IF A GOOD HAS MANY SUBSTITUTES, DEMAND WILL BE ELASTIC

⇒ QUANTITY DEMANDED WILL CHANGE A LOT WHEN PRICE CHANGES BECAUSE CONSUMERS WILL SWITCH TO ONE OF THE SUBSTITUTES.

✪ IF A GOOD HAS FEW SUBSTITUTES, DEMAND WILL BE INELASTIC

⇒ QUANTITY DEMANDED WILL CHANGE VERY LITTLE WHEN PRICE CHANGES BECAUSE CONSUMERS DO NOT HAVE ALTERNATIVES.

✪ DETERMINANTS OF PRICE ELASTICITY OF DEMAND:

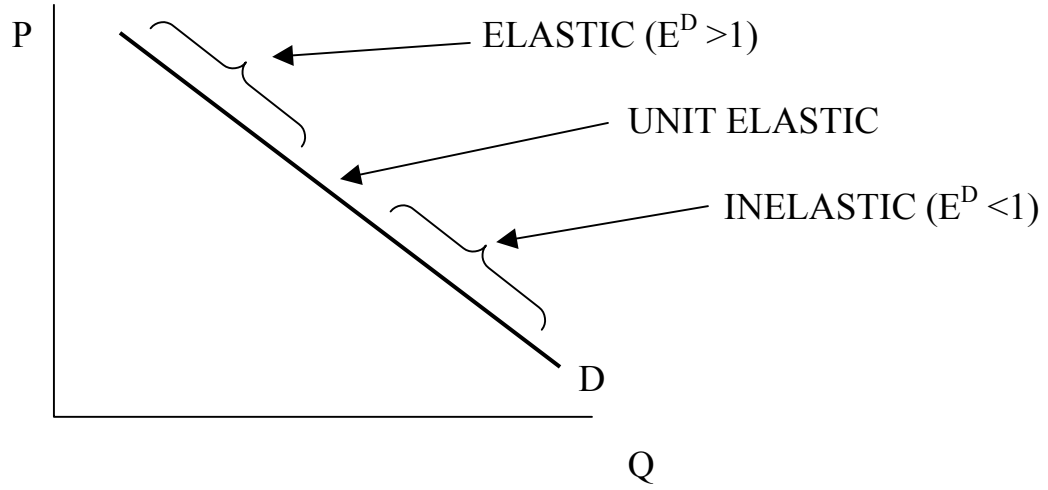
(1) Availability of substitutes.
(2) Time.
(3) The fraction of our budget that the good uses

For goods that make up only an insignificant portion of our budget (goods that we don't buy very often or that have a very low price) – we might not react that much to a price change.

OK- Another important point about the price elasticity of demand:

✪ The price elasticity of demand must be measured at a particular point on the demand curve, and will change as we move along the demand curve (even if the D curve has a constant slope).

This is tough to see at first, but if we Lets look at the demand curve and remember that we're dealing with percentages, we can see it :



QUESTIONS….

OK- Now we have to look a little closer into how to calculate E^D

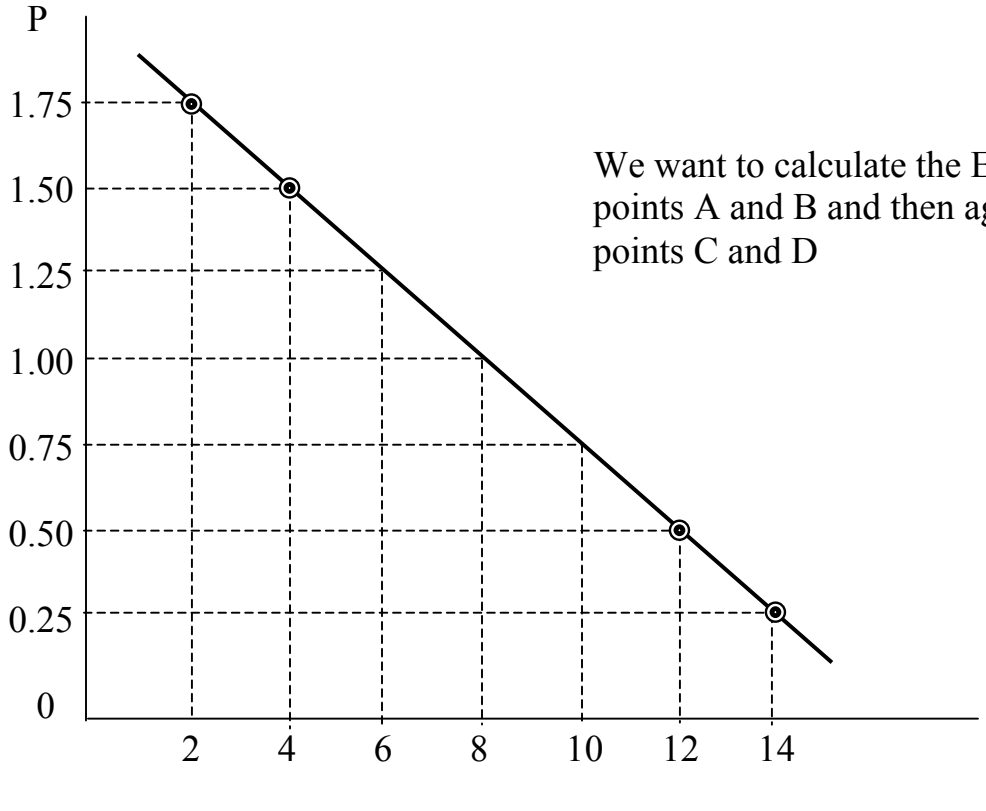
✪ Calculating the price elasticity of demand

