Econ 300 Notes

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1 Review and Mathematical Background

1.1 Essence of Microeconomics

(Chapter 1)

Much of microeconomics is about LIMITS:

- limited incomes that consumers spend on goods and services
- limited budgets and technical knowledge that firms use to produce things
- limited number of hours in a week that workers can allocate to labor or leisure

But, microeconomics is also about **how to make the most of those limits**

→ It is about the allocation of scarce resource and

- explains how consumers, can best allocate their limited incomes to various goods and services available for purchase
- explains how firms can best allocate limited financial resources to hiring additional workers versus buying new machinery and to producing one set of products versus another
- explains how workers can best allocate their time to labor instead of leisure or to one job instead of another.

There are several recurring themes in microeconomics that will continually come up throughout the course:

1. Trade-offs
2. Prices and markets
3. Theories and models
4. Positive and normative analyses

1.1.1 Trade-offs

In general microeconomics describes the trade-offs that government, consumers, workers and firms face & shows how these trade-offs might be best made.

→ The idea of making an optimal trade-off (i.e. an optimal choice) is key throughout this course (i.e. what is the best choice?)

→ Every choice/decision provides some benefit and costs something - but how do we use the power of the abstract to model these choices? We will use **marginal analysis** to guide us through this.

1.1.2 Prices and Markets

All of the trade-offs we consider are going to be quantified and based on the prices faced by consumers, workers, and firms.

e.g. consumers' trade-off pepsi for coke based partly on their preferences, but also on their relative prices to other goods.

→Microeconomics explains how prices are determined

- in a market economy, prices are determined by the interactions of consumers, workers, government and firms & **these interactions occur in markets!!**

1.1.3 Theories and Models

Just like any science, economics is concerned with **explanations** of observed phenomena.

e.g. why does the price of gas rise before a hurricane that has not hit land or caused any damage yet?

→In economics, as in other sciences, explanations and predictions are based on **theories**.

Theories are developed to explain observed phenomena / circumstances in terms of a set of basic rules and assumptions

e.g. in our (to be developed later in the course) theory of the firm, all we start with is a single assumption: **Firms make decisions to try to maximize their profits.**

- The theory uses this assumption to explain how firms choose the amount of labor, capital and raw materials they use for production and for the amount of output they produce.

- it also explains how these choices depend on the prices of inputs and the prices that firms can receive for their output.

→ Point is that economic theories are also the **basis for making predictions**.

e.g. the theory of the firm tells us whether a firm's output level will increase or decrease in response to a change in a price....

Of course it is important to remember that no theory is perfectly correct.

- a theories usefulness and validity depends on whether it succeeds in explaining and predicting the set of circumstances that it is intended to explain or predict.

→ Theories are therefore always tested against observations and modified if necessary

e.g. because firms do not always max their profits, sometimes the predictions of the firms choices are off - but on average the theory does a good job and has stood up to repeated testing - becoming an important tool for managers and policy makers.

1.1.4 Positive and Normative Analyses

Positive analysis - deals with "what is" (explanations and predictions) e.g. describes relationships of cause and effect

→ how we will employ our theories

Normative analysis - deals with what "ought to be" and questions of "what is best for society" e.g. in the public interest

→ Ambiguous and usually includes value judgements.

1.2 Price Comparisons

As noted, prices are a central theme of economics, and we need a way of comparing them - not only between goods and services, but over time.

→We will use a common method for this and distinguish between real and nominal prices.

1.2.1 Real v's Nominal Prices

In making comparisons of the price of a good today, in the past and in the future, a common method is to measure prices relative to an **overall price level**.

e.g. while our rental price might seem a lot more than our parents in the 1980's, we really can't tell without comparing relative prices and how they have changed over time.

→ We need to correct for inflation!

→ We want to measure prices in "real" terms rather than "nominal" terms where:

nominal price = absolute price in current dollars (nominal price =real price +inflation)

real price = nominal price adjusted for inflation (real price = nominal price-inflation)

The most common aggregate measure - the Consumer Price Index (CPI):

CPI - calculated by the BLS monthly

- records how much the cost of a large basket of goods purchased by a typical consumer in some base year changes over time
- base year CPI=100
- % changes in the CPI measure the rate of inflation in the economy

→ Most often I will be using real prices rather than nominal - allows us to evaluate prices on a common basis

1.3 Basics of Market Analysis (Chapter 2 and Sections from Chapter 9)

Review of demand, supply and markets.

