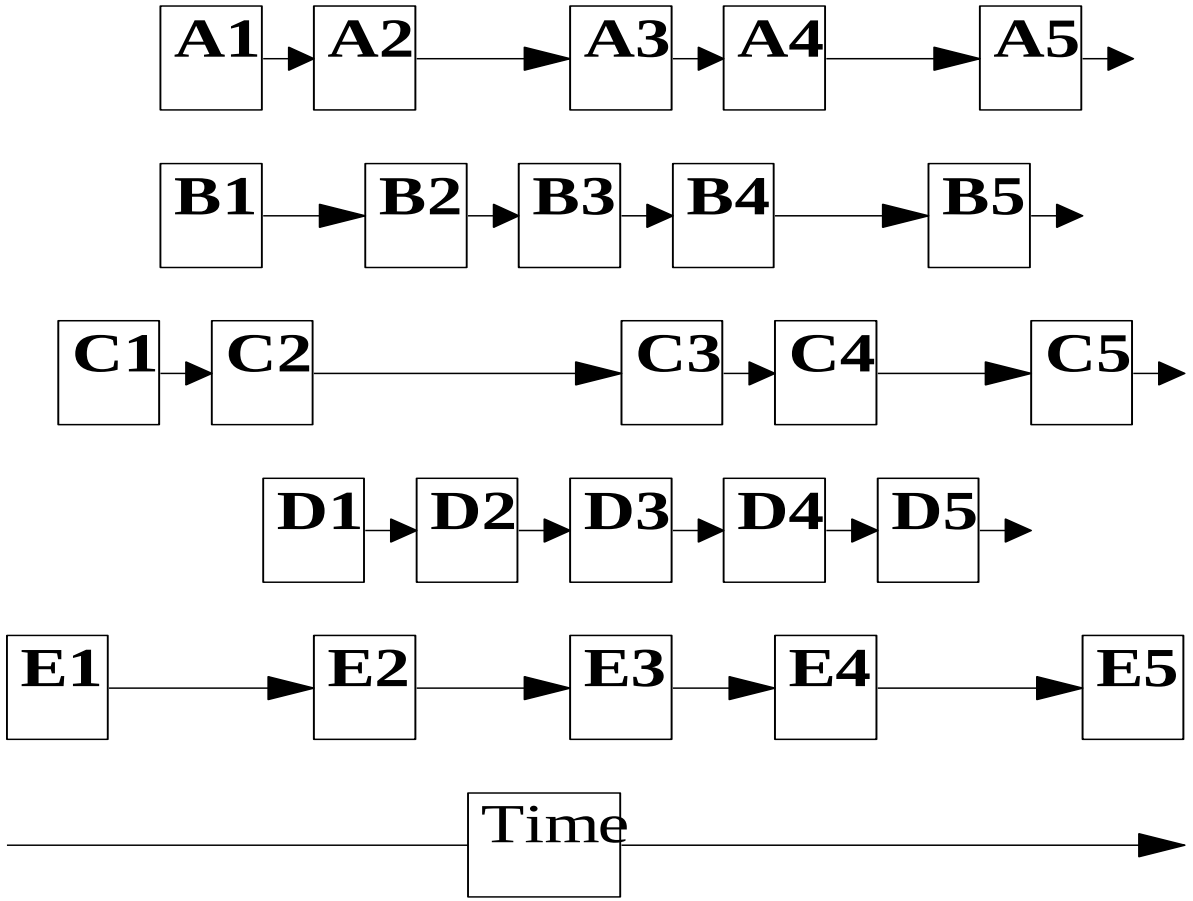
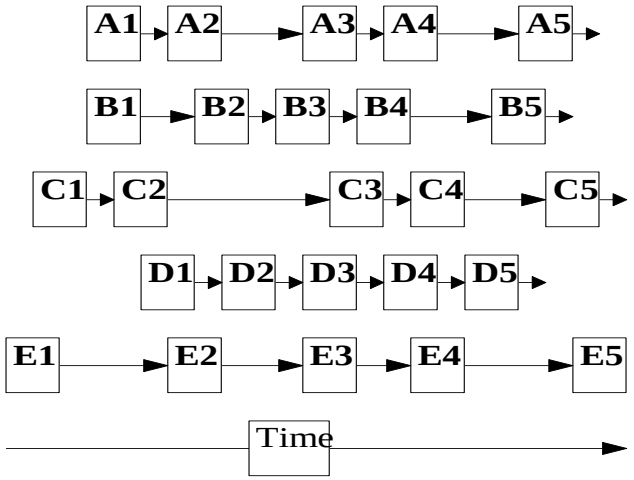
The problem of organization.

The master gun-maker -- the entrepreneur -- seldom possessed a factory or workshop. ... Usually he owned merely a warehouse in the gun quarter, and his function was to acquire semifinished parts and to give those out to specialized craftsmen, who undertook the assembly and finishing of the gun. He purchased material from the barrel-makers, lock-makers, sight-stampers, trigger-makers, ramrod-forgers, gun-furniture makers, and, if he were engaged in the military branch, from bayonet-forgers. All of these were independent manufacturers executing the orders of several master gun-makers. ... Once the parts had been purchased from the "material-makers," as they were called, the next task was to hand them out to a long succession of "setters-up," each of whom performed a specific operation in connection with the assembly and finishing of the gun. To name only a few, there were those who prepared the front sight and lump end of the barrels; the jiggers, who attended to the breech end; the stockers, who let in the barrel and lock and shaped the stock; the barrel-strippers, who prepared the gun for rifling and proof; the hardeners, polishers, borers and riflers, engravers, browners, and finally the lock-freers, who adjusted the working parts. [G. C. Allen, *The Industrial Development of Birmingham and the Black Country*, 1906-1927. London, 1929, pp. 56-57.]

Crafts production.

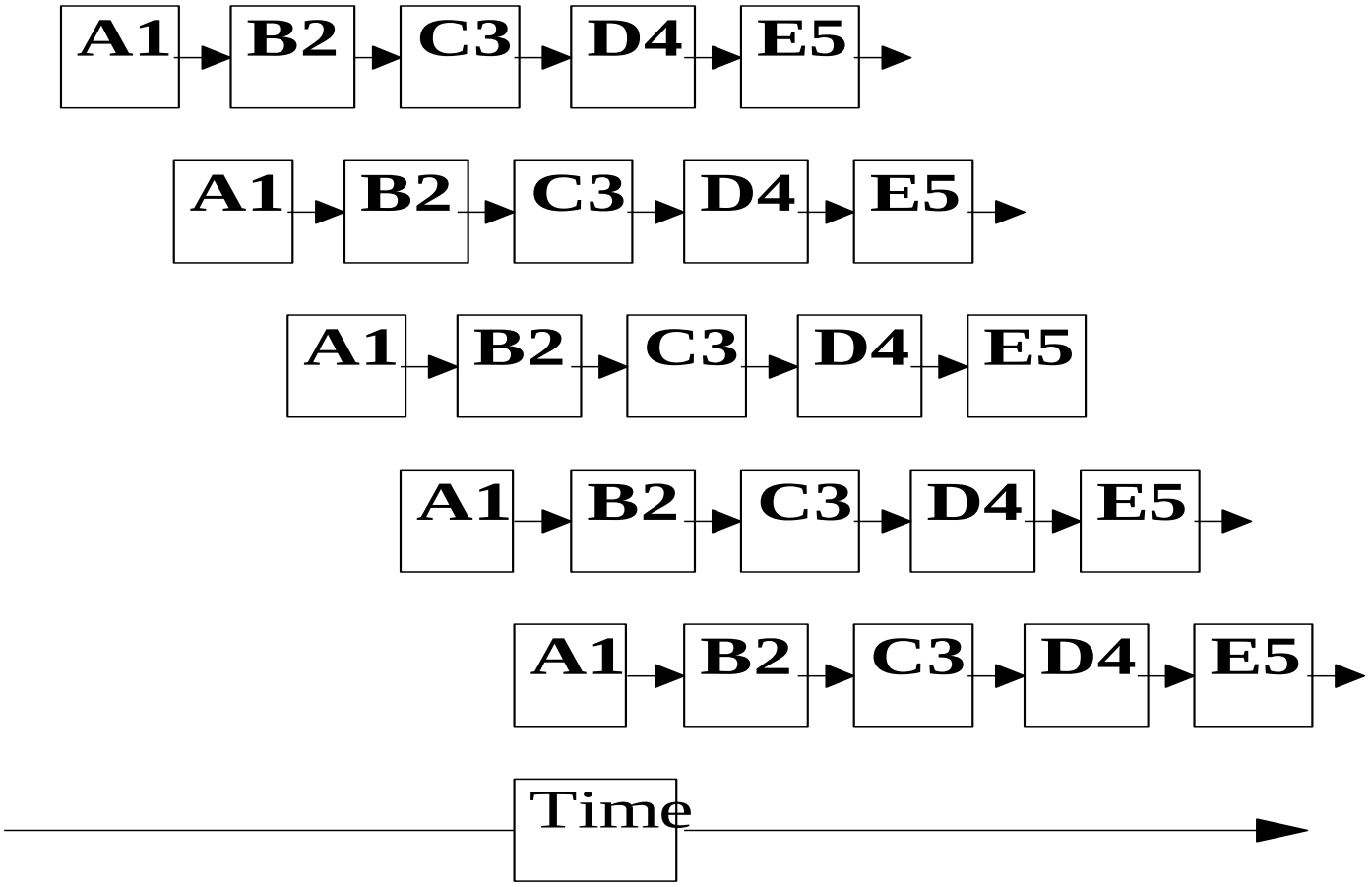


Crafts production.



- Artisans work at their own pace.
- Differences in absolute and comparative skill across tasks.
- Ease of “systemic” change in product.
  - Uniqueness of crafts-made goods.
- Need for “wide” human capital.
  - Skilled artisan must master many different tasks.

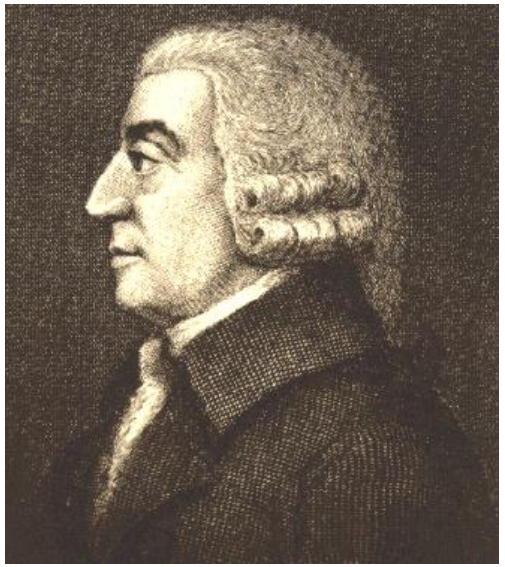
Factory production.



The division of labor.

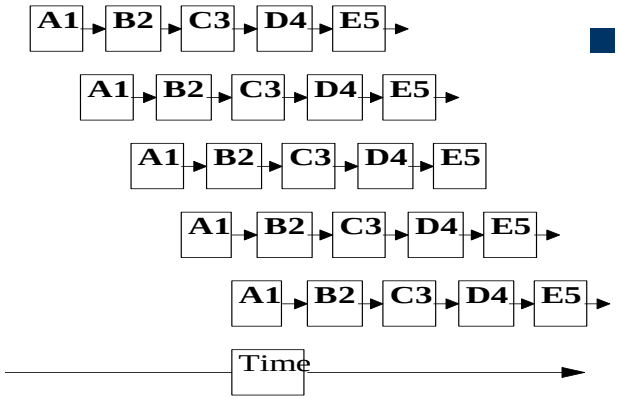
- Improvement in "skill and dexterity."
  - Learning by doing.
- Spread fixed set-up costs.
  - Less "sauntering" between tasks.
- Increased innovation.
  - Operative focused on and benefits from "abridging labour."
  - Specializing in invention.
- Assign operatives according to comparative advantage.

Charles Babbage (1791-1871).



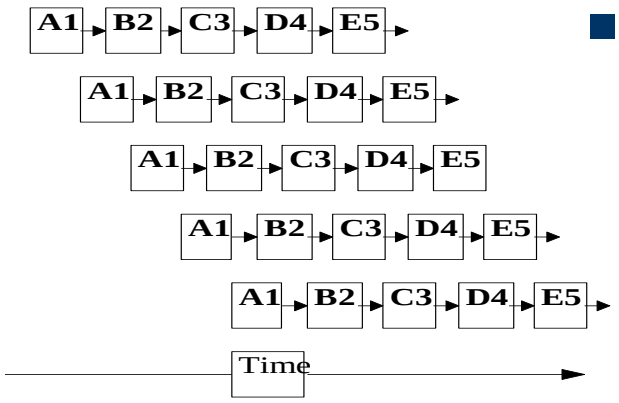
Adam Smith (1723-1790). Author of the *Wealth of Nations* (1776). Picture courtesy of the Warren J. Samuels Portrait Collection at Duke University.

Factory production.



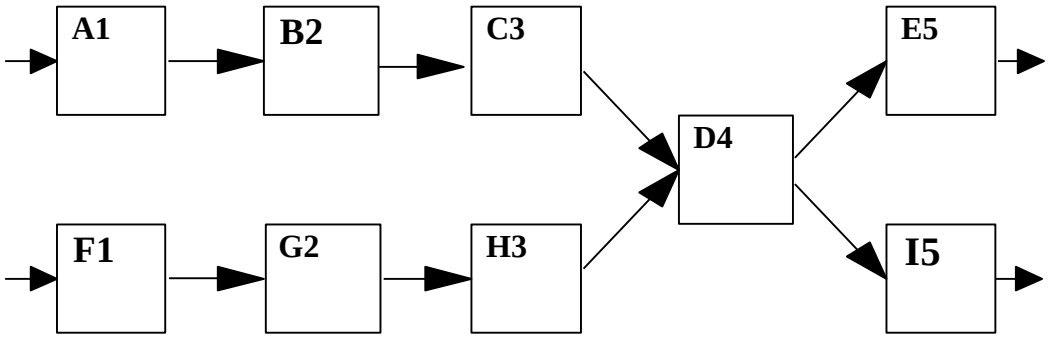
- Shift from parallel to series.
  - Time phasing of inputs.
  - Workers work at pace of team.
  - Workers complements not substitutes.
- Product standardized.
  - Difficulty of systemic change.
  - Ease of “autonomous” change and learning by doing.

Factory production.



- Physical capital saving.
  - Need only one set of tools.
  - Economizes on work-in-process (buffer) inventories.
- Human capital saving.
  - "Deskilling."
  - Workers sorted by comparative advantage.
  - Human capital "deepening" instead of widening.

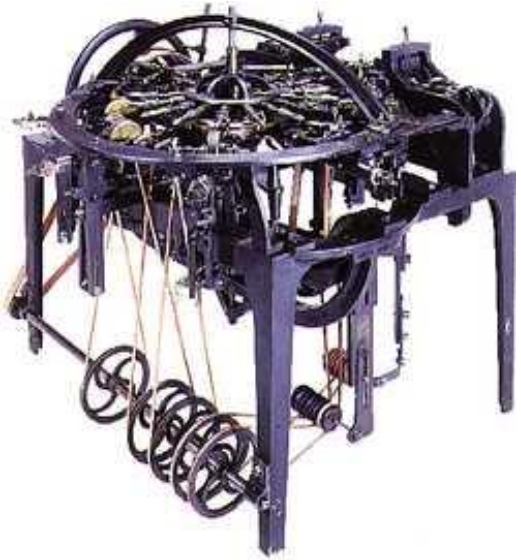
Factory production.



Parallel-series scale economies.

- Stage D is an “antibottleneck.”
- By replicating production lines, can double output without doubling inputs.

The division of labor.



Howe pin-making machine, about 1840. (Smithsonian Institution.)

- Adam Smith (1776): ten men could make 48,000 pins a day, or almost 5,000 per person per day.
- Karl Marx (1867): one woman or girl could supervise four machines, each making 145,000 pins per day, for almost 600,000 per person per day.
- Pratten (1980): one person could supervise 24 machines, each making 500 pins a minute, or about 6 million pins per person per day.

Workers and tools.

- Smith assumes that tools are always specialized and that workers become more specialized with the division of labor.
- But: can machines also change their level of specialization?
- Ames and Rosenberg (1965).

Workers and tools.

Definition: Activity.

Necessary acts carried out by a factor.

Workers and tools.

Definition: Operation.

A set of related activities.

Workers and tools.

Definition: Process.

A specific set of operations necessary to produce the commodity.

- There may be a number of alternative processes.

Workers and tools.

- An activity is associated with a command:
  - If *x*, do *y*.
  - May be sequential or branching.
- Making the command more specific:
  - "Make me a watch" versus "do x_1, x_2, x_3, etc."
  - Substituting machines for labor is a process of making commands more specific.

Workers and tools.

Definition: Skill.

The more activities *x* performs, the more skillful *x* is in the sense of skill widening.

Specialization.

$$\text{Specialization} = \frac{1}{\text{skill}}$$

1 ← Doers.

skill ← Activities.

$$0 < \text{Specialization} < 1$$

Complete non-specialization

Complete specialization

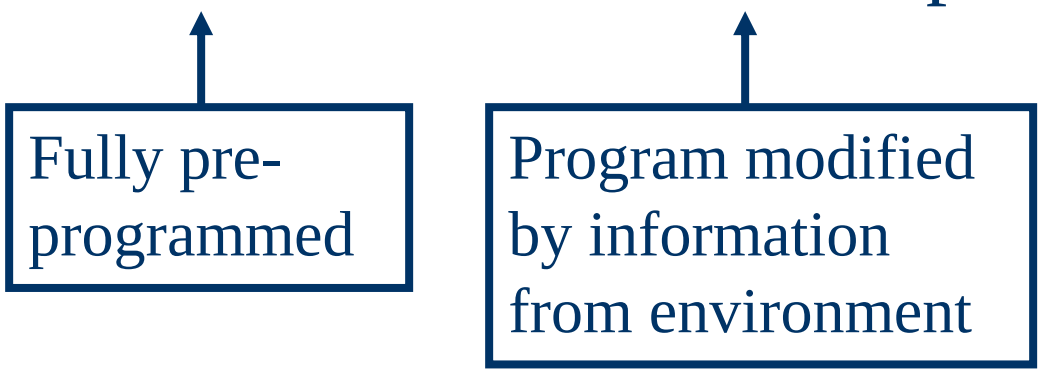
Specialization.

Three activities:

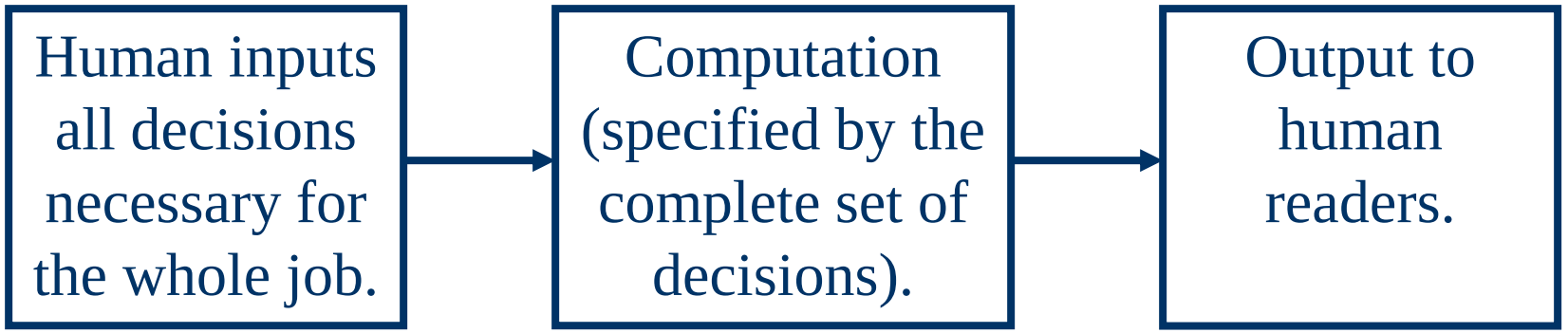
Technology.	Workers.	Machines.	Labor specialization.	Machine specialization.	
A	1	3	1/3	1	Crafts production.
B	3	3	1	1	Smithian division of labor.
C	1	1	1	1/3	Volume effect.

Skill and routine.

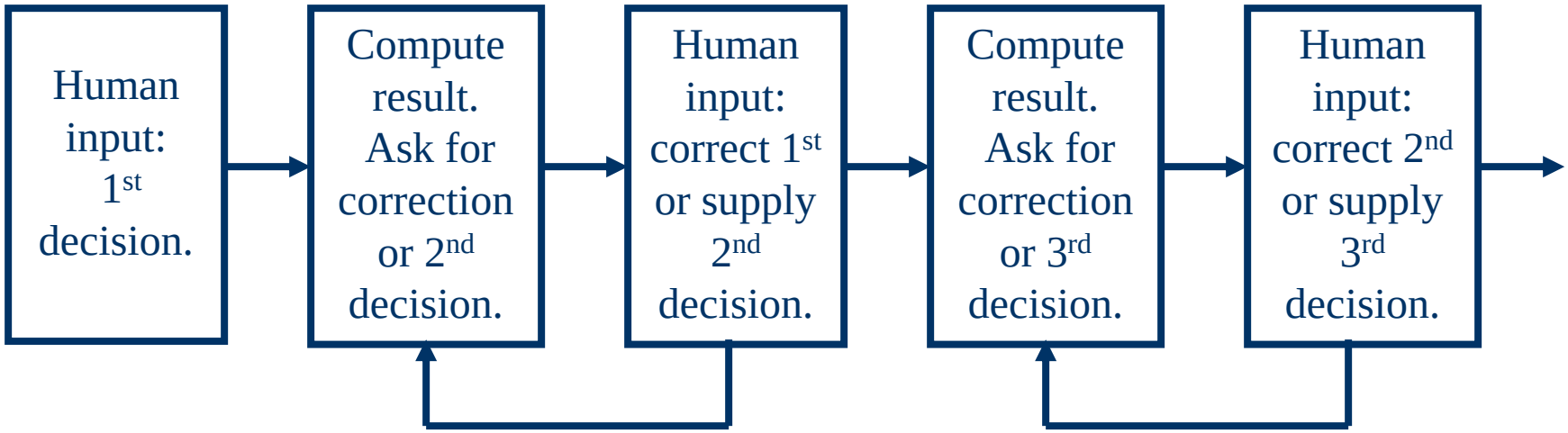
- Stinchcombe: “skill” as a matter of information processing.
  - Problem of uncertainty or variety.
- Batch versus interactive processing.



Batch processing.



Interactive processing.



Skill and routine.

- Skill as a set of routines.
  - Workers follow routines.
  - Use decision principles (higher-level routines) to choose among routines.
- Skilled workers have many routines among which they can switch.
- Variety limits use of batch processing and calls for use of skilled workers.

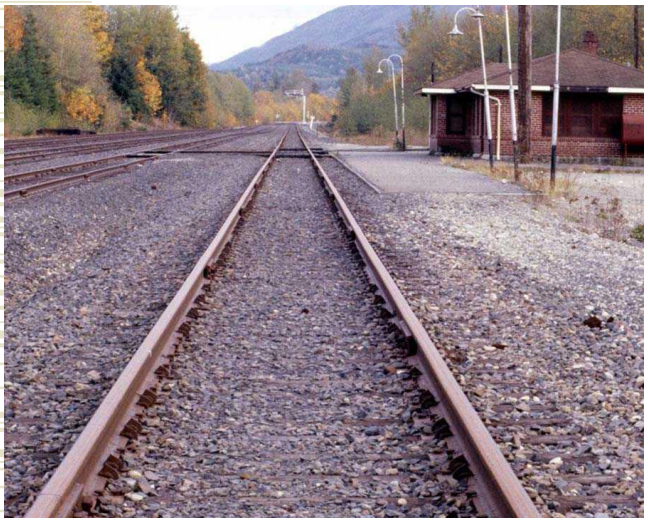
Skill and routine.

- Examples.
  - Research versus registrar's office.
  - Neurosurgeons versus pathologists.
  - Flexible production versus mass production.

Mass production.

- Moving from the task of selecting among routines to the task of perfecting a single (limited set) of routines.
- Increased batch production requires elimination of variation.

Mass production.



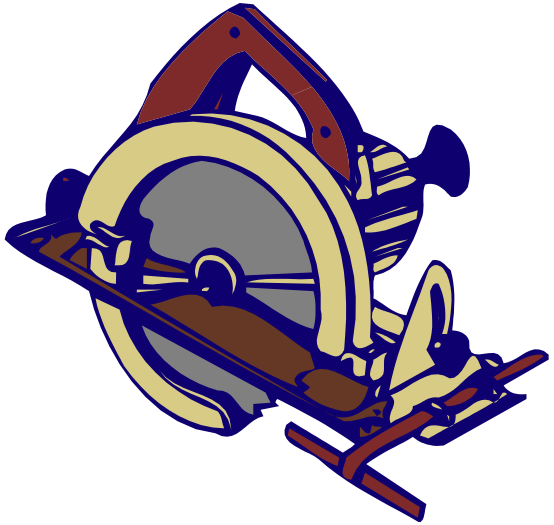
"If we want an organism or mechanism to behave effectively in a complex and changing environment, we can design into it adaptive mechanisms that allow it to respond flexibly to the demands the environment places on it. Alternatively, we can try to simplify and stabilize the environment. We can adapt organism to environment or environment to organism." (Simon 1960, p. 33.)

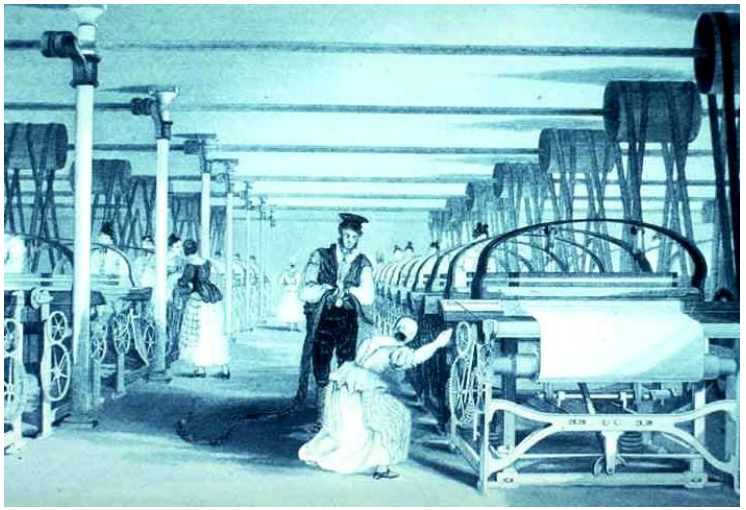
Fordism.

- Batch programming.
- Narrowing of skills.
- Management with authority to create jobs.
- Engineers design work.
- Skilled maintenance and other workers “buffer” uncertainty.

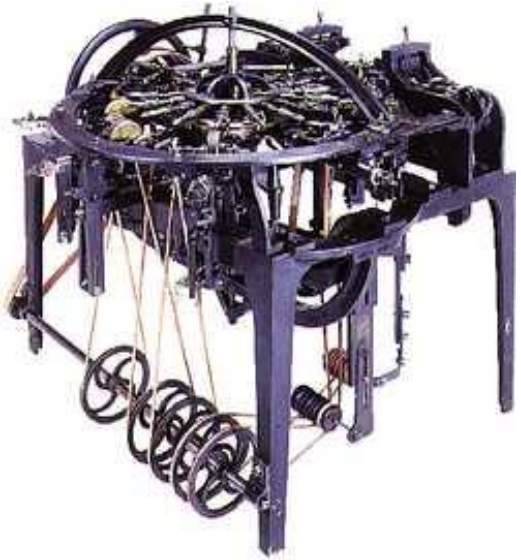
Mechanization.

- Skill enhancing versus skill displacing technical change.
  - Power tools versus power loom.





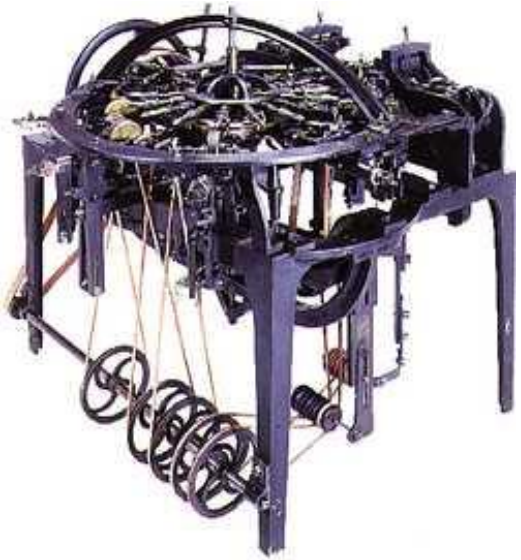
Volume effect.



Howe pin-making machine, about 1840. (Smithsonian Institution.)

- Reduced environmental variation and increased batch programming leads to increased skill and reduced specialization of machines.
- The volume effect: a large, stable extent of the market militates in favor of unspecialized machines.

Volume effect.



Howe pin-making machine, about 1840. (Smithsonian Institution.)

- The "method of production is a function of the volume of output, especially when output is produced from basic dies – and there are few, if any, methods of production that do not involve 'dies'" (Alchian 1959).
- With increased volume, it pays to invest in *more durable* dies.

Knowledge reuse.

In drilling the plate A without the jig the skilled mechanic must expend *thought* as well as skill in properly locating the holes. The unskilled operator need expend no thought regarding the location of the holes. That part of the mental labor has been done once for all by the tool maker. It appears, therefore, that a "*transfer of thought*" or *intelligence* can also be made from a person to a machine. If the quantity of parts to be made is sufficiently large to justify the expenditure, it is possible to make machines to which all the required skill and thought have been transferred and the machine does not require even an attendant, except to make adjustments. Such machines are known as *full automatic* machines. (Kimball 1929, p. 26, emphasis original.)

Knowledge reuse.

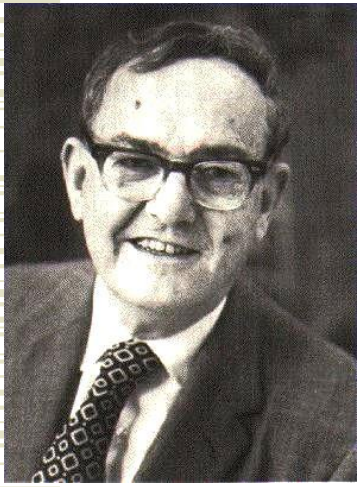
- Interactive (crafts) production.
  - Workers reuse routines.
  - But new knowledge must be generated in choice among routines.
- Batch (factory) production.
  - Decisions programmed once and then spread over many units.
  - Source of economies of scale (and scope).

Cognitive comparative advantage.

Herbert A. Simon (1916-2001)

"[M]an's comparative advantage in energy production has been greatly reduced in most situations -- to the point where he is no longer a significant source of power in our economy. He has been supplanted also in performing many relatively simple and repetitive eye-brain-hand sequences. He has retained his greatest comparative advantage in: (1) the use of his brain as a flexible general-purpose problem-solving device, (2) the flexible use of his sensory organs and hands, and (3) the use of his legs, on rough terrain as well as smooth, to make this general-purpose sensing-thinking-manipulating system available wherever it is needed." (Simon 1960, p. 31.)

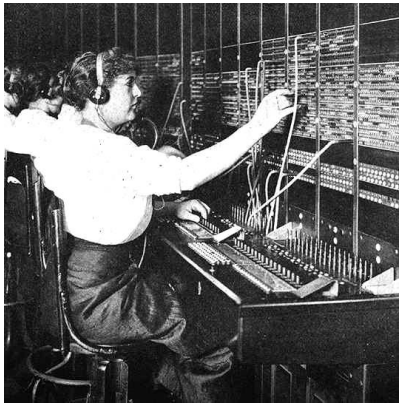
Cognitive comparative advantage.



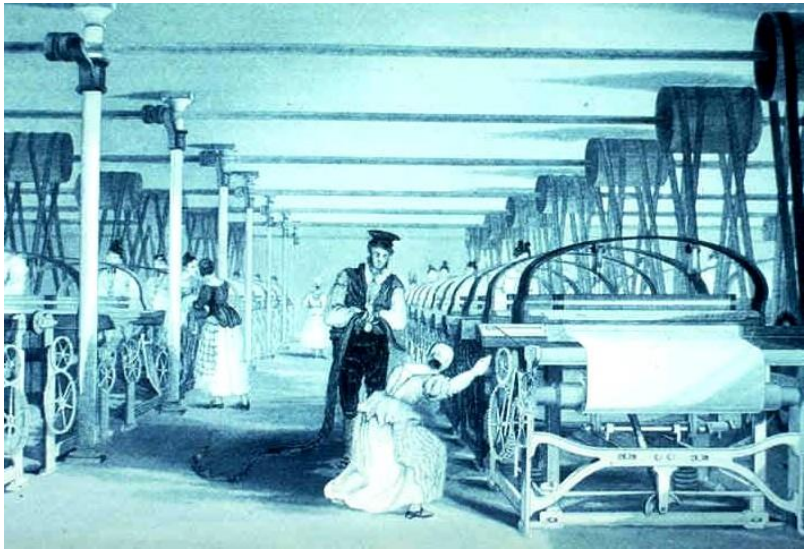
Herbert A. Simon
(1916-2001)

- We should see humans "crowded into" tasks that call for the kinds of cognition for which humans have been equipped by biological evolution.
  - Exercise of judgment in situations of ambiguity and surprise.
  - Abilities in spatio-temporal perception and locomotion.
- We should see machines "crowded into" tasks with a well-defined structure.

Mechanization.



- Labor-displacing technical change calls forth demand for increased human skill.



- Humans as information processors.
- Humans as "buffers."

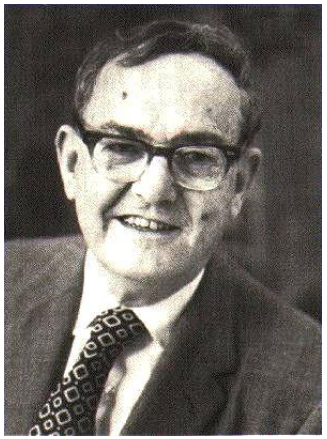
A paradox?

Herbert A. Simon (1916-2001)

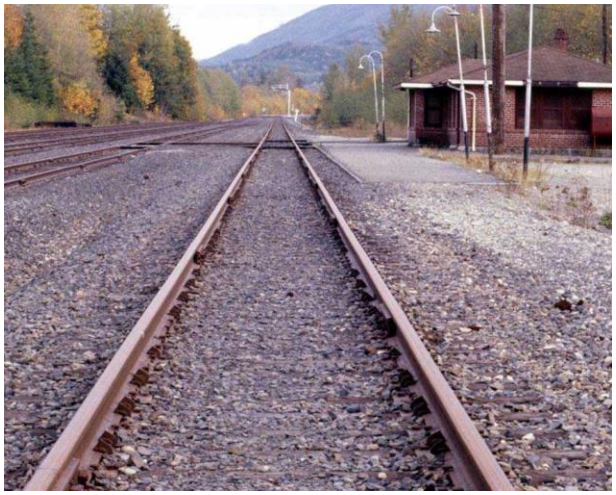
Aren't computers also information processors?

"Duplicating the problem-solving and information-handling capabilities of the brain is not far off; it would be surprising if it were not accomplished within the next decade." (Simon 1960, p. 32).

Modes of adaptation.



