TRADE

Adam Smith, Wealth of Nations 1776:

‘If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it of them with some part of the produce of our own industry, employed in a way in which we have some advantage’

Ricardo, 1817: comparative advantage is all that’s needed. Consider the following costs:

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Wine</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Portugal</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>

Portugal has an absolute advantage in the production of both. However, England has a comparative advantage in wheat — each unit of wheat produced costs only \( \frac{1}{2} \) unit of wine versus Portugal’s \( \frac{2}{3} \) unit (i.e. the opportunity cost of a unit of wheat is \( \frac{1}{2} \) unit of wine). Portugal has the comparative advantage at wine — a unit costs 1.5 units of wheat rather than 2.
TRADE (2)

- See how it works. Suppose England has 270 units of labour available versus Portugal's 180. Production in autarky (i.e., no trade) is

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Wine</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Portugal</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>11</td>
</tr>
</tbody>
</table>

- Production with trade is

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Wine</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Portugal</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>12</td>
</tr>
</tbody>
</table>

- Mill's insight: welfare gains from trade come from the ability to import some goods more cheaply. Only significant role of exports is in paying for these imports.

- More modern models: e.g., Heckscher-Ohlin model looks at two factors of production: capital and labour. The country with more capital will export capital-intensive goods.

- Under perfect competition, free trade is optimal. Economists' consensus: also a pragmatic optimum.
Growth

Adam Smith: output a function of land, labour, capital, improving technology and increasing specialisation lift productivity, support more people, facilitate land improvement/colonisation, and capital accumulates (classical theory).

Marx: progress would lead to unemployment, pushing down wage rates and causing revolutions.

The Keynesian school (Harrod, Domar, Robinson, Kalecki): growth depends on capital formation, leading to complex models of investment and of saving by workers and entrepreneurs.

Neoclassical school (Solow, Swan, ...) models growth as a function of technology, population growth, saving propensity and initial capital-labour ratios.

Objectives from environmentalists, development economists.

Current leading view (Becker, Romer): it is know-how that drives growth, both via human capital (education etc) and innovation. For example, Charles Jones attributes US growth 1950-9: 30% to better education, 50% to worldwide R+D and 20% to population growth in idea-producing countries. Ideally we should quadruple R+D!
Tragedy of the Commons

- Observed long ago, documented by 1830s, used to justify enclosures
- 100 peasants each graze a sheep on the village common, which uses its capacity
- What if one peasant adds an extra sheep?
- He gets twice as much, everybody else get 1% less
- Common becomes overgrazed
- Modern examples: overhunting, overfishing
- Welfare theorems etc. assume complete property rights, atomistic participants and complete information, preventing such outcomes
- When this breaks down, need to consider not just the economic cost of transactions but their social cost (total cost to all participants)
Externalities are goods / bads people care about, but are not sold in markets: typically side-effects

Example of consumption externality: smoking in restaurants. Market mechanisms may provide partial solution (smoking / non-smoking dining rooms) but only sometimes (not in Lisbon or in San Francisco)

Example of production externality: steelworks pollutes a river and damages a fishery. Again, market mechanisms can sometimes find a solution (steelworks buys fishery) but not always

Positive production externality: common file formats can be recycled by other application vendors

Anyway, in presence of externalities, competitive market outcomes are unlikely to be Pareto efficient

We may be able to fix the problem using property rights, but this is hard for many players
Public Goods

- In the many-player case, we often find goods (and bads) that are non-excludable.
- Example: scientific knowledge. The producer can appropriate only a small part of the benefit (e.g., PhD thesis); the rest of the benefit is spillover for the whole community.
- Example of a public bad: air pollution. Again, everyone gets to ‘consume’ the same amount.
- Strong temptation for participants to free-ride rather than producing public goods.
- If production level decided communally, we get ‘impossibility theorem’ problems with voting etc.
- Alternatives?
Public Goods (2)

- We might ask everyone how much they were prepared to pay for a public good and if the total exceeded the cost, charge them pro-rata.
- But people would lie in order to free-ride (strategic agents).
- How to design a strategy-proof mechanism:
- Suppose a TV costs £300 and three housemates are prepared to pay £50, £50, and £250 to have a TV in the house.

A Groves-Clarke tax works as follows:

<table>
<thead>
<tr>
<th>Person</th>
<th>Share</th>
<th>Bid</th>
<th>Net</th>
<th>Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice</td>
<td>100</td>
<td>50</td>
<td>-50</td>
<td>0</td>
</tr>
<tr>
<td>Bob</td>
<td>100</td>
<td>50</td>
<td>-50</td>
<td>0</td>
</tr>
<tr>
<td>Charlie</td>
<td>200</td>
<td>250</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

- Works under certain conditions (see Varian) but is not in general Pareto optimal.
- CS application: try to find strategy-proof mechanisms for resource allocation in distributed systems.
Monopoly Rents

If there are no barriers to entry, firms will enter the market until we have an equilibrium with zero profits and all factors of production being paid their market price (= opportunity cost).

