Microeconomic Analysis

- Introduction (today)
- Overview and Revision (next two lectures)
- Consumers → demand side
- Firms → supply side
- Market structures
- Pricing strategies
- Markets for inputs
- Normative economics – “ought” ⇒ policy

Issues in Microeconomics

- How can bad weather help farmers?
- How do borrowing and lending help smooth consumption over years?
- What impact does a fall in discount rates have on this pattern?
- Why do some people choose not to work?
- Why do some people choose not to work longer when their wage rates increase?
- Why is there a greater reliance on machinery in Australian construction than in Chinese construction?
- When will higher tax rates raise tax revenues, and when will such revenues fall?
- Why do some firms go out of business?
- Why do some restaurants offer “weekday specials”?
- Why do high interest rates discourage investment?
- Why might price controls result in queuing?
- How could minimum wage laws result in lower employment?
- When might governments use quotas (which raise no revenues) rather than tariffs (which, as taxes on imports, do raise revenues)?
- How can growing demand for computers accompany lower prices for computers?
- How best should governments allocate scarce resources, such as the electro-magnetic spectrum?
• When is a monopoly not a monopoly? (Or, should Alan Fels and the Australian Competition and Consumer Commission care that there is only a single manufacturer of Coca Cola in Australia?)

• Are Australian CD prices too high? If so, why, and what could the Government do to reduce them?

• Why have slide rules disappeared from sale?

• Why does Telstra charge a monthly amount, plus an amount per call?

• How could Telstra change its billing, and how would subscribers’ behaviour change?

• What methods do firms use to reduce loafing on the job?

• Why are employee-owned firms rare?

• What is the difference between a firm’s average cost and marginal cost? And does it matter?

• What information does the firm need to calculate both costs?

• How do decision makers respond to future uncertainty?

• What if advertising were prohibited?

• What if coffee drinking (or cigarette smoking) were prohibited?

• What is Gresham’s Law and why is it important in times when the quality of items is not easily observed before purchase?

• How should the Encyclopædia Britannica counter the threat of Microsoft’s Encarta on CD-ROM?

**What is Micro-economics?**

The study of the way resources are allocated among competing uses to satisfy human wants.

*Wants* are the ends of the process

(There is no intrinsic value.)

Resources are *scarce*

(Not all wants can be met at once, and so there must be sacrifices and trade-offs.)

Subject to technology, or production knowledge—

1. *allocate* resources (inputs — eg?)

2. determine the *composition* of outputs (goods and services — eg?)

3. *distribute* the products or outputs to households.
Modelling

What is a model?
What is a good model?
A simplified picture of a part of the real world. Has some of the real world’s attributes, but not all. A picture simpler than reality.

We construct models in order to explain and understand.

Three Rules for Model Building:
- Think “process”.
- Develop interesting implications.
- Look for generality.

Judge models using: truth, beauty, justice.

Interplay between the real world, world of aesthetics, world of ethics, and the model world.

Prices, Costs, and Values → Profits

We use verbal, graphical, and algebraic models of how consumers, firms, and markets work.

We assume rationality: that economic actors (consumers and firms) will not consistently behave in their worst interests.

Not a predictive model of how individuals act, but robust in aggregate.

OVERVIEW
& REVISION
(next two lectures)

1. Maximization: How individuals, households, and firms choose their bundles of consumption goods and services or their production levels.

2. Prices: What are nominal prices, real prices, inflation, and price indices (such as the CPI)? How are these related to real and nominal income?

3. Demand: What factors determine demand? What effects do relative price changes have? What effects do changes in nominal income have? What are complements and substitutes? What are normal and inferior goods?

4. Supply: What can we say about supply and price at this stage?

5. Elasticity: A dimensionless measure of the sensitivity of a dependent variable to an independent variable.

6. Equilibrium: How do supply and demand interact in the market to result in equilibrium price and quantity?
1. Maximization

- individual, “consumer”
  maximizes his or her “utility” or satisfaction
  subject to constraints
  - prices
  - income (a flow, $ per unit time)
  - availability
  - (budget?)