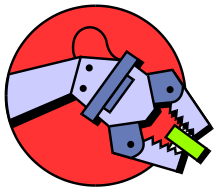
Herbert A. Simon
(1916-2001)



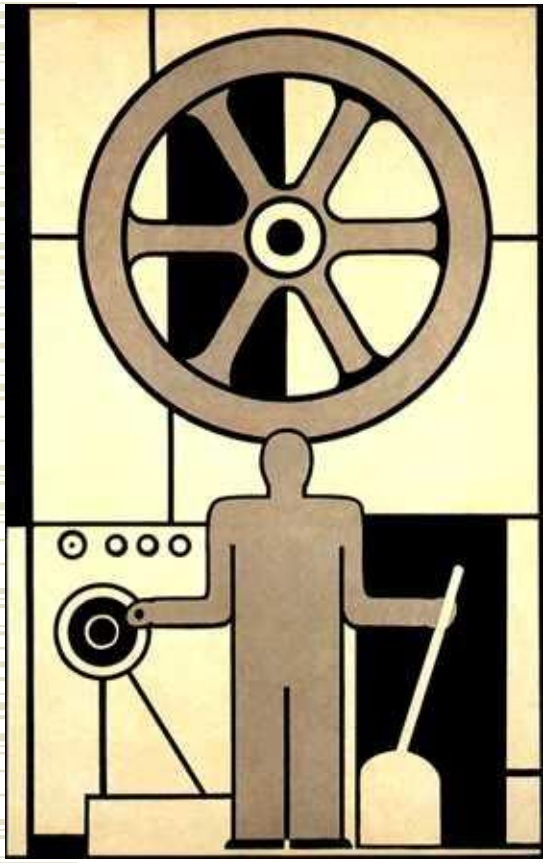
"If we want an organism or mechanism to behave effectively in a complex and changing environment, we can design into it adaptive mechanisms that allow it to respond flexibly to the demands the environment places on it. Alternatively, we can try to simplify and stabilize the environment. We can adapt organism to environment or environment to organism" (Simon 1960, p. 33).

Modes of adaptation.

- Simon's argument is based on comparative advantage.
- Following the "adaptation" strategy is hard.
  - The robot's problem.
  - Nature prefers to make *idiots-savants*.
  - Easier to change the environment than to adapt to it.



The organization of work.



1. Tasks not yet automated or costly to automate.
2. Maintenance, including preventive maintenance.
3. Managers — but not supervisors.
4. Designers, including designers of organizations.
5. Personal-service workers, who have to deal with the most unpredictable environment of all — other humans.

The problem of organization.

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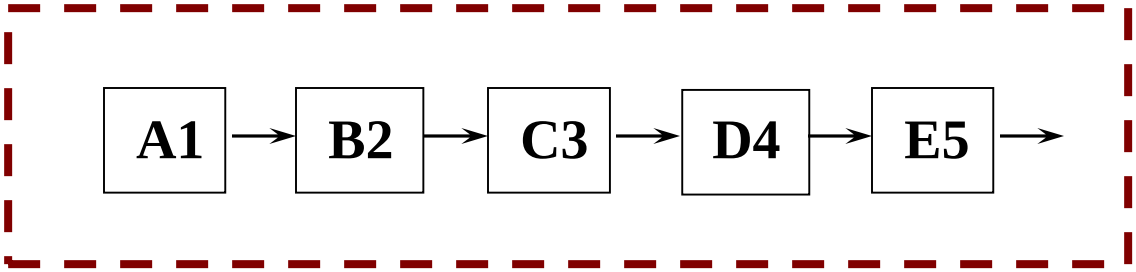
The “task approach” to labor markets

David Autor

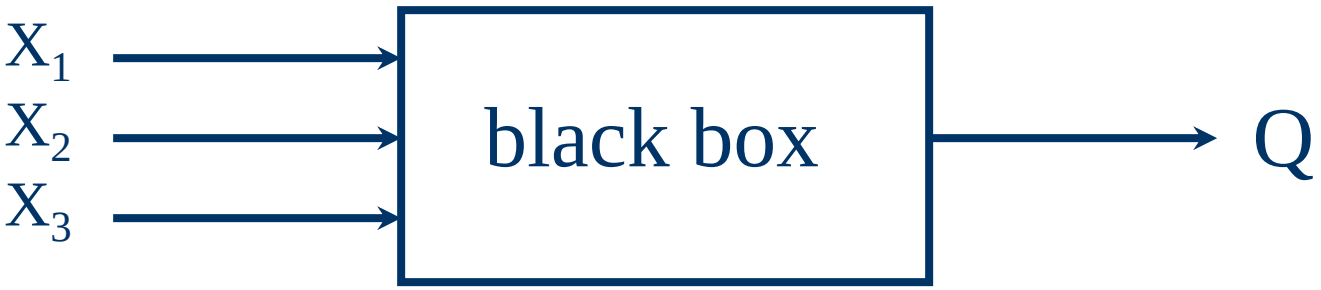
- Commencing in the 1970s, labor input of routine cognitive and manual tasks in the U. S. economy declined, and labor input of nonroutine analytic and interactive tasks rose.
- Shifts in labor input favoring nonroutine and against routine tasks were concentrated in rapidly computerizing industries. These shifts were small and insignificant in the precomputer decade of the 1960s, and accelerated in each subsequent decade.
- The substitution away from routine and toward nonroutine labor input was not primarily accounted for by educational upgrading; rather, task shifts are pervasive at all educational levels.
- Paralleling the within-industry task shifts, occupations undergoing rapid computerization reduced input of routine cognitive tasks and increased input of nonroutine cognitive tasks.
- journalists and expert commentators overstate the extent of machine substitution for human labor and ignore the strong complementarities.

The problem of organization.



- The division of labor by itself doesn't say anything about the boundaries of the firm.
- Are the stages of production each a separate firm, or are some stages within a single firm?
- Vertical integration.

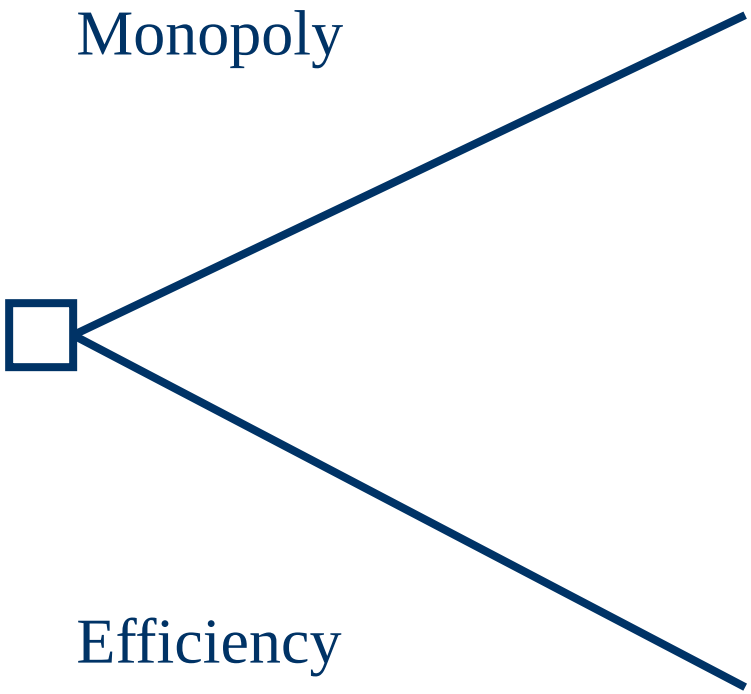
The problem of organization.



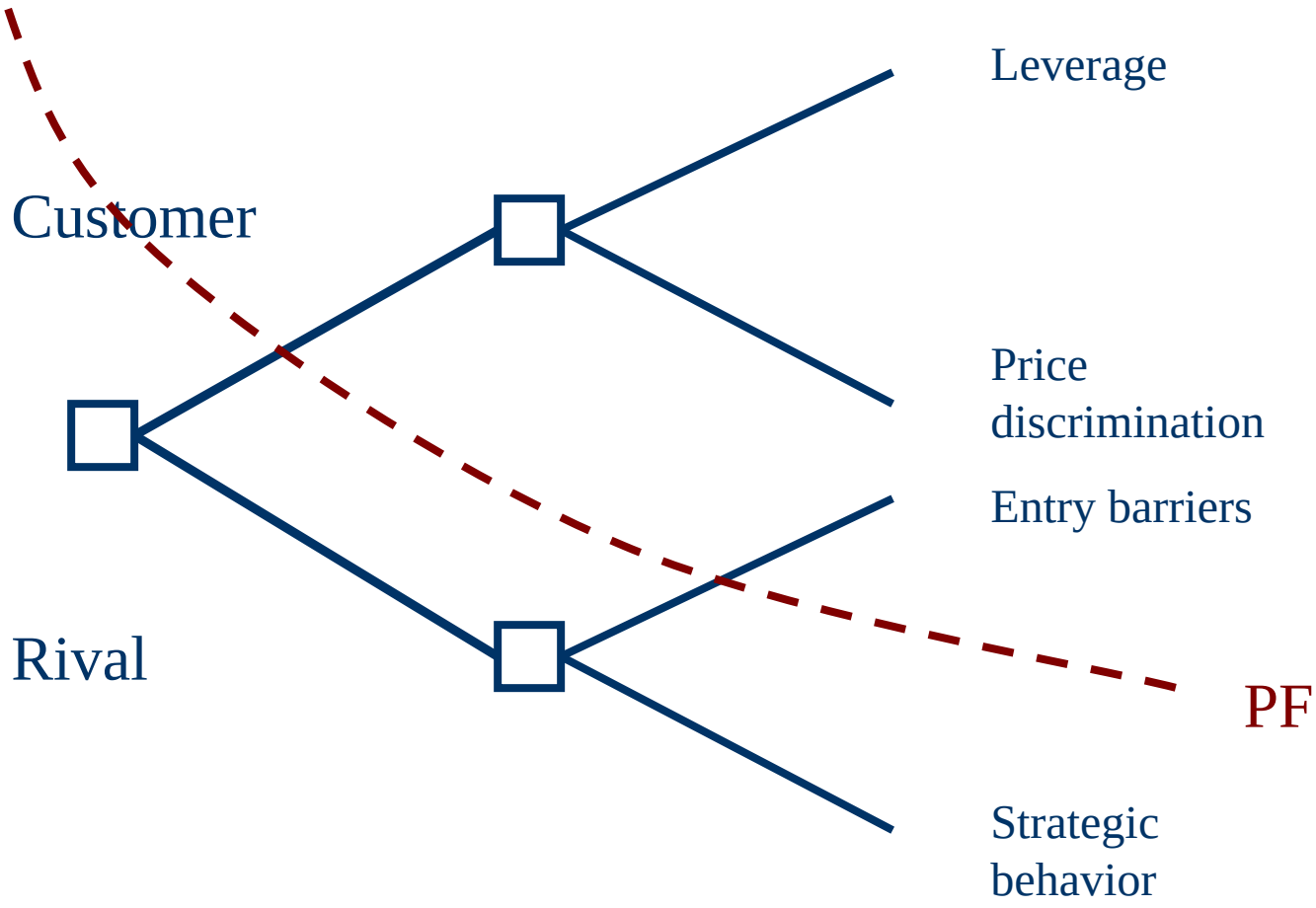
- The neoclassical theory of the firm doesn't help much.
- The firm as a black box.
- Boundaries of the firm assumed.

Cognitive map of contract.

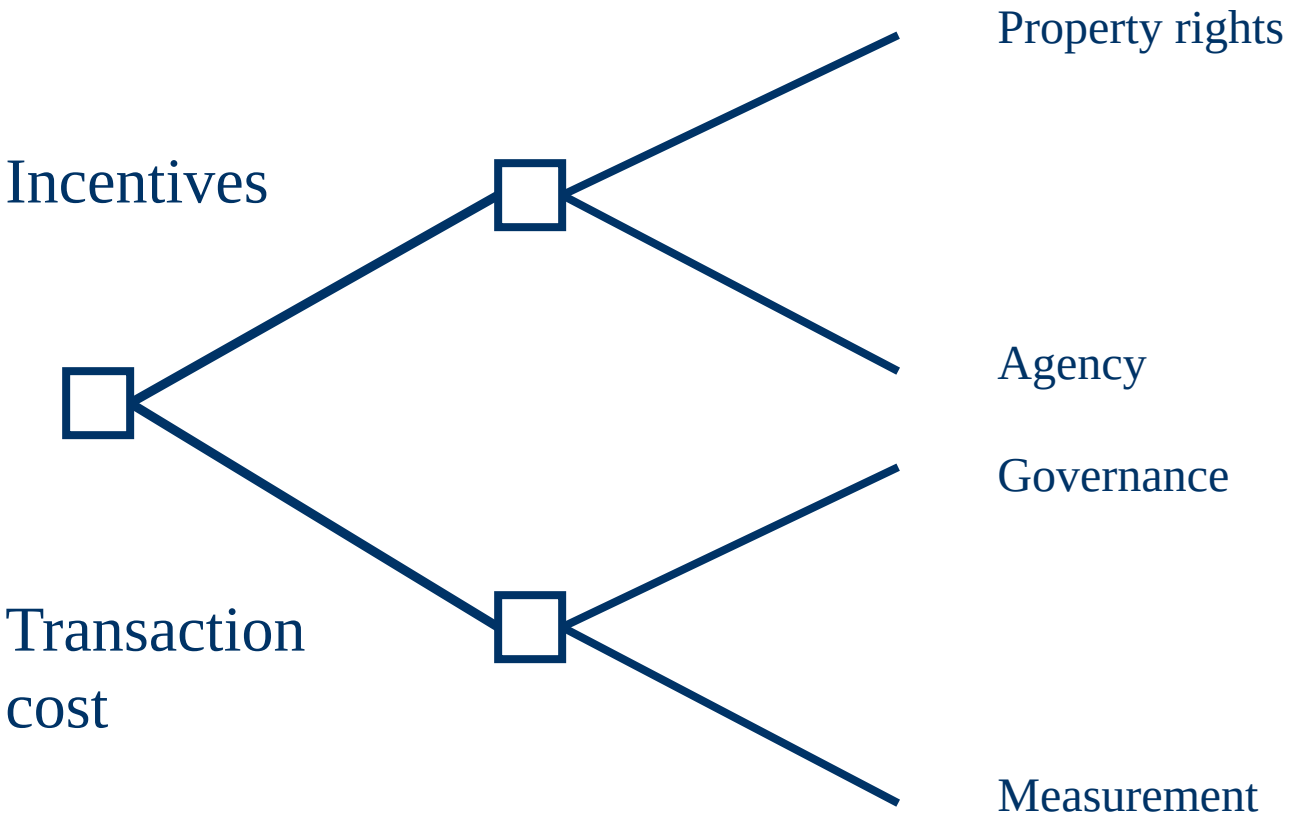
Oliver E. Williamson (1932-)



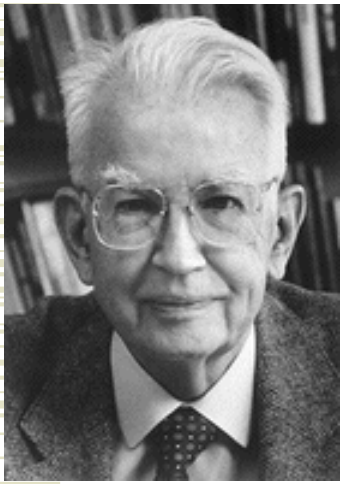
Monopoly branch.



Efficiency branch.



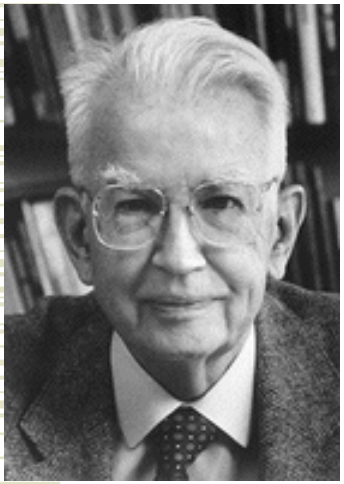
What is a firm?



Ronald H. Coase

- The Market.
  - The exchange of products or outputs.
  - Exchange is coordinated spontaneously, in the sense that relative prices rather than fiat direct resources.
- The firm.
  - Replaces contracts for products with employment contracts, effectively substituting a factor market for a product market (Cheung 1983).
  - Replaces spontaneous coordination with some kind of central design or direction.

What is a firm?



Ronald H. Coase

- Notice that this leaves two unexamined alternatives:
  - Product markets governed by central direction and
  - Factor markets coordinated spontaneously.
- Inside contracting and outsourcing are examples of the former.
- Voluntary production is an example of the latter.

What is a firm?

	Don't self-identify	Self-identify
Products	Inside contracting Outsourcing	Classic market
Effort	Classic firm	Voluntary production

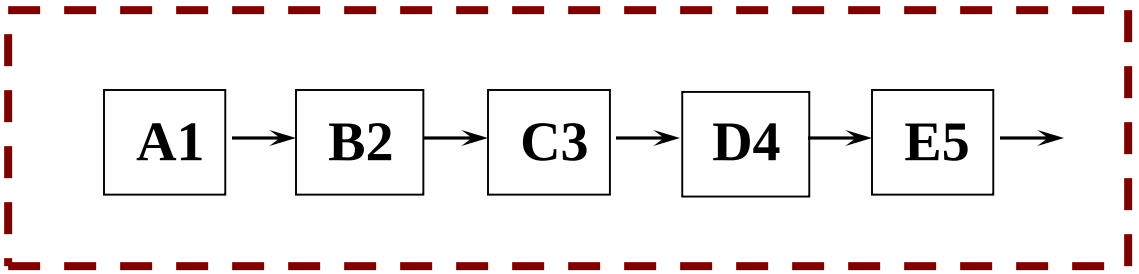
Why are there firms?

Ronald H. Coase
(1910-2013)

"The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism."

The size of the firm.

Ronald H. Coase (1910-)



- The size of the firm not its output (Q) but the number of transactions or activities within its boundaries.

The size of the firm.

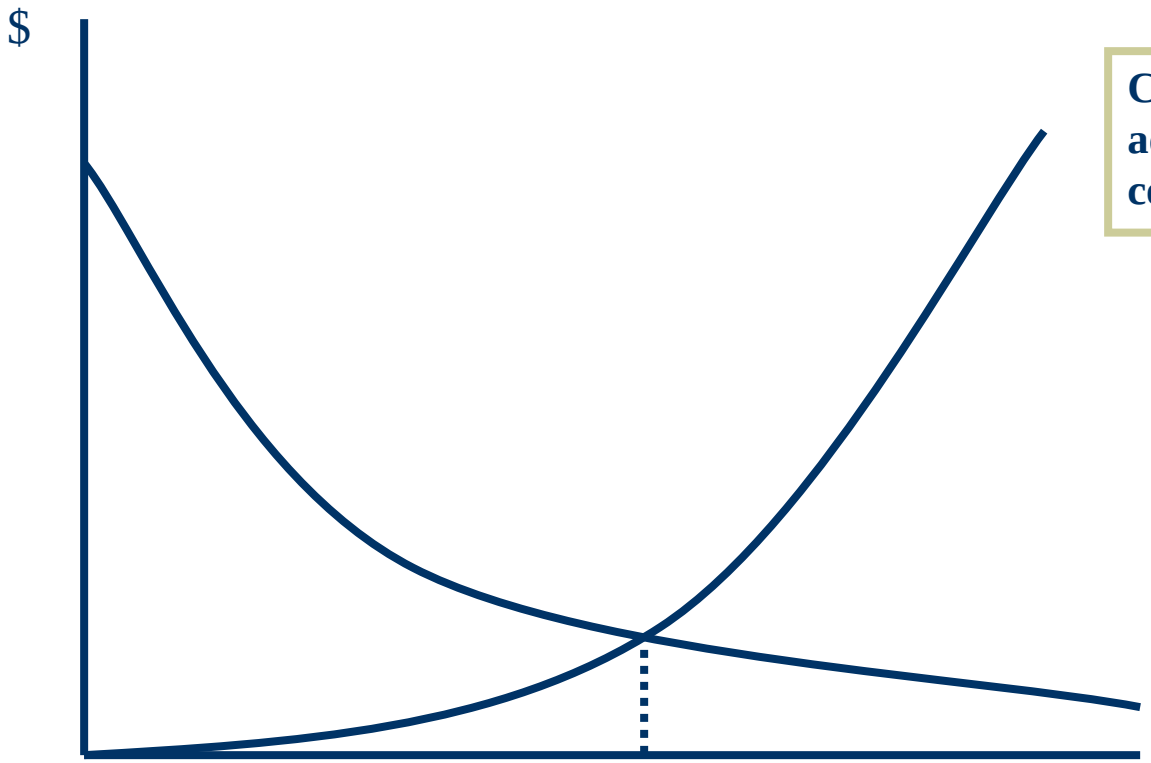
- Why doesn't the firm expand forever?
- V. I. Lenin: "The whole of society will have become one office and one factory."
- But: diminishing returns to internal coordination.
  - Management as a fixed factor.

The size of the firm.

Ronald H. Coase
(1910-2013)

"A firm will tend to expand until the costs of organising an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market or the costs of organising in another firm." (Coase 1937, p. 395.)

The size of the firm.



Markets versus firms.

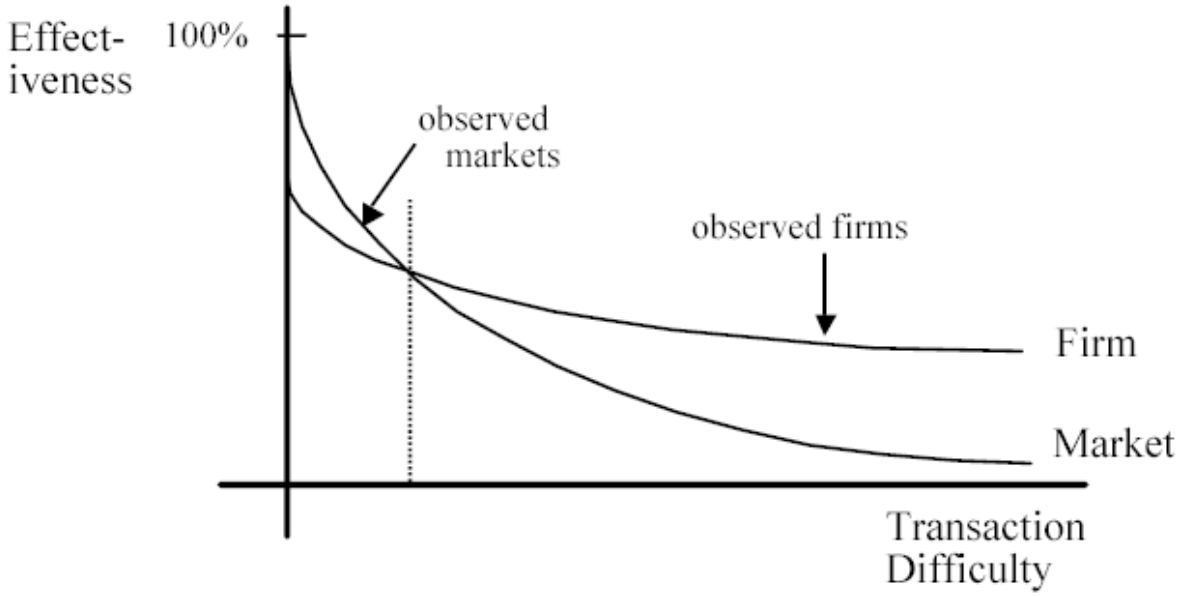


Figure 1: Coase (1937) Meets Heckman (1976)

From Gibbons (2004)

The size of the firm.

Ronald H. Coase
(1910-2013)

"It should be noted that most inventions will change both the costs of organising and the costs of using the price mechanism. In such cases, whether the invention tends to make firms larger or smaller will depend on the relative effect on these two sets of costs. For instance, if the telephone reduces the costs of using the price mechanism more than it reduces the costs of organising, then it will have the effect of reducing the size of the firm."

(Coase 1937, p. 397n.)

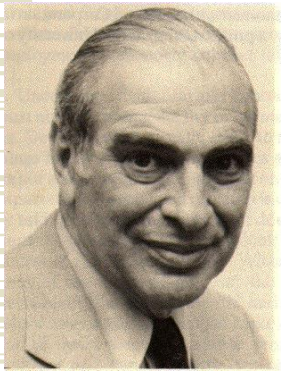
Transaction costs.

Ronald H. Coase (1910-2013)

Oliver E. Williamson (1932-)

- The "costs of using the price system" came to be called transaction costs.

Transaction costs.



Kenneth Arrow

Oliver E. Williamson

Kenneth Arrow has defined transaction costs as the "costs of running the economic system" (1969, p. 48). Such costs are to be distinguished from production costs, which is the cost category with which neoclassical analysis has been preoccupied. Transaction costs are the economic equivalent of friction in physical systems (Williamson 1985, pp. 18-19).

Transaction costs.

Ronald H. Coase
(1910-2013)

- Neoclassical tradition.
  - The costs resulting from the transfer of property rights.
    (Allen 2000, p. 901.)
  - Dahlman: identical to transportation costs.
  - The iceberg model.

Transaction costs.

Ronald H. Coase
(1910-2013)

- Property rights tradition.
  - The costs of establishing and maintaining property rights.
    (Allen 2000, p. 898.)
  - Direct costs as well as indirect costs of misallocation from rent-seeking activity.
  - The “Coase theorem.”

Transaction costs.

The notion of a “transaction” includes both exchanges and contracts. An exchange is a transfer of property rights to resources that involves no promises or latent future responsibility. In contrast, a contract promises future performance, typically because one party makes an investment, the profitability of which depends on the other party’s future behavior. The transactions that are the focus of Williamson’s approach are contractual, not just spot exchanges or even a long-lasting series of spot exchanges. In a contract a promise of future performance is exchanged, and investments are made, the value of which becomes dependent on the fulfillment of the other party’s promises. -- Alchian and Woodward (1988, p. 66).

Transaction costs.

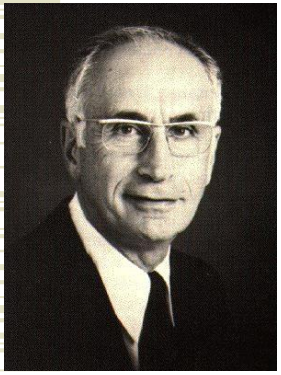
Ronald H. Coase
(1910-2013)

- Coase seems more interested in costs of exchange.
  - Cost of discovering the relevant prices.
    - Not completely eliminated by intermediaries.
  - Costs of negotiating and concluding a separate contract for each exchange.
    - Employment contract vs. spot contract.
  - Costs of coordinating when tasks are uncertain.

The parable of the secretary.

- Why not pay for office services by the piece?
  - $1 per letter typed, etc.
- Manager unlikely to know in advance which services needed.
- Manager pays for the secretary's time, and decides tasks later.
  - Contract for "job description."
  - Manager chooses $x \in \Omega$.

The nature of the firm.



Armen Alchian
(1919-2013)

Harold Demsetz
(1930-)

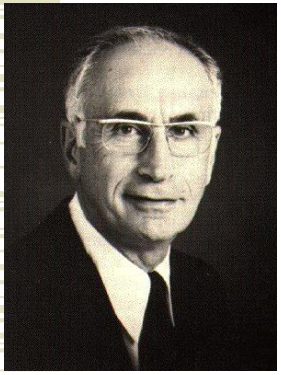
- But is a firm something different from a market?
- "Telling an employee to type this letter rather than to file that document is like my telling a grocer to sell me this brand of tuna rather than that brand of bread." (Alchian and Demsetz 1972, p. 777.)
- The firm as a nexus of contracts.

Asset specificity.

- Williamson is more interested in contract than exchange.
- Three "critical dimensions" of transactions:
  - Uncertainty;
  - Frequency;
  - Asset specificity.
- "The most critical dimension for describing transactions is asset specificity."
- Agency, monitoring, incentive alignment.

Oliver Williamson

Moral hazard versus holdup.

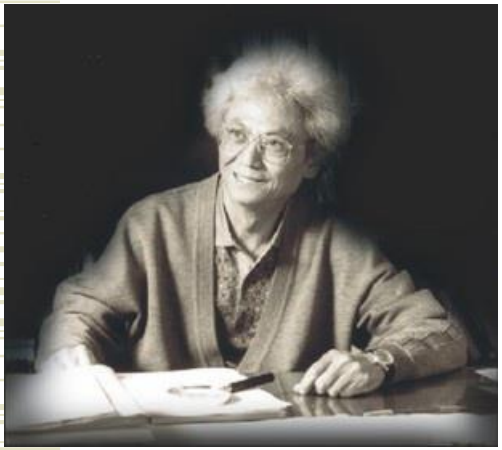


Armen Alchian
(1919-2013)

- Alchian and Woodward: two sources of "opportunism."
  - Moral hazard and plasticity.
    - Measurement and monitoring costs.
  - Asset specificity and holdup.
    - Governance costs.

Measurement costs.

- Cheung: the emergence of the firm involves "the replacement of a product market by a factor market, resulting in a saving in transaction costs."
- Measurement cost as another "cost of discovering prices."
  - "In every transaction, some characteristics or attributes must be measured, whether the deal is between an agent and a customer, an agent and an input owner, or an input owner and a customer."
  - Measuring a proxy.



Steven N. S. Cheung

Measurement costs.

- Consumers seek *attributes* of goods, not goods themselves.
- Costly to measure attributes.
- Measuring a proxy.

Measurement costs.

- Amount purchased depends on:
  - Buyer's demand for attribute ↑
  - Buyer's cost of measuring ↓
  - Posted price of commodity ↓
  - Distribution of attribute:
    - Average quality ↑
    - Variability of commodity ↑

Measurement costs.

- No added penalty for inspecting an exceptionally poor item, but added gain to finding an exceptionally good one.
- Sellers will try to sort just enough to dissuade buyers from sorting.
- Net price goes down when excessive measurement reduced.

NP = P(seller's sorting costs) + consumer's sorting costs

Limiting buyer sorting.

- Lowering costs of errors.
  - Warranties, share contracts.
- Persuading buyers that sorting is unnecessary.
  - Brand names, reputation standards.
- Raising sorting costs.
  - Suppressing information
  - De Beers.

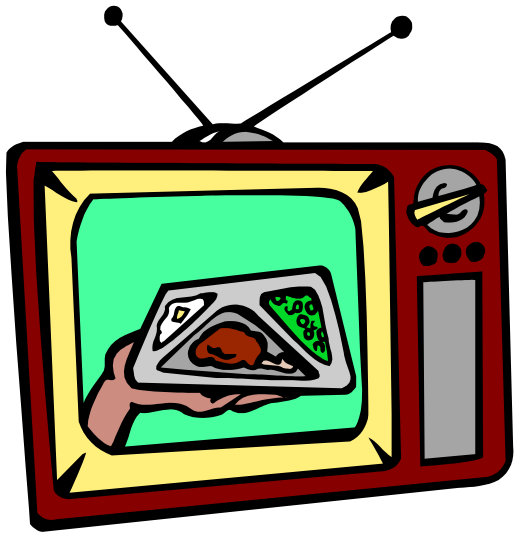
Sorting.

The DTC - De Beers' selling and marketing arm - processes some two thirds, by value, of the world's diamond production. All diamonds are sorted and valued into over 16,000 categories of shape, quality, colour and size by highly-skilled staff. The diamonds are sold by the DTC at regular sales called "sights" to the world's leading diamantaires.

Once sorted, diamonds are blended into 'selling mixtures' in preparation for sale to the DTC's 120 or so clients, or Sightholders as they are also known, comprising the most experienced diamond polishers and dealers in the world.

Source: De Beers.

Measurement and advertising.



- Three kinds of goods.
  - Search goods.
    Nelson (1974).
  - Experience goods.
    Nelson (1974)
  - Credence goods.
    Darby and Karni (1973).
- Actual goods may have *characteristics* of two or more types.

Measurement and advertising.

- Search goods.
  - Qualities can be determined prior to purchase.
    - Size, ripeness, color, etc.
  - Consumer can cheaply verify the truth of claims about search characteristics.
    - Incentive to target ads to the right consumers.
  - Misleading advertisement of search characteristics costly to advertiser.

Measurement and advertising.

- Experience goods.
  - Qualities can be determined only after purchase.
  - Direct information about quality harder to verify (and thus less valuable to consumers).
    - Non-specific claims of quality or no quality claims at all.
  - Indirect information.
    - Advertising as a signal.
    - Advertising and reputational capital.

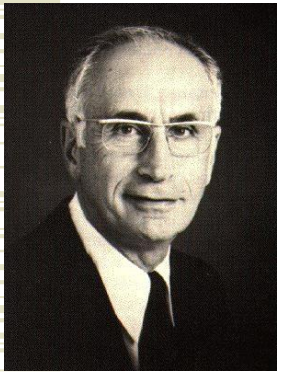
Measurement and advertising.

- Credence goods.
  - Qualities can't be determined even *after* purchase.
    - Medical care, car repair.
    - Consumers uncertain about both amount and quality.
  - Producers have scope to sell "too much" or cheat on quality.
  - But consumers have incentive to engage in too much search.
    - AMA: all doctors identical.

Measurement and organization.

- Measuring the value of intermediate products costly.
- Measurement of a *proxy*.
- Entrepreneur can measure inputs (effort) when market can't measure output.
  - Employment contract vs. piece rate.
  - Is this what Coase meant?

Moral hazard and monitoring.



Armen Alchian
(1919-2013)

Harold Demsetz
(1930-)

- Moral hazard: the incentive to cheat in the absence of penalties for cheating.
  - Origins in insurance.
- Another kind of "plasticity" of behavior after contract is signed.
- If monitoring is costly, agents have incentive to supply less effort than they agreed to.
- Alchian and Demsetz: costly monitoring explains the organization of the firm.

Moral hazard and monitoring.

Team production.

- Marginal products of team members not separately measurable.
  - Members paid on the basis of the whole team's output.
- Incentive to shirk.
  - Each member receives all the benefits of shirking (leisure) but can spread the costs of shirking to other members.
- Inefficiency.
  - Since everyone has the same incentives, all shirk, and the team ends up in a low-output equilibrium no one wants.

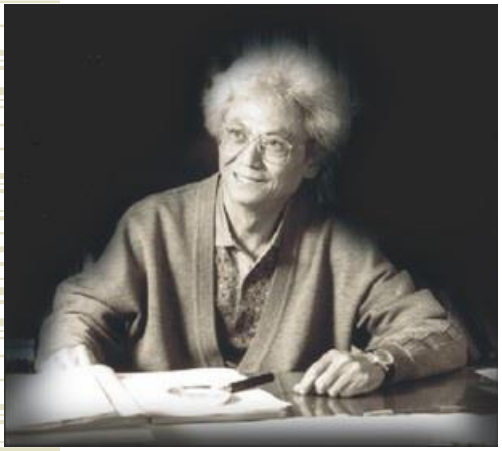
Moral hazard and monitoring.

Team production.

- Solution.
  - One team member becomes the “boss” and specializes in monitoring the others.
- But who guards the guardian?
  - “Boss” also becomes the owner — the residual claimant — and is monitored by the market.

Measurement costs.

- Cheung: “My own favorite example is riverboat pulling in China before the communist regime, when a large group of workers marched along the shore towing a good-sized wooden boat. The unique interest of this example is that the collaborators actually agreed to the hiring of a monitor to whip them.”

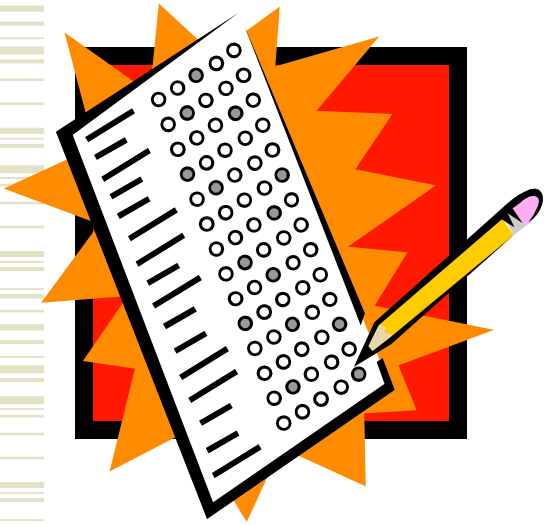


Steven N. S. Cheung

- “The point here is that even if every puller were perfectly ‘honest,’ it would still be too costly to measure the effort each has contributed to the movement of the boat, but to choose a different measurement to all would be so difficult that the arbitration of an agent is essential.”