1.3.1 Demand Curve

- determinants of demand
  - movements along the demand curve

- movements/shifts in demand

Remember: each point on the demand curve represents the max \$ some person would be willing to pay (wtp) for the last unit of the good (marginal wtp or marginal benefit)

So, as we know what each point represents,

$$\text{total wtp} = \sum(\text{marginal wtp})$$

=sum of wtp for all units up to that price

=AREA UNDER DEMAND

→ This measure of the total wtp is the total benefits / value to society

e.g. if price decreases from p_1 to p_2 what are the **total benefits** to society from the price change?

Linear demand:

$$Q_d = a - bP$$

where

a = horizontal intercept

b = slope (remember way economists draw it)

$\frac{a}{b}$ = vertical intercept

But remember the slope as we usually see it, $y = mx + b$ where $m = \frac{rise}{run}$. The easiest way to not be confused is the convert the **normal demand curve**

$$Q_d = a - bP$$

to the **inverse demand curve**

$$P_d = \frac{a}{b} - \frac{1}{b}Q$$

where

$\frac{a}{b}$ = vertical intercept

a = horizontal intercept

$\frac{1}{b}$ = slope

1.3.2 Supply Curve

- determinants of supply
  - movements along the supply curve
  - shifts in supply

Remember - each point on the supply curve represents (at the minimum) what a seller or producer would be willing to accept (wta) for the last unit sold (marginal wtp).

Q: what would be the min wta? Probably at a minimum what it cost (additionally) to produce that unit.

$\rightarrow$ So

$$\begin{aligned}\text{Each point on the supply curve} = \text{min wta} \\ &= \text{marginal wta} \\ &= \text{marginal cost}\end{aligned}$$

So again as each point is MC then the:

$$\begin{aligned}\text{total cost of production} &= \sum MC \\ &= \text{sum of wta for all units up to that price} \\ &= \text{area under supply}\end{aligned}$$

e.g. if price decreases from p_1 to p_2 what are the **total costs** to society from the price change?

Linear Supply Normal supply curve:

$$Q_s = c + dP$$

where
$c =$ horizontal intercept
$-\frac{c}{d} =$ vertical intercept
$d =$ slope (but remember the way economists write the supply curve)
Inverse supply curve (in $y = mx + b$ form):

$$P_s = -\frac{c}{d} + \frac{1}{d}Q$$

1.4 Concepts in More Detail and Math Review

1.4.1 Optimal decision making

Perhaps our most important question and task is to use the power of the abstract to reflect common sense and answer the basic question:

How should a firm/individual/government make its decisions?

$\rightarrow$ What is the objective of the agent's decision making process?

- Firms ultimate objective is to make their profits as large as possible
- Individuals objective is to make their utlity (happiness) as large as possible

In general we say firms maximize their profits (which we could simply call net benefits as they are the net of the benefits of doing business - i.e. their revenues $-$ costs of doing business)

-they do this by weighting the additional benefits they gain from producing more against the additional costs from producing more.

i.e.

If additional benefits > additional costs - do it
If additional benefits < additional costs - don't do it
When additional benefits = additional costs the decision is as good as it is going to get.

Economists call this basic decision procedure the **marginal analysis** of evaluating trade-offs (by comparing benefits and costs of decisions).