Limiting factors of production - natural resources; talent - all have an equilibrium rental rate.

What if we impose barriers to entry?

- New York City taxi licences cost about $100,000, yet drivers made only $8 an hour (in 1986) after paying license rental of $55-65 per shift.
- Will raising the fares increase wages?
- Licence owner makes about $17,000 pa after depreciation, maintenance etc - 17% pa.
- Increasing each car's takings by $10,000 pa will increase value of licence by $60,000.
- Wage rate, set in competitive labour market, should be almost unaffected.

Monopoly-oligopoly conditions in effect create a rent.

Rent seeking refers to efforts directed at acquiring or keeping claims to factors in fixed supplies. Accounts for much political activity, from farm subsidies to med school admission.
Price Competition

- Where the marginal cost of production of information is zero — i.e., all the costs lie in producing the first copy — you expect competition to drive the price to zero.

  Example: machine readable phone books
  1986 — Nynex charged $10,000 per disk
  - ProCD had the phone book retyped in Beijing and started selling for $20
  - American Business Information joined in...
  - Now a CD phone book costs under $20 (and there are free services online)

- That’s why there’s so much free material online!

- FSF etc.: “information wants to be free”

- So how can you make money out of selling information? Sometimes you can get a legal monopoly (patent, copyright, ...) and sometimes you use other strategies
LOCK IN

Often, buying a product commits you to buying more of it, or investing in:
- durable complementary assets, eg software for a computer or PBX, CDs for a sound system, videocassette for a VCR
- skills, eg fluency with Office/Windows or Mac or Linux
- services, e.g. network service for a PC or mobile phone, directory service for TiVo
- combinations of the above, e.g. integrating a new general ledger package with your business systems, and general hassle factor

The same can apply with services—it can be expensive to switch facilities management contracts.

This is not entirely new—more people change their spouses than their bankers—but the effects are very pronounced in information goods markets.
'Fundamental theorem': the net present value of your customer base is the total cost of switching

Why this works:
- suppose you're an ISP, and it costs £25 to set up a new customer
- suppose it costs a customer £50 of hassle to switch to a new ISP
- so total switching costs = £75
- if you can figure out a business model that makes this customer worth £100,
  offer them £60 cashback to switch
  they are £10 ahead, you're £15 ahead

Is it a good idea to replace the half-dozen or so population registers in the UK (DVLA, tax, NI, births/deaths, passports, ...) with a single system?
LOCK-IN (3)

- Incumbent will try to maximise switching costs; competitors to minimise them
  - 'file format wars' between Word, WordPerfect
  - loyalty programs
  - regulatory struggles, eg phone number portability
  - promote complementary goods and services and find ways to lock customers in to them
  - from apps that only run on your operating system, to tied game cartridges

- Asymmetric switching costs make things more complex
  - eg mobile phone networks - to get a new customer you need to give them a phone, while existing customers can be bribed with extra minutes whose marginal cost is zero
  - similarly, pay-TV and set-top-boxes

- But where the asymmetry is based on physical assets (phones, mainframes, telephone switchgear) it will depreciate, and the lock-in
Network Externalities

- Many networks have the property that the more people use them, the more valuable they are to each user – as there are more people to talk to.

- Metcalfe’s Law: the value of a network is proportional to the square of the number of users.

Locally, at least, it’s even more pronounced; the value to each user is more than linear in the total number of users.

\[ v = ku^2 \]

Examples
- Telephone, late 19th century
- Fax, 1985 - 88
- Email, 1995 - 99
Network Externalities (2)

- Phone, fax, and email are 'real' networks
  - There are also 'virtual networks' that depend on complements. The classic example is PCs and software
- People buy PCs (rather than Macs or Sun workstations) because there's lots of software for them
  - Companies write software for PCs (and specifically, Windows) first, because the market is bigger than for Macs or Sun
  - Bugs as well as goods: virus writers target Windows for the same reason
- Many other examples
  - credit cards and merchants
  - petrol-engined cars and petrol stations
Network Externalities (3)

- Markets with network externalities may "tip" in favor of one competing standard.

- Classic example: PC versus Mac in 1980s. Eventually PC was perceived as the likely victor, so developers wrote software for the PC first, so more people bought PCs.

- Demand-side economies of scale cause positive feedback, and "winner-takes-all".

- Historical examples (see Shapiro and Varian):
  - Rail gauges in 19th century
  - Colour TV standards in 1950s
  - VHS versus Betamax video cassettes
Strategic Issues

- Combination of high fixed costs, low marginal costs, high switching costs and network externalities leads to a dominant-firm model
- Huge first-mover advantages
- Hence race for market share during dotcom bubble
- Hence also 'ship it Tuesday and get it right by V.3'
- Incumbents aren't completely invincible though
  - technological progress (PC beat mainframe; CD beat LP; DVDs ousting VCRs...)
  - change the nature of the platform (Netscape challenge to MS)
  - antitrust laws (breakup of AT&T)
  - industry reaction (everyone paranoid about IBM 20 years ago, about Microsoft now)