Multi-task agency problem.


Paul Milgrom & Bengt Holmström



- Tasks have multiple dimensions.
  - Some dimensions more costly to measure than others.
- Performance-based compensation leads agents to maximize the proxy.
  - Rewarding teachers for test scores.
- May be better to pay fixed wages even when objective output measures available.

Separation of ownership and control.

Adolf A. Berle (1895-1971)
with John F. Kennedy

- Big modern firms are not owner managed (as in Alchian and Demsetz story).
- Adolf A. Berle and Gardiner C. Means, *The Modern Corporation and Private Property* (1932).
  - Separation of ownership and control.
  - Managers "plunder" stockholders.

Agency theory.

Michael C. Jensen (1939-)

An agency relationship is a contract under which one or more persons (the principals) engage another person (the agent) to perform some service on their behalf that involves delegating some decision making authority to the agent.

- Divergence of interest between principal and agent.

Agency theory.

Michael C. Jensen (1939-)

Agency costs are the sum of:

- Monitoring expenditures by the principal.
- Bonding expenditures by the agent.
- The residual loss of misaligned incentives.

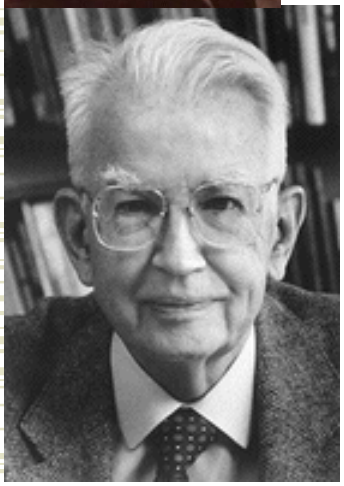
Separation of ownership and control.

Michael C. Jensen (1939-)

- Agency costs of separation small compared to increased capital supply.
  - Risk diversification benefits of passive ownership.
- Modern corporation has mechanisms to reduce agency costs.
  - Stock market.
  - Takeover market.
  - Managerial labor market.
  - Expert boards.

Externalities.

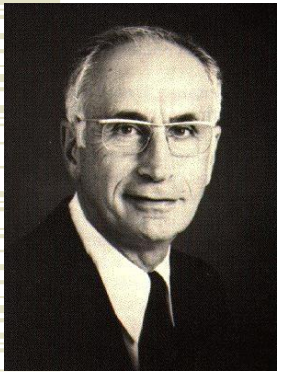
A. C. Pigou



Ronald Coase

- Coase (1960).
  - Externalities as problems of institutional design – not as a mysterious divergence of private and social cost.
  - In the absence of transaction costs, rights end up in the hands of those who value them the most.
    - Which Coase considered bloody obvious, not a "theorem."
  - In a world of transaction costs, need to pay attention to the structure of property rights.

“Old” property rights approach.

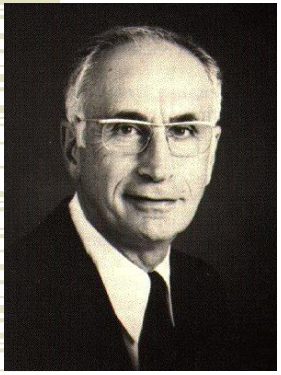


Armen Alchian
(1919-)

Harold Demsetz
(1930-)

- Grows out of Coase (1960).
  - Externality as about property rights not “social cost.”
  - The right (or not) to exclude others.
- How are property rights assigned in a world full of contractual plasticity and monitoring costs?
- Property as a social convention.

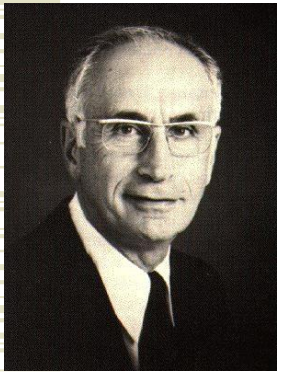
Property rights.



Armen Alchian (1919-)

- Alchian: a system of property rights is "a method of assigning to particular individuals the 'authority' to select, for specific goods, any use from a nonprohibited class of uses." (Alchian 1965 [1977, p. 130]).
- Each property owner has "the right to use goods (or transfer that right) in any way the owner wishes so long as the physical attributes or uses of all other people's private property is unaffected."
  - Pecuniary externalities.
  - "Transcendental externalities" or "moralisms."

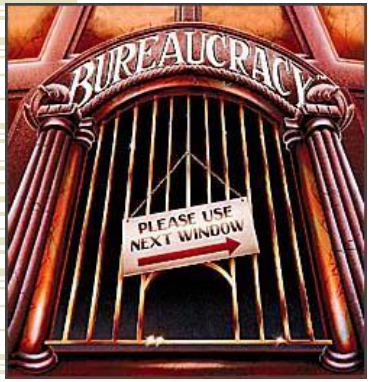
Property rights as an institution.



Armen Alchian
(1919-)

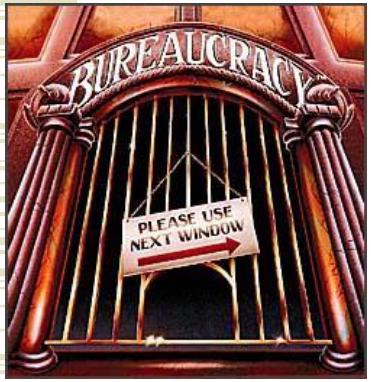
- Instantiated in explicit rules.
- Enforced by an organization with a local monopoly on the use of force.
- But also – importantly – a social convention.
- Key to extended anonymous cooperation and the division of labor.

Partitioning and ownership.



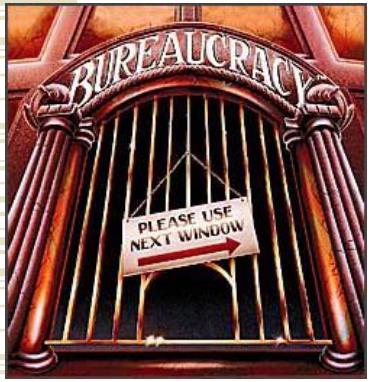
- Property rights as a bundle:
  - Use, income, alienation, etc.
  - But also the right to exclude.
- Fee simple ownership:
  - Right to use and right to exclude vested in a single decision-making unit.

Partitioning and ownership.



- Common pool:
  - Everyone has use rights.
  - No one has exclusion rights.
  - Common pool a function of scheme of property rights, not (just) technology.
- Tragedy of the commons:
  - Overuse of resources.
  - In the limit, full dissipation of rents.
- Correctives:
  - Create and enforce exclusion rights.
  - Collective management schemes (Ostrom).

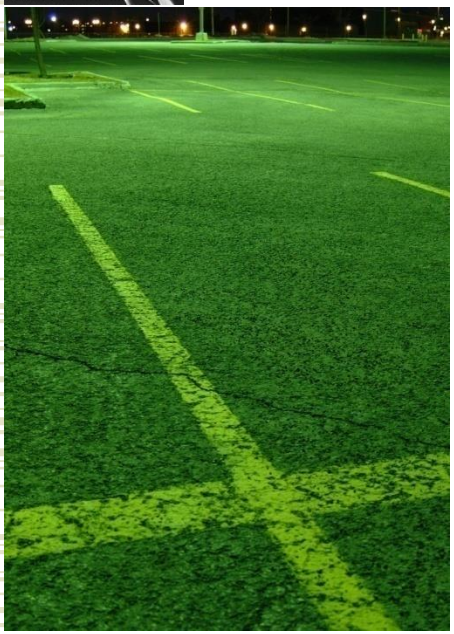
Partitioning and ownership.



- Anticommons:
  - Many entities have exclusion rights (veto power).
- Tragedy of the anticommons:
  - Underuse of resources.
  - In the limit, full dissipation of rents.
- Examples:
  - Bureaucracy, especially in post-Soviet/developing countries.
  - Patents in complex systems products.

Commons and anticommons.

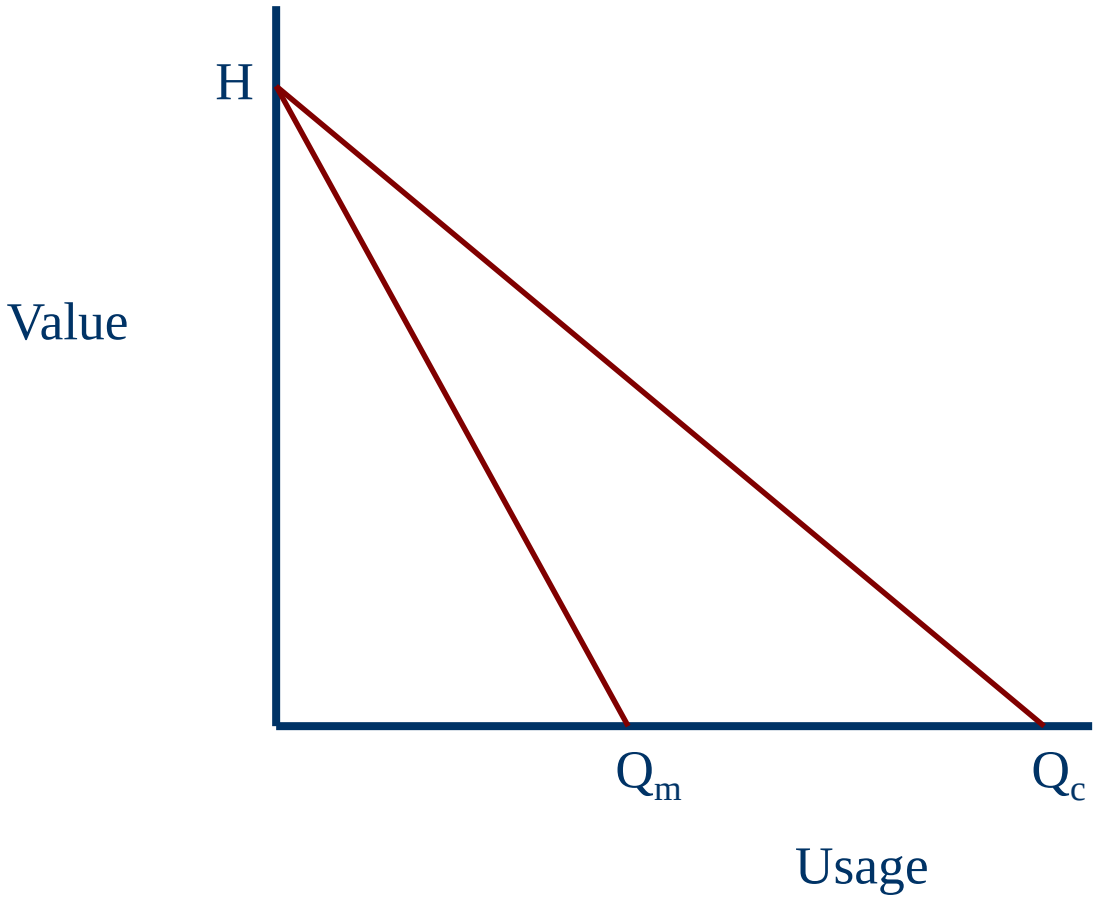
James Buchanan



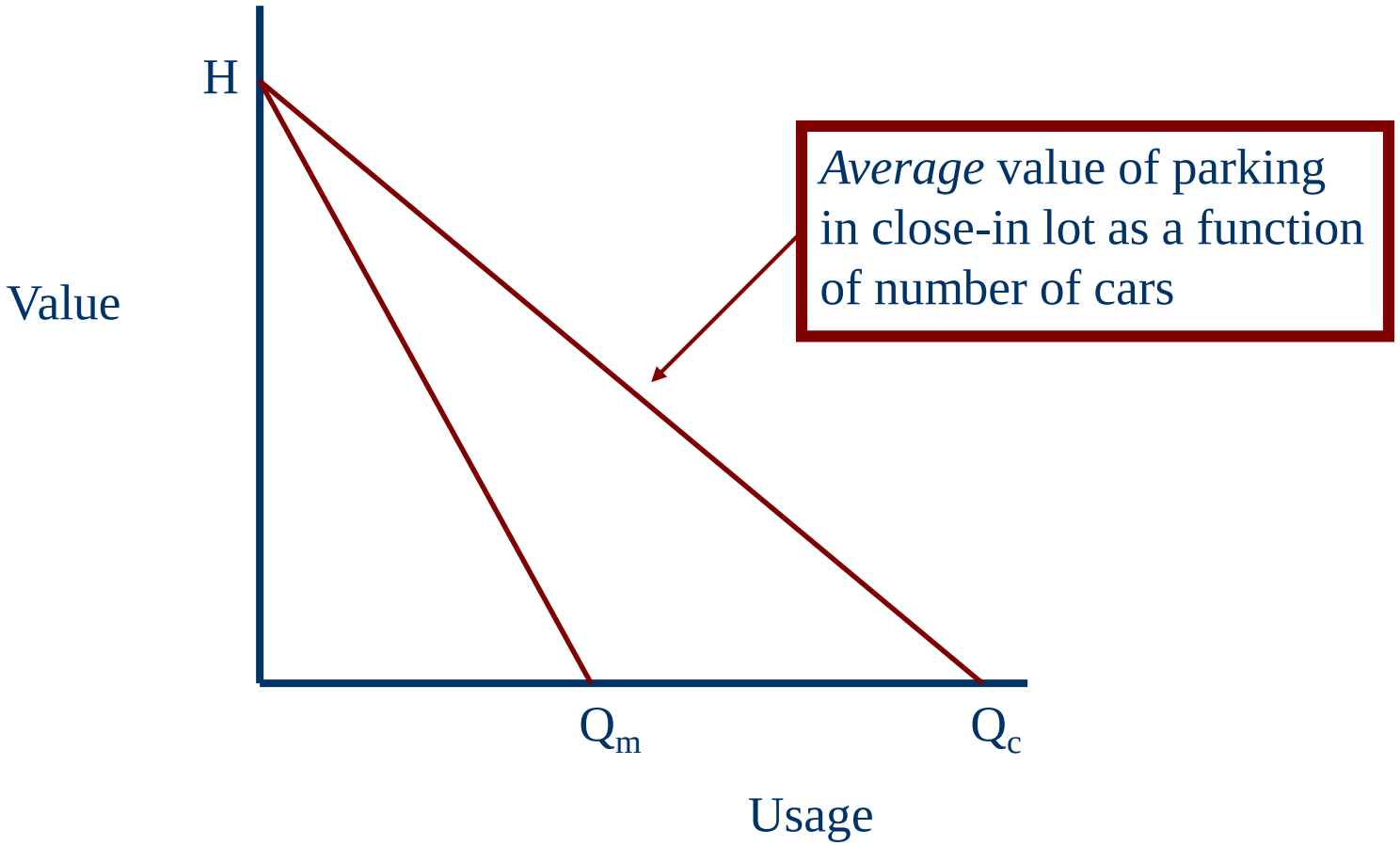
Buchanan and Yoon (2000)

- Imagine a vacant lot near a village.
  - Can be used for parking, but capacity less than open-access demand.
  - Ample parking 1 mile away.
  - Because of congestion, value of parking in close-in lot is monotonically and inversely related to number of users.

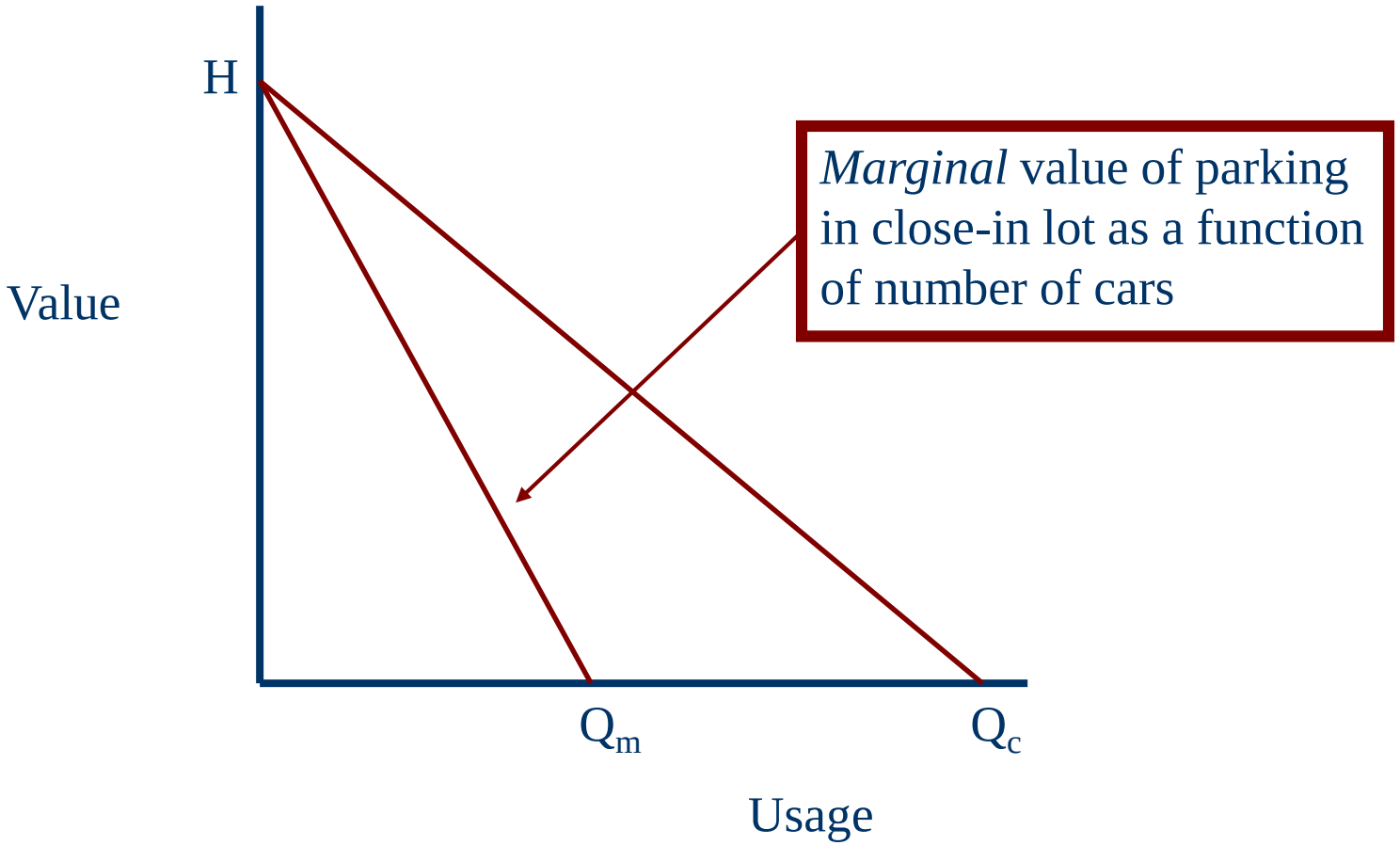
Commons and anticommons.



Commons and anticommons.

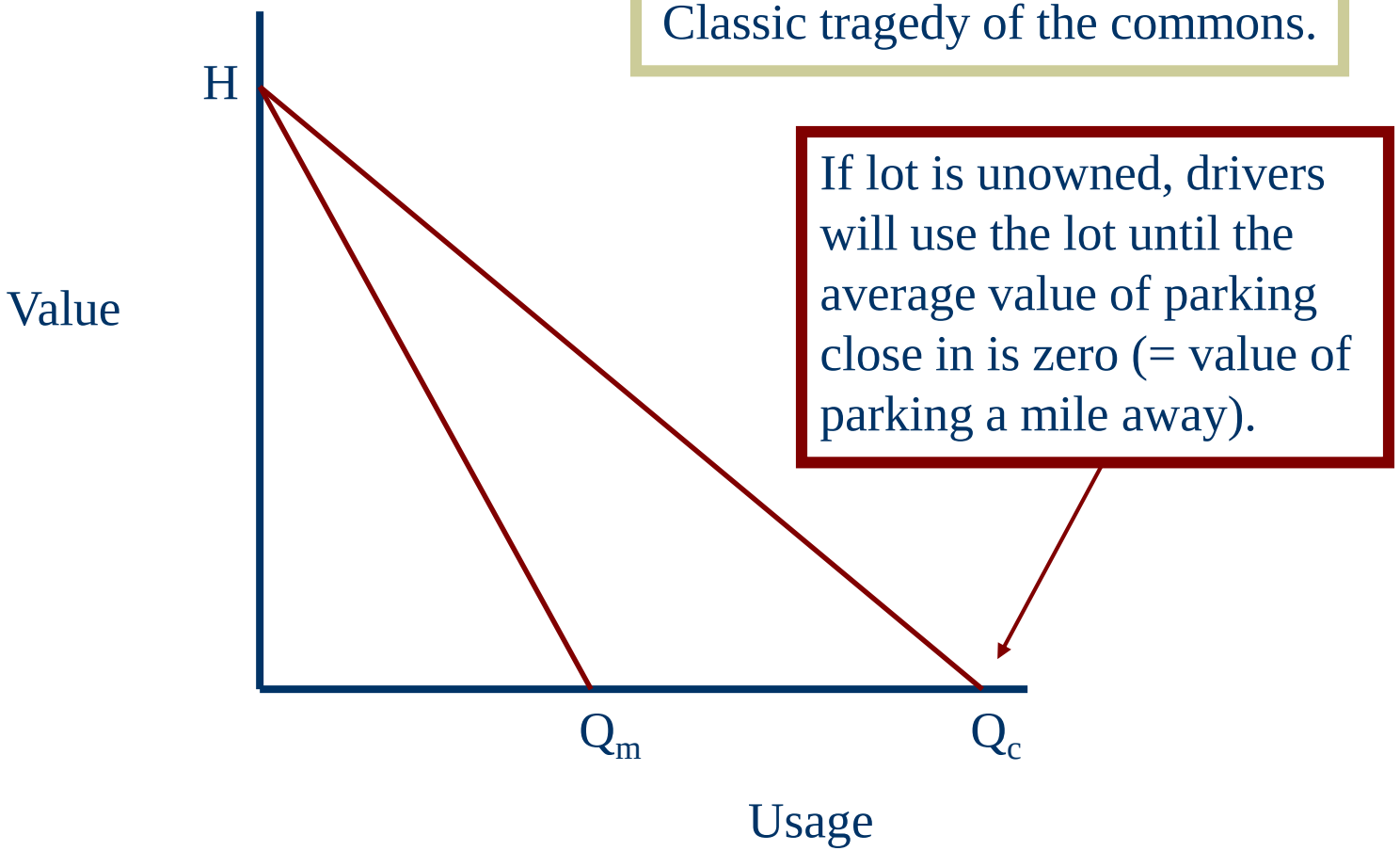


Commons and anticommons.



Commons and anticommons.

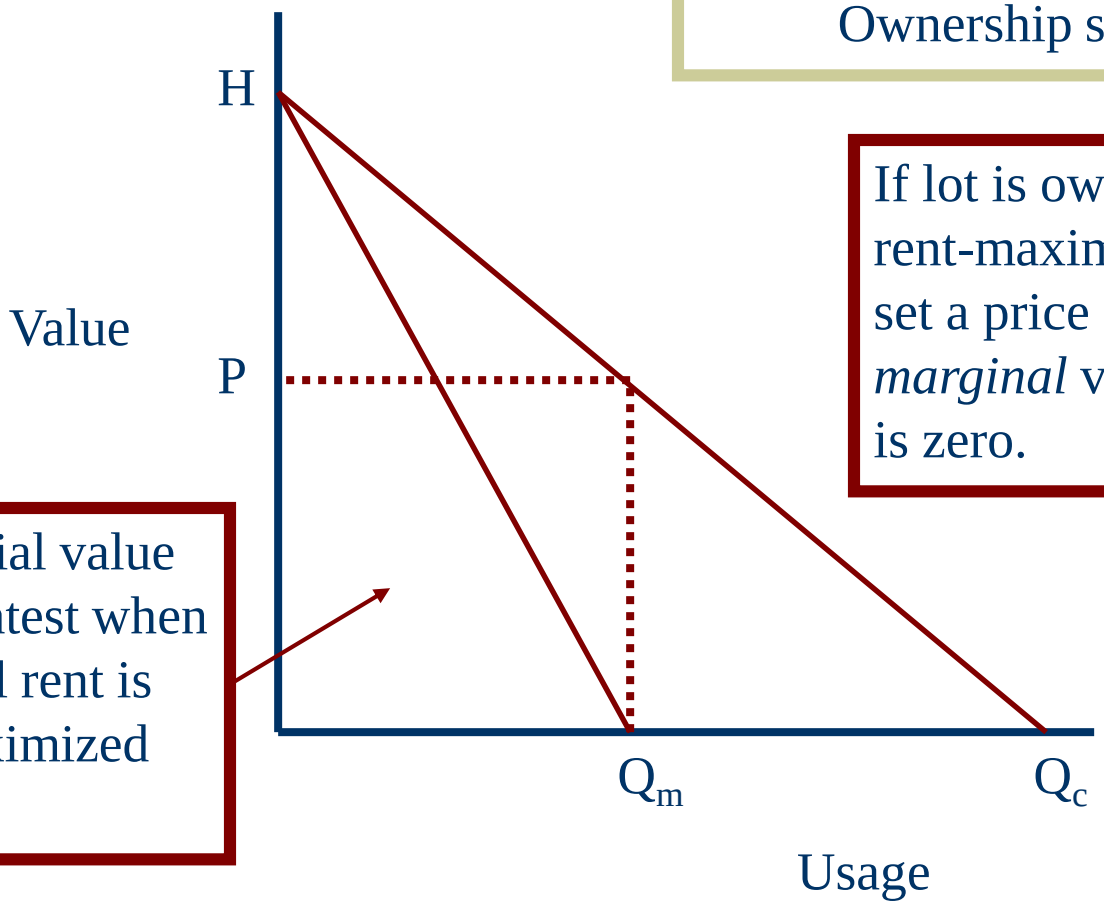
Classic tragedy of the commons.



If lot is unowned, drivers will use the lot until the average value of parking close in is zero (= value of parking a mile away).

Commons and anticommons.

Ownership solution.

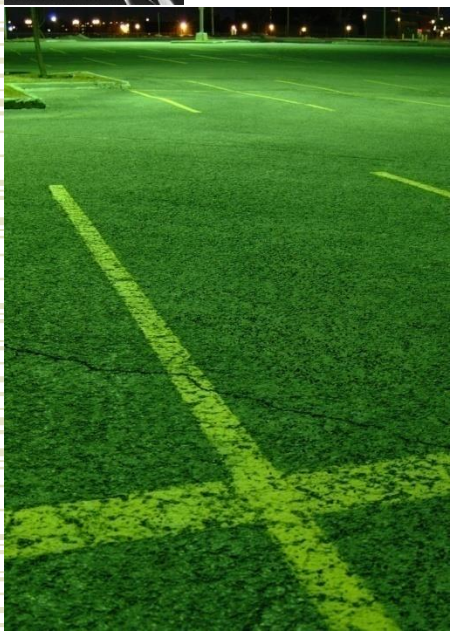


If lot is owned, a (single) rent-maximizing agent will set a price P so that the *marginal* value of parking is zero.

Social value greatest when total rent is maximized

Commons and anticommons.

James Buchanan

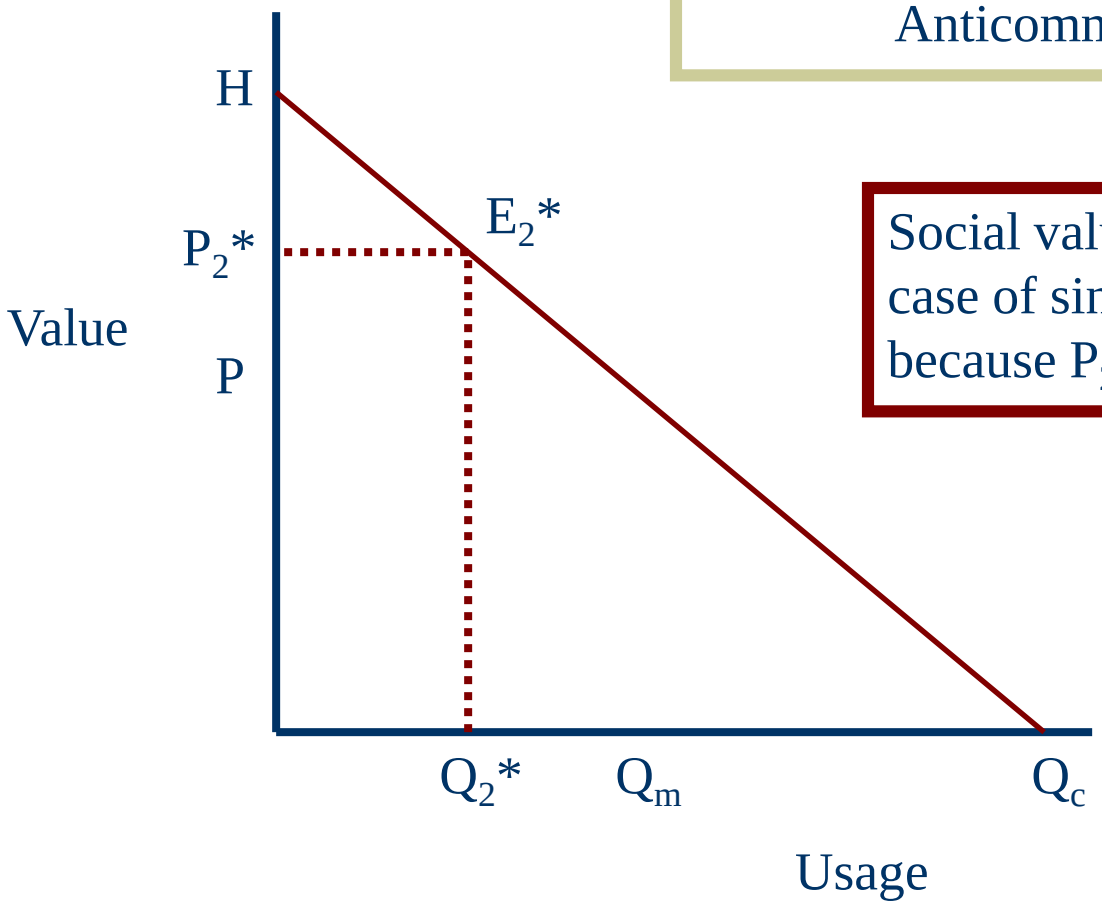


Buchanan and Yoon (2000)

- Now assume that, instead of a single owner, two parties are granted rights of exclusion.
- Drivers must buy a green ticket and a red ticket to park.
- In Nash equilibrium, the price of parking P_2^* will be greater than P.

Commons and anticommons.

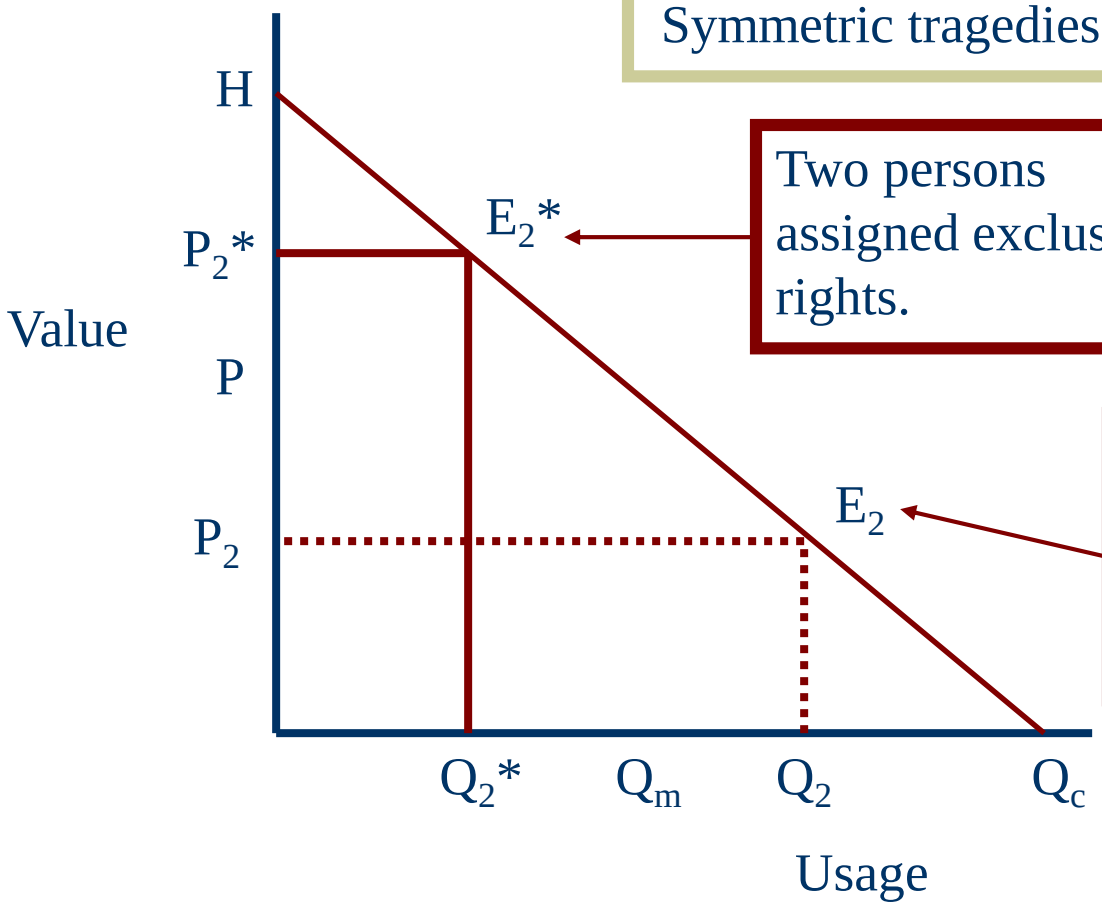
Anticommons.



Social value less than in case of single ownership because $P_2^*Q_2^* < PQ_m$.

Commons and anticommons.

Symmetric tragedies: $P_2^*Q_2^* = P_2Q_2$

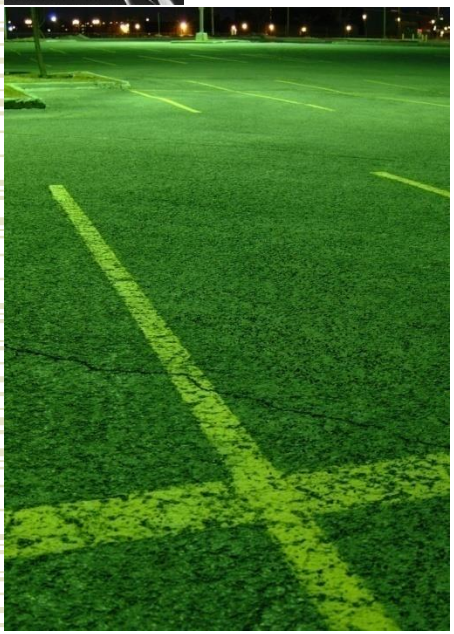


Two persons assigned exclusion rights.

Two persons assigned use rights but there are no exclusion rights.

Commons and anticommons.