- individual firm
  maximizes its profit (a flow)
  subject to constraints
  - competition
  - price of output
  - costs and availability of inputs —
    labour, materials, etc.
  - government regulations (for externalities)
  - technology

*Question:* What if you have a “fruit budget” of $10/week, bananas cost $2.99/kg and oranges cost 10¢ each?

\[
\text{income} = \text{price of oranges} \times \text{no. of oranges} + \text{price of bananas} \times \text{amount of bananas}
\]

\[
I = P_O \times O + P_B \times B
\]

\[
10 = 0.10 \times O + 2.99 \times B
\]

\[
\therefore O = 100 - 29.9 \times B \text{ (equation of the Budget Line)}
\]

**Flow** of goods: units of amount per period

**Stock**: units of amount (NB: no time element)

**Utility**: a function of amounts of bananas and oranges eaten

**Concepts**: utility, indifference curves, bliss point, satiation, feasible set, utility function, choice point, budget line.

\[
U = f(O, B)
\]
**Consumer’s problem:**

To maximize $U(x, y \cdots)$, the utility function

subject to the income constraint:
\[ I \geq x P_x + y P_y + \cdots \]

Utility $U$ is a function of many things:

where $x$ amount of one good bought (oranges) at $P_x$
y "another" at $P_y$
$z$
$a$
b
$c$
$\cdots$

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Maximization problem

(constrained maximization)

(\text{use \textit{Lagrange Multipliers}}

to solve that) — \textit{not for exam}

→ to derive 1\textsuperscript{st} order, necessary conditions for
max., and to describe their economic meaning.

examples: \[ U = x + 2y, \quad U = x^2y^3 \]

Each \textit{indifference curve} corresponds to a particular level of
utility $U_1, U_2, \ldots$ “Contours of utility on a hill of
satisfaction.”

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**Maximizing**

Two assumptions:

- consumers maximize “utility”
- producers (firms) maximize “profit”

Mathematically— (chose vector $x$)

\[
\begin{align*}
\max_x & F(x_1, \cdots, x_n) \\
\text{subject to the constraint} & f(x) = a, \quad (e.g., \text{purchases within budget}) \\
& (\text{for example, } p_1x_1 + p_2x_2 + \cdots p_nx_n = a) \\
\end{align*}
\]

where $x$ are the decision variables,
\[ x > 0, \ x_i \geq 0. \]

We can solve the maximization problem using the method
of \textit{Lagrange Multipliers}. — \textit{not for exam}
2. Prices

Prices do several things at once:

1. reward the seller

2. ration the good by
   - consumer’s willingness to pay
   - consumer’s ability to pay
   - supplier’s willingness to sell

3. signal the costs and values throughout the system
   (decentralised information)
   e.g. Eastern Europe

Nominal or Money Income is a flow of money or goods
or services, measured in dollars of the day, so that through
time with price inflation the value of an amount (say,
$100) of money—as measured by its power to
purchase—falls.

Real Income is a flow of purchasing power in constant
dollars.

Now let $\bar{P}$ be a price index (e.g., the Consumer
Price Index or CPI), a weighted average of $n$ prices, where $P$ is defined
as the weighted sum over the $n$ prices $P_i$.

$$\bar{P} \equiv \sum_{i=1}^{n} \alpha_i P_i = \alpha_1 P_1 + \alpha_2 P_2 + \cdots + \alpha_n P_n$$  \hspace{1cm} (1)

The weights, $\alpha_i$, are non-negative and sum to 1, and have
been chosen to mirror the proportions in the Statistician’s
average basket of consumer goods and services. (See the
weighting pattern of $\alpha_i$ in the Table.)

$$\text{where } \sum_{i=1}^{n} \alpha_i = 1, \quad \alpha_i \geq 0,$$

so that

$$\Delta \bar{P} = \sum_{i=1}^{n} \alpha_i \Delta P_i,$$  \hspace{1cm} (2)

where $\Delta \bar{P}$ is the change in $\bar{P}$. 
Then $I$ (real income) is defined by *deflating* (normalising) the money income $M$:

$$I \equiv \frac{M}{P} \quad (3)$$

from which can be derived (by taking logs and differentiating — *not for exam*):

$$\frac{\Delta I}{I} = \frac{\Delta M}{M} - \frac{\Delta P}{P}, \quad (4)$$

where $\Delta P / P$ is the rate of *inflation*.

