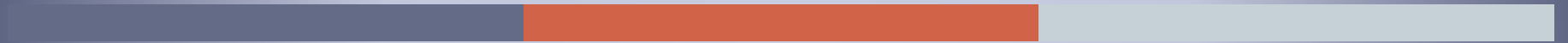


Productivity and Efficiency



The proximate causes

- ✓ Physical capital
- ✓ Population growth
 - ✓ fertility
 - ✓ mortality
- ✓ Human capital
 - ✓ Health
 - ✓ Education
- ✓ Productivity
 - ✓ Technology
 - Efficiency
- International trade

Introduction

- Efficiency is a *global concept* used to explain all productivity differences that are not due to differences in technology.
- Efficiency is thus explained by its absence in comparison to what we know *could* be done.

Introduction

In this chapter, we will

1. Conceptualize efficiency for quantitative analysis.
2. Decompose productivity differences into technology differences and efficiency differences.
3. Compare efficiency differences between countries.
4. Look at case studies in inefficiencies.
5. Propose a taxonomy of inefficiency types.

Quantitative Analysis



Breaking down productivity

Breaking down productivity

- ❑ *Technology*: The stock of knowledge about how to combine inputs in order to produce outputs.
- ❑ *Efficiency*: The ability with which technology and inputs are effectively used to produce outputs.

Quantitative analysis

- India's productivity is 0.31 that of the USA.
- Can we estimate the shares of efficiency and technology that are responsible for that difference?

Country	Output per Worker, y	Physical Capital per Worker, k	Human Capital per Worker, h	Factors of Production, $k^{1/3}h^{2/3}$	Productivity, A
United States	1.00	1.00	1.00	1.00	1.00
Norway	1.12	1.32	0.98	1.08	1.04
United Kingdom	0.82	0.68	0.87	0.80	1.03
Canada	0.80	0.81	0.96	0.91	0.88
Japan	0.73	1.16	0.98	1.04	0.70
South Korea	0.62	0.92	0.98	0.96	0.64
Turkey	0.37	0.28	0.78	0.55	0.68
Mexico	0.35	0.33	0.84	0.61	0.56
Brazil	0.20	0.19	0.78	0.48	0.42
India	0.10	0.089	0.66	0.34	0.31
Kenya	0.032	0.022	0.73	0.23	0.14
Malawi	0.018	0.029	0.57	0.21	0.087

Sources: Output per worker: Heston, Summers, and Aten (2011); physical capital: author's calculations; human capital: Barro and Lee (2010). The data set used here and in Section 7.3 is composed of data for 90 countries for which consistent data are available for 1975 and 2009.

Decomposing productivity:

Quantitative analysis

- Average Total Factor Productivity (TFP) growth in the USA was estimated to be 0.54% per year between 1975 and 2009.
- Let us suppose that all this growth is due to technological progress, that is, assume no change in efficiency in the USA.
- Suppose further that the level of technology in India is ℓ years behind that of the USA.
- Take note...

Quantitative Analysis

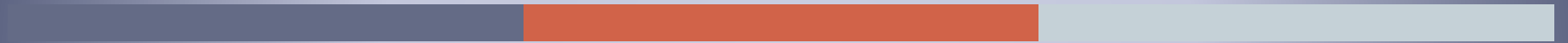
- If technology in India is 10 years behind that of the USA, then efficiency in India is 33% that of the USA.
- But it is difficult to say exactly how important is India's technological lag w.r.t. the USA.
- The following table presents the same calculations for different given values of technological lags in years:

Years India Lags United States in Technology (<i>G</i>)	Level of Technology in India Relative to United States (<i>T</i>)	Level of Efficiency in India Relative to United States (<i>E</i>)
10	0.95	0.33
20	0.90	0.35
30	0.85	0.36
40	0.81	0.38
50	0.76	0.41
75	0.67	0.46
100	0.58	0.53
125	0.51	0.61

Quantitative Analysis

- It is difficult to imagine that India could be more than 20 years behind the USA technologically.
- Let's take 30 years, to be safe. This means that India's technology level is now 85% that of the USA, which implies a level of efficiency equal to 36% that of the USA.
 - Unless India's technological lag is very important, its productivity difference is mainly due to a difference in efficiency.
- Similar numbers suggest that most productivity differences in the world are due to efficiency differences. However, we cannot observe them directly.
- Since efficiency appears to be so important but cannot be measured directly, we look at some case studies which point to its existence.

Case studies in INefficiencies



Case studies in inefficiencies

1. Oil extraction in California, early 20th C.
2. Fishing in Iceland
3. Central planning in the USSR
4. The textile industry in New-England 1910
5. Productivity differences between countries per industry
6. Coal mines USA 1949-94
7. Health care in Canada?