James Buchanan



Buchanan and Yoon (2000)

- As number of excluders gets large, total rent goes to zero, and all rent is dissipated, as in case of a commons.
- In general:

$$TR(n) = n(a^2/b)/(n+1)^2$$

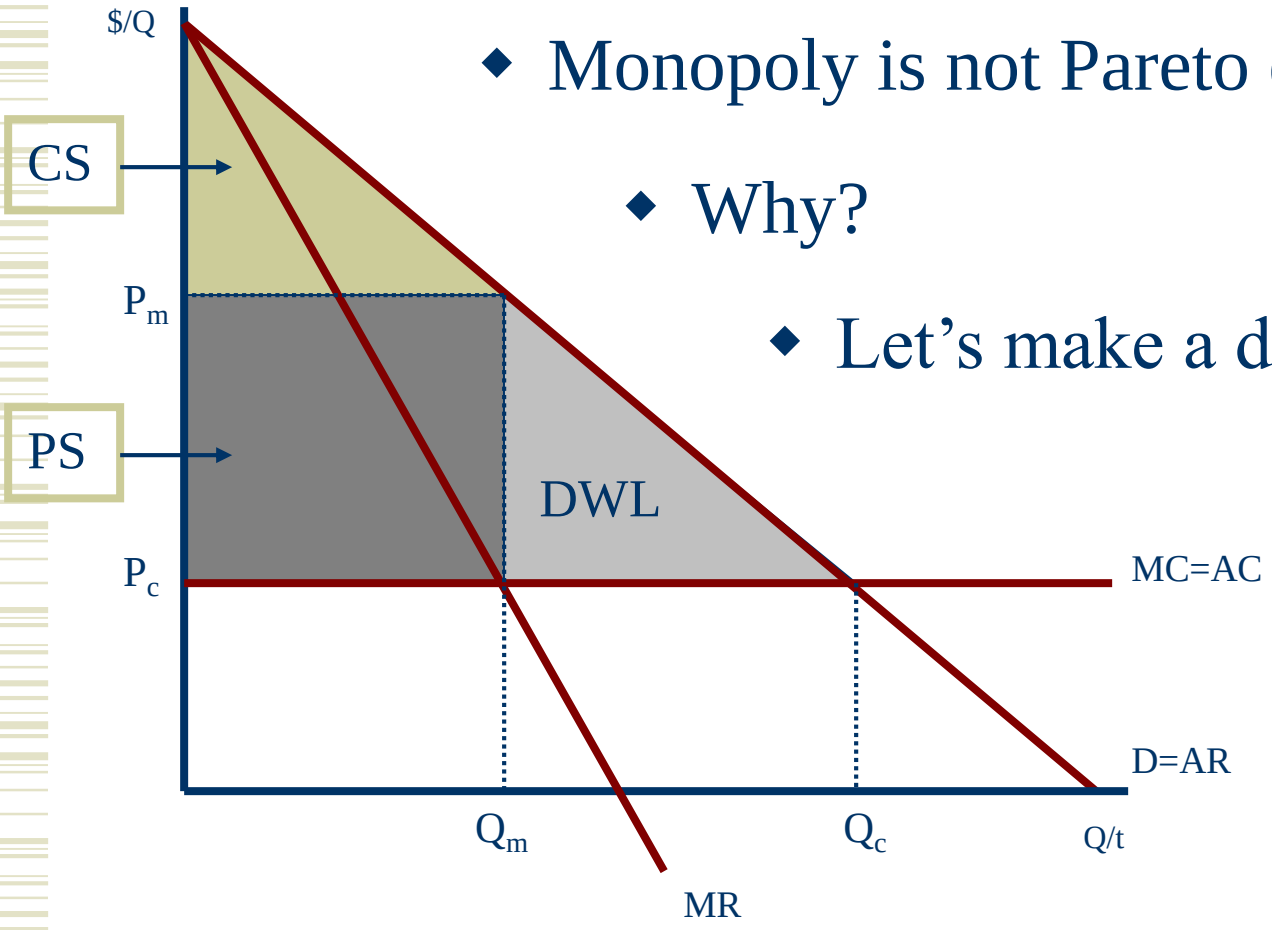
(a and b are the constants in the value function P = a - bQ)

Transaction costs.

Ronald Coase

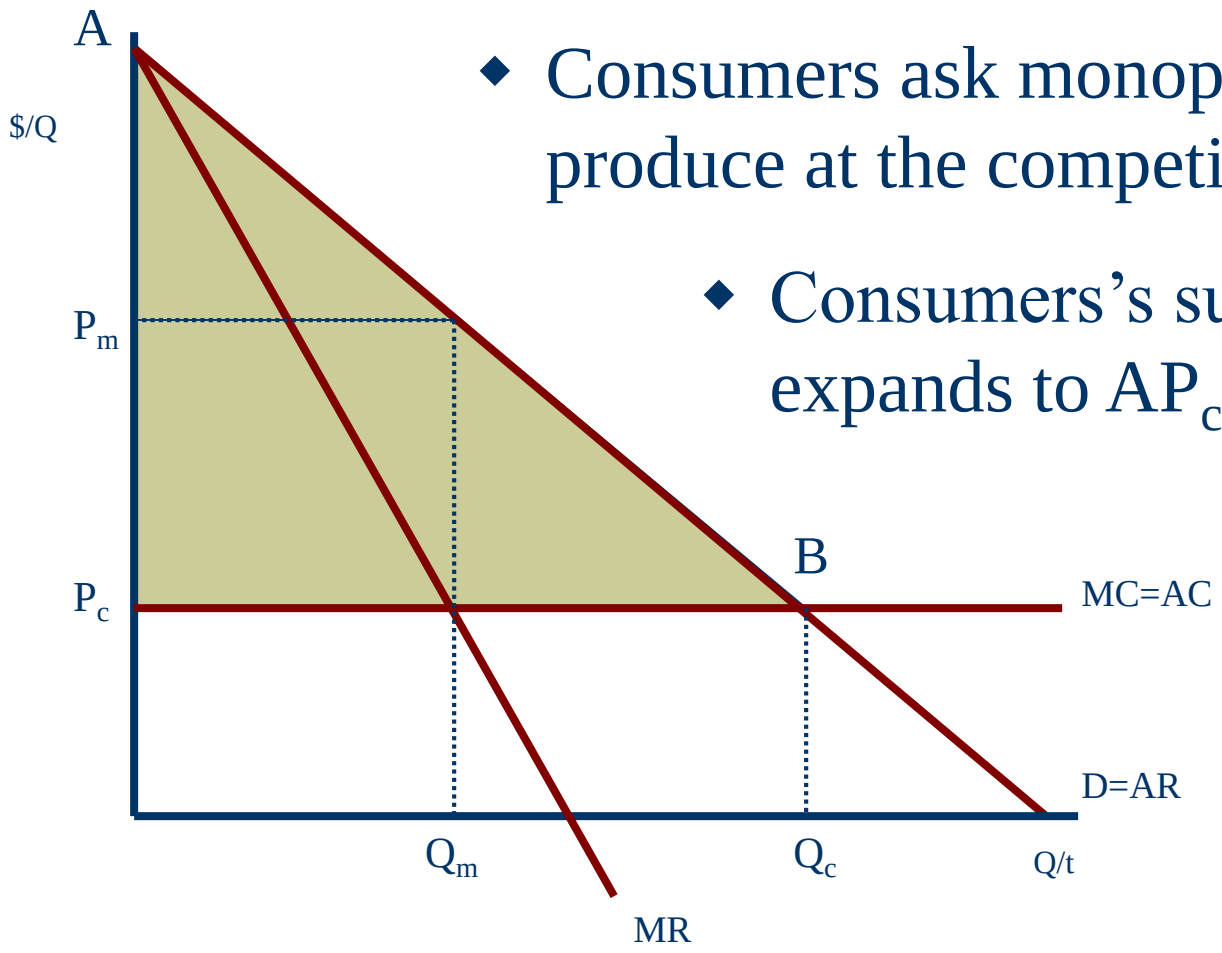
- "Coase theorem": in the absence of transaction costs, rights end up in the hands of those who value them the most.
  - No gains from trade unexploited.
- Example: monopoly.

Monopoly and transaction costs.



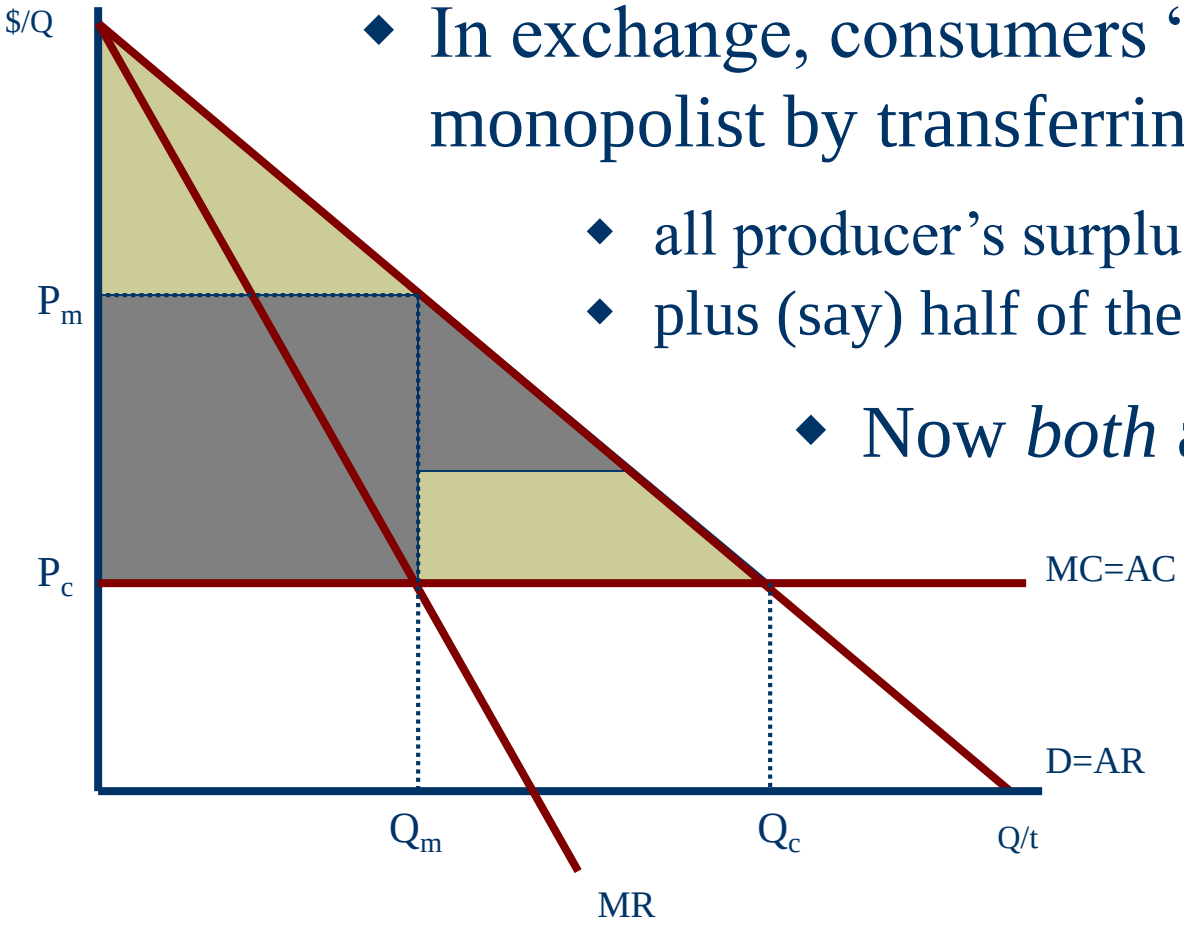
- Monopoly is not Pareto efficient.
  - Why?
    - Let's make a deal.

Monopoly and transaction costs.

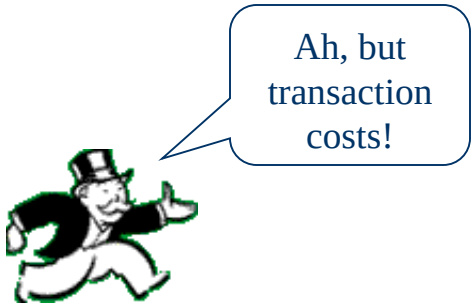


- Consumers ask monopolist to produce at the competitive level Q_c.
  - Consumers's surplus expands to AP_cB.

Monopoly and transaction costs.



- In exchange, consumers "bribe" the monopolist by transferring back:
  - all producer's surplus,
  - plus (say) half of the DWL.
    - Now *both* are better off.



Emergence of property rights.

- "Coase theorem": in the absence of transaction costs, rights end up in the hands of those who value them the most.
  - No gains from trade unexploited.
- But this also applies to the emergence of property rights in the first place.
  - Barzel: Ownership of attributes of assets not assets themselves.
  - Because of measurement costs, it may not pay to specify all attributes.
  - Why restaurants put salt "in the public domain."

Emergence of property rights.

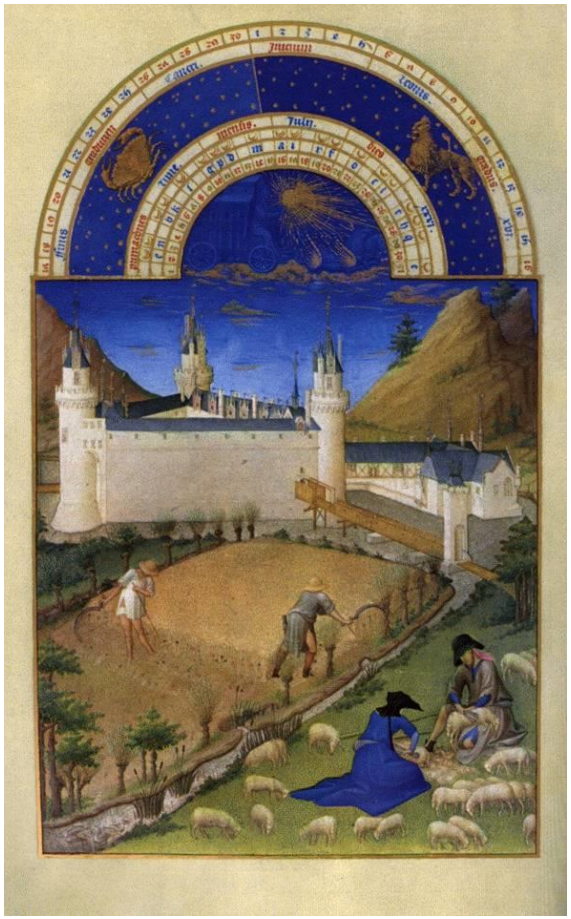
- Demsetz: property rights emerge when the benefits of having rights exceed the costs of enforcement.
  - Montagnais of Québec.
    - Before Europeans, demand for pelts small compared to supply – so no need for property rights.
    - Demand from European trade creates tragedy of the commons, and tribes mark off territories and create property rights.

Harold Demsetz (1930-)

Institutional innovation.

- Ruttan: institutional innovation depends on supply factors as well as demand.
- Demand for institutional innovation.
  - Change and technology or relative prices creates profit opportunities for those who can change institutions.
- Supply of institutional innovation.
  - Collective action and persuasion.
- Example: Microwave telephone transmission and deregulation.

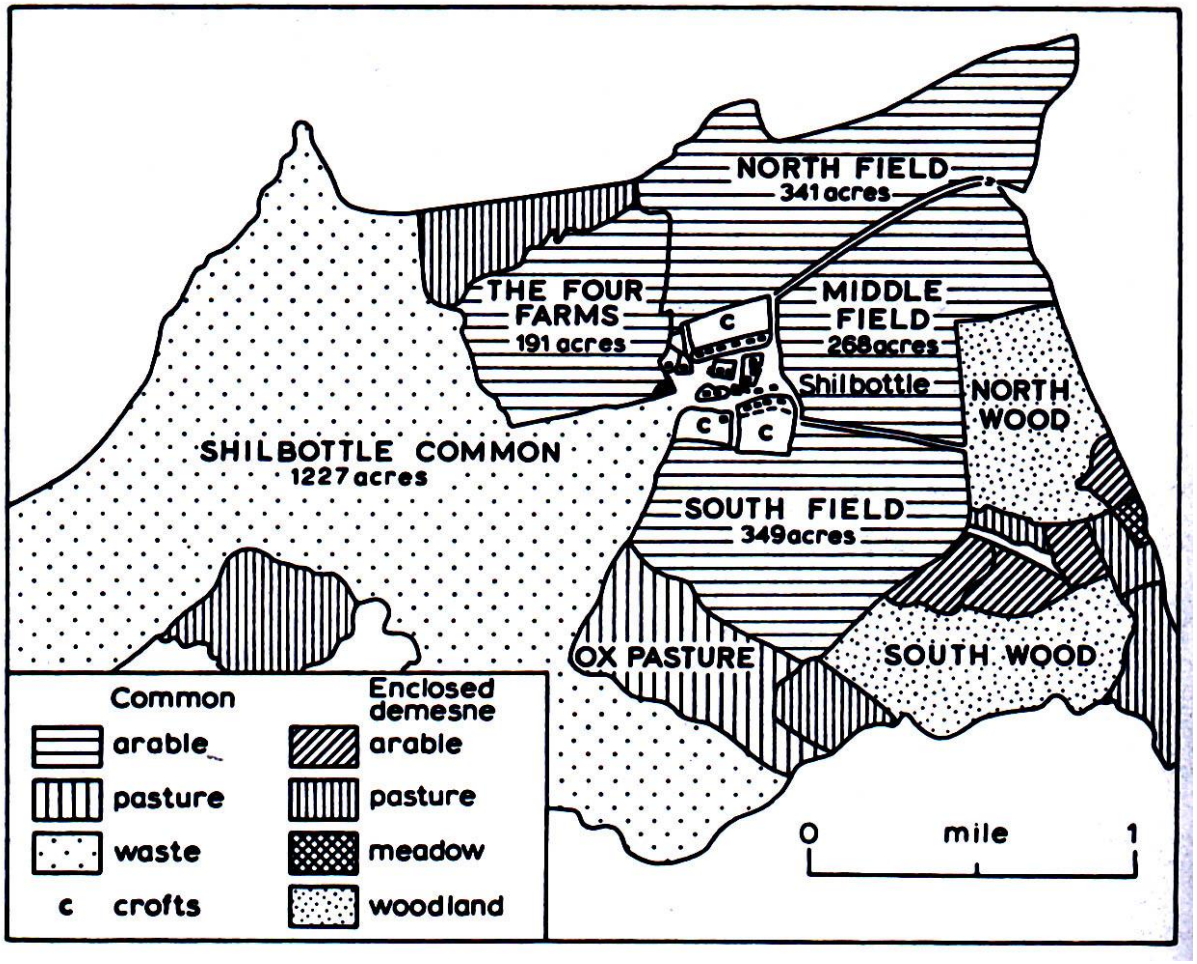
The Open Field System.



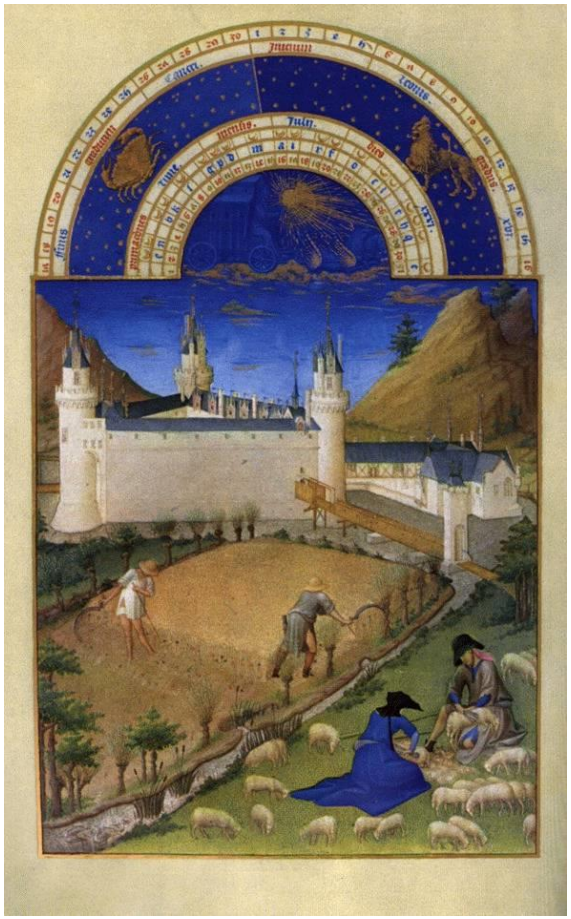
July, from *Les très Riches Heures du Duc de Berry* (c. 1412). The Chantilly Museum, Paris.

- No tragedy of the commons.
- Dahlman: a complex system for managing semi-autarkic production.
  - Interpendencies among tasks.
  - Different MES of tasks.
  - Collective management.
    - Cf. Ostrom.

The Open Field System.



The Open Field System.



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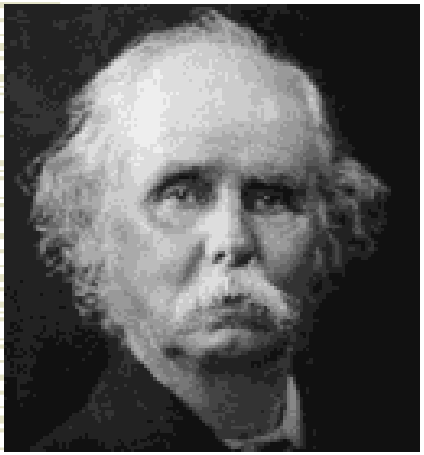
- No tragedy of the commons.
- Dahlman: a complex system for managing semi-autarkic production.
  - Interpendencies among tasks.
  - Different MES of tasks.
  - Collective management.
    - Cf. Ostrom.
- With the revival of trade, the OFS became an *anticommons*.
  - Enclosure movement.

Composite quasirent.



Alfred Marshall
(1842-1924)

Indeed, in some cases and for some purposes, nearly the whole income of a business may be regarded as a quasi-rent, that is an income determined for the time by the state of the market for its wares, with but little reference to the cost of preparing for their work the various things and persons engaged in it. In other words it is a *composite quasi-rent* divisible among the different persons in the business by bargaining, supplemented by custom and by notions of fairness … Thus the head clerk in a business has an acquaintance with men and things, the use of which he could in some cases sell at a high price to rival firms. But in other cases it is of a kind to be of no value save to the business in which he already is; and then his departure would perhaps injure it by several times the value of his salary, while probably he could not get half that salary elsewhere.

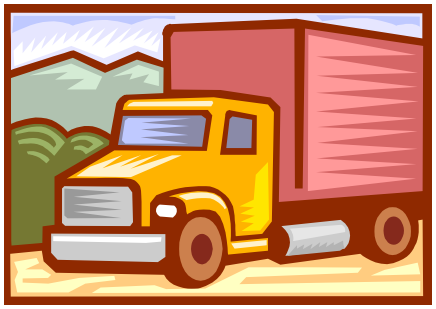
(Marshall 1961, VI.viii.35.)

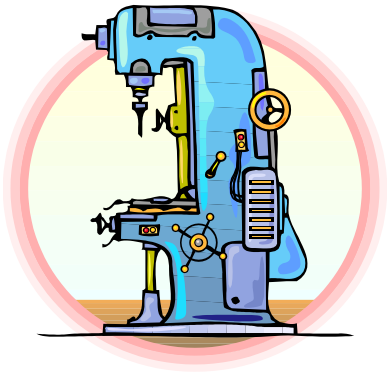
Asset specificity.

Oliver E. Williamson (1932-)

- The "fundamental transformation."
  - Incentives change once the contract is signed.
- One party may have an incentive to "hold up" the other.
  - Transfer some of the quasirents of cooperation.

Asset specificity.





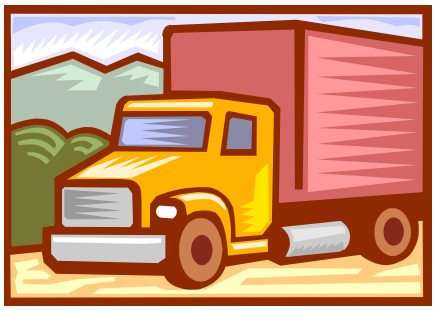
- One party owns a generic asset.
  - High value outside of the transaction (next best use).
- The other party owns a highly specific asset.
  - Low value outside the transaction.
  - Next best use is as a boat anchor.
- Assume also that parties cannot recontract until “next season.”

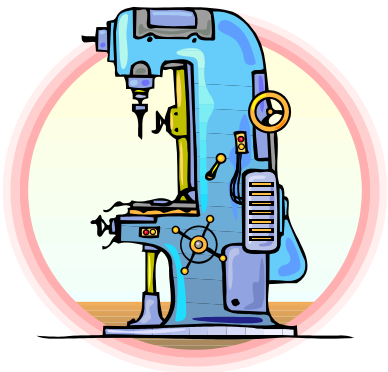
Asset specificity.

Oliver E. Williamson (1932-)

- Cooperation nets $50,000.
  - Agree to split 50/50.
- Once the contract is signed, the party with the generic asset threatens to pull out of the contract.
  - Demands $49,000 of the quasirents of cooperation.
  - “Post contractual opportunism.”

Asset specificity.





- Foreseeing such "contractual hazards," parties will be reluctant to cooperate.
  - Or will choose less specialized but therefore less efficient technology.
- Vertical integration solves the hold-up problem.
  - The two parties jointly own both assets.
  - Incentives now properly aligned.

Asset specificity.

Oliver E. Williamson (1932-)

- Choice between markets and internal organization.
  - Markets promote high-powered incentives.
  - Markets can aggregate demands and realize economies of scale.
  - But internal organization can sometimes solve problems of opportunism.

Asset specificity.

Oliver E. Williamson (1932-)

The model.

β(k) = bureaucratic costs of internal governance.

M(k) = governance costs of markets.

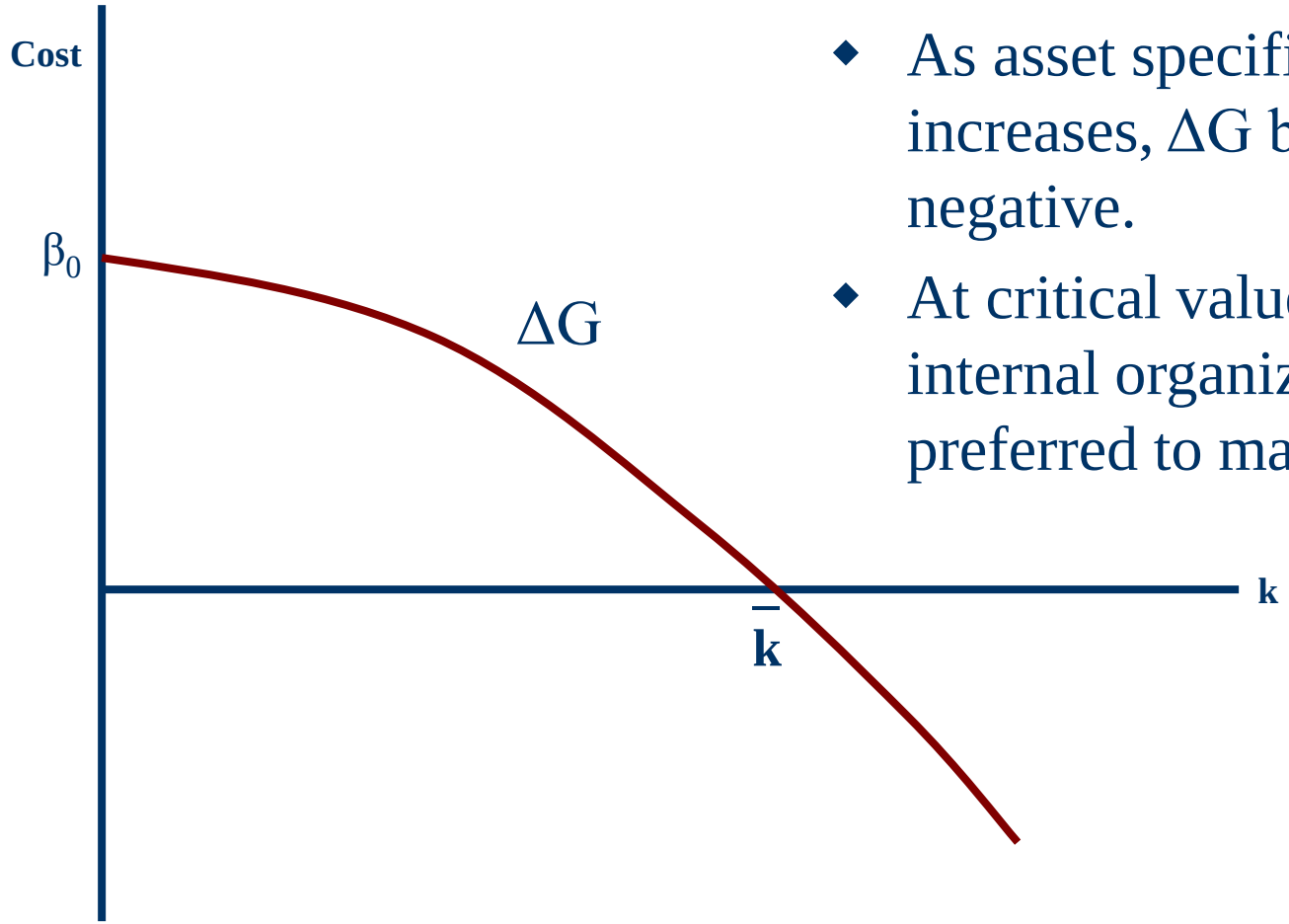
k = index of asset specificity.

β(0) > M(0) because advantages of markets not offset by costs of asset specificity.

But β declines faster than M as k increases (M' > β' ∀ k).

ΔG(k) = β(k) - M(k).

Asset specificity.



- As asset specificity increases, ΔG becomes negative.
- At critical value of k, internal organization preferred to market.

Asset specificity.

Oliver E. Williamson (1932-)

Economies of scale and scope.

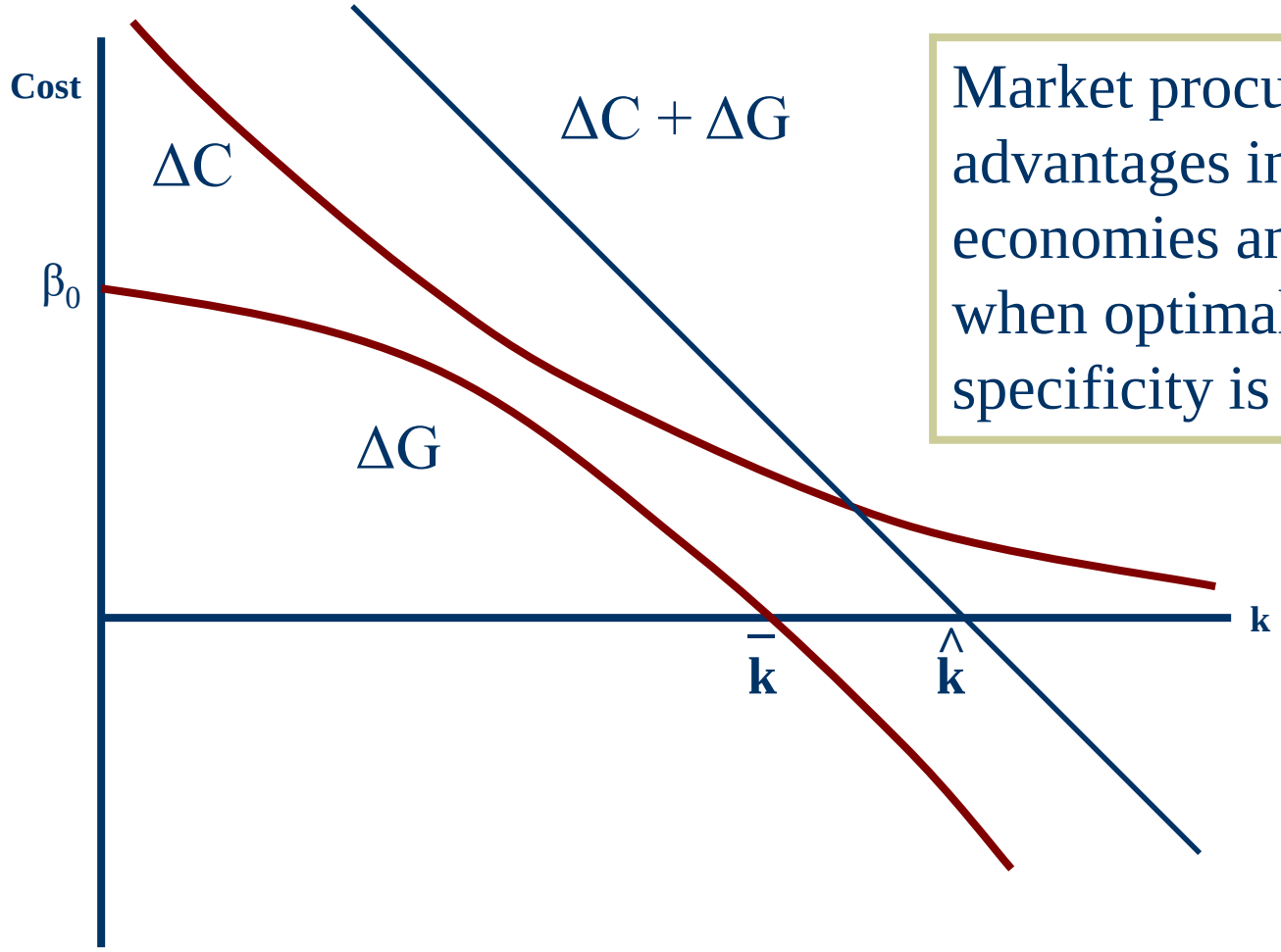
Markets can aggregate demands and take advantage of economies of scale and scope.

Production-cost penalty for internal organization.

ΔC = steady-state production-cost difference between producing to one's own requirements and the steady-state cost of procuring the same item in the market.

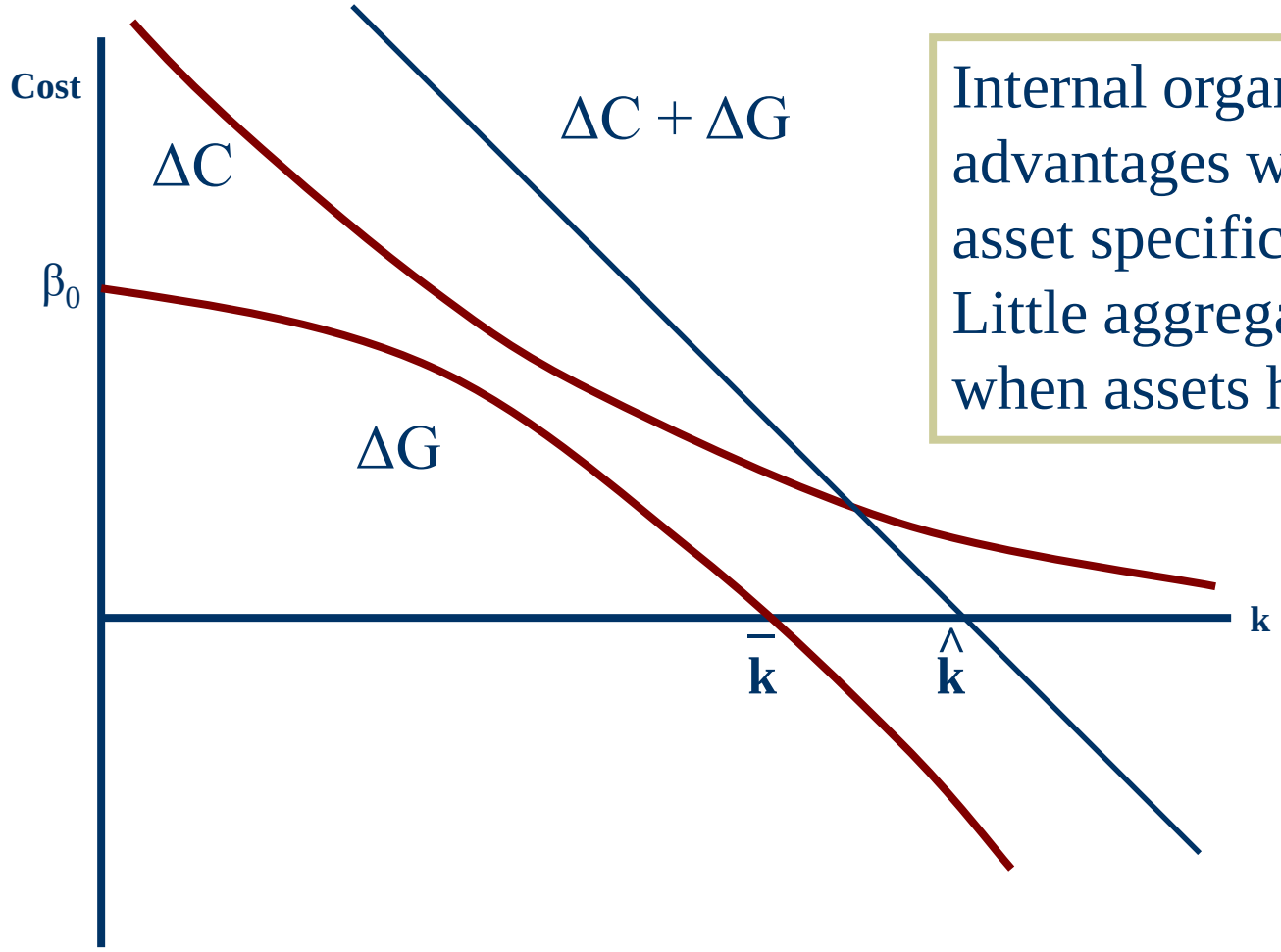
ΔC always positive but decreasing in k.