That is, *the proportional growth in real income $I$ equals the proportional growth in money income $M$ minus the proportional growth in the price index $P$, which is nothing other than the rate of inflation, if the weights $\alpha_i$ truly reflect the proportions in the average household’s purchases of goods and services.*

So if inflation is 10% p.a. ($\frac{\Delta P}{P} = 10\% \text{ p.a.}$),

and if there is no change to money income ($\Delta M = 0$),

then real income will be falling by 10% p.a. ($\frac{\Delta I}{I} = -10\% \text{ p.a.}$).

Now, the weights $\alpha_i$ measure the effect on the index $\bar{P}$ of a change in the $i$th price $P_i$:

$$\frac{\partial \bar{P}}{\partial P_i} = \alpha_i, \text{ (where } \partial \Rightarrow \text{ partial differentials)}$$

so $P_i \uparrow \rightarrow \bar{P} \uparrow \rightarrow I \downarrow$

That is, if *any* price rises, real income falls,

\[ \text{ceteris paribus or other things equal} \]

NB: *the partial* differential keeps other things equal.
Question: If the minimum weekly wage in 1911 was £2/2/- (or 42/- or $4.20), what money income in 1988 would give the same purchasing power?

Answer: Since £1 → $2 in the conversion from old currency to new, £2/2/- would have been $4.20. Constant purchasing power is equivalent to constant real income, so the question is asking what money income in 1988 would equate real incomes in that year and 1911, given a money income of $4.20 in 1911.

Let $M_{1911} = 4.20$. From the table $P_{1911} = 53$ and $P_{1988} = 1,594$. Using equation (3)

$$I \equiv \frac{M}{P}$$

the answer is simple. Equating $I_{1911}$ and $I_{1988}$, we get

$$\frac{M_{1911}}{P_{1911}} = \frac{M_{1988}}{P_{1988}}$$

which results in

$$M_{1988} = 4.20 \times \frac{1,594}{53} = 4.20 \times 30.08$$

$$= M_{1911} \times \frac{P_{1988}}{P_{1911}} = 126.32$$

In words, a weekly income in 1911 of $4.20 should have given equal purchasing power as a weekly income of $126.32 in 1988.

3. Demand

The quantity demanded is a function of:

- the price of the good ("own price") $P_X$
- the prices of related goods $P_Y$
- one’s income $I$
- the tastes of the consumer $T$
- the wealth of the consumer $W$
- her expected future prices $P_X^e$
- the expected future availability

Examples?

We can write this algebraically:

$$X^D = \text{function}(P_X, P_Y, I, T, W, P_X^e) \quad Y \neq X$$

The Law of Demand is

$$\frac{\partial X^D}{\partial P_X} \leq 0,$$

that is, in response to a price increase, demand never increases, and response to a price fall, demand never decreases. (Note: partial differentiation $\Rightarrow$ ceteris paribus condition.)

Let’s relax the ceteris paribus assumption (and consider the comparative statics):

- how does the demand curve respond to changes in
  - $P_Y$ the prices of related goods?
  - $I$ the income? etc.?
3.1 The Law of Demand

The lower the price, ceteris paribus, the greater the quantity of the good desired to be bought (per time period).

(ceteris paribus = keeping everything else the same)

Plot: price as independent variable and quantity as dependent variable

The Law of Demand:

\[ \frac{\partial X^D}{\partial P_X} \leq 0, \text{ ceteris paribus, that is, a negatively sloped demand curve.} \]

Exceptions to Law of Demand?

(i.e. higher price → higher quantity demanded?)

1. Prestige goods  ? Not really

2. Dynamic expectations?

3. mythical “Giffen” goods (e.g. Irish potatoes in the famine)

   substitution effect (prices change) versus
   income effect (real income changes)

   if the income effect > substitution effect
   then perhaps rise in price of potatoes
   \( \rightarrow \) rise in consumption of potatoes

Question: How does demand change with income?

