The theory of exchange

Objectives for the next three weeks

1. To develop an understanding of the neoclassical theory of value
   - In perfectly competitive markets
   - In a monopoly
   - and possibly in an oligopoly

2. To apply our understanding to some real life examples
   - commodity markets
   - public policy directed to producers in these markets
Some motivation: “I like cappuccini!”
Some motivation: “I like cappuccini!”

1. Is coffee traded at a “fair” price?

2. Is milk?
Coffee prices on the international market -- Brazilian and other naturals
Coffee prices on the international market -- Brazilian and other naturals

Real prices

Nominal prices

$ per pound
Milk Price in Canada -- partly skimmed
Some motivation: “I like cappuccini!”

1. Is coffee traded at a “fair” price?

2. Is milk?

Why are coffee producers receiving highly variable prices that are getting lower and lower?

How is it that milk producers are able to get stable and steadily increasing prices?

• To answer these questions we need to develop a model of how markets work for these types of commodities, and how public policy can influence the equilibrium price and quantity.
1. Exchange and the division of labour

Why trade? Why have markets?

There are important advantages to exchange

- In an economy without production individuals can obtain a better distribution of the goods they have, and increase their welfare

- In an economy with production exchange makes specialization in production possible, increases productivity, and increases both the quantity and variety of goods

  o Adam Smith gave a famous example of this benefit of exchange in recounting his observations of production in a pin factory
1. Exchange and the division of labour

In the Wealth of Nations – published in 1776 – Smith wrote:

The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgement with which it is anywhere directed or applied, seem to have been the effects of the division of labour. ...

... a workman not educated to the trade of pin-maker (which the division of labour has rendered a distinct trade), nor acquainted with the use of the machinery employed in it (to the invention of which the same division of labour had probably given occasion), could scarce, perhaps, with his utmost industry, make one pin in a day, and certainly not make twenty. But in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations, ...

1. Exchange and the division of labour

The point is that the possibility of exchange permits a society to have access to larger amount and wider variety of goods.

This possibility also cuts both ways … with new goods comes the technical possibility of producing even more new goods, and extends further the possibility of exchange.

Exchange (trade) takes place in a market.
2. The definition and scope of a market

The term market refers not to a particular market-place in which things are bought and sold.

Rather a market is a location, or set of locations, in which buyers and sellers of a particular commodity are in regular communication.

- Different locations form a single market according to the potential and actual transfer of transactions from one place to another
  - For example coffee is sold in a number of exchanges across the world, in New York, Berlin ....
- In a market buyers and sellers have the capacity to interact
  - Buyers try to make their purchases at the lowest net cost to themselves
  - Sellers try to obtain the highest prices for their goods
2. The definition and scope of a market

Communication and transport costs put limits on the extent or scope of the market.

Rational buyers and sellers consider not just the price of the commodity but also the costs in obtaining it. These include costs of transport, tariffs, communication.

Some commodities have local markets
  - Their costs of transport are high relative to their prices
    - This occurs for bulky items, or perishability
    - Examples?
  - Improvements in communications and transport, or in tariffs, may change the scope of the market
    - Examples?
2. The definition and scope of a market

Goods with wide markets have certain characteristics

- Easily and exactly described so that they can be bought and sold by people at a distance from one another, and from the commodity

  - Examples: commodities like cotton, wheat, iron
  - Take coffee: Brazilian, Columbian, Ethiopian ...
  - What about: cement, milk, bread?
  - What about manufactured goods?
    - How is it that the scope of the market is also rather wide for dresses? For shoes?
2. The definition and scope of a market

- How large is a market?
  - There is both a commodity and a geographic dimension to a market
  - In reality there may be a certain vagueness to the definition of how large a market is, but we will assume there is no ambiguity
3. Perfectly competitive markets

There are four different types of markets

1. perfectly competitive
2. monopolistically competitive
3. oligopolistic
4. monopolistic

Prices and quantities are determined differently in each of these market structures.