⇒ Use the "midpoint formula" for calculating percentage change (Table 5.2 p 114)

Midpoint formula:

$$\% \Delta Q = \frac{\Delta Q}{\frac{1}{2}(Q_1 + Q_2)} \times 100\% \quad \text{and} \quad \% \Delta P = \frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} \times 100\%$$

Example: calculating E^D from points on a D curve using the midpoint formula.



E^D between A→ B:

We need the percent change in Q^D and the % Δ P → using the midpoint formula:

Δ P = 0.25 (price falls from 1.75→1.50)
Δ Q = 2.00 (quantity rises from 2→4)

$$\%\Delta P = \frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} \times 100\% = \frac{0.25}{\frac{1}{2}(1.75 + 1.50)} \times 100\%$$

$$= \frac{0.25}{1.625} \times 100\% = 0.154 \times 100\% = 15.4\%$$

$$\%\Delta Q = \frac{\Delta Q}{\frac{1}{2}(Q_1 + Q_2)} \times 100\% = \frac{2}{\frac{1}{2}(2 + 4)} \times 100\%$$

$$= \frac{2}{3} \times 100\% = 0.67 \times 100\% = 67\%$$

$$E^D{}_P = \frac{\%\Delta Q^D}{\%\Delta P} = \frac{67}{15.4} = -4.35 \text{ (ADD NEGATIVE)}$$

→ is this elastic or inelastic?

→ elastic because > 1 in abs value

E^D between C→ D:

We need the percent change in Q^D and the % Δ P → using the midpoint formula:

Δ P = 0.25 (price falls from 0.50→0.25)
Δ Q = 2.00 (quantity rises from 12→14)

$$\%\Delta P = \frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} \times 100\% = \frac{0.25}{\frac{1}{2}(0.50 + 0.25)} \times 100\%$$

$$= \frac{0.25}{3.75} \times 100\% = 0.67 \times 100\% = 67\%$$

$$\%\Delta Q = \frac{\Delta Q}{\frac{1}{2}(Q_1 + Q_2)} \times 100\% = \frac{2}{\frac{1}{2}(12 + 14)} \times 100\%$$

$$= \frac{2}{13} \times 100\% = 0.154 \times 100\% = 15.4\%$$

$$E^D{}_P = \frac{\%\Delta Q^D}{\%\Delta P} = \frac{15.4}{67} = -0.23 \text{ (ADD NEGATIVE)}$$

→ is this elastic or inelastic?

→ inelastic because < 1 in abs value

E^D between C→ D:

We need the percent change in Q^D and the % Δ P → using the midpoint formula:

Δ P = 0.25 (price falls from 0.50→0.25)
Δ Q = 2.00 (quantity rises from 12→14)

$$\%\Delta P = \frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} \times 100\% = \frac{0.25}{\frac{1}{2}(0.50 + 0.25)} \times 100\%$$

$$= \frac{0.25}{3.75} \times 100\% = 0.67 \times 100\% = 67\%$$

$$\%\Delta Q = \frac{\Delta Q}{\frac{1}{2}(Q_1 + Q_2)} \times 100\% = \frac{2}{\frac{1}{2}(12 + 14)} \times 100\%$$

$$= \frac{2}{13} \times 100\% = 0.154 \times 100\% = 15.4\%$$

$$E^D{}_P = \frac{\%\Delta Q^D}{\%\Delta P} = \frac{15.4}{67} = -0.23 \text{ (ADD NEGATIVE)}$$

→ is this elastic or inelastic?

→ inelastic because < 1 in abs value

✪ IMPORTANT POINT: the general demand for a good may not be unconditionally elastic or inelastic – elasticity can and does change with changes in price.

OK – why is this elasticity thing important?