Demand and income: not so clear cut as price

Define

- “normal” goods \( \frac{\partial X^D}{\partial I} \geq 0 \text{ ceteris paribus} \)
- “inferior” goods \( \frac{\partial X^D}{\partial I} < 0 \text{ ceteris paribus} \)

examples: ?
4. The Supply Curve

The quantity supplied (made and offered for sale) is a function of the price

\[ X^S = f(\text{price}), \]
ceteris paribus, that is, holding these constant:

- technology \((Tech)\)
- supply curves of inputs \((Supp)\)
- taxes & subsidies \((Gov)\)
- regulation
- the state of nature \((Nat)\)
- the period of adjustment, or lag

\[ X^S = X^S(P_X, \overline{Tech}, \overline{Supp}, \overline{Gov}, \overline{Nat}) \]
\[ = X^S(P_X), \text{ ceteris paribus} \]

\[ \Rightarrow \text{There is no law of supply.} \]
5. Elasticity

— a dimensionless measure of the sensitivity of one variable to changes in another, cet. par.

Def. The **price elasticity of demand** is the percentage change in the dependent variable \( X^D \) divided by the percentage change in the independent variable, \( P \).

So the price elasticity of demand is given by the measurements:

\[
\eta_P = \frac{\Delta X / X}{\Delta P / P} = \frac{P}{X} \frac{\Delta X}{\Delta P} \leq 0
\]

mid-point:

\[ P = \frac{P_1 + P_2}{2} \]

point: \( \eta_P = \frac{P_1}{X_1} \frac{\partial X}{\partial P} \) (by convention, use \(|\eta_P|\))

\[ e.g. \quad \text{demand} \quad X^D = 3500 - 500P \]

\[ \therefore \frac{\partial X^D}{\partial P} = -500 = \frac{1}{\text{slope}} \]

(point) \[ \therefore \eta_P = - \frac{P}{X^D} \times 500 \]

( NB: elasticity ≠ the slope! — a frequent trap)
The expression $|\eta_P|$ is the absolute value of the elasticity: never negative.

When $|\eta_P| > 1$ we speak of elastic demand
- $= 1$ we speak of unitary elastic demand
- $< 1$ we speak of inelastic demand
- $= 0$ we speak of perfectly inelastic demand
- $\rightarrow \infty$ perfectly elastic

\[ |\eta_P| = \infty \]

\[ |\eta_P| >> 1 \text{ elastic} \]

\[ \eta_P = 0 \]

\[ |\eta_P| > 0 \text{ inelastic} \]

\[ \eta_P = 1 \text{ unitary} \]

(A rectangular hyperbola.)

A property of price elasticity of demand: $\eta_P$

Expenditure = Revenue $R = P \times X^D = P \times X^D(P)$, where $X^D(P)$ is a demand function.

How does revenue change in response to a change in price?

Diff. totally:
\[
\frac{dR}{dP} = P \frac{\partial X^D}{\partial P} + X^D
\]
\[
= X^D \left( \frac{P}{X^D} \frac{\partial X^D}{\partial P} + 1 \right)
\]
\[
= X^D \left( \eta_P + 1 \right)
\]

So:
\[
\eta^P = -1 \quad \text{unitary} \quad |\eta_P| = 1 \quad \Rightarrow \quad \frac{dR}{dP} = 0
\]
\[
\eta^P < -1 \quad \text{elastic} \quad |\eta_P| > 1 \quad \Rightarrow \quad \frac{dR}{dP} < 0
\]
\[
\eta^P > -1 \quad \text{inelastic} \quad |\eta_P| < 1 \quad \Rightarrow \quad \frac{dR}{dP} > 0
\]

\[ \therefore \text{ Taxes on what?} \]
To summarize:

| $|\eta_P|$ | Price | Total Expenditure (Revenue) |
|---|---|---|
| > 1 | Up | Down |
| Down | Up |
| = 1 | Up | Constant |
| Down | Constant |
| < 1 | Up | Up |
| Down | Down |

5.2 Cross-Price Elasticity of Demand:

is the effect on the demand $X^D$ of a price change $P_Y$ of good $Y \neq X$, but where $X$ and $Y$ are related goods, ceteris paribus.