They differ by the extent and nature of “power” the producers and consumers have.
3. Perfectly competitive markets

Perfectly competitive markets are those in which three conditions hold.

1. There are a large number of buyers and sellers.
   - The proportion of market transactions carried out by any single participant is very small, so that each buyer and seller separately has a negligible influence on values in the market
   - Entry into the market must be easy for there to be a large number of buyers and sellers

2. The commodity is homogeneous
   - Each unit of this commodity is identical to every other unit, and buyers and sellers are indifferent – given the price – about whom they buy from or sell to
3. Perfectly competitive markets

3. All participants must have full knowledge of the price at which market demand is equal to market supply in the particular time period

- Full information implies that all transactions take place at market clearing prices
- Full knowledge refers to the present market conditions: buyers and sellers may have different expectations of future market conditions
4. Stock and Flow Concepts

The analysis can be concerned with stocks or with flows. In each possible period of time – a week, a month, a year, a generation – the problem being studied.

But economic activity always occurs at some point or during some period of time, and the length of the period of time used in analysis depends on the demand and supply curves (or the graphically depiction of these as schedules) relevant to perfectly competitive markets can be analysed with the help of demand and supply schedules.
4. Stock and flow concepts

Stock
- Refers to the quantity of a particular item in some specific period to time.
- It is measured in units of the commodity

Flow
- Refers to the time rate of change in the quantity of a particular item in some specific time period.
- It is measured as a time rate in some period

Examples
- Wealth is a stock; income is a flow
- Individuals – both sellers and consumers -- have a stock demand of a good; and they adjust their flow demand to obtain their desired stock
5. Demand schedules and curves

A market demand schedule
 Indicates the relationship between the desired time rate of purchase of a commodity and its price

• It gives information about the time rate of demand at alternative prices for the commodity in the particular market, in the specified period of time
• It assumes that prices are constant for the period of time
• It assumes that all other factors affecting demand are constant for the period of time
• (caeterius paribus)

Example

• the demand for apples in Ottawa during a specific month
5. Demand schedules and curves

Demand for apples in Ottawa in a specified month

<table>
<thead>
<tr>
<th>Price in specific month ($/kg)</th>
<th>Quantity demanded in specific month (‘000s kgs/ week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.89</td>
<td>200</td>
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<tr>
<td>0.79</td>
<td>230</td>
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<tr>
<td>0.69</td>
<td>260</td>
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<td>0.59</td>
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<td>410</td>
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</table>
We are assuming that apples are sold in a perfectly competitive market in a particular geographic area.

In particular it is assumed that apples are a distinct and homogenous commodity:

- a distinct fruit, different from other fruits
- homogeneous with no difference between different types of apples
There are factors other than price that influence the demand for apples.

These factors, whose values will affect the position of the demand curve, are examples of “parameters.”

What parameters are being held constant in this case?
We are holding the following parameters constant:

- stocks of apples or other related goods
- tastes
- money incomes
- prices of other commodities
- expectations of future prices

Average weekly rate of demand for apples in Ottawa in a specific month:

Price of apples (\$/kg) vs. quantity of apples ('000s kgs / week)
6. Price elasticity of demand

The demand curve relates quantities demanded to price, but its shape depends upon the units of measurement.

- If price was still measured in $ / kg, but quantity was measured in kgs / week rather than thousands of kgs / week the curve would look different, indicating that quantity demanded was very responsive to price
- For this reason it is useful to measure the responsiveness of quantity to price in a way that is independent of the units of measurement
- In this way we can also make comparisons in the responsiveness of demand to price for different commodities: between apples and coffee for example
6. Price elasticity of demand

The Cambridge UK economist Alfred Marshall developed the concept of “elasticity” in the late 1800s to deal with the responsiveness of quantity demanded to price.

But this is a general concept that can be used to characterize the relationship between any two variables: say the income elasticity of demand for example.