Asset specificity.



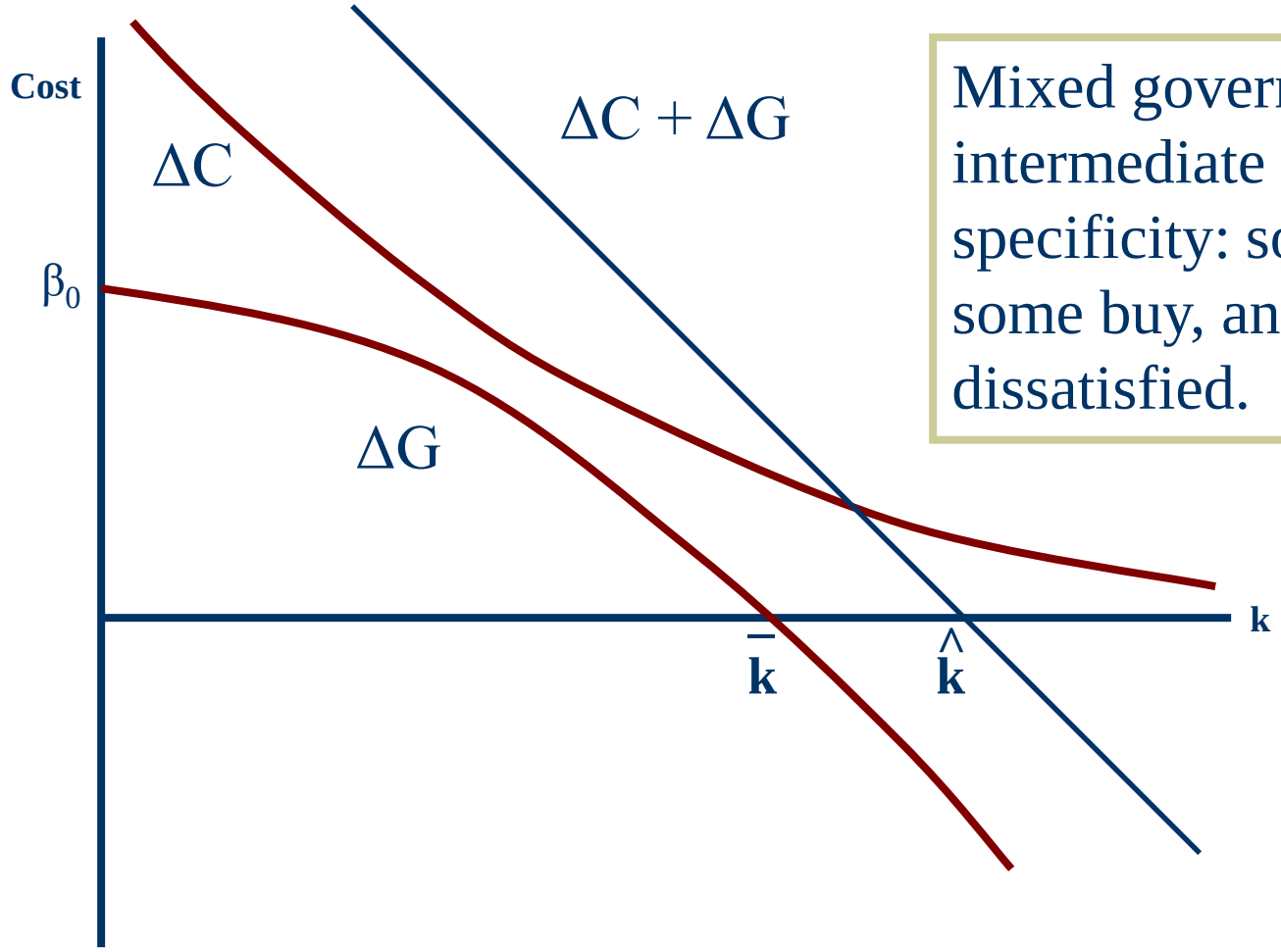
Market procurement has advantages in both scale economies and governance when optimal asset specificity is slight.

Asset specificity.



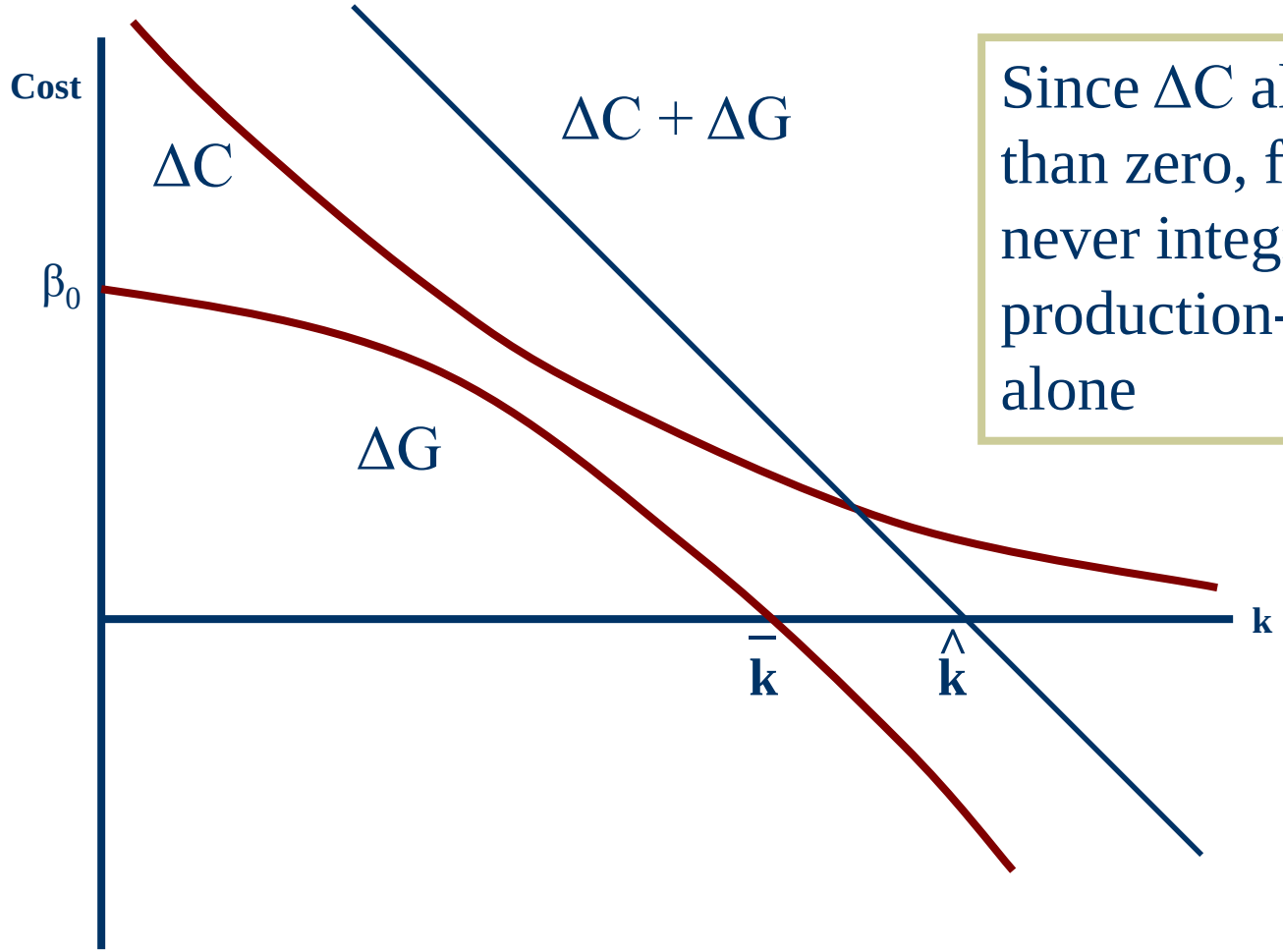
Internal organization has advantages when optimal asset specificity substantial. Little aggregation benefits when assets highly specific.

Asset specificity.



Mixed governance for intermediate levels of asset specificity: some make, some buy, and all are dissatisfied.

Asset specificity.



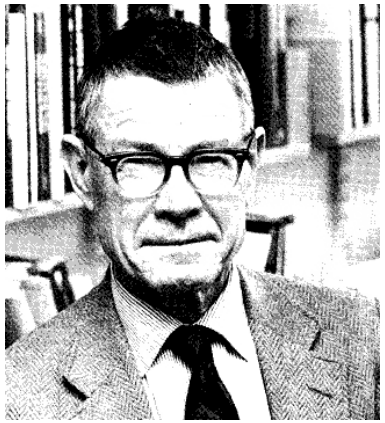
Since ΔC always greater than zero, firm will never integrate for production-cost reasons alone

The hostage model.

Oliver E. Williamson (1932-)

But sometimes markets can solve problems of asset specificity without integration if cooperating parties can make credible commitments before the contract is signed.

Credible commitments.



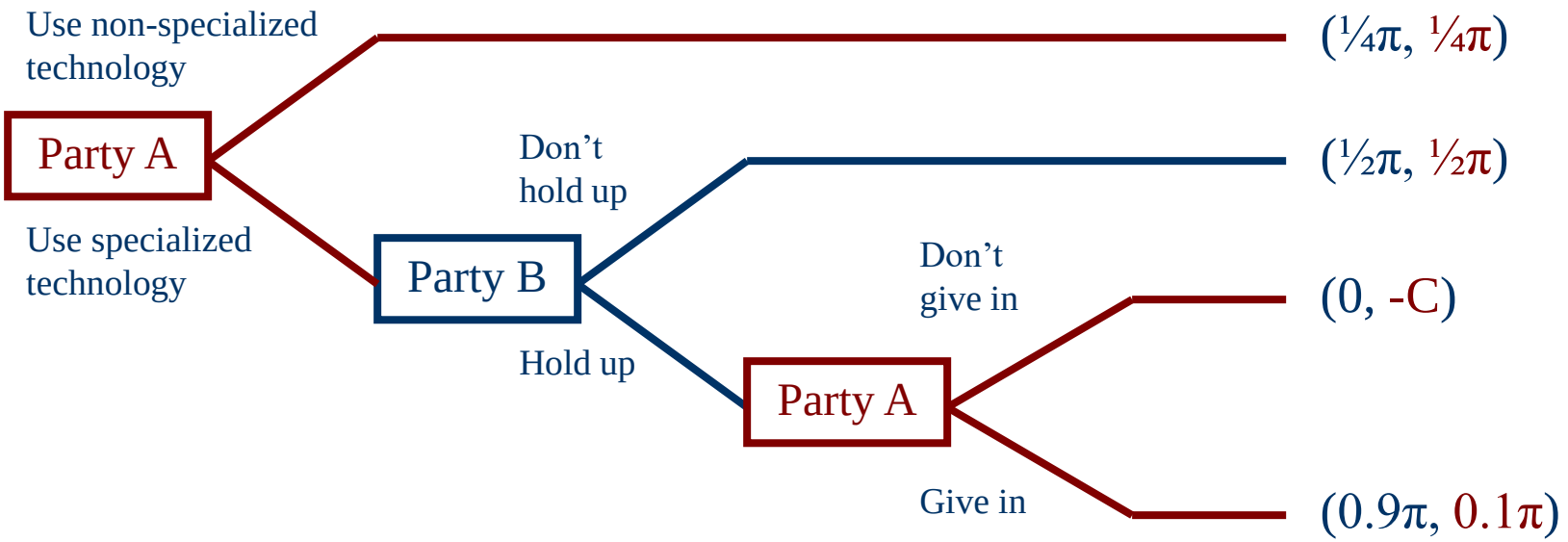
Thomas C. Schelling, 1921-

- To make a threat credible, a player must make an irreversible commitment that changes his or her incentives or constrains his or her action.
  - Ulysses and the Sirens.
  - The Doomsday Device.

Ulysses and the Sirens by John William Waterhouse (British, 1849-1917), National Gallery of Victoria, Melbourne, Australia.

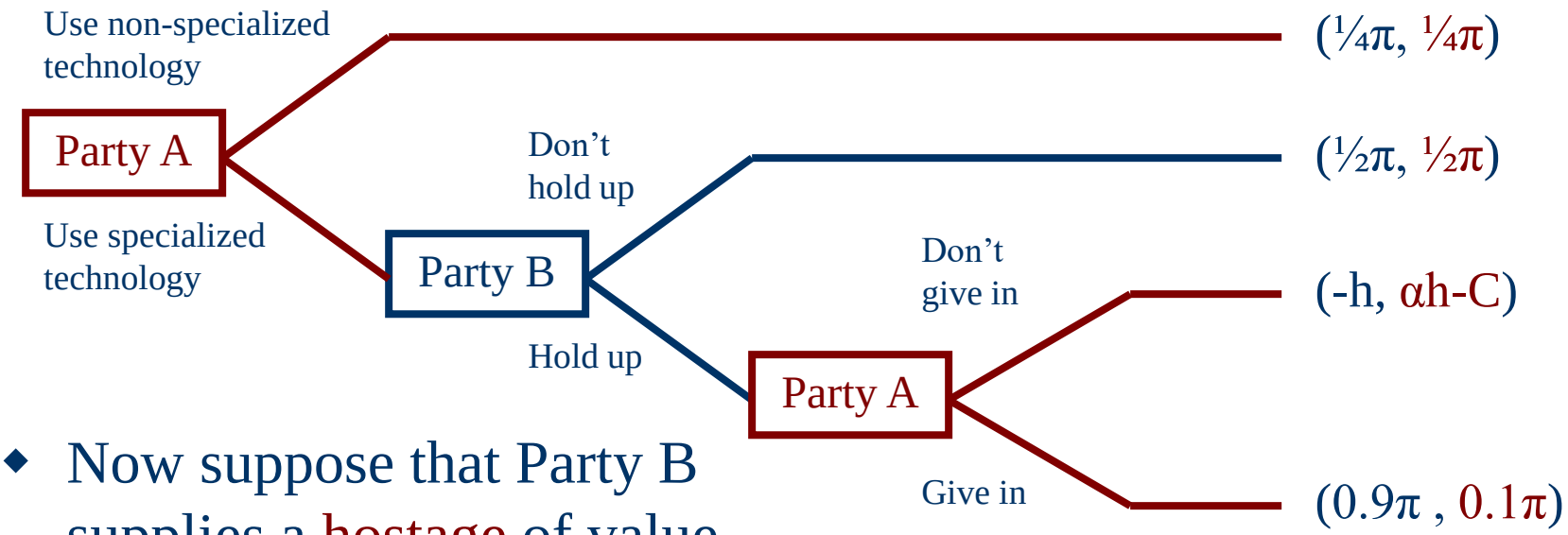
Peter Sellers in *Dr. Strangelove* (1964).

The hostage model.



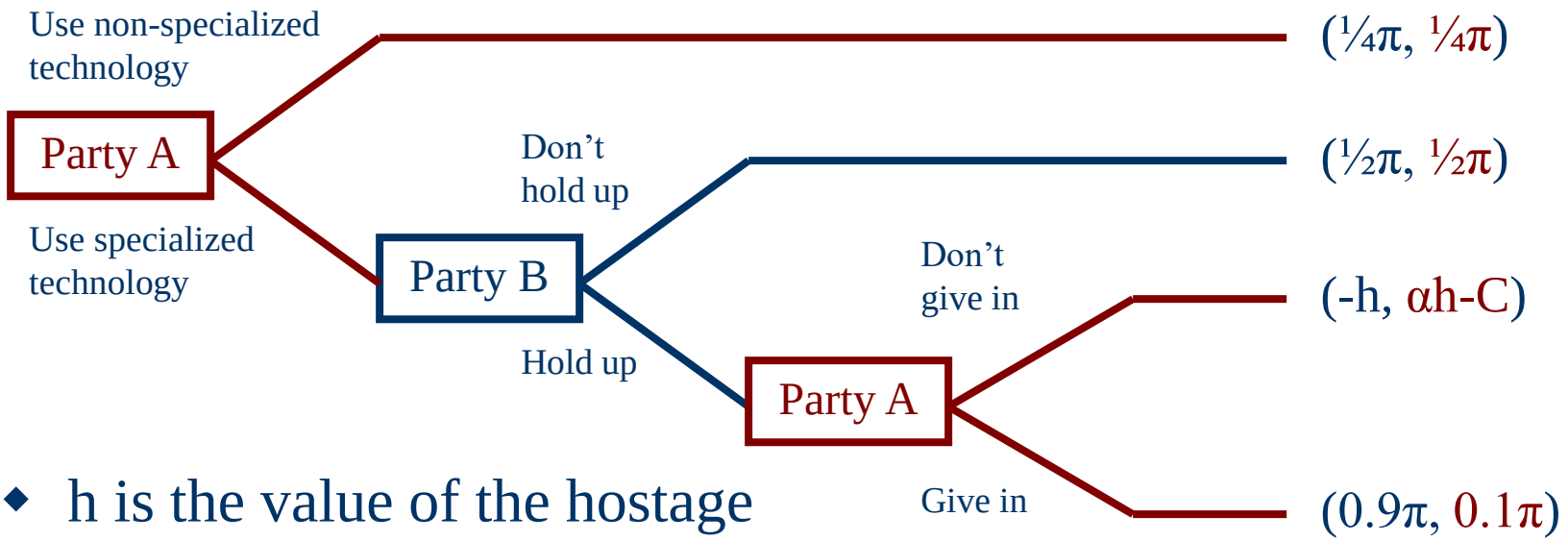
- The hold-up threat in extensive form.
- Party A incurs a sunk cost C once the contract is signed.
- Party A's optimal strategy is to use the less-efficient technology. (Why?)

The hostage model.



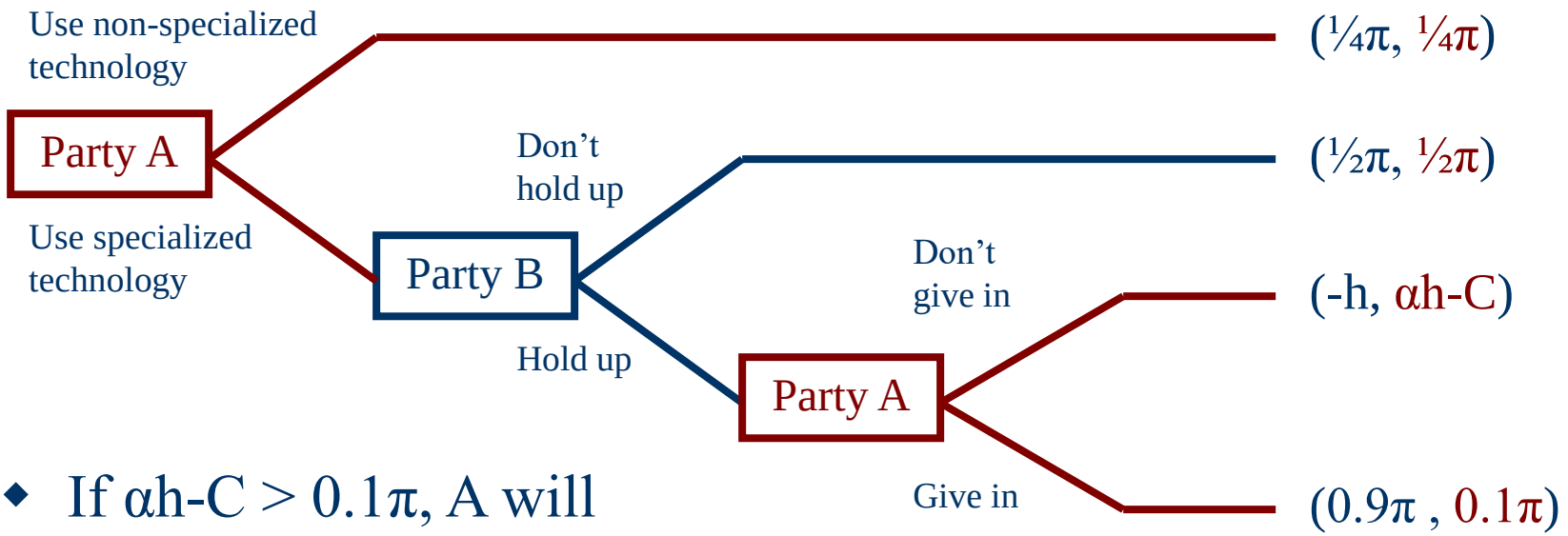
- Now suppose that Party B supplies a hostage of value αh before the game begins.
- The hostage — a credible commitment — is forfeit in the event of contract breach.

The hostage model.



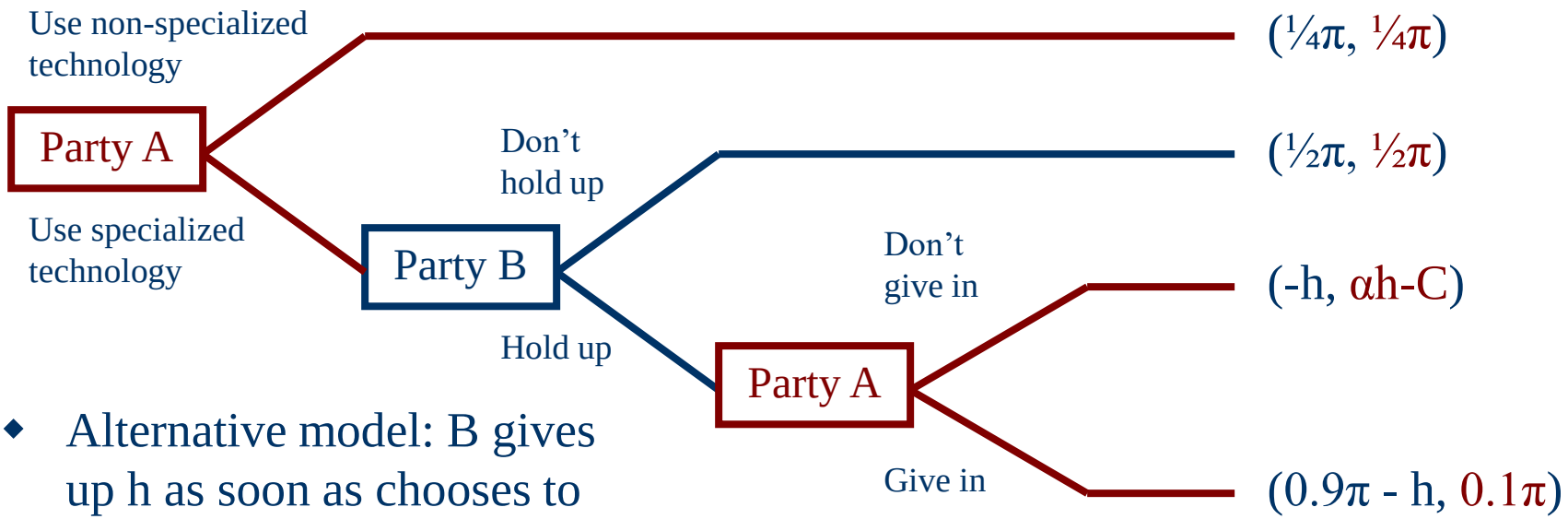
- h is the value of the hostage to B; α is the fraction of h that has value to A.
- A money bond would have α = 1. But is an in-kind hostage a more credible commitment?

The hostage model.



- If αh-C > 0.1π, A will choose the more efficient specialized technology.
- Notice that if α = 0, hostage h doesn't seem to affect outcome.

The hostage model.



- Alternative model: B gives up h as soon as chooses to hold up (but A doesn't get αh unless he doesn't give in).
- Even if $\alpha = 0$, B has no incentive to hold up A if $0.9\pi - h < \frac{1}{2}\pi$ (i.e., $h > 0.4\pi$).

Incomplete contracts.

Frank H. Knight (1885-1972)

Ronald H. Coase (1910-)

- Knight: uncertainty requires use of "judgment" by entrepreneur.
  - Judgment noncontractible.
- Coase: uncertainty raises costs of output contracts and makes use of "authority" more economical.

Ownership and uncertainty.

"[I]f I am quite sure what kinds of actions my neighbour contemplates, I might be indifferent between his owning the field at the bottom of my garden and my owning it but renting it out for him to graze his horse in. But once I take into account that he may discover some new use for the field that I haven't yet thought of, but would find objectionable, it will be in my interest to own the field so as to put the use of it under my own control. More generally, ownership of a resource reduces exposure to unexpected events. Property rights are a means of reducing uncertainty without needing to know precisely what the source or nature of the future concern will be." (Littlechild 1986, p. 35.)

“New” property rights approach.

Oliver D. Hart
(1948-)

- Incomplete contracts.
  - Costly or impossible to specify all future contingencies in a contract.
- When unanticipated contingencies occur, how are conflicts resolved?
- Party with the residual rights of control has authority to decide outcome.
  - “Specific” rights can be contracted away.
  - Residual control rights non-contractible.

“New” property rights approach.

Oliver D. Hart
(1948-)

- Possession of the residual rights of control constitutes “ownership.”
  - Even when specific rights contracted away.
- Bright-line definition of the boundaries of the firm.
  - Firm as all owned non-human assets.
    - Machines, client lists, patents, etc.
    - Human assets can’t be “owned.”
  - Contrast with nexus-of-contracts view.

“New” property rights approach.

Oliver D. Hart
(1948-)

- Core of the theory:
  - Misallocation of residual rights causes distortions.
  - Explaining the boundaries of the firm a matter of finding the efficient allocation of residual rights.

“New” property rights approach.

Oliver D. Hart
(1948-)

- Why does misallocation cause distortions?
  - If you own assets, you have greater threat potential.
    - Contrast with asset-specificity approach: inalienable vs. alienable control rights.
  - Highly complementary assets should be owned in common.
  - Employers are “boss” because they control the physical assets workers need to be productive.

Criticisms and perspectives.

Oliver D. Hart
(1948-)

Harold Demsetz
(1930-)

- Demsetz: can residual control rights ever be rented?
  - They can be divided (e. g., coops).
- Foss & Foss: selective and asymmetric costs of enforcement.
  - Future contingencies costly to regulate by contract, but no "plasticity" in the present.
  - Contracts of human assets costly to enforce but not contracts over non-human assets.
- Pagano: "holes of incomplete contracts are open in a desert of perfectly working and costless markets."

Fisher Body.

- Fisher Body pioneers closed car body.
- GM acquires 60 percent of Fisher Body in 1919 and initiates long-term contract.
- In 1926, GM fully integrates with Fisher.
- Why?

Fisher Body.

Benjamin Klein

Klein.

- Closed bodies required more firm-specific investment than open bodies.
- Contract worked well until 1925, when GM demand increased.
- Fisher brothers increased short-term profit by using inefficient labor-intensive processes.
- Integration (plus side payments) solved contractual hold-up problem.

Fisher Body.

Ronald Coase

Coase.

- Fisher never actually failed to collocate body plants.
- Implausible under contract that they used inefficient methods.
- Specific dies, etc., were owned by GM.
  - Teece: quasi-vertical integration (or vertical quasi-integration.

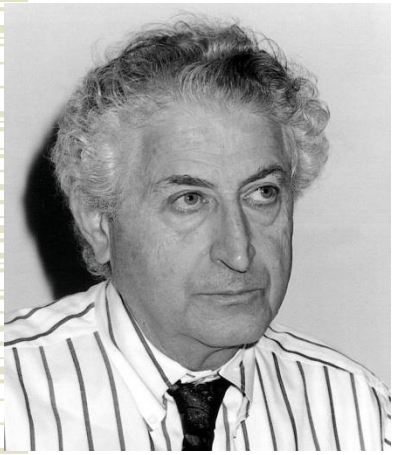
Fisher Body.

Benjamin Klein

Klein.

- Fishers really could transfer income from GM under the terms of the contract.
- Efficient hold-up: try to keep the pie big while transferring income.
  - That's why no evidence of hold-up.
- The specific investment was really investment level not tools and dies.
- But do we now have Klein/Williamson or Hart?

Criticisms and perspectives.



Yoram Barzel

- Barzel: ownership of attributes of assets not assets themselves.
  - Because of measurement costs, it may not pay to specify all attributes.
- The efficient pattern of ownership over the attributes of an asset is the one that minimizes uncompensated exploitation of attributes – that is, internalizes externalities.
  - Entrepreneur's reward for self-policing.

Who owns the firm?

Henry B. Hansmann (1945-)

- Owners are those persons who share two formal rights: the right to control the firm and the right to appropriate the firm's residual earnings.
  - Formal not *de facto* rights.
  - It is often efficient to assign the formal right of control to persons who are not in a position to exercise that right very effectively.
    - Because giving those rights to others would create worse incentives.
    - For example: why managers don't have formal ownership rights.

Who owns the firm?

Henry B. Hansmann (1945-)

- Ownership falls to a class of patrons.
  - Capital suppliers.
  - Customers.
  - Input suppliers.
  - Workers.
  - Government.
  - No one (but non-profits have donors).
- All ownership structures are really coops.

Who owns the firm?

Henry B. Hansmann (1945-)

- Which patrons should own the firm?
- Balance the costs of contracting (with non-owning patrons) and the costs of ownership (for owning patrons).

Who owns the firm?

Henry B. Hansmann (1945-)

Costs of contracting (with non-owners).

- Monopoly or monopsony.
  - Example: bottleneck stage.
- Contractual lock-in.
  - Relation-specific assets.
- Asymmetric information.
  - One party has specialized knowledge that is costly to transmit to others.

Who owns the firm?

Henry B. Hansmann (1945-)

Costs of ownership.

- Monitoring (agency) costs.
  - All else equal, patrons who are least-cost monitors are most efficient owners.
- Collective decision-making.
  - How to aggregate the interests of members of a patron class?
- Risk bearing.
  - Which class in the best position to bear risk?

Who owns the firm?

The public corporation.

- A “capitalists cooperative.”
- Because of asymmetric information, all other patrons have higher agency costs.
- Risk diversification benefits of investor ownership.
- Common denominator of profit reduces costs of decision-making.

Who owns the firm?

Customer cooperatives.

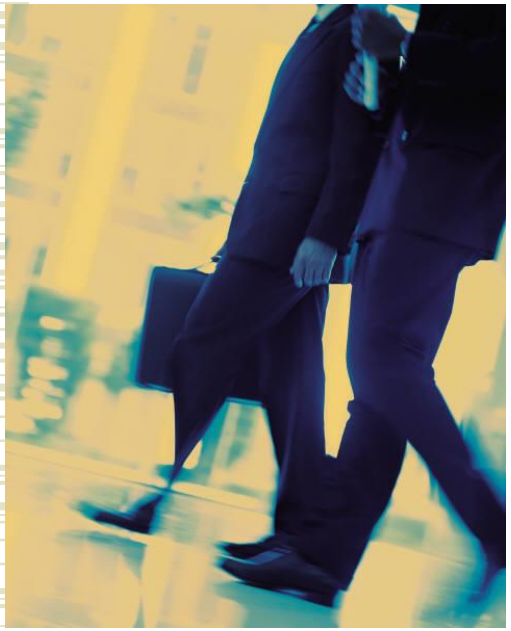
- Retail coops rare.
  - Customers not homogeneous.
  - Campus bookstores and monopoly.
- Most customer cooperatives are at the wholesale level.
  - Ace, True Value, IGA, Associated Press, Sunbeam Bread.
  - Monopoly supply stage.
- Coops and franchises.
- Financial and insurance mutuals.

Who owns the firm?

Supplier cooperatives.

- Analogous to customer coops.
- Monopsony processing stage.
- Common in agriculture.
  - Ocean Spray, Land o' Lakes, Cabot, Sunkist, much of French wine.
  - The electric power grid?
- Problems of collective decision-making and flexibility?

Who owns the firm?



Worker-owned firms.

- Proletarian coops rare.
  - Unskilled workers easier to monitor than other patrons.
- Most worker-owned firms in professional services.
  - Law, medicine, consulting.
  - Professionals can monitor one another more cheaply than can outsiders.
  - Little physical capital per worker.
- Are professional firms consumer coops?
  - Independent firms sharing common assets.

Who owns the firm?

Non-profit firms.

- Some kinds of transactions pose special agency problems.
  - Payments to third parties to provide goods and services (United Way)
  - Support of public goods (PBS).
- Customers (donors) are the natural residual claimants.
- But monitoring by donors costly.
- Ownership by other patrons creates incentives to appropriate donor resources.

Who owns the firm?

Non-profit firms.

- So managers "hold the firm in trust" for the donors.
- No residual claims – but that needn't mean no profit.
  - Reliance on formal rules and bureaucracy.
    - Because market control mechanisms absent.
  - Boards of directors chosen for impartiality not expertise.
    - Important donors sit on board.
- Are non-profits really donors coops?

Tacit and dispersed knowledge.

Michael C. Jensen (1939-)

Economic organization must solve two different kinds of problems.

- The rights assignment problem:
  - determining who should exercise a decision right.
- The control or agency problem:
  - ensuring that self-interested decision agents exercise their rights in a way that contributes to the organizational objective.

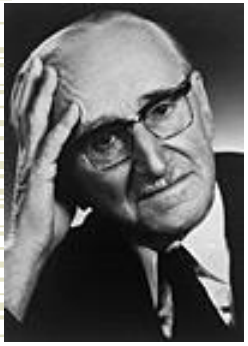
Tacit and dispersed knowledge.

Michael C. Jensen (1939-)

There are basically two ways to ensure a *collocation* of knowledge and decision-making:

- Move the knowledge to those with the decision rights.
- Move the decision rights to those with the knowledge.

Tacit and dispersed knowledge.



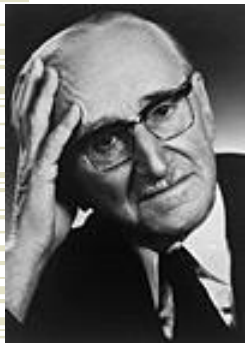
F. A. Hayek
(1899-1992)

The use of knowledge in society.

- "Knowledge of the particular circumstances of time and place."
  - Tacit versus explicit knowledge.
- Cost of moving knowledge to decision-makers suggests giving rights to them.
- Minkler: monitoring agents who know more (in a qualitative sense) than the principal.

Tacit and dispersed knowledge.

Ronald H. Coase (1910-)



F. A. Hayek (1899-1992)

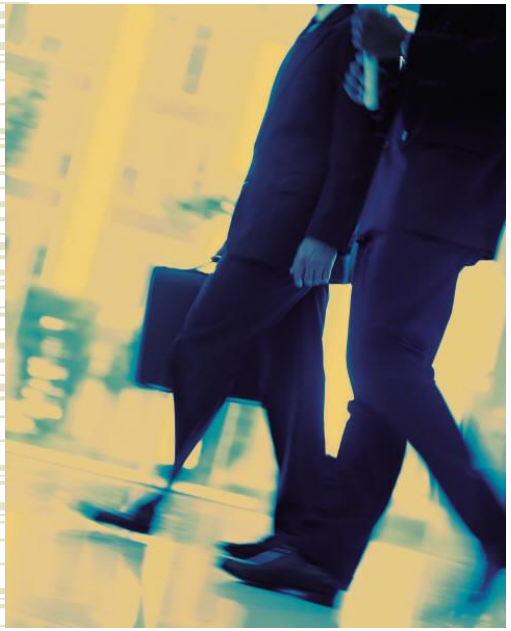
The nature of the firm redux.