$$\eta_{X,Y} = \frac{\Delta X^D}{X^D} \left/ \frac{\Delta P_Y}{P_Y}\right.$$

(arc)

$$\eta_{X,Y} = \frac{\partial X^D}{\partial P_Y} \frac{P_Y}{X^D}$$

(point)

$$\Delta X^D = X_1^D - X_2^D$$

$$\Delta P_Y = P_{Y1} - P_{Y2}$$

midpoint convention:

$$\frac{X^D}{P_Y} = \frac{\frac{X_1^D}{2} + \frac{X_2^D}{2}}{P_{Y1} + P_{Y2}}$$

If $\eta_{X,Y} > 0$ then $X$ and $Y$ are **substitutes**

If $\eta_{X,Y} < 0$ then $X$ and $Y$ are **complements**

If $\eta_{X,Y} = 0$ then $X$ and $Y$ are **unrelated**

Examples?

of substitutes?

of complements?
A good’s own-price elasticity of demand is seen to depend on:

1. more substitutes \( \rightarrow \) \(|\eta_P| \uparrow\)
2. a larger proportion of budget: \(|\eta_P| \uparrow\)
3. the higher the price: \(|\eta_P| \uparrow\)

(These properties do not follow from the axioms and definitions; they have been observed in the market.)

5.3 Income Elasticity of Demand \(\varepsilon\)

**Defn.** The proportional change in the amount demanded in response to a 1 percent change in real income.

Or algebraically:

\[
\varepsilon \equiv \frac{\Delta X^D}{X} \bigg/ \frac{\Delta I}{I}
\]

\(\varepsilon\) high \(> 1\) \(> 0\) “normal” good

\(\varepsilon\) low \(< 1\) \(< 0\) “inferior” good

“luxuries” \(\varepsilon\) high \(> 1\) \(> 0\)

“necessities” \(\varepsilon\) low \(< 1\) \(< 0\)

Examples?

\[
5 \bigg/ 9 = \frac{(2,500 - 2,000) / 2,250}{(3 - 2) / 2.5} = \frac{\Delta X / X}{\Delta P / P}
\]

higher

lower

\(X^D = 3500 - 500P\)

elasticity ≠ slope
An increase in the price of Polaroid film $P_{PF}$

→ left-ward shift in the demand for Polaroid cameras $X_{PC}^D$

\[
\frac{\partial X_{PC}^D}{\partial P_{PF}}, \quad \frac{\partial X_{PF}^D}{\partial P_{PC}} < 0 \quad \text{complements}
\]

"normal" goods:
- increased income $I$
  → increased demand

"inferior" goods:
- increase in income $I$
  → fall in demand

\[
\frac{\partial X_A^D}{\partial I} < 0
\]

e.g. public transport
  ground mince
  living in Western Suburbs (?)
An increase in the price of public transport
⇒ right-ward shift in the demand for petrol
\[
\frac{\partial X_{\text{Petrol}}^D}{\partial P_{\text{Public Transport}}} > 0
\]

Petrol & Public Transport are *substitutes*. 

A *glut* occurs when: \( S > D \)
A *shortage* occurs when: \( D > S \)
A *buyer’s market* occurs when: \( S > D \)
A *seller’s market* occurs when: \( D > S \)
Sellers are on the *long* side when: \( S > D \)
Sellers are on the *short* side when: \( D > S \)
Revision

CPI Insert

Summary:
The introduction has looked at six broad aspects of microeconomics, in a study of the way in which economic agents (individuals, households, firms) choose among scarce alternatives. We have considered:

1. **Maximisation**, as a revision of the principles underlying the assumed behaviour of *utility-maximising individuals* and *profit-maximising firms*. (Note that it’s not necessary that such a theory be able to predict all choices of every such agent, just that it be better than the next theory at prediction, especially of aggregate behaviour, which it is.)

2. **Prices**, as motivation for the sellers, and sacrifices for the buyers, and signals for everyone. Inflations, real, nominal (or current-year), prices indices.


4. **Supply**, as a function of price.

5. **Elasticity**, as a measure of the sensitivity of one variable to another, in this case quantity demanded to price or income.

6. And determination of *equilibrium*, market-clearing price and quantity, when supply equals demand, and buyers and sellers are all *price takers*.

**H&H:** Chapters 1 and 2.