1. Oil extraction in California 1920s

- Underground petrol covers thousands of acres.
- According to the law:
 - Each individual cannot own more than 20 acres of surface land to extract.
 - Rule of capture
- Implication of the law:
 - Only oil at the surface is “private property”.
 - Oil underground is “open access”, i.e. does not belong to anyone.
 - Race to extract as fast as possible. This increases costs of extraction due to pressure losses, etc. This means that more inputs (energy, labor, capital) are needed to produce the same output.
 - Surface storage (privatization) leads to losses from evaporation, fires, leaks, environmental damage, etc.



Flow from the Otto Morris and Marr Oil Well Flow, an oil well in south Arkansas. Earthen storage pits were used for the crude oil. From 1922 to 1934, up to eight percent of the oil produced was wasted, and almost all of the natural gas escaped. (<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=383#>)



Oil Derricks Early Huntington Beach, California, 1928



Oil Rigs on Signal Hill, California 1937

Oil extraction in California

- Estimated recuperation rates:
 - 20-25% in the case of “race to extract”.
 - 85-90% with controlled extraction.
- Losses due to evaporation and fires: 5 to 11%.

People react to incentives!

- Laws and regulations are **institutions** that shape incentives.
- An institution is what defines the rules of the game.

2. Fishing in Iceland

- In order to reduce overexploitation of fisheries, the number of boats allowed on the water is capped. Fishers' reaction:
 - *Cut the boats in half and make them longer...*
- The extra costs of modifying the boats may leave fishers worse off in the end.

People react to incentives!

- Laws and regulations are institutions that shape incentives.

3. Central planning in the USSR

- During the 20th C., the USSR accumulated a lot of physical and human capital.
- We cannot say that the country lagged a lot technologically.
- In 1985, per capita income in the USSR was 1/3 that of the USA. Economic growth was also weak.
- This difference with OECD countries can only be explained through the concept of efficiency.
- So how can we explain so much inefficiencies in the USSR? Below are two candidates for an explanation based on:
 1. Information burden
 2. Incentive problems

Central planning in the USSR

Problems with central planning:

- Works well in theory, i.e. allocation decisions *can replicate* the decentralized markets.
- In practice, it seems like it does not work as well as the market price system.
- The *information burden* on planners is huge:
 - Which firms need inputs the most?
 - Which goods are demanded most?
 - How to make supply and demand coincide?
- Upshot:
 - Shortages of goods were common.
 - Long waiting lines for consumers, i.e. rationing by time instead of prices implies waste of resources.
 - Lower output due to shortage of inputs.
 - Some useless goods were being produced.

Central planning in the USSR

2. *Low incentives* to perform for workers and managers alike. In the absence of any form of competition:
 - Little incentives to minimize costs
 - Little incentives to adopt or develop better technology
 - Little incentives to raise product quality
 - Generally, as far as compensation is concerned, there is little difference between firms that “try hard” and the others.

Central planning in the USSR

- ❑ End of communism in the early 1990s and the market economy:
 - Improvements were not forthcoming.
 - It seems that a well-functioning “market economy” is much more complex than just “letting firms compete”.
 - Institutions (rules of the game) are important and good ones do not come spontaneously.
 - The government still has an important role to play.

4. The textile industry in New-England

- In 1910, it is observed that New England textile workers receive a salary which is
 - 50% higher than in England
 - Twice those of France and Germany
 - Three times those of Italy or Spain
 - 10 times those of Japan, India, China
- Why?
- USA government inspectors were hired to provide explanation.