- The existence of firms implies that there are offsetting benefits of not delegating rights.
  - Transaction costs of decentralization.
- Minkler: as tasks become more knowledge intensive, it pays to delegate greater authority to workers.
  - But why not vertical disintegration rather than worker participation?

Collocation.

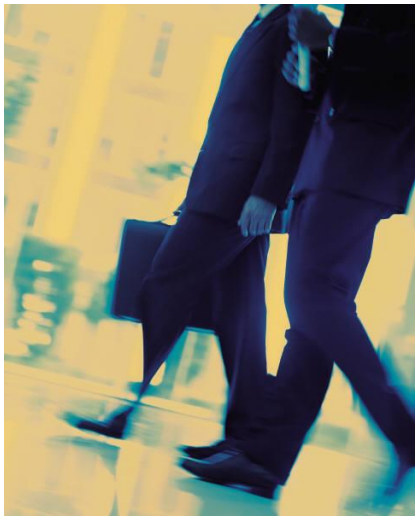
Benefits of centralized rights	Monitoring: Easy	Monitoring: Hard
High	Classic firm	"Worker participation"
Low	Anonymous markets (e.g., putting out)	Professional networks

Professional production.



- Professional skills complex.
  - Knowledge and judgment.
- Professions as production organizations.
- Shared routines (including common “toolkits”) permit decentralization.

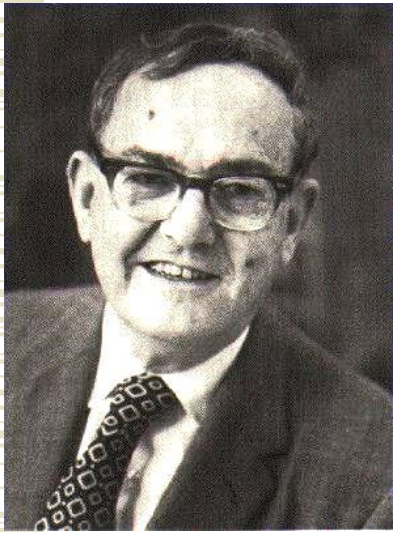
Professional production.



Hubless network solves knowledge and incentive problems.

- Information-sharing and reciprocity.
  - Cooperation.
  - Competition.
  - Innovation
- Authority and autonomy.
  - As the analogue to ownership in a network organization.
- Reputation and self-monitoring.

Decomposable systems.



Herbert A. Simon
(1916-2001)

- Nondecomposable systems.
  - Lower set-up costs.
  - Highlight errors and inconsistencies.
- Decomposable systems.
  - Extensive communication.
  - Fragility: Tempus and Hora.

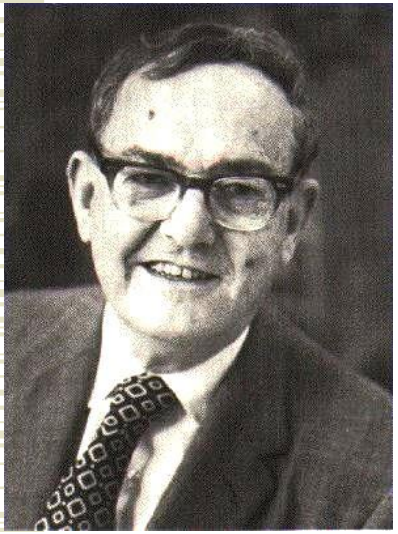
A non-decomposable system.

	a_1	a_2	a_3	a_4	a_5	a_6	a_7
a_1	x	x	x	x	x	x	x
a_2	x	x	x	x	x	x	x
a_3	x	x	x	x	x	x	x
a_4	x	x	x	x	x	x	x
a_5	x	x	x	x	x	x	x
a_6	x	x	x	x	x	x	x
a_7	x	x	x	x	x	x	x

A nearly decomposable system.

	a_1	a_2	a_3	a_4	a_5	a_6	a_7
a_1	x	x					
a_2	x	x					
a_3			x	x			
a_4			x	x			
a_5					x	x	
a_6					x	x	
a_7							x

Decomposable systems.



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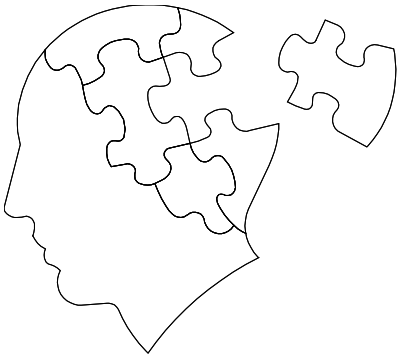
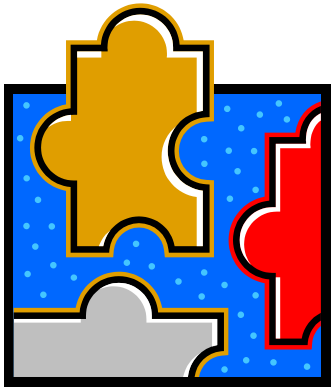
Decomposability.





- Encapsulation.
  - Most interaction "topologically close."
- Information hiding.
  - Reveal as little as possible about inner workings.

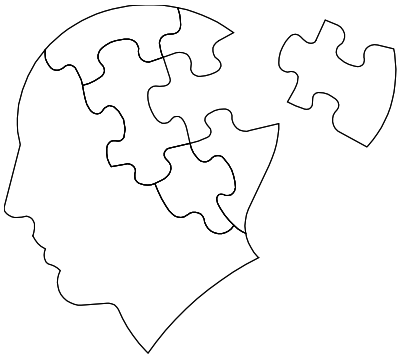
A nearly decomposable system.

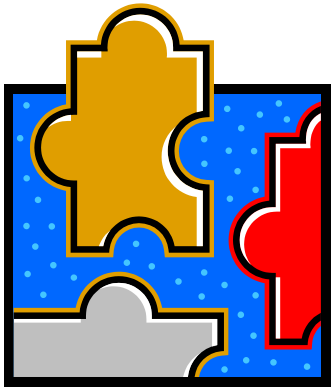
	a_1	a_2	a_3	a_4	a_5	a_6	a_7
a_1	x	x					
a_2	x	x					
a_3			x	x			
a_4			x	x			
a_5					x	x	
a_6					x	x	
a_7							x

A system with common interface.

	a_1	a_2	a_3	a_4	a_5	a_6	a_7
a_1	x	x	x	x	x	x	x
a_2	x	x	x				
a_3	x	x	x				
a_4	x			x	x		
a_5	x			x	x		
a_6	x					x	x
a_7	x					x	x

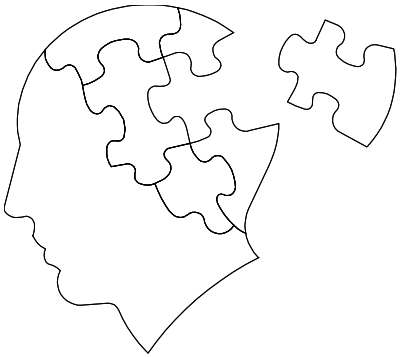
Modular systems.

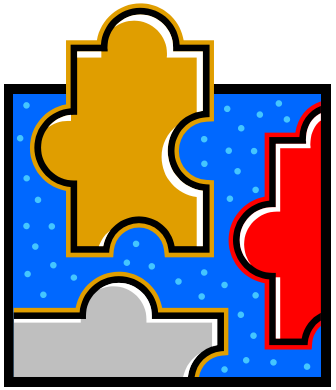




- A common interface as *lean* if it enables communication among the subsystems without creating a non-decomposable system, that is, if it enables communication without filling up the off-diagonal.
- Standardized interfaces.
- Open vs. closed interfaces.

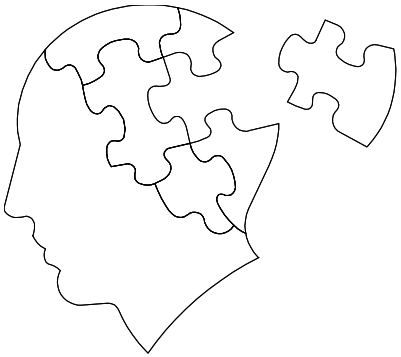
Modular systems.

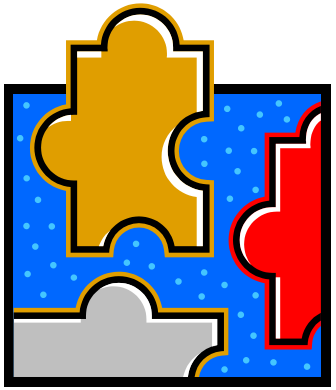




- Visible design rules.
  - Architecture.
  - Interfaces.
  - Standards.
- Hidden design parameters.

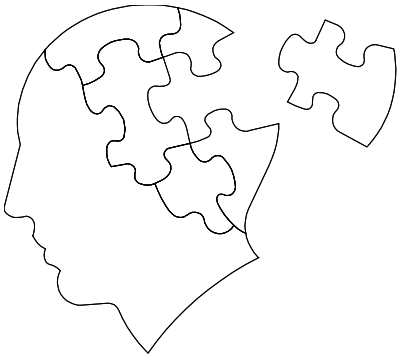
Role of standards.

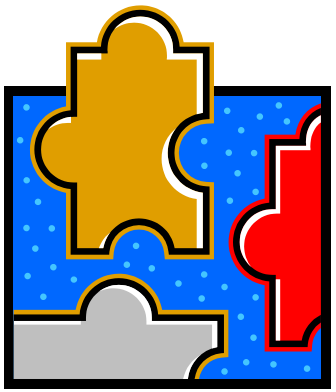




- Standards as institutions.
  - Aid in coordination.
  - Reduce transaction costs.
- “External” economies of scope.
  - Public interfaces.
  - “Reuse” of knowledge.

Tradeoffs.





- Enabling.
  - Modularization must be firm to encourage modular innovation.
- Constraining.
  - A too-firm modularization can lead to “lock in.”
- “Just embedded.”
  - Technology and standards coevolve, “each of these reciprocally and continually shaping the other” (Garud and Jain 1996, p. 393).

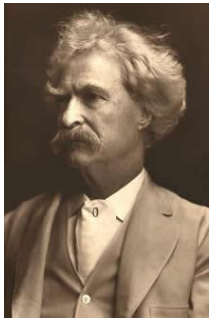
Network effects.

A network is a system of *complementary* nodes and links.

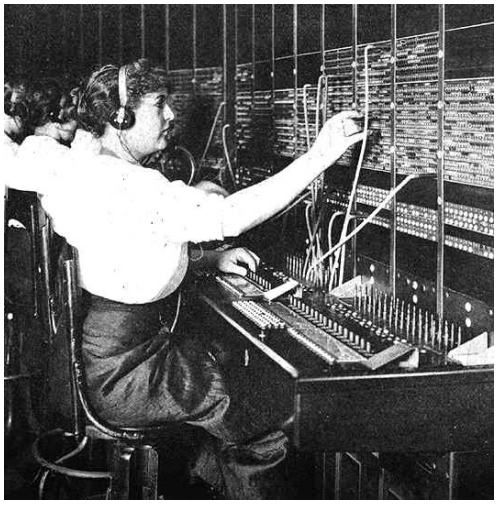
See the Dictionary of Terms in Network Economics.

Network effects.

- Physical connection networks.



Mark Twain had one of the first telephones in Hartford.



- "Virtual" networks.
  - Hardware-software networks.

Network effects.

Standards:

The set of rules that assure compatibility between nodes and links in the network.

The great Baltimore fire of 1904.

Network effects.

Network effects:

Membership in the network becomes more valuable in proportion to the number of other people who are already members (or who are expected to become members).

See the Dictionary of Terms in Network Economics.

Path-dependence and “lock-in.”

Paul A. David, 1935-

The Sholes & Glidden Type Writer (1874)

A path-dependent sequence of economic changes is one of which important influences upon the eventual outcome can be exerted by temporally remote events, including happenings dominated by chance elements rather than systematic forces. (David 1985, p. 332).

- Example: the QWERTY keyboard.

Path-dependence and “lock-in.”

Paul A. David, 1935-

The Sholes & Glidden Type Writer (1874)

The story of QWERTY.

- Christopher Latham Sholes 1868.
- Remington produces first model 1874.
- The QWERTY layout:
  - Marketing gimmick?
  - Attempt to slow typing speed?
- Crucial typing contest in Cincinnati 1888.
  - The invention of touch typing.
  - A historical accident that QWERTY won?

Path-dependence and “lock-in.”

Paul A. David, 1935-

The Sholes & Glidden Type Writer (1874)

Typing as a virtual network.

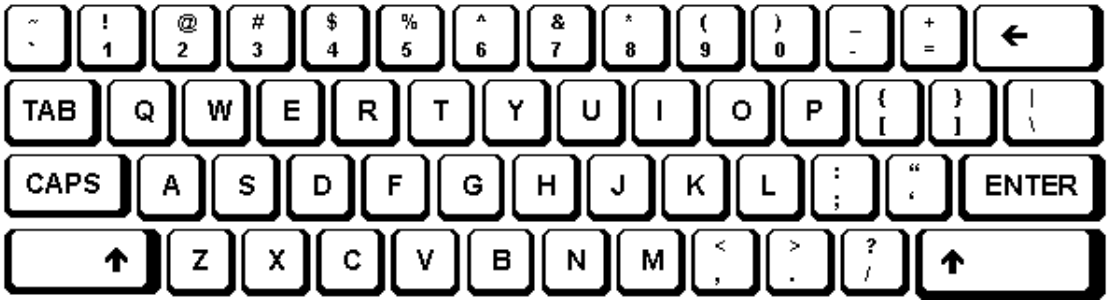
- Hardware: the keyboard layout.
- Software: touch-typing skills.
  - Technological interrelatedness.
  - High conversion costs.
  - Positive feedback.
- “Tipping” to a dominant standard.

Path-dependence and “lock-in.”

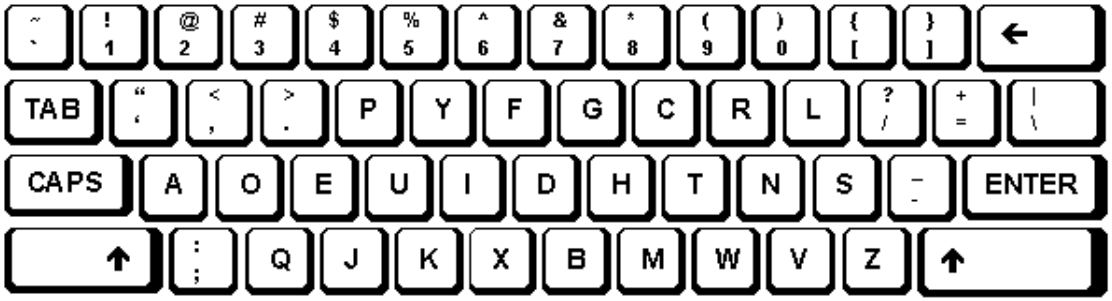
Paul A. David, 1935-

The Sholes & Glidden Type Writer (1874)

Are we “locked in” to an inefficient keyboard standard?



The QWERTY keyboard.



The Dvorak keyboard.

Path-dependence and "lock-in."

- The choice of QWERTY not entirely historical accident.
  - There were many competing typewriters.
  - There were many typing contests like the one in Cincinnati.
- Dvorak is not greatly superior to QWERTY.
  - The Navy study.
  - The importance of rhythm.

Liebowitz and Margolis criticize the QWERTY story.

Path-dependence and “lock-in.”

- Sensitivity to starting point.
- But no inefficiency.
- Examples:
  - Language.
  - Side-of-the-road driving conventions.

First degree path dependency.

Liebowitz and Margolis (1995).

Path-dependence and "lock-in."

- Sensitivity to starting point.
- Imperfect information.
- Outcomes are regrettable *ex post*.
- But no inefficiency, in the sense that no better decision could have been made *at the time*.

Second degree path dependency.

Liebowitz and Margolis (1995).

Path-dependence and “lock-in.”

- Sensitivity to starting point.
- Inferior outcome.
- Inefficient, in the sense that the inferior outcome *could have been avoided*.
- Error is *remediable*.

Third degree path dependency.

Liebowitz and Margolis (1995).

Path-dependence and "lock-in."

Table 1: Adoption Payoffs										
Number of Previous Adoptions	0	10	20	30	40	50	60	70	80	90	100
Technology A	10	11	12	13	14	15	16	17	18	19	20
Technology B	4	7	10	13	16	19	22	25	28	31	34

Table from Arthur (1989).

- Technology B is superior.
  - Produces highest value in the long term.
- But Technology A has higher short-term payoffs.
  - Example: QWERTY stops mechanical keys from jamming.
- Conclusion: choice of – and lock-in to – wrong standard.

Path-dependence and "lock-in."

Table 1: Adoption Payoffs										
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Table from Arthur (1989).

- But this result depends on imperfect information.
- If users could correctly forecast, they would adopt B.
- The real issue: which institutional structure will choose best under poor information?
- Do markets choose badly?

Path-dependence and "lock-in."

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Table from Arthur (1989).

- The role of a technology "champion."
  - Someone who "owns" a system has an incentive to see it adopted.
- Champions who forecast higher long-term payoffs can subsidize adoption in the short term.
  - MS-DOS versus Apple and other examples.
- Competing champions and local knowledge.

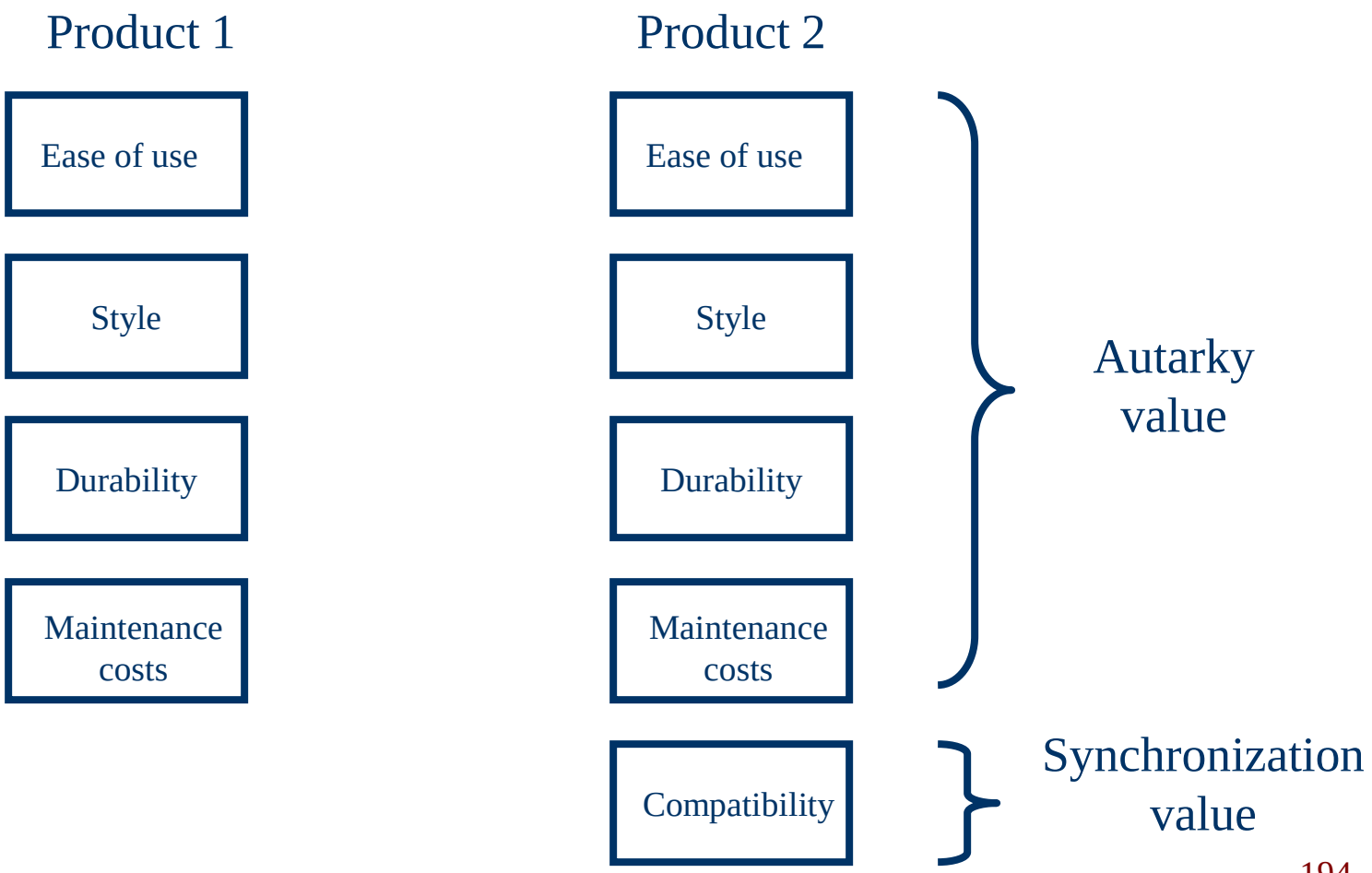
Standards as barriers.

Economics of networks predicts a single dominant standard, not necessarily a single monopoly owner.

Types of Standards:

- Open versus closed.
  - Some “semi-open.”
  - Example: Windows
- Proprietary versus non-proprietary.
  - Privately proprietary (IBM 360).
  - “Collectively” owned (fax standards).
  - Unowned (stereo systems, Linux?)

Anatomy of a network product.



Standards as barriers.

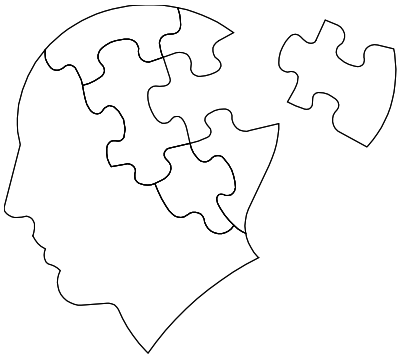
- If someone "owns" a standard, he or she has a property right to a restricted input.
  - The compatibility attribute.
- Microsoft and the "applications barrier to entry."

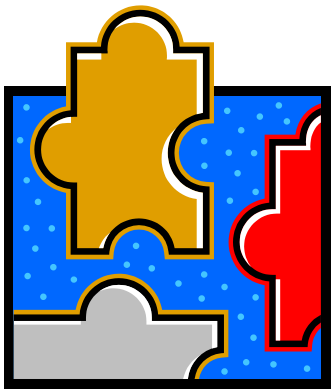
Standards as barriers.

- Standards as "essential facilities."
  - *U. S. v. Terminal Railroad Association* (1912).
  - Ski slopes and copier parts.
- Standards and "serial monopoly."

  - Schumpeterian competition.
  - Is (temporary) monopoly necessary to encourage champions to subsidize valuable standards?

Tradeoffs.





- Enabling.
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  - A too-firm modularization can lead to “lock in.”
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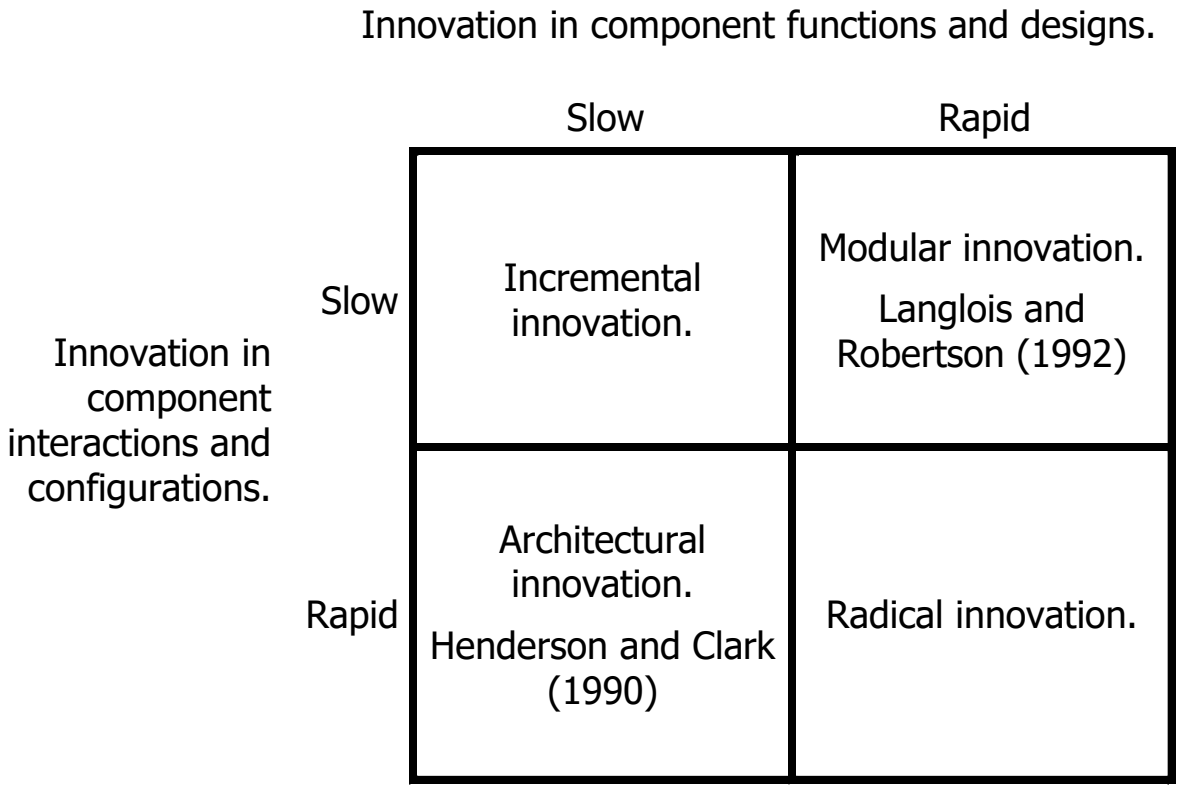
  - Technology and standards coevolve, “each of these reciprocally and continually shaping the other” (Garud and Jain 1996, p. 393).

Types of innovation.



After Sanchez and Mahoney (1996).

Modular systems.

Figure 5.1a. Components of the original widget.

Figure 5.1b. Components of the improved widget.

Externalizing capabilities.

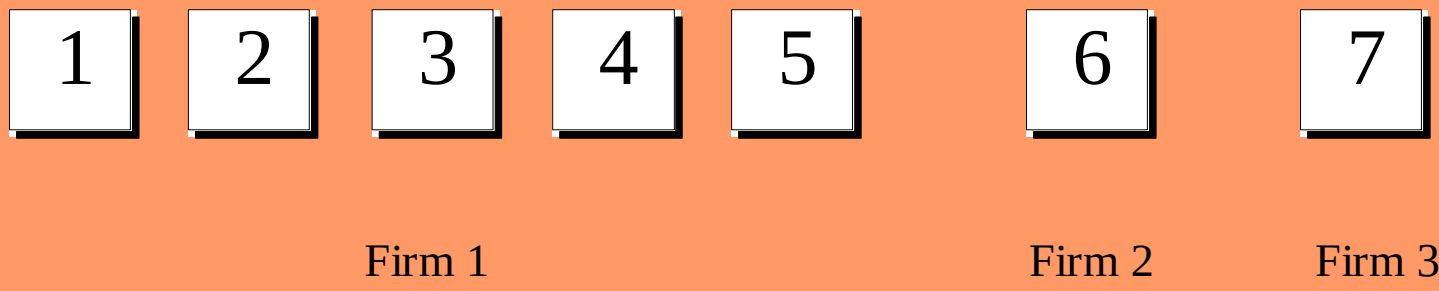


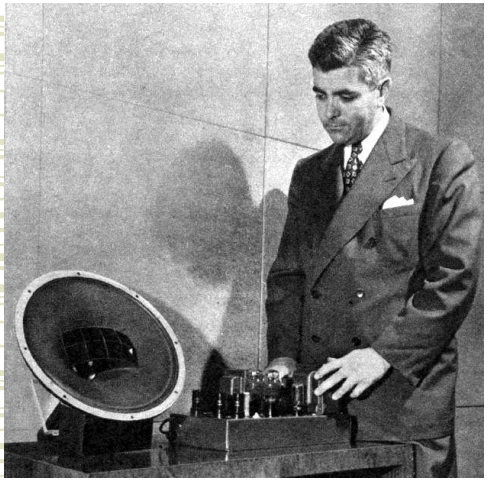
Figure 5.2 Firms involved in the production of components of the improved widget.

Examples.

- The electronics industry.
- Semiconductor manufacturing equipment.
- Medical practice.
- Open-source (voluntary) production.

Early audio versus the PC.

IBM PC (1982).



Avery Fisher (1946).

- Cumulative-systems products with relatively low-cost assembly.
- Early importance of hobbyists.
- Imprimatur, standardization, and software.

Radio.

RCA Radiola (1923).

David Sarnoff (1891-1971).

- A “national champion” internalizes a patent anticommons.
- Package-licensing discourages innovation outside of RCA.
  - Columbia as integrated competitor.
- Did this structure fully exploit the option value of the architecture?
  - How about the IBM 360?

IBM 360.

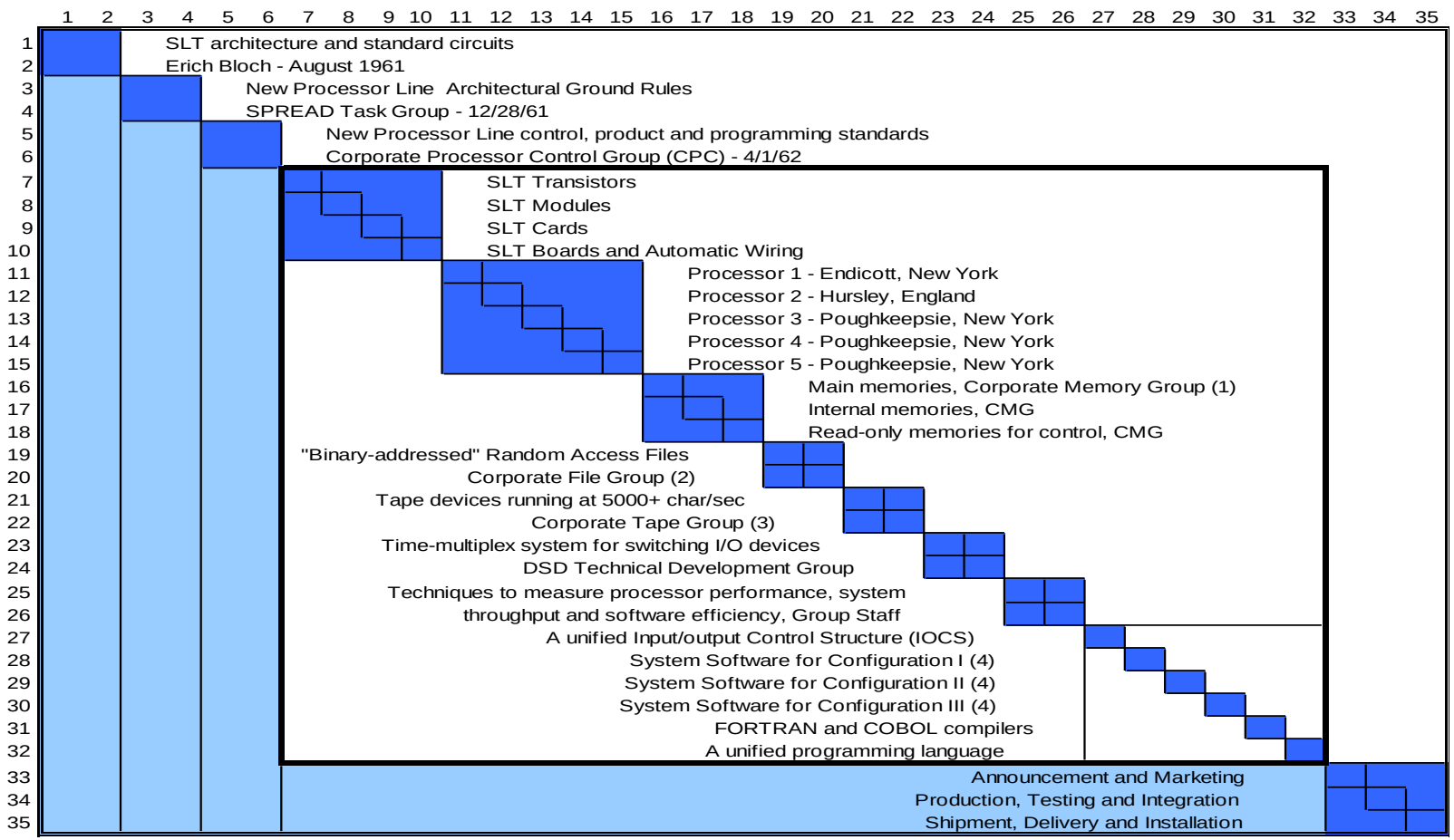


Image courtesy Carliss Baldwin

IBM 360.