Benefit Side The upside of a decision is given by the additional benefits it generates. We call these additional benefits **marginal benefits (MB)** and calculate them as:

MB of a 1 unit increase in an activity=additional benefit received from a 1 unit increase in an activity

So we can extend this formally:
MB = change in total benefit from a 1 unit change in activity
$MB = \frac{\Delta TB}{\Delta A} \approx \frac{dTB}{dA}$
where A = activity

Cost Side The downside of a decision is given by the additional cost it generates. We call these additional costs **marginal cost (MC)** and calculate them as:

MC of a 1 unit increase in an activity=additional cost from a 1 unit increase in an activity

So we can extend this formally:
MC = change in total cost from a 1 unit change in activity
$MC = \frac{\Delta TC}{\Delta A} \approx \frac{dTC}{dA}$
where A = activity

Economic Decision Rule The decision makers choice then comes down to weighing the MB against the MC:
If:

$MB > MC$ we can increase the activity by 1 unit and what we get (MB) outweighs what it costs us additionally (MC) $\rightarrow$ do it
$MB < MC$ we can increase the activity by 1 unit and what we get (MB) is less than what it costs us additionally (MC) $\rightarrow$ don't do it

So as long as $MB > MC$ we can increase the activity and be better off.
$\Rightarrow$ keep increasing the activity whenever $MB > MC$ until we cannot increase net benefits anymore
$\Rightarrow$ the point where $MB = MC$ maximizes net benefits, the best one can do, the **optimal choice!**
Thus the economic decision rule is to undertake an activity until $MB = MC$ and maximize the objective.

1.4.2 Key Analytical Tools

To facilitate our analysis - it is going to be useful to use some math, and in particular we will use a lot of functions and graphs.

Functions - mathematically describe relationships between variables

Single value functions: $y = f(x)$

Multivalued functions: $y = f(x, z, t)$

Graphs

Single value functions: $y = f(x)$ in two dimensions

Multivalued functions: $y = f(x, z)$ in three dimensions - tend to be very difficult to plot - so we tend to plot by holding one of the variables constant and reducing the picture to 2D.

We do this (a technique called finding "level curves") by hold some variables constant and observing the relationship between the two we want to focus on.

With multivalued functions we invoke the assumption of **ceteris paribus** (all else constant).

e.g. for $y = f(x, z)$ we might hold x constant at $\overline{x}$ and observe how y varies with changes in z.

Linear Curves Familiar equation of a straight line (linear equation) $y = mx + b$:

where:

y is the dependent variable
x is the independent variable
m is the slope (slope coefficient)
b is the (y-axis) intercept

and we can calculate:

m =slope= $\frac{\text{change in y}}{\text{change in x}} = \frac{\Delta y}{\Delta x}$, which is a constant for linear curves

To find the slope of a linear curve for any two given points (x_1, y_1) and (x_2, y_2):

$m = \frac{y_2 - y_1}{x_2 - x_1}$

and then we can find the linear equation by taking the slope and one of the points and rearranging this formula:

use

(x_1, y_1)

and know

$m = \frac{y_2 - y_1}{x_2 - x_1}$

so

$y - y_1 = m(x - x_1)$

or

$y = mx \underbrace{- mx_1 + y_1}_{b}$

Nonlinear Curves Have a nonconstant slope $y = f(x)$, and may be convex (slope increases as x increases) or concave (slope decreases as x increases).

The slope along the line changes depending where on the function you are looking. We are always going to be talking about the slope at a single point on the curve.

&

Slope at a point on a curve = slope of a line tangent to the curve at that point.

Calculus is useful for nonlinear curves.

In-class calculus review notes.

1.4.3 Equilibrium Analysis

Markets bring demand and supply together:

-people who have it

-people who want it

Markets allow the process of exchange to occur.

⇒ Question becomes, why do they work, and do the work well?

To answer this and related questions we will focus on the concept of

Economic Efficiency

- tells us the most desirable outcome from a social point of view
- requires markets to balance between:

[value of what is produced] & [value of what is used up to produce it]

where:

[value of what is produced] is from the demand side and concerned with social values.

- we measure social value from the demand curve, where we know total value/ total benefits = area under demand

and

[value of what is used up to produce it] is from the supply side and concerned with the social costs of production

- we measure total social costs from the supply curve (remembering this is essentially the MC curve) and know total costs = area under supply

So given these two sides we can develop a measure of the net benefit to society from exchange:

[Net benefit to society] = [Total benefit] − [Total costs]

and then define the market perspective of an **efficient outcome:**

Efficient Outcome = the one which maximizes the net benefits to society.