An “elasticity” is the percentage change in a dependent variable divided by the percentage change in an independent variable

- A “dependent” variable is the thing being determined
- An “independent” variable is the causal force
- Price determines quantity demanded so quantity is the dependent variable
6. Price elasticity of demand

The dividing line between “high” and “low” elasticity is the numerical value of one.

Demand is said to be “elastic” if the elasticity is greater than one (in absolute value) and is said to be “inelastic” if the elasticity is less than one (in absolute value).

- If the demand is “elastic” total expenditures on the commodity will fall if price increases.
- If demand is “inelastic” total expenditures on the commodity will increase if price increases

To calculate an elasticity:

\[
\frac{\text{change in quantity} / \text{initial quantity}}{\text{change in price} / \text{initial price}}
\]
Neoclassical theory of value

1. Exchange and the division of labour
   • Two important advantages to exchange

2. Definition and Scope of a market
   • Definition of a market
   • Communication and transport costs
   • How large is a market?

3. Perfectly competitive markets
   • Four types of markets
   • Characteristics of perfectly competitive markets

4. Stock and Flow concepts

5. Demand schedules and curves
   • An example of apples, and role of “parameters”
6. Price elasticity of demand

- Definition
- Inelastic versus elastic
- Method of calculation
### 6. Price elasticity of demand

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### 6. Price elasticity of demand

Demand for applies in Ottawa in a specified month

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<tbody>
<tr>
<td>0.89</td>
<td>200</td>
<td>-1.335</td>
</tr>
<tr>
<td>0.79</td>
<td>230</td>
<td>-1.030</td>
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<tr>
<td>0.69</td>
<td>260</td>
<td>-1.062</td>
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<tr>
<td>0.59</td>
<td>300</td>
<td>-0.885</td>
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<tr>
<td>0.49</td>
<td>345</td>
<td>-0.923</td>
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<tr>
<td>0.39</td>
<td>410</td>
<td>-0.951</td>
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<tr>
<td>0.29</td>
<td>510</td>
<td>-0.625</td>
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<tr>
<td>0.19</td>
<td>620</td>
<td></td>
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</tbody>
</table>
Average weekly rate of demand for apples in Ottawa in a specific month.
When the price is $0.29 per kilogram, 510,000 kilograms are bought.

And total expenditure is $147,900, given as price \times quantity

or equivalently as the area of the rectangle under the demand curve.
When the price falls from $0.29 per kilogram to $0.19 per kilogram the amount demanded increases by 110,000 kilograms per week to 620,000

But total expenditure falls to $117,800

Price fell by about a third, and quantity increased only by about a fifth

At this point the demand curve is inelastic
7. Income and cross elasticity of demand

Elasticity is a general concept relating the percentage change in a dependent variable and an independent variable

- the income elasticity of demand is the percentage change in quantity demanded divided by the percentage change in income
  - normal goods have an income elasticity that is positive
    - two types of normal goods
      - “luxuries” when the income elasticity is greater than one
      - “necessities” when it is between zero and one
  - inferior goods have an income elasticity that is negative

- the cross elasticity of demand is the percentage change in quantity demanded by the percentage change in the price of another good
  - substitutes are goods with a positive cross price elasticity
  - complements are goods with a negative cross price elasticity
8. Analysis of comparisons and changes

The demand curve permits a “comparison” of the differences in quantities demanded due to a difference in price, all other things given.

This is not the same as analyzing a “change” in price.

To do this we need to know:
- whether the change affects the values of the parameters
- the length of time available for the adjustment to the change in price

A change in price may influence the parameters:
- expectations about future prices
- price of related goods
“Movements” along a curve refer to a comparison of different positions on the same curve.