→ E^D can tell us what Δ in Q to expect for a given Δ in P

- IF we know the Δ in P and we know the Δ in Q that results, then we can calculate the Δ in REVENUE that results.

✪ <u>REVENUE</u> = dollars brought in = Price x quantity sold

eg: sell 5 pizzas at $10 each ⇒ Total Revenue = $10 x 5 = $50.00

Q: What happens if we increase price to $12.00? – will revenue increase?
A: we don't know… If we increase price to $12, what will happen to Q^D?
→ Q^D will fall.

So P will rise and Q will fall – so we don't know what will happen to the product of P and Q unless we know which change is bigger.

→ If price increases by more than quantity decreases ⇒ revenue will increase
→ If price increases by less than quantity decreases ⇒ revenue will decrease

How do we know which change will be bigger?

✪ Elasticity of D tells us the size of the Q change for a given P change.

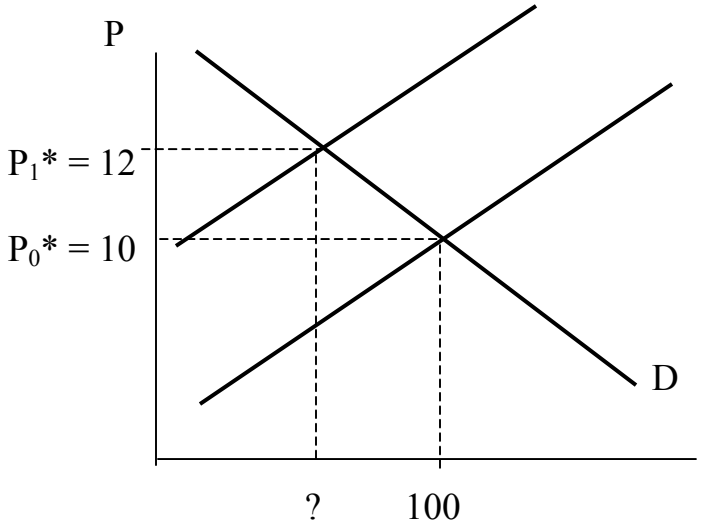
So, we need to look at the implications of price elasticity of demand for <u>changes in revenue</u> following price changes.

Let's do an example to see this idea:

We run a pizza place. Our current market price is $10.00 for a large cheese pie, and at this price we sell 100 units per week.

→ draw graph: $P_0^* = \$10$ and $Q_0^* = 100 \Rightarrow$ an efficient market outcome

→ now we have to change something…



… assume that the price of tomato sauce increases. ⇒ Supply will decrease.

→ Supply shifting back causes ↑ P and ↓ Q

Assume the new price = $12 ⇒ $\Delta P = 2$

? What will happen to revenues?

→ we're selling fewer pizzas, but we're charging a higher price.

→ if we know E^D_P we can figure it out…

Let's assume that our pizza is the only decent NY style pizza around – there are very few substitutes for our pizza.

Q: so is the demand for our pizza going to be <u>elastic or inelastic</u>?
→ few substitutes ⇒ that demand will be <u>inelastic</u>.

Q: so will E^D be a large number or a small number in absolute value?

→ A small number – inelastic D ⇒ there will be a small % Δ in Q^D for a given % Δ price. (inelastic D ⇒ $\left|E_p^d\right| < 1$)

✪ Let's assume that $E^D_P = -0.5$

Now we can calculate the change in quantity that results from the change in price, and as a result we can calculate the change in revenues.

First we have to put the price change in percentage terms:

$$\%\Delta P = \frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} \times 100\% = \frac{2}{\frac{1}{2}(10+11)} \times 100\%$$

$$= \frac{2}{11} \times 100\% = 0.182 \times 100\% = 18.2\%$$

$$E^D_P = -0.5 = \frac{\%\Delta Q^D}{\%\Delta P} = \frac{\%\Delta Q^D}{18.2} \Rightarrow \%\Delta Q^D = (18.2)(-0.5) = -9.1\ \%$$

✪ Q^D will <u>decrease</u> by 9.1% ⇒ new equilibrium $Q^D = 91$

? So what happens to revenue?