Draw total benefits and show that as $Q \uparrow \Rightarrow TB \uparrow$

Draw total costs and show that as $Q \uparrow \Rightarrow TC \uparrow$

All a market does is merge these two sides and finds a point of "balance" or equilibrium between the two, which is achieved through market prices!.

As we noted above, in a market economy, prices are determined by the interactions of consumers, workers, government and firms & **these interactions occur in markets!**

We know from our review of demand that the demand curve presents the max wtp of people for certain units of a good. The supply curve represents the min wta for certain units of a good. Where these two concepts interact is the market place, and what brings them into balance are market prices.

For example, in a situation when the quantity offered for sale is less than the quantity people demand (so what people are wtp is more than what firms are wta) there is a shortage of the good and buyers will try to outbid other people for the few units of the good. Firms see these good returns (their min wta or MC's are less than what they are receiving for the good) and increase production to take advantage of the situation. But, as they increase production, their min wta for additional units produced rises (MC's rise); at the same time as there are more units of the good being offered to consumers what they are willing to pay falls. But as long as max wtp>min wta there will be bidding wars for limited units and firms will have an incentive to increase production, with max wtp's falling and min wta's rising.

Of course, whenever the quantity offered for sale is less than what people demand (so what people are wtp is less than the min wta of firms) then we have a surplus. In this situation there is a lot of the good for sale, and to sell their units firms compete with each other and undercut one another to grab some of the limited demand. But this means that at least some of them have to lower their price below their min wta (their MC) and this is not good for their profits of course. So they start lowering production. As they lower production their min wta per unit falls, but at the same time the max wtp for those units rises.

So if we start from a shortage situation or a surplus there are forces bringing the max wtp's and min wta's together! The system comes to a balance or equilibrium when max wtp = min wta and demand and supply are in balance at a single price, quantity combination. There is no incentive at this equilibrium point (all else constant) to change anything, and the balance is assured.

Of course at this point of balance we know the total benefits to society of the market outcome (the area under demand) and we know the total costs to society (the area under supply). We therefor can easily calculate the net benefits to society from the market outcome as the difference between total benefits and total costs.

$$\text{Total benefits from market equilibrium} = \text{area under demand}$$
$$\text{Total costs from market equilibrium} = \text{area under supply}$$

Net benefits from market outcome = **total surplus** = total benefits - total costs

And this surplus measure is a measure of welfare to society from the market outcome. It is easy to show that total surplus is maximized from a market equilibrium! So (in well functioning markets) markets result in **gains from trade** and they maximize social welfare!

It is important to remember that total surplus is a measure of societies welfare (and society in this simple model consists of consumers driving demand and producers driving supply). But we can separate out consumer welfare from total surplus and producer welfare from total surplus.

The consumer welfare component of total surplus is called **consumer surplus** and it measures consumer welfare as simply the sum of all differences between max wtps and the market price, so

Consumer surplus = area under demand above market price

The intuition is simple - if people are paying something less than their max wtp for the good they are happy!

The producer welfare component of total surplus is called **producer surplus** and it measures producer welfare as simply the sum of all differences between min wta and the market price, so:

Producer surplus = area under market price above supply

It should also be obvious that:

Total surplus = consumer surplus + producer surplus

Of course, if we remember our economic decision rule and realize that the demand curve measure MB to consumers and the supply curve measures MC to producers we would quickly realize that max net benefits will be where $MB = MC$ and total surplus is maximized at a market equilibrium.

$\Rightarrow$markets deliver the efficient outcome when $MB = MC$ and thus demand equals supply.

$\Rightarrow$ when successful, markets will produce an efficient allocation of resources - what we call a **Pareto optimal allocation of resources** such that there is no way to reallocate resource without making at least one person worse off.

So conceptually, what does all this mean?

$\Rightarrow$ socially optimal allocations of resources are possible through the free exchange of goods and services if:

1. consumers and producers act in their own self interest (they act to max their own net benefits)

2. a complete set of markets exists

Where (1) and (2) above are the characteristics of a successful market system. With a successful market system all gains from trade can be captured!

1.4.4 Changes in Economic Variables on Market Equilibria

We will often extend our market equilibrium analysis to consider / predict the effects of changes in market conditions i.e. what happens to the market equilibrium from a change in a determinant of supply or demand?