“Shifts” of a curve refer to a comparison of different curves. Shifts in the demand curve occur if the values for at least one of the parameters affecting demand is different.
9. Price elasticity of demand and the passage of time

The nature of a commodity determines its price elasticity
- If it is considered essential and if there are no close substitutes the price elasticity will be low
- The quantity demanded will be relatively constant even if price differs because its consumption is necessary and this need cannot be satisfied in other ways

The classification of commodities also influences elasticity values
- Elasticities are higher for narrowly defined goods and lower for broadly defined goods

The length of time consumers have to adjust to a price change also determines the elasticity
- The longer the adjustment period, the greater the price elasticity
  - Time is required for habits to change
  - Time is required to make physical changes for substitution
10. Supply schedules and curves

A market supply schedule
Indicates the relationship between the desired time rate of offer of a commodity and its price

- It gives information about the time rate of offer at alternative prices for the commodity in the particular market, in the specified period of time
- It assumes that prices are constant for the period of time
- It assumes that all other factors affecting supply are constant for the period of time
- In a perfectly competitive market an individual seller cannot affect the price, meaning that the supply schedule is independent and distinct from the demand schedule

Example
- the supply of apples in Ottawa during a specific month
10. Supply schedules and curves

Supply of applies in Ottawa in a specified month

<table>
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<th>Price in specific month ($/kg)</th>
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<tbody>
<tr>
<td>0.89</td>
<td>430</td>
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<tr>
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This market supply schedule is influenced by the following parameters, which are all assumed to be constant:

- the stocks of apples available to potential sellers
- the expected future prices for apples in this and other markets
- costs of storage and transportation
- costs of producing apples in the recent past
11. Price elasticity of supply

The price elasticity of supply is a measure of the responsiveness of quantity supplied to price.

It is the percentage change in quantity supplied divided by the percentage change in price, and its sign (positive or negative) depends upon the sign of the slope of the supply curve.
12. Price elasticity of supply and the passage of time

The price elasticity of supply is influenced by the amount of time suppliers have to adjust to any differences in price.

The longer the time period the more elastic the supply curve.

- in short time periods supply is limited to the existing stocks and the current rate of production.
- if the commodity is perishable and cannot be stored the supply curve will be perfectly inelastic.
- a longer period of time will permit the rate of production from existing facilities to be changed.
- and even longer periods of time will allow the facilities of production to be changed.
13. Equilibrium price and quantity

Demand and supply curves are used in the analysis of price determination in perfectly competitive markets.

The price is determined at the intersection of the demand and supply curves:
- at all other prices the quantity supplied and the quantity demanded would differ
- this is not sustainable in the context of full information
- at a price above the equilibrium sellers would want to sell more than buyers would want to purchase, but since everyone knows this buyers refrain for making purchases
- similarly at lower prices as sellers refrain from making offers

The equilibrium price clears the market, with every buyer purchasing the amount desired, and with every seller selling the amount desired.
13. Equilibrium price and quantity

In his famous text book *Principles of Economics* – first published in 1890 – Alfred Marshall wrote:

We might as reasonably dispute whether it is the upper or the under blade of a pair of scissors that cuts a piece of paper, as whether value is governed by utility or cost of production. It is true that when one blade is held still, and the cutting is effected by moving the other, we may say with careless brevity that the cutting is done by the second; but the statement is not strictly accurate, and is to be excused only so long as it claims to be merely a popular and not a strictly scientific account of what happens.

London: MacMillan and Co, p.348
The equilibrium price is $0.49 per kilogram, and the equilibrium quantity exchanged is 345,000 kilograms per week.

No trades take place out of equilibrium because of the perfect information assumption. It is as if there is an auctioneer who establishes the equilibrium price, and only then permits trade.
14. An exercise dealing with gas price increases on the Friday before a long weekend
15. Another exercise

Illustrate, using demand and supply curves, why weather conditions may lead to sharp fluctuations in the prices of agricultural commodities from season to season in the absence of government intervention.
There may be important differences in the way primary commodities are produced—some may be produced by peasant farmers others by large multinational corporations—but certain conditions apply to most of these goods:

- the goods are homogeneous can be easily graded and categorized
- the number of buyers and sellers is large
- there is full information (or close to it) of market conditions on the part of all participants

These are the assumptions of a perfectly competitive market and therefore demand and supply curves might be an appropriate tool to analyse market outcomes.
16. Commodity markets as an application of demand and supply analysis

In markets for primary commodities the producers’ incomes depend on the factors that determine demand and supply

- weather will play a role
- expectations about the future
- there are substantial costs in switching productive capacity into alternative products
- there are few alternatives for switching demand into alternative products

This implies that both demand and supply will tend to be inelastic over at least some medium term horizon
16. Commodity markets as an application of demand and supply analysis

Incomes of producers will therefore depend heavily on the price they receive.