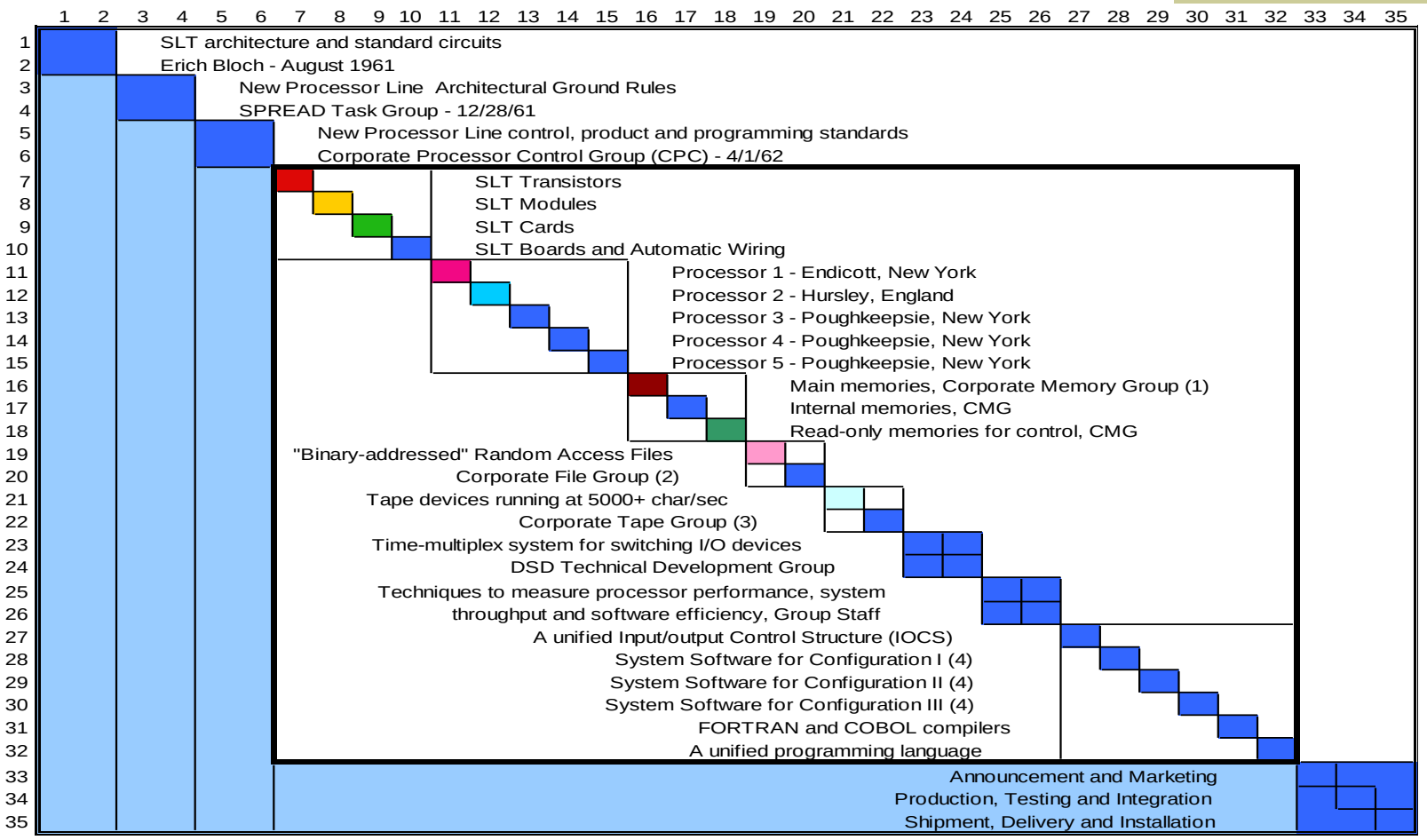


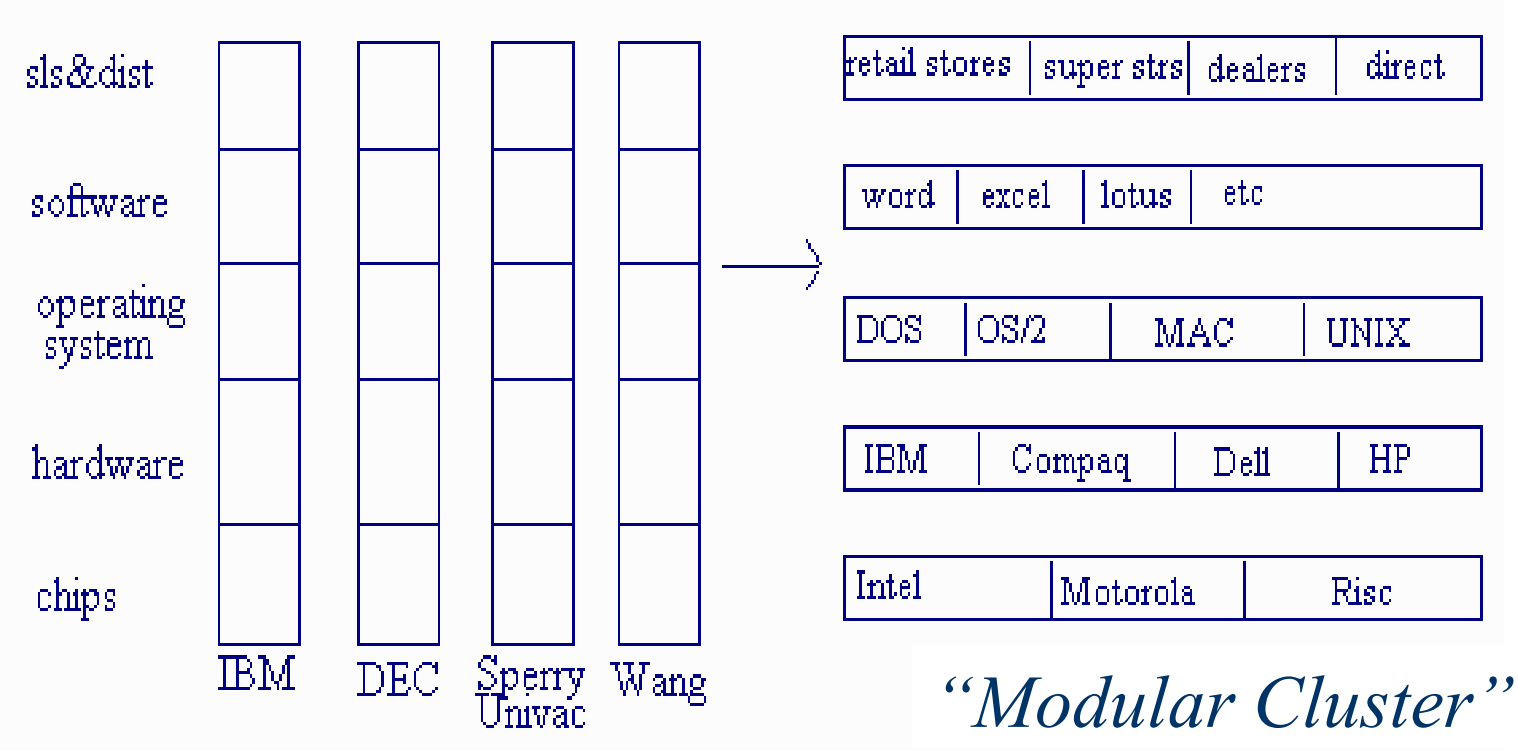
Image courtesy Carliss Baldwin

Personal computer.

Michael Dell.

- Is a PC inherently more modular than a radio?
  - But not than early audio electronics more broadly.
- IBM cannot assert IP over the standard it set.
- Vertical to horizontal transition in the computer industry.
  - Rents earned by controlling bottlenecks (Intel, Microsoft) or by “footprint competition” (Dell).

Andy Grove: a vertical-to-horizontal transition in the computer industry.

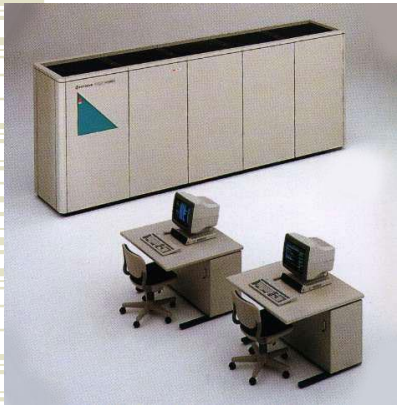


"Vertical Silos"

"Modular Cluster"

American failure and success.

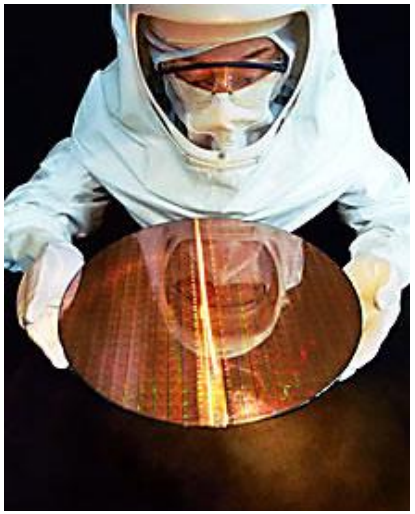
Sharp TV3-14T (1953).



Hitachi M-680H (1985).

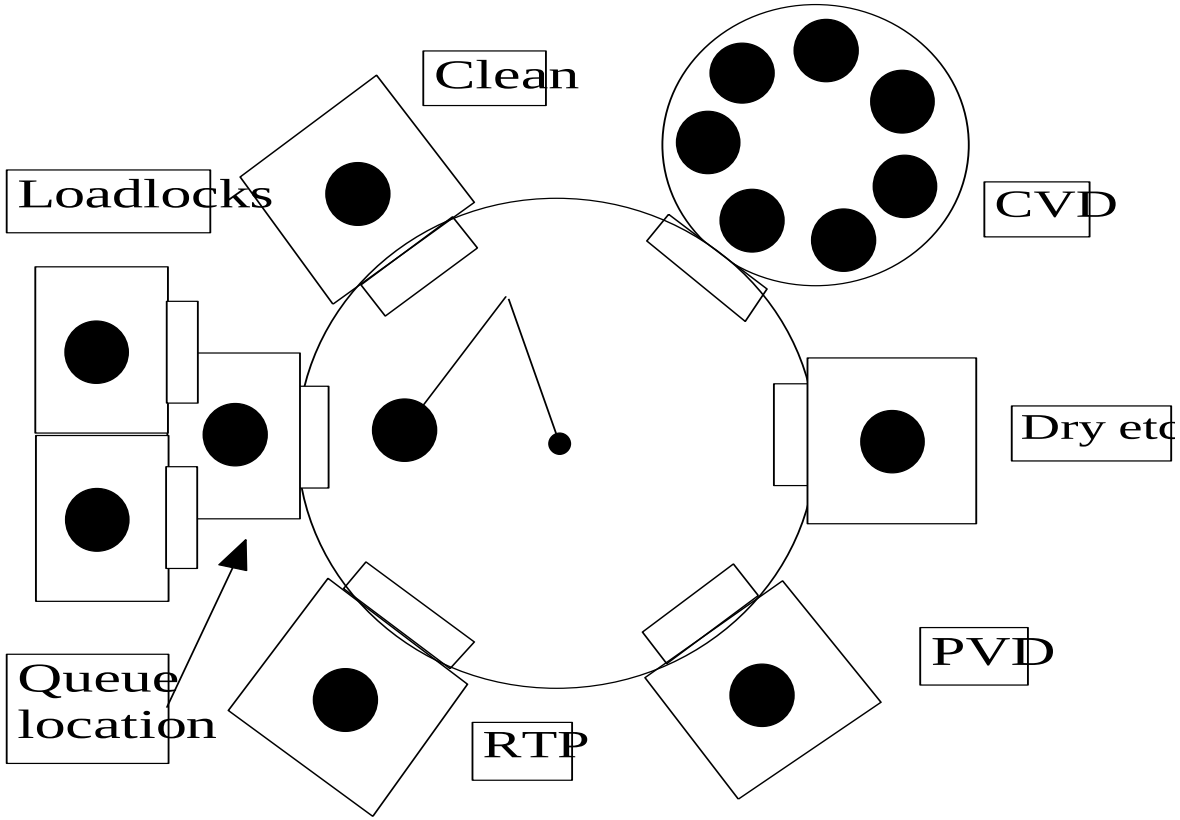
- A vertical structure sitting on an architecture with high option value is vulnerable to a focused attack by integrated competitors.
  - Consumer electronics.
    - B&W and color TV.
    - Transistor radios.
    - Video tape recording.
  - Semiconductors (DRAMs).
  - Mainframes.
- Especially if incumbents are earning rents from IP or relaxed competition and are distracted by defense R&D.

American failure and success.



- But U. S. exploits full option value of the PC, taking American semiconductor manufacture along for the ride.
- Japanese vulnerable to East Asian competitors copying their strategy.
- Convergence between digital technology and consumer electronics creates advantages for American firms.
  - And an international division of labor.

Cluster tools.



Cluster tools.

- “Mainframe” paradigm vs. “best of breed.”
- External economies of scope and knowledge reuse.
- Standard-setting and competition.

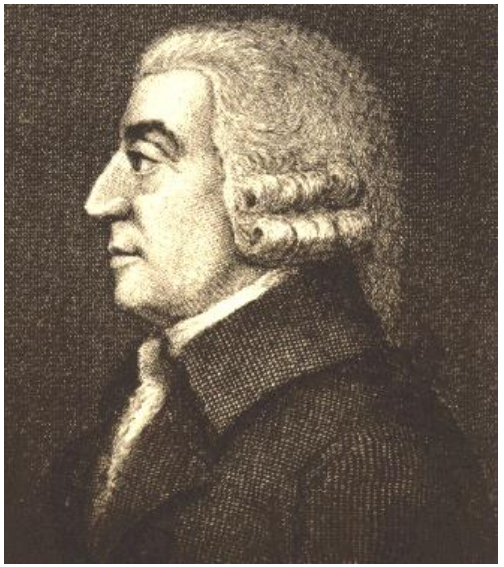
Medical practice.

- Task variability and decentralization.
- Modularization of “toolkit” and standardization of “interfaces” with other specialties.
  - Shared “core competences.”
- Localized knowledge and self-monitoring.

The mental division of labor.

Gaspard Riche de Prony (1755-1839)

Charles Babbage (1791-1871).



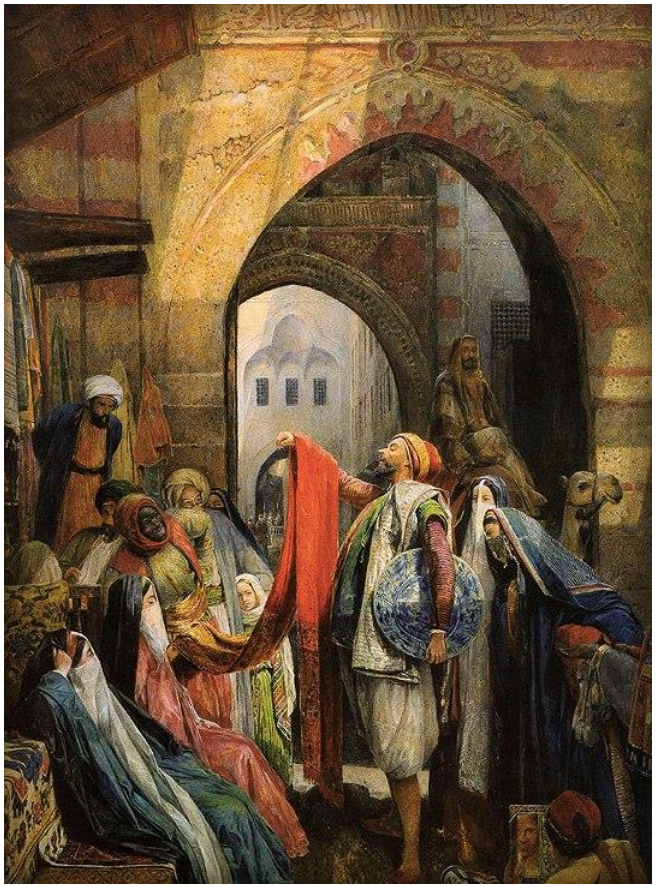
Adam Smith (1723-1790).

Examples.

- “Collective invention” (Osteloh and Rota 2004).
  - Industrial communities (Allen 1983).
  - The professions (von Hippel 1989; Savage 1994).
- Journal editing and refereeing (Bergstrom 2001).
- Online open bibliographic databases, like Research Papers in Economics (RePEc) (Krichel and Zimmermann 2005).
- Literary and hobbyist collaboration.
  - Wikipedia, photo.net.
- “Open science” (David 1998).

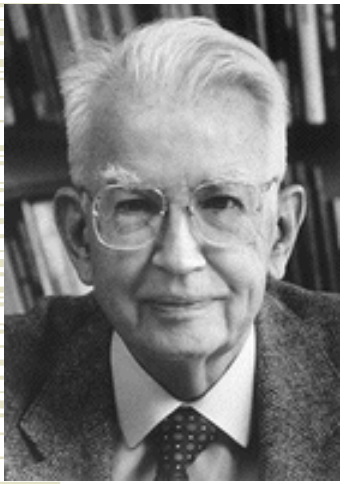
Organization.

Ely Cathedral, Cambridgeshire.



John Frederick Lewis (1805-1876),
A Cairo Bazaar (1875), Watercolor.

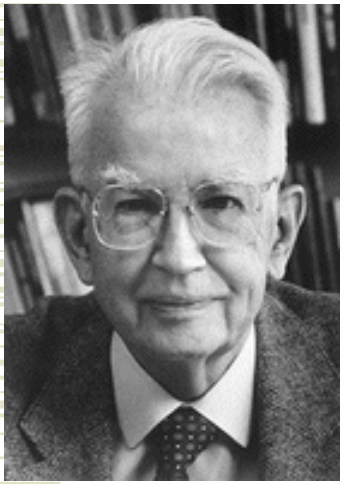
Generalizing Coase.



Ronald H. Coase

- The Market.
  - The exchange of products or outputs.
  - Exchange is coordinated spontaneously, in the sense that relative prices rather than fiat direct resources.
- The firm.
  - Replaces contracts for products with employment contracts, effectively substituting a factor market for a product market (Cheung 1983).
  - Replaces spontaneous coordination with some kind of central design or direction.

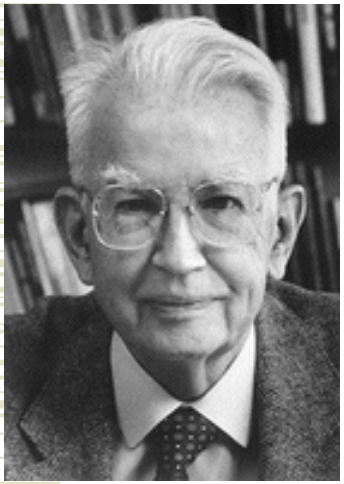
Generalizing Coase.



Ronald H. Coase

- Notice that this leaves two unexamined alternatives:
  - Product markets governed by central direction and
  - Factor markets coordinated spontaneously.
- Inside contracting and outsourcing are examples of the former.
- Voluntary production is an example of the latter.

Generalizing Coase.



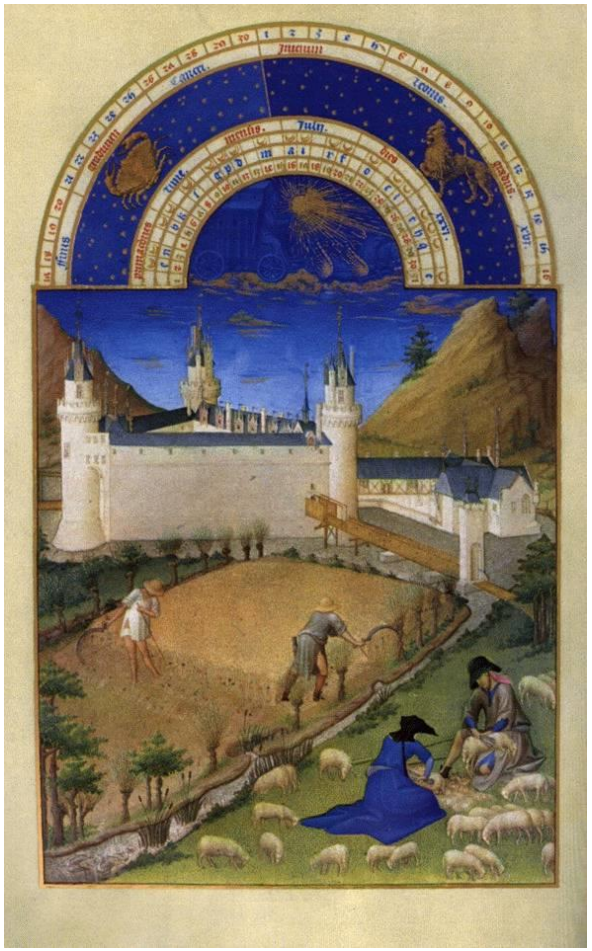
Ronald H. Coase

That is, *voluntary production (open-source collaboration) is an organizational form that permits the exchange of effort rather than the exchange of products, and it does so under a regime in which suppliers of effort self-identify like suppliers of products in a market rather than accepting assignment like employees in a firm.*

Generalizing Coase.

	Don't self-identify	Self-identify
Products	Inside contracting Outsourcing	Classic market
Effort	Classic firm	Voluntary production

Property rights and modularity.



July, from *Les très Riches Heures du Duc de Berry* (c. 1412). The Chantilly Museum, Paris.

- Rights as encapsulation boundaries.
  - Division-of-knowledge benefits.
  - Incentive benefits.
- Externalities as non-encapsulated effects.
- Emergence and re-partition of rights.
  - Commons and anticommons.

Property rights and modularity.

- Rights as encapsulation boundaries.
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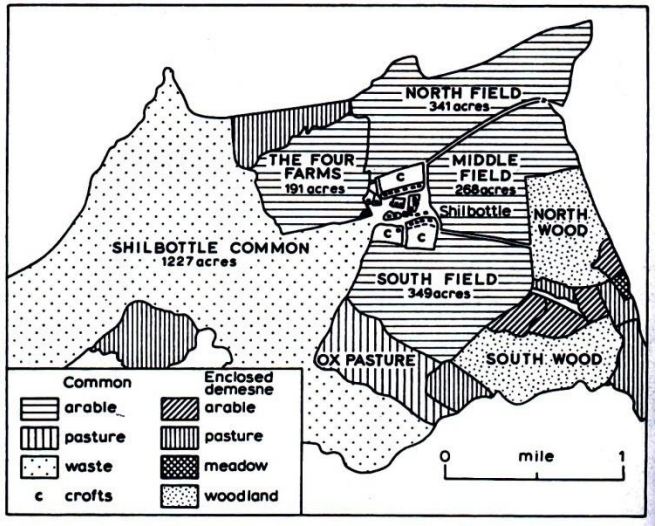
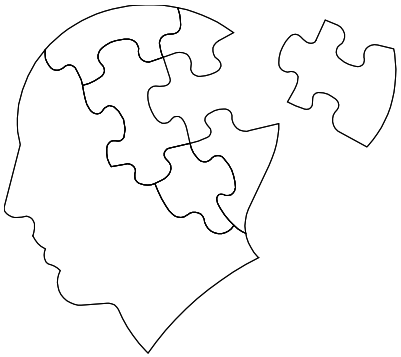
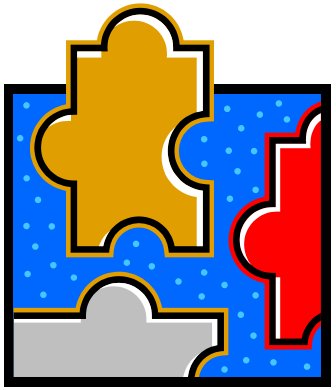


Modularity theory of the firm.



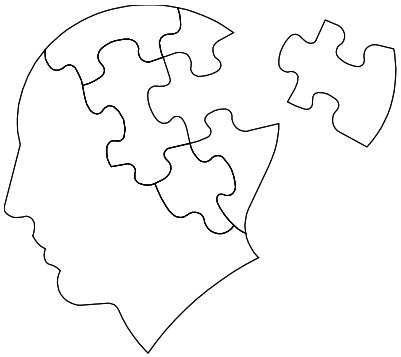


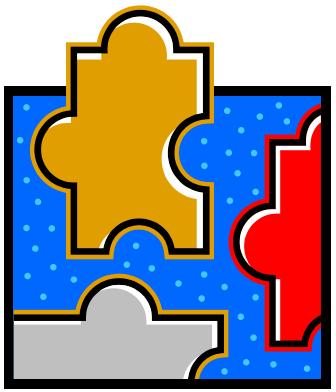
- Comparative institutional analysis à la Demsetz (1969).
  - Choice among (given) discrete institutional alternatives.
- Modularity theory of the firm.
  - Langlois (2002); Baldwin and Clark (2003).
  - Generalize comparative institutional analysis.
  - Consider engineering-design (evolutionary-design) problem that generates the alternatives.
  - the modular structure of a system of production determines the system's pattern of transaction costs.

Modularity theory of the firm.

- Baldwin and Clark:
  - Production as a network of tasks.
  - Transfers of material, energy and information among agents.
  - Not all transfers are transactions.
    - Must be defined, counted, valued, and paid for.

Modularity theory of the firm.



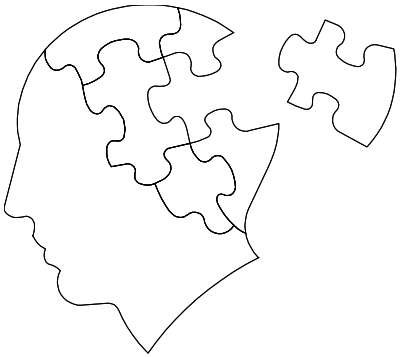


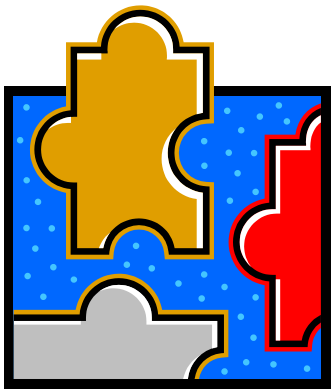
- Firms are a form of encapsulated local system.
- "Internalizing externalities" is equivalent to "encapsulating blocks of transfers."

Modularity theory of the firm.

- B&C: mundane transaction costs are the "costs of creating a transactional interface."
  - Costs of defining what is to be transferred.
  - Costs of counting the transfers.
  - Costs of valuing and paying for the individual transfers.

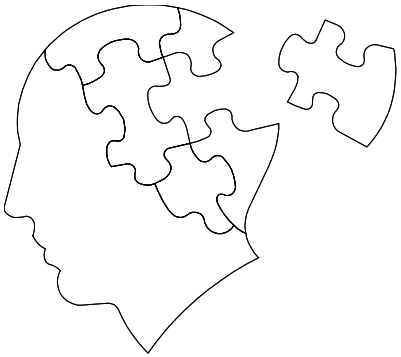
Modularity theory of the firm.

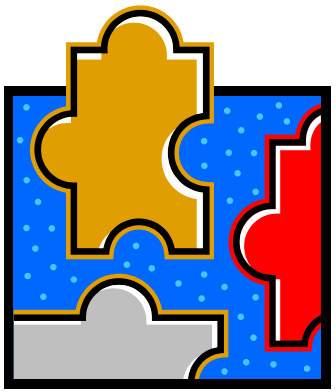




- Costs of creating a modularization.
- Costs of running a modularization.

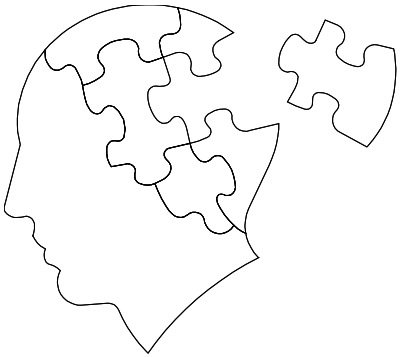
Costs of creating a modularization.

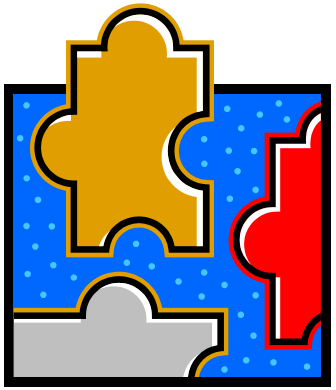




- Institutional set-up costs.
- Costs of defining what is to be transferred.
  - Increase with novelty, systemic change.
    - Ambiguous versus specific description.
    - Relationship to tacit or codified knowledge?

Costs of running a modularization.





- Transfers can be well specified, but residual (parametric) uncertainty.
  - Repertoire uncertainty.
    - The parable of the secretary.
  - Time specificity.
    - Trucking example.
- Frictional and measurement costs.
  - ATM example.
- Opportunism and agency costs.

Transaction costs.

Ronald H. Coase (1910-)

- Neoclassical tradition.
  - The costs resulting from the transfer of property rights. (Allen 2000, p. 901.)
  - Dahlman: identical to transportation costs.
  - The iceberg model.

Transaction costs.

Ronald H. Coase (1910-)

- Property rights tradition.
  - The costs of establishing and maintaining property rights. (Allen 2000, p. 898.)
  - Direct costs as well as indirect costs of misallocation from rent-seeking activity.

Types of transaction costs.

(1)	(2)	(3)
Fixed costs	Costs that are a function of time	Costs that are a function of number of exchanges or volume of trade
Examples: Legal, organizational, and technological standards; hostages and bonds; locks, closed-circuit TV.	**Examples**: Salaries of police, supervisors, and other monitors; monthly protection money; maintenance of fixed investments.	**Examples**: Brokerage fees, commissions; insurance premia; queuing at the bank, ATM fees; inspection and regulatory fees; per-transaction bribes.
Costs of property rights.		***Neoclassical T-costs.***
	Mundane transaction costs	

The economics of organization.

- Asset specificity and holdup.
- Incomplete contracts and residual rights.
- Moral hazard and “plasticity.”

Ex post costs can affect
ex ante choice of technology.

Maintained assumption.

Oliver Williamson

"A useful strategy for explicating the decision to integrate is to hold technology constant across alternative modes of organization and to neutralize obvious sources of differential economic benefit."

– Williamson (1985, p. 88)

The transaction-cost dichotomy.

- Producing.
  - Standard price theory.
  - Knowledge free and perfect.
- Transacting.
  - Fraught with hazards.
  - Knowledge asymmetric and imperfect.
  - Limited effect on production costs.

Production knowledge as "blueprints."

Missing elements.

- Capabilities.
- Qualitative coordination.

Production redux.

Harold Demsetz

- Firms exist because specialization (production for others) is efficient.
  - Separating existence from organization.
- Specialized knowledge and comparative advantage in direction.
  - Absorptive capacity and economies of scale in knowledge.

Knowledge Specialization.

- Knight: manager specializes in the exercise of judgment.
  - Uncertainty versus risk.
  - Not principally a risk-bearing story.
- Judgment reduces to choice of employees.
  - Can judge competence of others without knowing everything they know.
- Judgment is noncontractible.

Frank Knight (1885-1972)

Capabilities.

[I]t seems to me that we cannot hope to construct an adequate theory of industrial organization and in particular to answer our question about the division of labour between firm and market, unless the elements of organisation, knowledge, experience and skills are brought back to the foreground of our vision (Richardson 1972, p. 888).

G. B. Richardson (1924-)

Capabilities.

- Capabilities as the "knowledge, experience, and skills" of the firm.
- *Similar* capabilities.
- *Complementary* capabilities.

G. B. Richardson (1924-)

Capabilities.

"Where activities are both similar and complementary they could be co-ordinated by direction within an individual business. Generally, however, this would not be the case and the activities to be co-ordinated, being dissimilar, would be the responsibility of different firms. Co-ordination would then have to be brought about either through co-operation, firms agreeing to match their plans *ex ante*, or through the processes of adjustment set in train by the market mechanism" (Richardson 1972, p. 895).

G. B. Richardson (1924-)

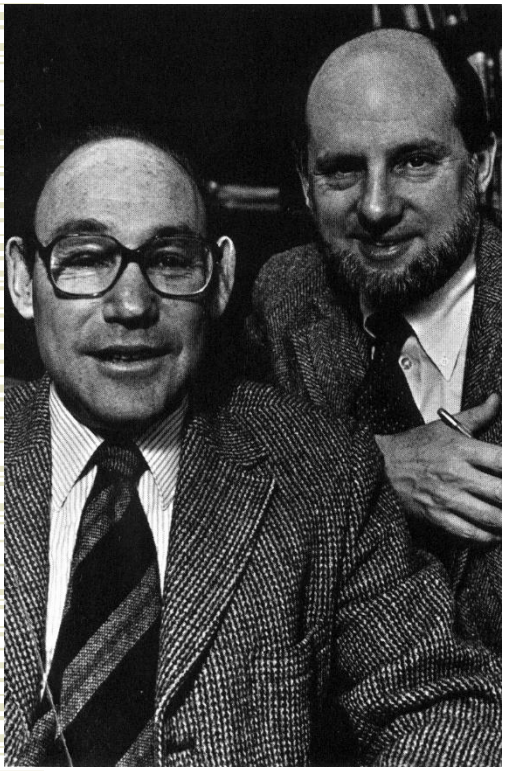
Capabilities.

Brian Loasby

- Production knowledge just as imperfect (and tacit and sticky) as knowledge in transacting.
- Loasby: standing on its head the implicit presumption of transaction-cost economics.

Transacting as a kind of production.

Capabilities and routines.



Richard Nelson
and Sidney Winter

- Skills as routines.
- Skills as tacit knowledge.
- Routines as organizational memory.
  - Contrast with blueprints.

Capabilities and agency problems.

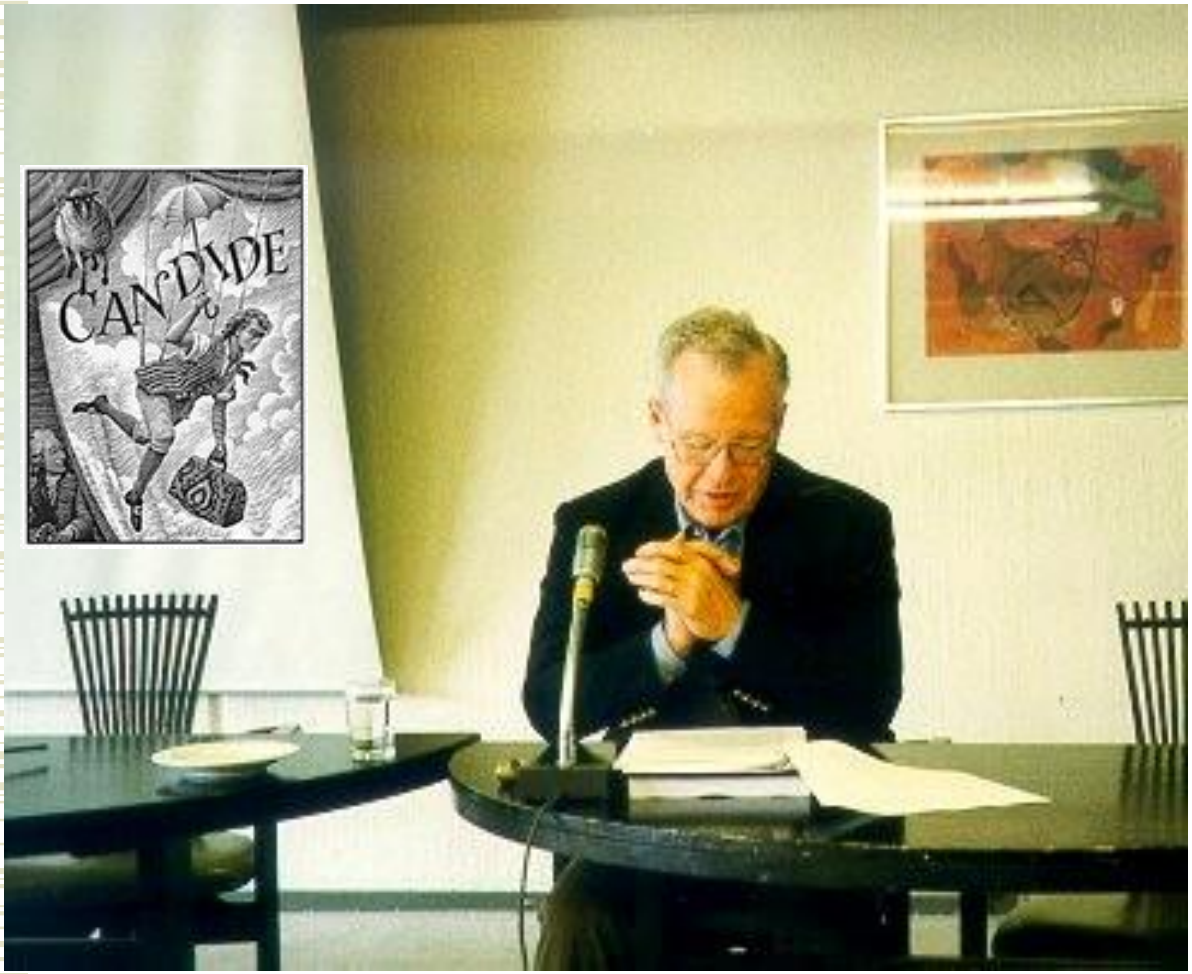
Can production routines solve moral hazard , adverse selection, and rent-seeking problems?

Richard Nelson

An “institution” is like a paved road across a swamp. To say that the location of the prevailing road is a “constraint” on getting across is, basically, to miss the point. Without a road, getting across would be impossible, or at least much harder. Developing an institutionalized way of doing something may be the only way to achieve a low transaction cost way of doing it.

— Nelson and Sampat (2001)

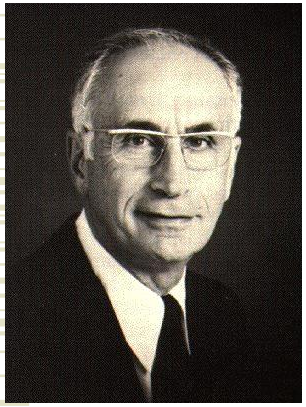
Explaining organization.



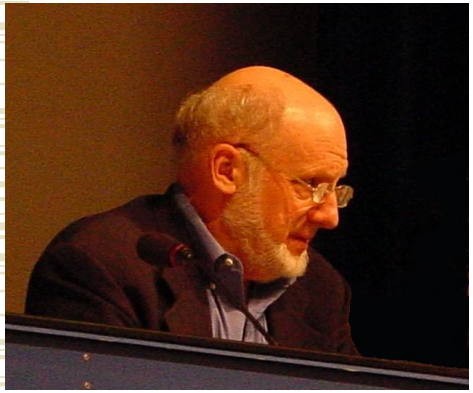
Organizations we observe are those that minimize the sum of production and transaction costs.

- But who is doing the minimizing?
- "As if" explanation.
- Functionalist explanation.
- Panglossian explanation.

Evolutionary explanation.