Government Intervention We will often be interested in predicting the market impacts of alternative government policies. In large part our analysis will focus on the distortionary impacts on market outcomes of basic government policies such as price rigidities (price caps and ceilings) and taxes and subsidies.

Price Caps/Ceilings and Price Floors (Sections of Chapter 9) An example of a price ceiling is a policy of rent control.

The market consequences depend if the price ceiling is set below where market price would be or above it.

An example of price floors are guaranteed prices for agricultural commodities (e.g. peanut, cotton in NM).

Again the market consequences depend on whether the price floor is set above or below where market price would be.

Taxes and Subsidies Remember the basics:

Taxes can be applied to the value of a purchase or a quantity; and they can be levied on the producer or consumer

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Subsidies can be applied to the value of a purchase or a quantity; and they can be levied on the producer or consumer

What are the consequences to consumers, producers, and society from these instruments?

Problems With This Analysis While this tool is all very well and good for understanding simple "single shifts" of either of our curves, problems quickly arise if a shock or policy causes both curves to shift - so we can't tell from a simple sketch whether price ended up going up or down or where the equilibrium quantity increases or decreases. In these cases the magnitudes of the shifts become important and these in turn depend on ELASTICITIES.

Example - Computer tablet sales.....

1.5 Elasticities (Chapter 3)

We use elasticity concepts to measure the responsiveness of Q^D and Q^S to changes in their own prices and any determinants of supply or demand.

$$\text{Elasticities} = \text{measure of responsiveness}$$

In general:

The elasticity of a variable X to a change in another variable Y is:

$$E_{X,Y} = \frac{\%\text{ change in } X}{\%\text{ change in } Y}$$

where % change $= \frac{\text{new variable}-\text{old variable}}{\text{old variable}} * 100$

so

$$E_{X,Y} == \frac{\left[\frac{\Delta X}{X}\right]}{\left[\frac{\Delta Y}{Y}\right]} = \frac{Y}{X}\left(\frac{\Delta X}{\Delta Y}\right) \approx \frac{Y}{X}\left(\frac{dX}{dY}\right)$$

Remember how we classify elasticities:

$$\begin{aligned} |E_{X,Y}| &> 1 \text{ - elastic} \\ |E_{X,Y}| &< 1 \text{ - inelastic} \\ |E_{X,Y}| &= 1 \text{ - unitary elastic} \end{aligned}$$

1.5.1 Own Price Elasticity

Measures the sensitivity of quantity demanded of a good Q_x^D to changes in its own price P_x.

$$\text{Own price elasticity of demand } \epsilon_{Q_x^D,P_x} = \frac{\%\text{ change in } Q_x^D}{\%\text{ change in } P_x}$$

If we are interested in the elasticity at a specific point (not interval) we can calculate the **point** elasticity which we can rewrite as

$$\epsilon_{Q_x^D,P_x} = \frac{\left[\frac{\Delta Q_x^D}{Q_x^D}\right]}{\left[\frac{\Delta P_x}{P_x}\right]} = \frac{P_x}{Q_x^D}\left(\frac{\Delta Q_x^D}{\Delta P_x}\right) \approx \frac{P_x}{Q_x^D}\left(\frac{dQ_x^D}{dP_x}\right)$$

where

$$\frac{dQ_x^D}{dP_x} = \text{slope of normal demand curve}$$

We could have repeated this for the own price elasticity of supply.

So, for a simple linear demand curve:

$$Q_D = a - bP$$

the point elasticity (the elasticity at any point on the demand curve) for the point (Q^*, P^*) is given by:

$$\epsilon_{Q_x^D,P_x} = \frac{P^*}{Q^*}\left(\frac{dQ^D}{dP}\right) = \frac{P^*}{Q^*}(-b)$$

where $b=$ slope of the normal demand curve! Note however how the magnitude of the elasticity depends on where on the demand curve you are at!

***Note that if given any three of the four components of $\epsilon_{Q_x^D,P_x} = \frac{P^*}{Q^*}(-b)$ you can estimate the linear demand function!