But the prices of the goods they purchase to support their production and their standard of living may be determined in different ways:

- manufactured goods for example may be priced differently and not track changes in primary goods
- the relative price of primary and manufactured goods will be important for the standard of living of primary producers
- therefore there is a great incentive for producers to attempt to act collectively to stabilize prices of the products they sell and maintain their levels relative to manufactured goods.
Stable prices controlled by domestic limits on production
Production limits set and enforced by the "Texas Railroad Commission" with most production coming from Texas, Oklahoma and Louisiana

Increasing demand during the post war period but gradual decline in prices after 1958

OPEC formed in 1960 with Iran, Iraq, Kuwait, Saudi Arabia and Venezuela as original members, and by 1971 including Qatar, Indonesia, Libya, UAE, Algeria, and Nigeria

In March 1971 no limits on domestic production as there is no more spare capacity in the US. The bargaining power to control prices shifts to OPEC
Yom Kippur War and Arab Oil Embargo

In 1972 oil prices are about $3.00 per bbl, by the end of 1974 they are $12 per bbl.

On October 5th Israel, Syria, and Egypt are at war.

OPEC acts collectively to cut production by 5 million bbl/day, but production increases in non-OPEC areas by 1 million bbl/day.

The net reduction in supply of 4 million bbl/day implies a seven percent reduction in world supply and leads to a 40% increase in prices in just six months.

From 1974 to 1978 oil prices are flat at 12 to 13 $/bbl as OPEC maintains solidarity.
The 1979 Iranian revolution leads to a loss of 2 to 2.5 million bbl/day in supply and the Iraqi invasion of Iran in September 1980 to a further loss of 6 to 6.5 million bbl/day. Total production falls by 10% and prices more than double from about 14 $/bbl to over 35 $/bbl in 1981. Iran and Iraq's production are still below the pre-1979 levels.
OPEC’s failure to control prices and changes in consumer behaviour

- A cartel always has difficulties enforcing member quotas, and in this case it is the Saudi spare capacity that acts as the enforcement mechanism.
- But the sharp increase in prices leads to a global recession that reduces demand, but there are also longer term changes in consumer behaviour.
- Better insulation in homes, more energy efficiency in production processes and in automobiles.
- The higher prices also spurred more exploration and production in non-OPEC countries increasing supply so that in these areas production increased by 10 million bbl/day between 1980 and 1986.
- Between 1982 and 1985 OPEC tries to set quotas low enough to keep prices from falling but members keep cheating and Saudi Arabia stops adjusting its supply in August 1985 so that production increases from 2 to 5 million bbl/day and price falls to less than $10/bbl by mid-1986.
Strong economic growth in the US and Asia-Pacific

Consumption increases by 6.2 million bbl/day between 1990 and 1997 as the lower prices give a spur to economic growth in the US, the OECD in general and also in Asia-Pacific regions. Consumer behaviour changes and automobiles become less efficient.

The Gulf war in 1990 leads only to a temporary spike in prices.

Further post 2000 Russian supplies come back on the world market after a hiatus during the 1990s, and OPEC has mixed success in controlling prices throughout the period in spite of East-Asian economic crisis in 1997.

September 11th, 2001 leads to lower prices even though OPEC and Russian cut supply and a strike in Venezuela reduces supply in that country.
March 19th 2003 sees military invasion of Iraq, improving US economy, increasing Asian demand together lead to oil price increases as demand growth outstrips supply.

no spare capacity in production and some problems in US refineries as well as low inventories in the OECD.