Armen Alchian



Sidney Winter

- Alchian: assume successful action not consciously selected by the agent but *selected for* by the environment.
  - Gas stations on the road from Chicago.
- Variation, retention, selection.
  - Overlooked importance of retention.
  - Does economic activity have memory?
- Winter: routines as genes.

Organization and economic change.

Oliver Williamson

"The introduction of innovation plainly complicates the earlier-described assignment of transactions to markets or hierarchies based entirely on an examination of their asset specificity qualities. Indeed, the study of economic organization in a regime of rapid innovation poses much more difficult issues than those addressed here."

— Williamson (1985, p. 143)

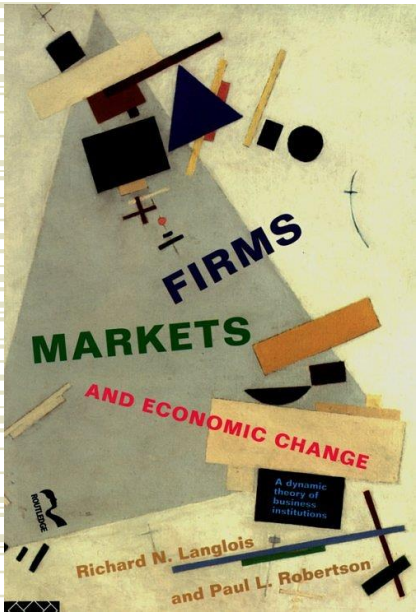
Organization and economic change.

- Strength of the selection environment.
  - "Good enough" not "optimal."
- Organizational form may depend on the past.
  - Path dependency.
- Organizational form may depend on the future.
  - Structural uncertainty.

Coordination.

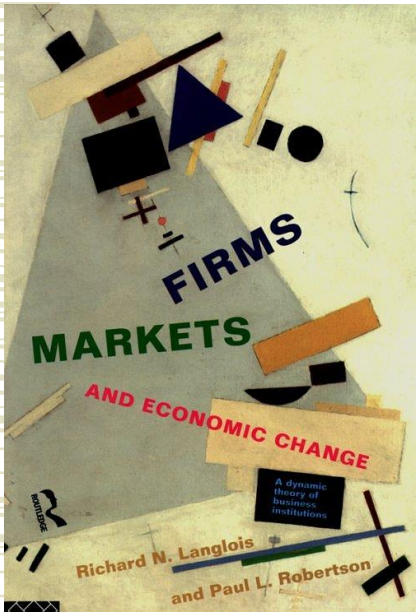
- As an entrepreneurial or innovative, not (only) a managerial or monitoring, activity.
- As involving changes in the structure of economic knowledge.

“Dynamic” governance costs.



- The costs of negotiating with, teaching, and persuading those who control or can cheaply create complementary capabilities.
- The costs of not having the capabilities you need when you need them.

Analytical framework.



- The pattern of existing capabilities in firm and market.
- The structure of the change.
  - Systemic versus autonomous.
- Economies of scale and scope.
  - Standards and modularity.
  - Internal versus external economies of scope.

Two scenarios.

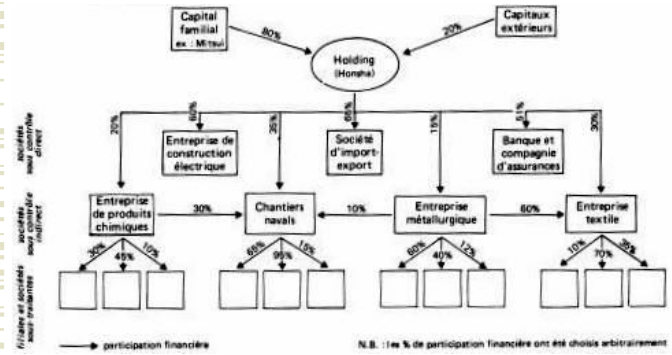
- The Visible Hand.

- The Vanishing Hand.

Scenario 1.

- Creative destruction of existing external capabilities.
- Unified ownership and coordination overcomes "dynamic" transaction costs.

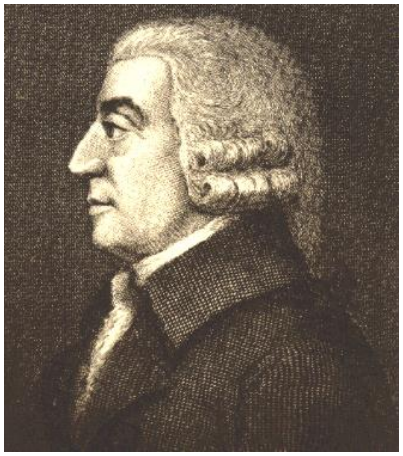
Business groups.



"My father and I started a cosmetic cream factory in the late 1940s. At the time, no company could supply us with plastic caps of adequate quality for cream jars, so we had to start a plastics business. Plastic caps alone were not sufficient to run the plastic molding plant, so we added combs, toothbrushes, and soap boxes. This plastics business also led us to manufacture electric fan blades and telephone cases, which in turn led us to manufacture electrical and electronic products and telecommunication equipment. The plastics business also took us into oil refining, which needed a tanker shipping company. The oil refining company alone was paying an insurance premium amounting to more than half the total revenue of the then largest insurance company in Korea. Thus, an insurance company was started. This natural step-by-step evolution through related businesses resulted in the Lucky-Goldstar (LG) group as we see it today."

(Cited in Kim and Lee.)

The Visible Hand.



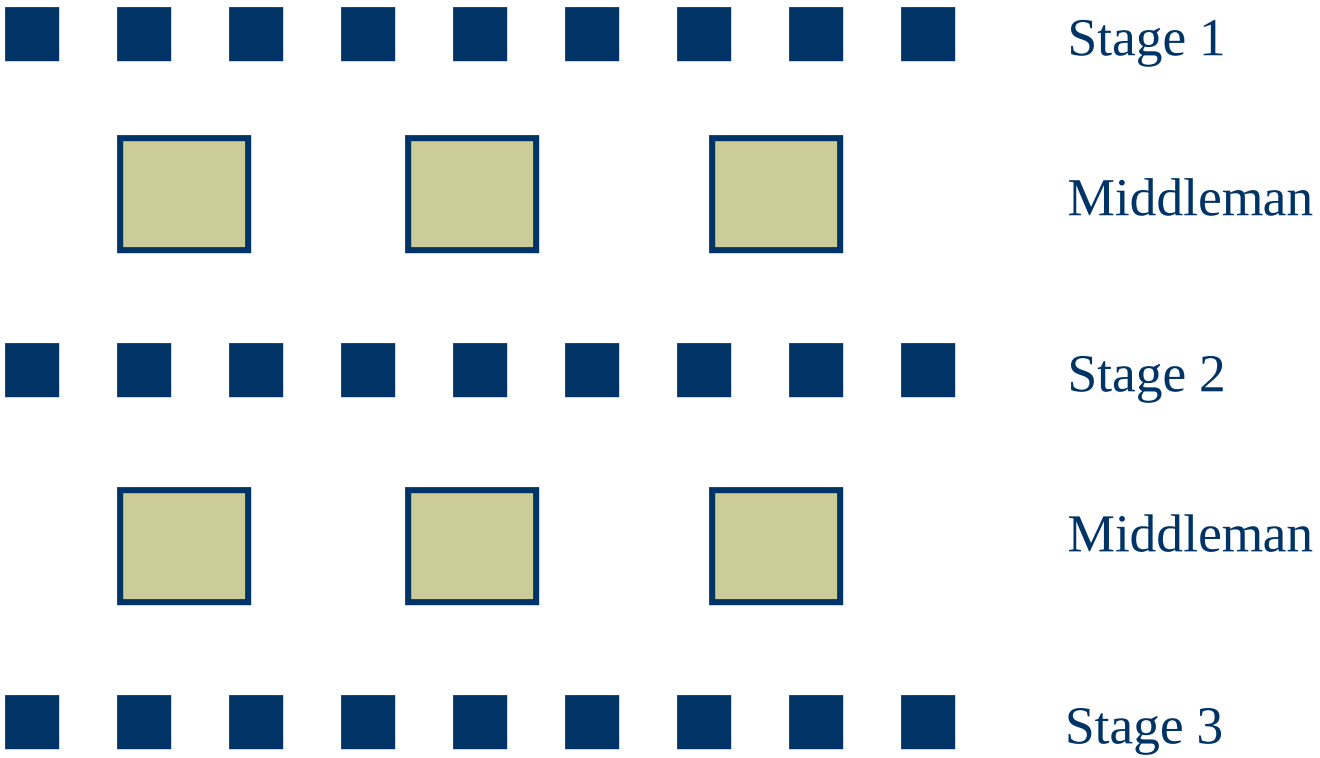
- Adam Smith:
  - Increasingly fine division of labor.
  - Coordination through markets.

- Alfred Chandler:
  - Visible hand of management replaces markets.

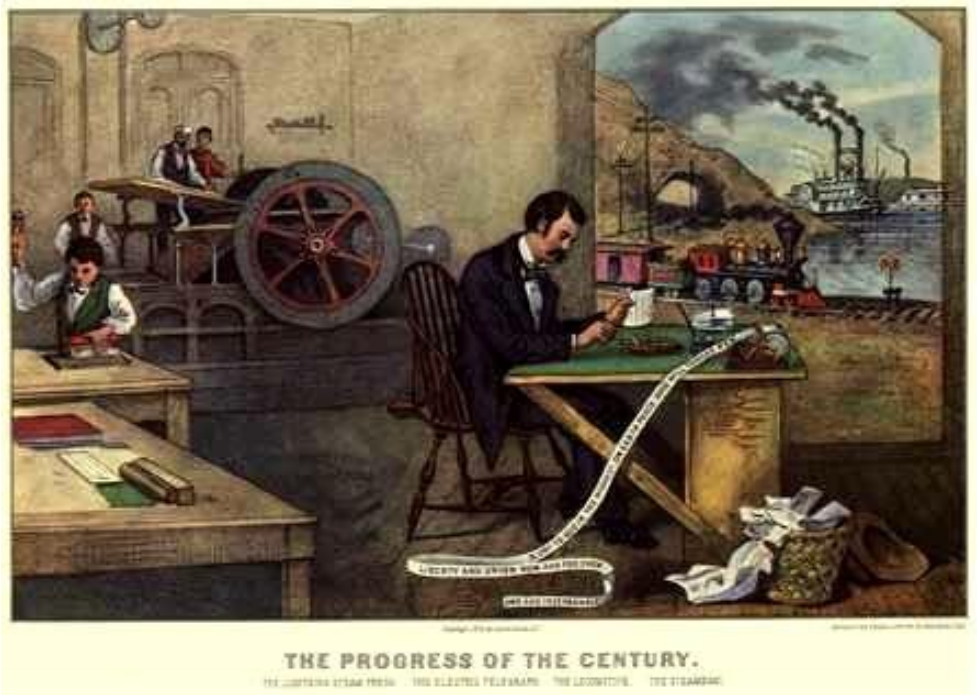
Antebellum America.

- High transportation and transaction costs.
- Small, localized, nonspecialized production and distribution.

The antebellum value chain.



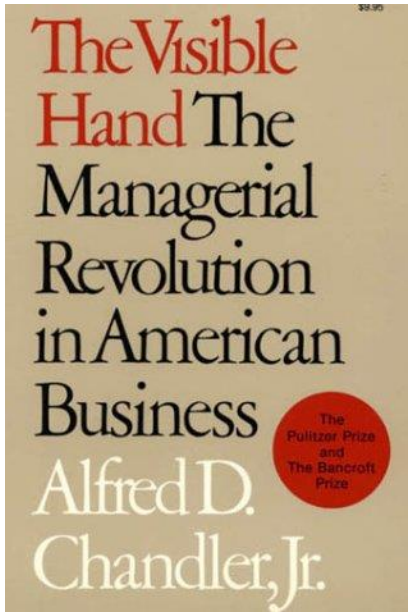
Postbellum America.



- Increased population and higher per-capita income.
- Lower transportation and communications costs.
  - the railroad.
  - ocean shipping.
  - the telegraph.

The rise of the large corporation.

Alfred D. Chandler, Jr., 1918-2007



"… modern business enterprise appeared for the first time in history when the volume of economic activities reached a level that made administrative coordination more efficient and more profitable than market coordination.

Such an increase in volume of activity came with new technology and expanding markets. New technology made possible an unprecedented output and movement of goods. Enlarged markets were essential to absorb such output. Therefore modern business enterprise first appeared, grew, and continued to flourish in those sectors and industries characterized by new and advancing technology and by expanding markets." (Chandler 1977, p. 8.)

Refrigerated meat packing.

Gustavus F. Swift (1839-1903).

Great Union Stock Yards, Chicago, early 20th century.

- Before the railroads, meat raised and slaughtered locally
- Opening of the western range led to economies of scale in cattle raising.
- Live animals shipped to eastern cities.

Refrigerated meat packing.

Gustavus F. Swift (1839-1903).

Great Union Stock Yards, Chicago, early 20th century.

- Swift recognized possibilities for additional economies of scale.
- “Disassembly line” in Chicago.
- Ship refrigerated dressed meat to eastern cities.

Refrigerated meat packing.

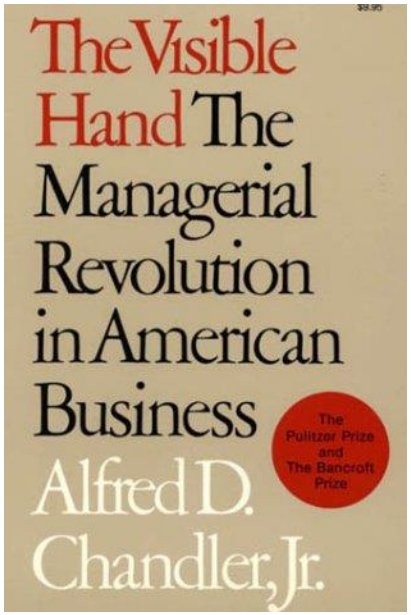
Gustavus F. Swift (1839-1903).

Great Union Stock Yards, Chicago, early 20th century.

- Systemic reorganization of meat-packing industry.
- Required network of refrigerated railroad cars, ice houses, warehouses, and retailing outlets.
- Swift forced to integrate vertically to overcome dynamic transaction costs.

The rise of the large corporation.

Alfred D. Chandler, Jr., 1918-



Cartel agreements and pools

Notoriously unstable

↓

Holding company

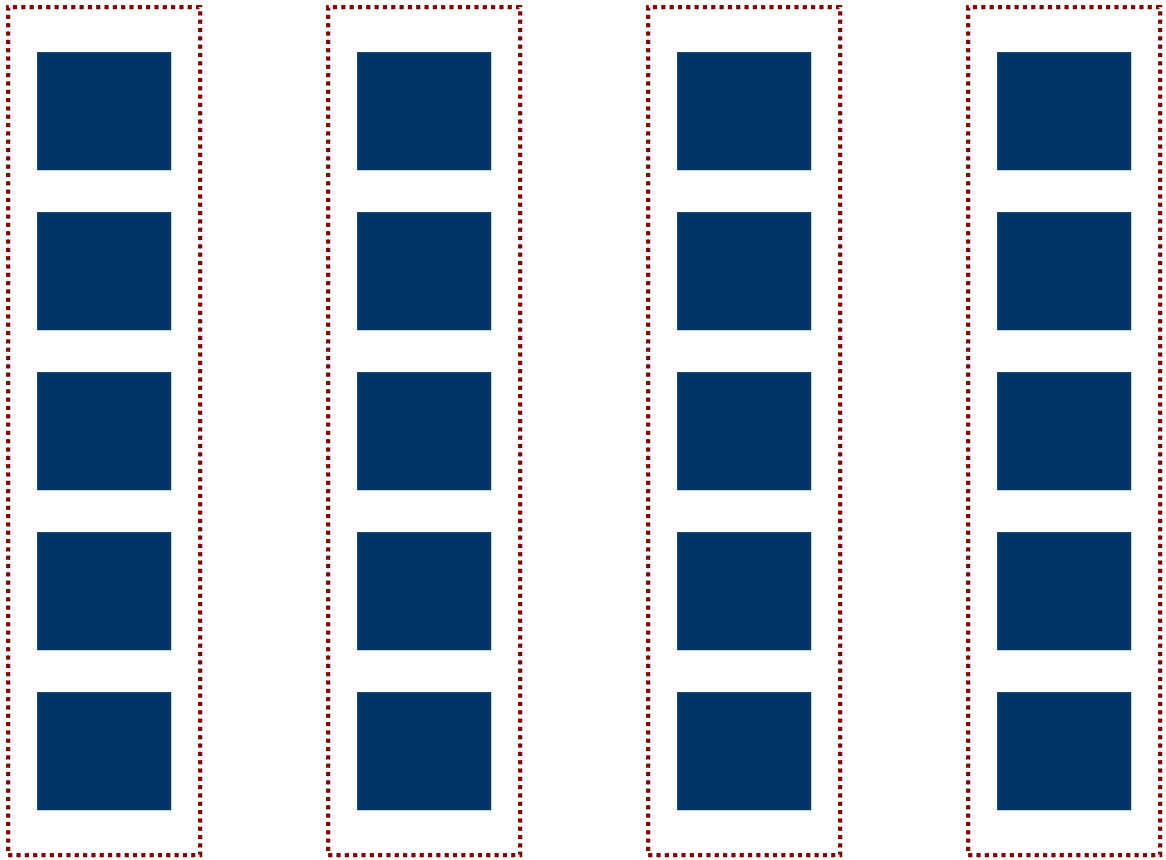
Exchanging separate firm ownership for shares in a meta-company

↓

Multidivisional modern corporation

Rationalization and professional management

The Chandlerian value chain.



Why management?

"In the capital-intensive industries the throughput needed to maintain minimum efficient scale requires careful coordination not only of the flow through the processes of production but also of the flow of inputs from suppliers and the flow of outputs to intermediaries and final users." (Chandler 1990, p. 24.)

Why management?

- Product-flow uncertainty.
  - High fixed costs demand high throughput.
  - Thin markets lead to internal coordination.
- Management as a way to “buffer” uncertainty.
  - Product standardization “pushes uncertainty up the hierarchy.”

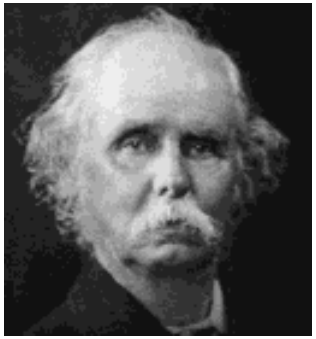
Scenario 2.

- Creative destruction of existing internal capabilities.
- Modularity and a high level of external capabilities.
- Development of institutions to support market exchange.

Industrial districts.

When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously. Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas. And presently subsidiary trades grow up in the neighbourhood, supplying it with implements and materials, organizing its traffic, and in many ways conducing to the economy of its material.

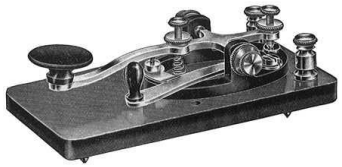
— Marshall, *Principles of Economics*, IV.x.3.



Alfred Marshall, 1842-1924

External economies.

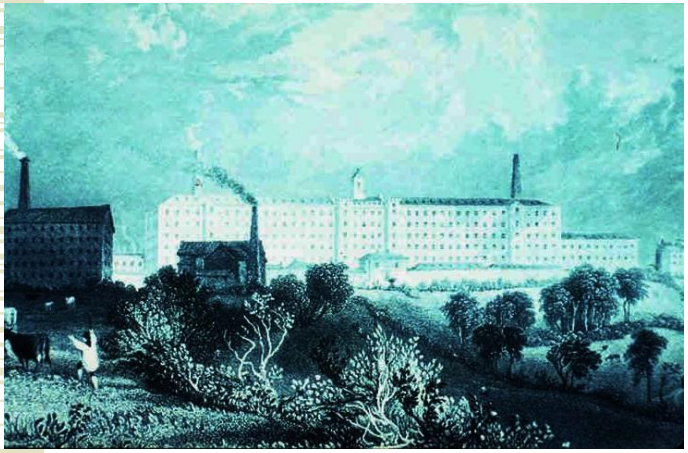
Lancashire.



The Manchester Cotton Exchange.

- Transportation.
  - Port of Liverpool develops with Manchester.
  - Canals, turnpikes, and railways.
    - World's first passenger railway.
  - Later, telegraph and telephone turn Manchester into communications center.
- Markets.
  - Cotton exchanges create thick market for worldwide imports.
  - Power loom and mule adapted to wide variety of cotton types and quality.
  - Worldwide network of commissioning agents.

Lancashire.



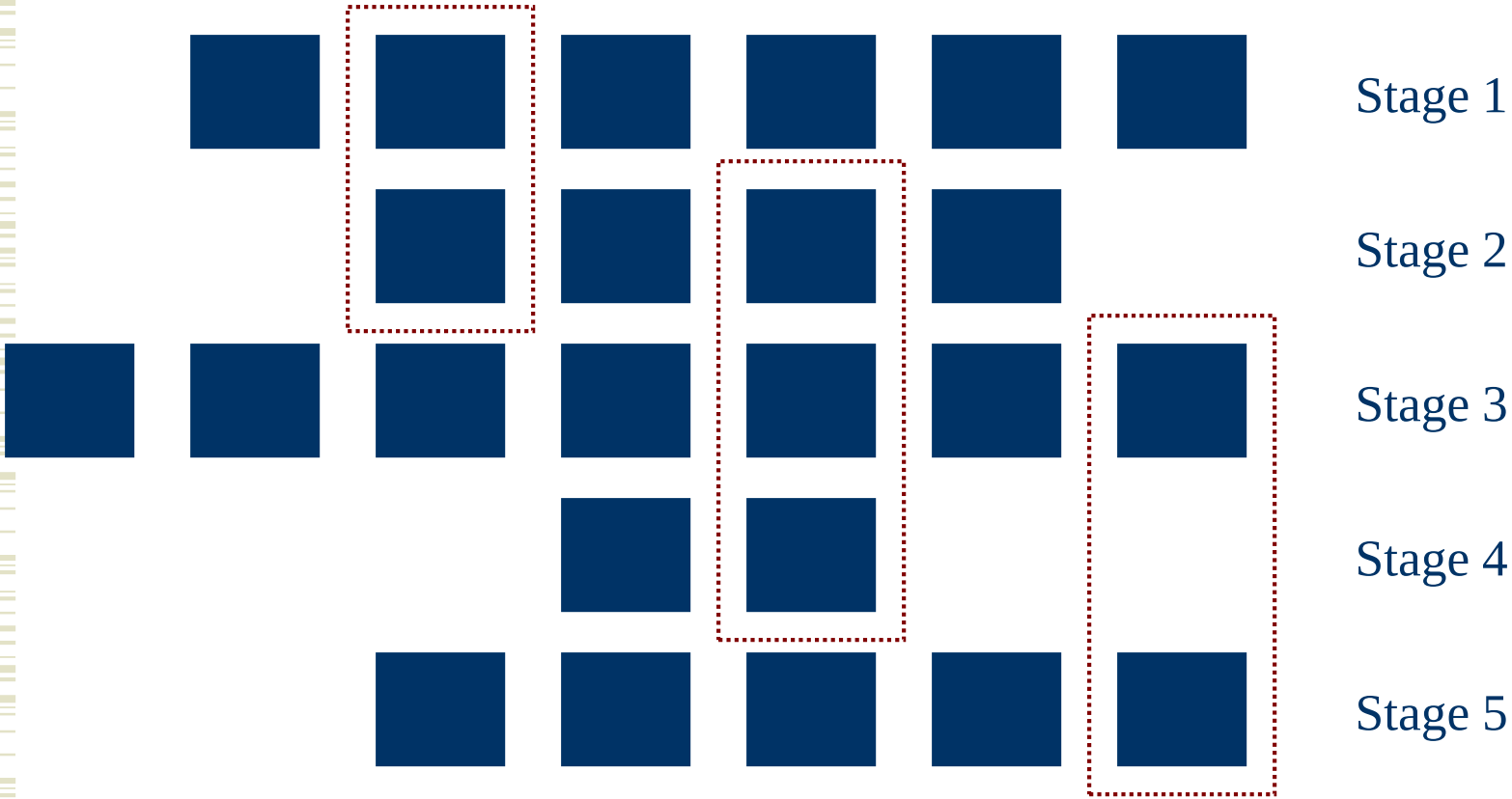
An Industrial Landscape in 1833: Swainson, Birley and Co., near Preston, Lancashire, England.

- Vertical specialization.
  - Low barriers to entry.
  - Tens of thousands of establishments.
  - Specialization by type of yarn or cloth.
  - One firm may lease space in several mills and one mill may contain several firms.
- Subsidiary industries.
  - Textile machinery industry.
  - Banking and finance.
  - Transportation and communication.

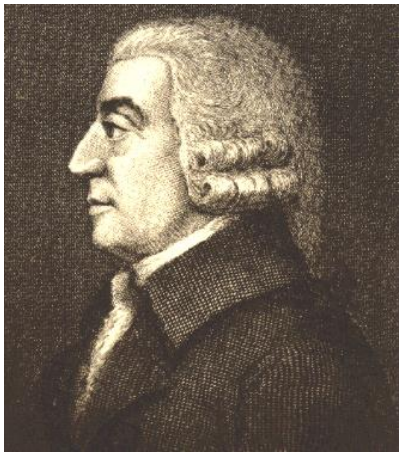
Personal computers.

- Origins in low-capability environment.
- IBM's exigency and historical accident.
- External economies: breaking the boundaries of the firm.
- "Horizontal" vs. "vertical" models.

The New Economy value chain.



The Visible Hand.



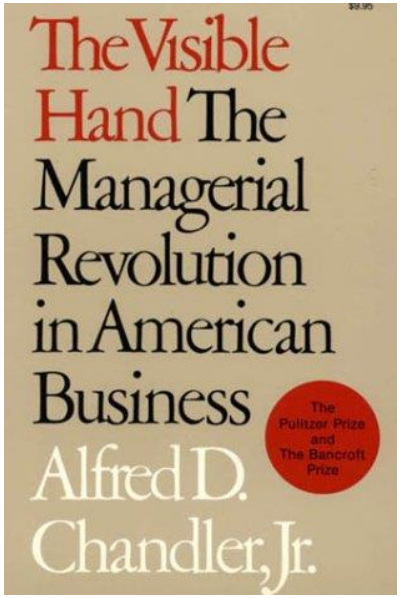
- Adam Smith:
  - Increasingly fine division of labor.
  - Coordination through markets.

- Alfred Chandler:
  - Visible hand of management replaces markets.

The Vanishing Hand.

- Diminished success of the large vertically integrated corporation.
- Resurgence of “contractual” forms of organization.
- The visible hand is fading into a ghostly translucence.

The menu of alternatives.



- Reject Chandler's account as having been wrong from the start.
- Deny that the large corporation is less successful and superior today than it was in the past.
- Reinterpret Chandler by placing his contribution in a frame large enough to accommodate both the rise and the (relative) fall of the large managerial enterprise.

The post-Chandlerian puzzle.

- Transportation and communication costs have been declining in secular fashion since antebellum times.
- Organizational structure has not change monotonically.
- Instead, it has followed a pronounced hump-shape pattern over time, moving from highly decentralized to integrated back to decentralized again.

Why?

The post-Chandlerian puzzle.

Alternatives.

- Modern technology – computers, communications, the Internet.
- Rising incomes.
- Growing extent of the market.

The post-Chandlerian puzzle.

Alternatives

- Modern technology – computers, communications, the Internet.
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Technology and the New Economy.

Ronald Coase

"It should be noted that most inventions will change both the costs of organising and the costs of using the price mechanism. In such cases, whether the invention tends to make firms larger or smaller will depend on the relative effect on these two sets of costs. For instance, if the telephone reduces the costs of using the price mechanism more than it reduces the costs of organising, then it will have the effect of reducing the size of the firm." (Coase 1937, p. 397n.)

Must argue that technical change lowers cost of market transaction more than it does cost of hierarchical organization.

Technology and the New Economy.

Malone and Laubacher (1998):

- Coordination technologies of the industrial era — the train and the telegraph, the automobile and the telephone, the mainframe computer — favored internal transactions.
- Only with the recent development of even more powerful coordination technology — personal computers and broadband communication networks — have markets been favored.

Technology and the New Economy.

- But is the evolution – and the bias – of coordination technology entirely exogenous?
- Technology and organization coevolve.

The post-Chandlerian puzzle.

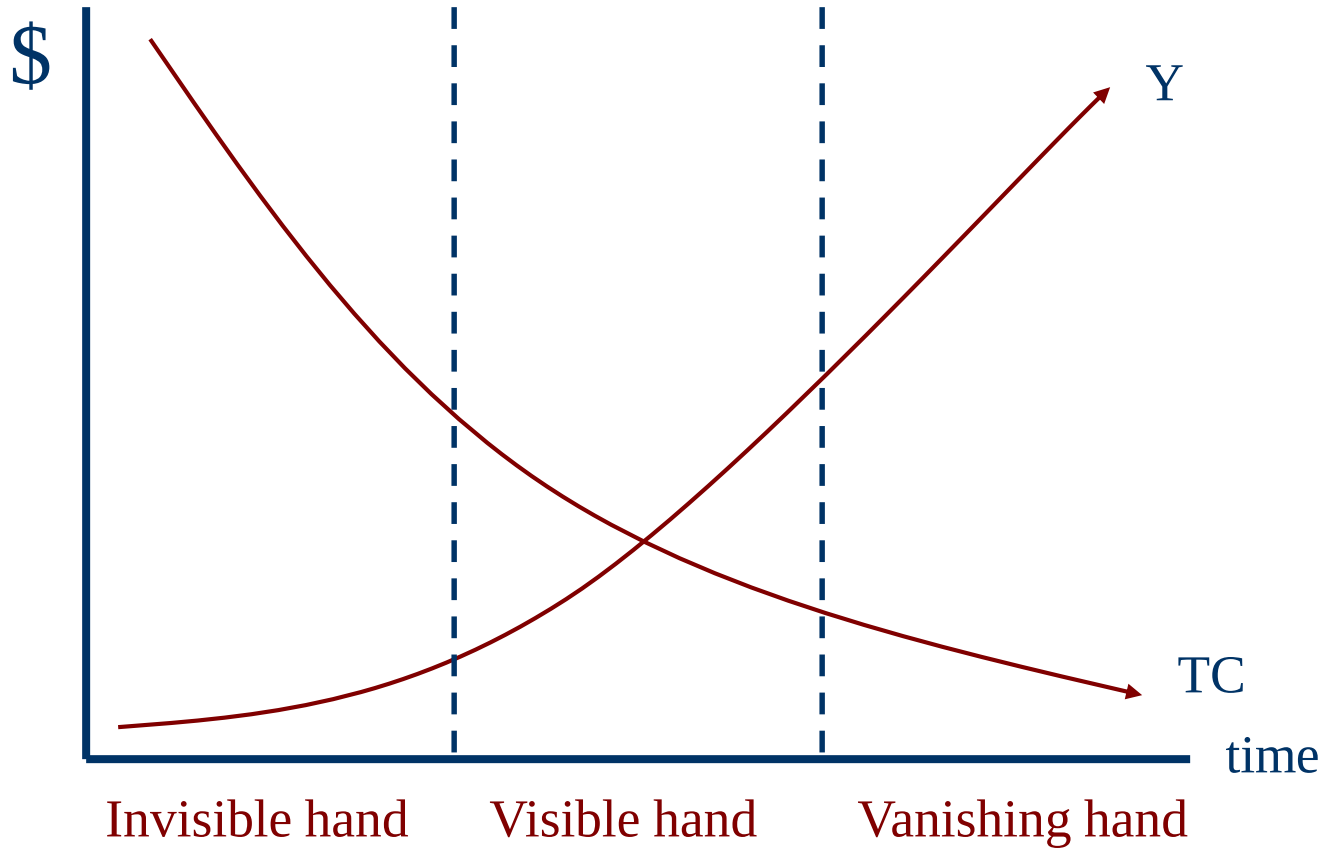
Alternatives

- Modern technology – computers, communications, the Internet.
- Rising incomes.
- Growing extent of the market.

Rising incomes.

- Lamoreaux, Raff, and Temin (2003).
  - Although transaction costs have been falling, incomes have been rising.
  - This has led to a "reswitching" of organizational form.

Rising incomes.



Underlying theory.

Oliver Williamson

The Chandlerian firm is the "product of a series of organizational innovations that have had the purpose and effect of economizing on transaction costs" – Williamson (1981, p. 1537)

- Asymmetric information.
  - The "externality principle."
  - Asset specificity.

The post-Chandlerian puzzle.

Alternatives

- Modern technology – computers, communications, the Internet.
- Rising incomes.
- Growing extent of the market.

The Vanishing Hand hypothesis.

- The Smithian process of the division of labor always tends to lead to finer specialization of function and increased coordination through markets.

The Vanishing Hand hypothesis.

- But the components of that process —technology, organization, and institutions — change at different rates.

The Vanishing Hand hypothesis.

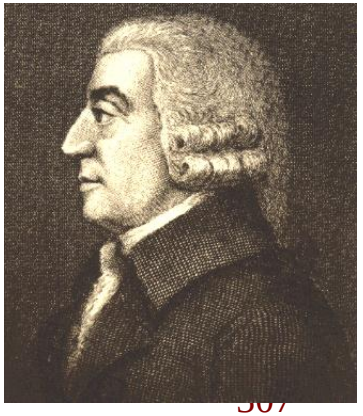
- The managerial revolution was the result of an imbalance between the coordination needs of high-throughput technologies and the abilities of contemporary markets and contemporary technologies of coordination to meet those needs.

The Vanishing Hand hypothesis.

- With further growth in the extent of the market and the development of exchange-supporting institutions, the central management of vertically integrated production stages is increasingly succumbing to the forces of specialization.

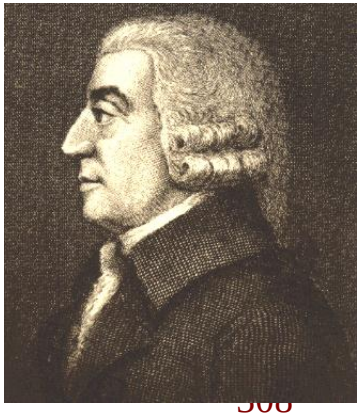
Extent of the market.

- Incorporates both technology effect and income effect.
  - Extent of the market increases as population and per capita incomes grow.
  - Extent of the market increases as transportation, communications, and transaction costs decline.



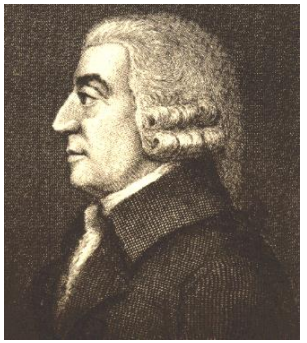
Extent of the market.

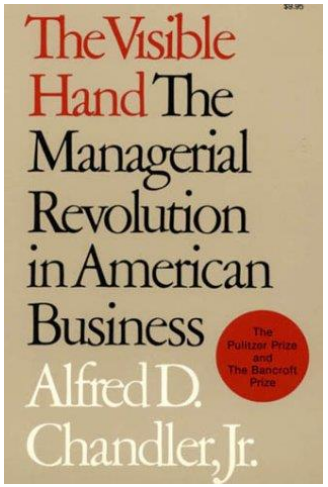
- "Extent" of the market is also about learning.
  - Williamson: "in the beginning there were markets."
  - But markets take time to learn.
    - Market-supporting institutions (like standards).
    - Examples: Grain markets, mortgage disintermediation.
- "General specialties" or GPTs.
  - Personal computers, the Internet, specialized logistics.
  - GPTs depend on absolute size of market.



The Visible Hand.

The managerial revolution is actually a manifestation of the division of labor.





- Management becomes a profession.
- The M-form decouples strategic functions from day-to-day management.
- Financial markets separate function of capital provision from management.
  - *Markets* as a way to buffer uncertainty.

From markets to management and back.