Likewise, for linear supply:

$$Q_S = c + dP$$

the point elasticity (the elasticity at any point on the supply curve) for the point (Q^*, P^*) is given by:

$$\epsilon_{Q_x^S,P_x} = \frac{P^*}{Q^*}\left(\frac{dQ_S}{dP}\right) = \frac{P^*}{Q^*}(d)$$

where

$$\frac{dQ_x^S}{dP_x} = d = \text{slope of normal supply curve}$$

Again could estimate the linear supply curve if given any three components of $\epsilon_{Q_x^S,P_x} = \frac{P^*}{Q^*}(d)$.

Of course sometimes we will be interested in calculating the elasticity between two points - called the **arc elasticity.** Continuing our focus on own price elasticities, the arc own price elasticity for demand (or supply) between two price quantity combinations (Q_1, P_1) and (Q_2, P_2) is:

$$\text{arc elasticity} = \epsilon = \frac{\%\text{ change in } Q}{\%\text{ change in } P} = \frac{\left[\frac{(Q_2-Q_1)}{\left(\frac{Q_2+Q_1}{2}\right)}\right]}{\left[\frac{(P_2-P_1)}{\left(\frac{P_2+P_1}{2}\right)}\right]}$$

Remember for any elasticity, depending on whether the (absolute value) of the value you calculate is less than or greater than one we call the relationship inelastic (less than one in absolute value) unit elastic (equal to one in absolute value) or elastic (greater than one in absolute value).

If the **elasticity** you calculate is equal to **zero**, then the relationship is **perfectly inelastic**.

If the **elasticity** you calculate is **infinity** in absolute value, then the relationship is **perfectly elastic**.

Several things are important in determining own price elasticities.

1. Availability of substitutes - as the number and the closeness of substitutes increases, the own price elasticity of demand increases. Also related is how

broadly a market is defined - the demand for food is more inelastic than the demand for cereal.

2. Share of consumers' income spent on a good - smaller the share, the more inelastic

3. Nature of a good - necessities tend to be more inelastic than non-necessities

4. Duration of time over which elasticity is measured - For different goods and different time horizons, elasticities vary.

For example for demand elasticities (remember I am talking about own price): these tend to be more elastic in the LR (b/c of more substitutes) apart from durable goods (b/c the total stocked owned by consumers is large relative to annual production)

Q: what does this mean for LR versus SR demand graphs?

Another example is that for own price elasticities of supply, most LR supply curves are more elastic because of SR capacity constraints. If durable goods are recyclable, then their supply curves in the SR may be more elastic.

Q: what does this mean for LR versus SR supply graphs?

Of course, it is important to realize that elasticities can be used to characterize the responsiveness of demand (and supply) to any of their respective determinants! The two most common are the cross price elasticity of demand and the income elasticity of demand.

1.5.2 Cross Price Elasticity

This measures the responsiveness of demand to changes in the price of related goods, which of course can be substitutes or complements:

Measures the sensitivity of quantity demanded of a good Q_x^D to changes in the price of good y, P_y.

$$\text{Cross price elasticity of demand } \epsilon_{Q_x^D,P_y} = \frac{\%\text{ change in } Q_x^D}{\%\text{ change in } P_y}$$

If we are interested in the elasticity at a specific point (not interval) we can calculate the **point** elasticity which we can rewrite as

$$\epsilon_{Q_x^D,P_y} = \frac{\left[\frac{\Delta Q_x^D}{Q_x^D}\right]}{\left[\frac{\Delta P_y}{P_y}\right]} = \frac{P_y}{Q_x^D}\left(\frac{\Delta Q_x^D}{\Delta P_y}\right)$$

$$\frac{dQ_x^D}{dP_y} = \text{how demand changes for a small change in } P_y$$

$\epsilon_{Q_x^D,P_y}$ tells us if goods x and y are substitutes or complements and also measures the closeness of substitutes and complements, where higher values indicate stronger relationships.