(old) revenue = $P_0 \cdot Q_0 = \$10.00 \cdot 100 = \$1000.00$

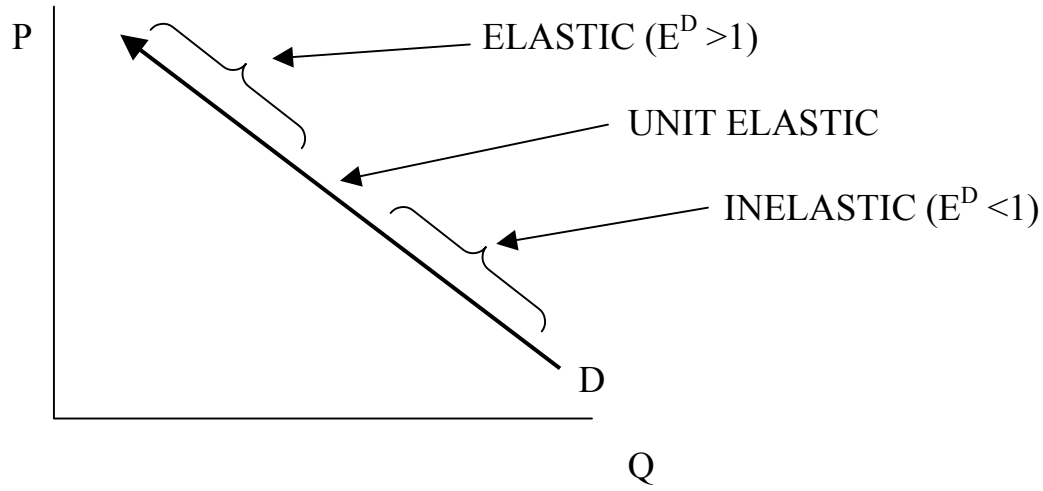
(new) revenue = $P_1 \cdot Q_1 = \$12.00 \cdot 91 = \$1092.00$

✪ When demand is inelastic, revenue will increase with a price increase because the (+) % Δ in P is > the (-) %ΔQ

⇒ the lost revenue due to lower Q will be more than offset by a gain in revenue due higher price.

Q: if this is the case, we can <u>increase revenue by raising price</u>, why don't we just <u>keep increasing price</u>?

→ what's going to happen to that elasticity if we keep increasing price?



↑ P ⇒ D will eventually become more elastic ∴ eventually price increases will cause a <u>loss</u> in revenue.

✪ With elastic demand: a positive change in price ⇒ ↓ revenue because the positive % Δ P < the negative % Δ in Q

SUM UP:

ELASTIC DEMAND ⇒ Price and revenue move in <u>opposite</u> directions

↑ P ⇒ ↓ revenue {Q^D falls a lot when ↑ P ∴ lose revenue}
↓ P ⇒ ↑ revenue {Q^D rises a lot when ↓ P ∴ gain revenue}

INELASTIC DEMAND ⇒ Price and revenue move in <u>the same</u> direction

↑ P ⇒ ↑ revenue {Q^D falls only a little when ↑ P ∴ gain revenue}
↓ P ⇒ ↓ revenue {Q^D rises only a little when ↓ P ∴ lose revenue}

✪ other elasticity measures

The income elasticity of demand (E^D_I) for a particular good measures the percent change in units purchased for a one percent change in income.

→ E^D_I tells us how sensitive sales of the good are to income changes.

$$E^D_I = \frac{\%\Delta units\_purchased}{\%\Delta Income}$$

? what is the sign of E^D_I ?

→ as income increases, do you buy more or less goods?
→ depends.

For some goods (most goods) you buy more as income ↑

≡ "Normal Goods": ↑ I ⇒ ↑ D ⇒ $E^D_I > 0$

* positive relationship between income and number of units purchased

For other goods, you buy less as income ↑

≡ "Inferior goods": ↑ I ⇒ ↓ D ⇒ $E^D_I < 0$

* inverse relationship between income and number of units purchased

Eg: the income elasticity of demand for pop tarts = -2

⇒ pop tarts are an inferior good

$$E^D_I = \frac{\%\Delta units\_purchased}{\%\Delta Income} = -2$$

⇒ %Δ I > 0 then %Δ units purchased < 0

For this example $E^D_I = -2$

? what will happen to the quantity of pop tarts purchased if the incomes of pap tart consumers increases by 25%?

$$E^D_I = -2 = \frac{\%\Delta units\_purchased}{\%\Delta Income} = \frac{\%\Delta units\_purchased}{25}$$

$\Rightarrow$ %Δ units purchased = (25) · (-2) = -50

$\Rightarrow$ units purchased will <u>decrease</u> by 50% when incomes rise by 25%

The last demand elasticity we need to talk about is the

<u>Cross-Price Elasticity of Demand</u> (E^D_{CP})

✪ $$E^D_{CP} = \frac{\%\Delta units\_of\_A\_purchased}{\%\Delta price\_of\_good\_B}$$

? What is the sign of the cross-price elasticity of demand?

$\rightarrow$ Depends on the relationship between A and B.

✪ If A and B are substitutes, then $\uparrow P_B \Rightarrow \uparrow$ Demand for A $\Rightarrow E^D_{CP} > 0$

✪ If A and B are complements, then $\uparrow P_B \Rightarrow \downarrow$ Demand for A $\Rightarrow E^D_{CP} < 0$