Examples:

$\epsilon_{Q^D_{chicken},P_{beef}} = 0.12$

$\epsilon_{Q^D_{pork},P_{chicken}} = 0.25$

1.5.3 Income Elasticity

Measures the responsiveness of demand to changes in income

Measures the sensitivity of quantity demanded of a good Q_x^D to changes in consumer income, I.

$$\text{Income elasticity of demand } \epsilon_{Q_x^D,I} = \frac{\%\text{ change in } Q_x^D}{\%\text{ change in } I}$$

If we are interested in the elasticity at a specific point (not interval) we can calculate the **point** elasticity which we can rewrite as

$$\epsilon_{Q_x^D,I} = \frac{\left[\frac{\Delta Q_x^D}{Q_x^D}\right]}{\left[\frac{\Delta I}{I}\right]} = \frac{I}{Q_x^D}\left(\frac{\Delta Q_x^D}{\Delta I}\right) \approx \frac{I}{Q_x^D}\left(\frac{dQ_x^D}{dI}\right)$$

where

$$\frac{dQ_x^D}{dI} = \text{how demand changes for a small change in } I$$

This not only measure responsiveness to changes in income, it also tells us whether or not the good is a normal good or inferior.

1.5.4 Elasticities from Estimated Functions

Many demand and supply functions are estimated using linear specifications:

In general

$$Q_x^D = f(P_x, P_y, I)$$

with a linear specification

$$Q_x^D = \alpha + \beta_1 P_x + \beta_2 P_y + \beta_3 I$$

and estimate

$$Q_x^D = a + b_1 P_x + b_2 P_y + b_3 I$$

using data gathered on Q_x^D, P_x, P_y, I and making distributional assumptions over the error specification to provide the estimates, where:

$$\begin{aligned} b_1 &= \frac{\partial Q_x^D}{\partial P_x} = \frac{\Delta Q_x^D}{\Delta P_x} \\ b_2 &= \frac{\partial Q_x^D}{\partial P_y} = \frac{\Delta Q_x^D}{\Delta P_y} \\ b_3 &= \frac{\partial Q_x^D}{\partial I} = \frac{\Delta Q_x^D}{\Delta I} \end{aligned}$$

where we know:

$$
\begin{aligned}
\epsilon_{Q^x_D,P^x} &= \frac{P^x}{Q^x_D}\left(\frac{dQ^x_D}{dP^x}\right) = \frac{P^x}{Q^x_D}\,(b_1) \\
\epsilon_{Q^D_x,P_y} &= \frac{P_y}{Q^D_x}\left(\frac{dQ^D_x}{dP_y}\right) = \frac{P_y}{Q^D_x}\,(b_2) \\
\epsilon_{Q^D_x,I} &= \frac{I}{Q^D_x}\left(\frac{dQ^D_x}{dI}\right) = \frac{I}{Q^D_x}\,(b_3)
\end{aligned}
$$

Example: famous study on coke and pepsi:

$$
\begin{aligned}
Q^D_C &= 26.17 - 3.98P_C + 2.25P_P + 0.99I + 2.6A_C - 0.62A_P + 9.58S \\
Q^D_P &= 17.48 - 5.48P_P + 1.4P_C + 1.92I + 2.83A_P - 4.81A_C + 11.98S
\end{aligned}
$$

where
Q^D_C=demand for Coke (ten million cases)
Q^D_P=demand for Pepsi (ten million cases)
P_C=price per 10 cases of Coke (1986$)
P_P=price per 10 cases of Pepsi (1986$)
I= Disposable income in U.S. (thousand 1986$)
A_C=square root of quarterly advertising expenditures by Coke (million 1986$)
A_P=square root of quarterly advertising expenditures by Pepsi (million 1986$)
S= dummy variable (=1 in spring and summer quarters, =0 else)
Average Values:
$\overline{P_C} = 12.96$
$\overline{P_P} = 8.16$
$\overline{I} = 20.63$
$\overline{A_C} = 5.89$
$\overline{A_P} = 5.28$
$\overline{S} = 1$

1.5.5 Elasticity Summary

1 Elasticities provide quantitative measures of the responsiveness of demand to different factors.

2.They can be used to measure the impact of internal and external changes on the demand for a product.

3. Managers and policy makers can anticipate the effects of pricing changes (internal factors) and economic conditions (external factors) on the total revenue derived from a product.

4. Anticipating changes in total revenues can lead to other managerial decisions to counteract anticipated changes and vice versa.