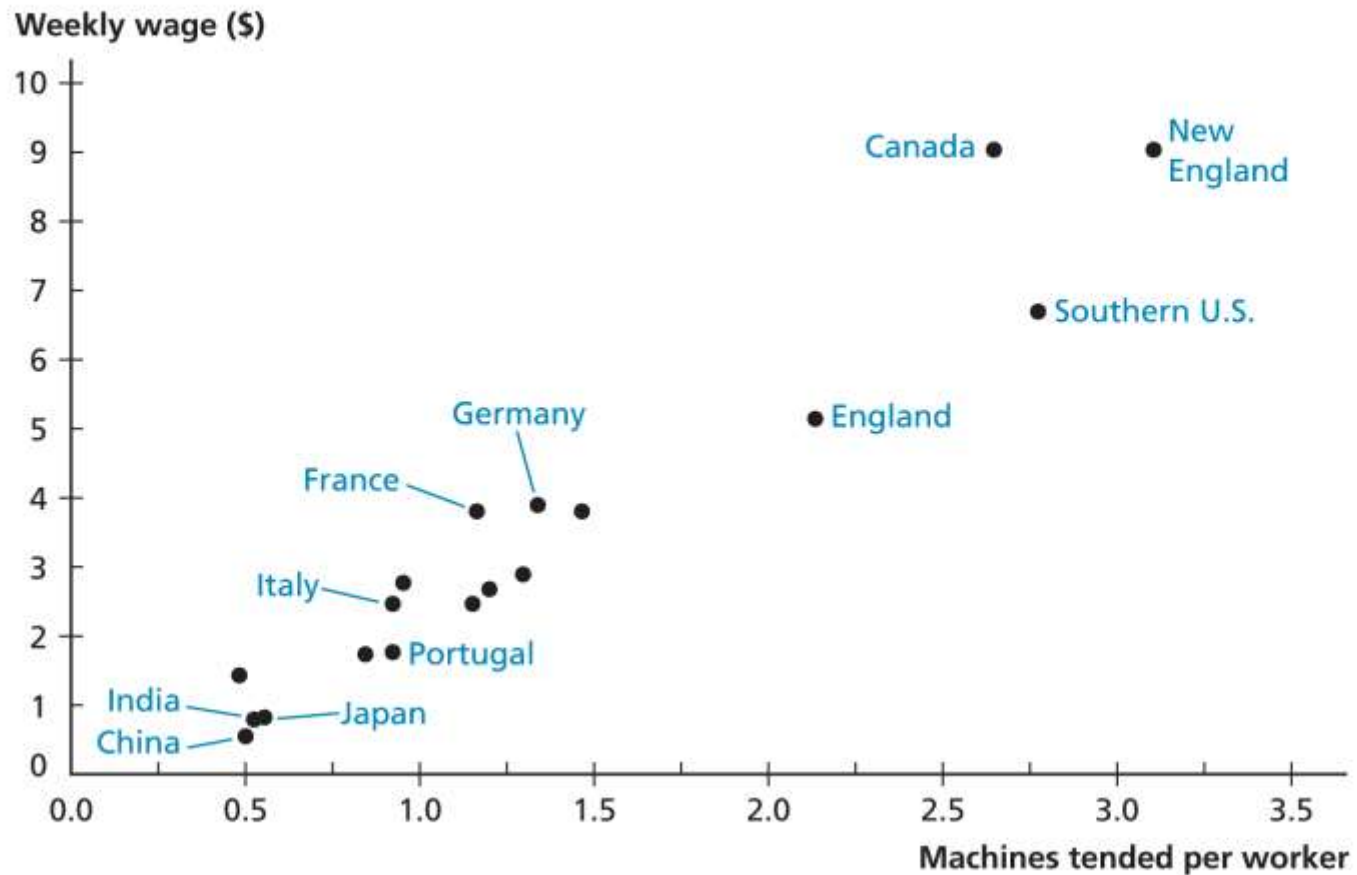
The textile industry in New-England

Observations:

- The same machines are being used. No technological differences.
- The same raw material is being used.
- Salaries are higher in places where workers tend more machines.
- Where workers receive higher salaries, each loom produces more output even though they are tended by less workers.

FIGURE 10.1

Wages and Machines in the Textile Industry, 1910



Source: Clark (1987).

The textile industry in New-England

How can we explain that?

- ❑ Health and education differences did not seem to matter much.
- ❑ Differences in *organization* and *labor practices* appeared to be the most important explanations.
- ❑ US observers at the time were convinced that workers in other countries could tend more machines. “Something” seemed to impede that.
- ❑ That “something” was causing inefficiencies.
- ❑ NB In the 1980s, a similar phenomenon happened in reverse when US auto producers started to try to understand why the Japanese were becoming so much better at producing cars.

5. Productivity differences between countries per industry

- The table below compares the productivities of different industries in the 1990s. It involves the collection of detailed data about labor and capital inputs, as well as the organization of production.

TABLE 10.2

Productivity in Selected Industries in the Early 1990s

	United States	Japan	Germany
Automobiles	100	127	84
Steel	100	110	100
Food Processing	100	42	84
Telecommunications	100	51	42
Aggregate Productivity	100	67	89

- Note how the Japanese are more productive in steel and cars, but much less for the rest.
- Germany and the USA are generally quite close, except for telecommunications. (This has probably changed by now with deregulation.)

Productivity differences between countries per industry

- How to explain such differences? Certainly not with technology.
 - How could we explain that in the car industry, people can use the latest technology and not in the food industry?
 - We observe differences in productivity even within the same firms across countries.
 - Productivity in the beer industry is low in Germany even though the Germans actually build the machines for that sector.

One explanation comes from organization:

- Car manufacturers in Japan are very much “integrated” with their suppliers. They maintain good, long-term relations.
- In the USA, this relation is often “adversarial”.
- The food industry in Japan hires more people than the steel and car industries combined. It is subject to complicated and obscure regulation and norms.

Differences within an industry

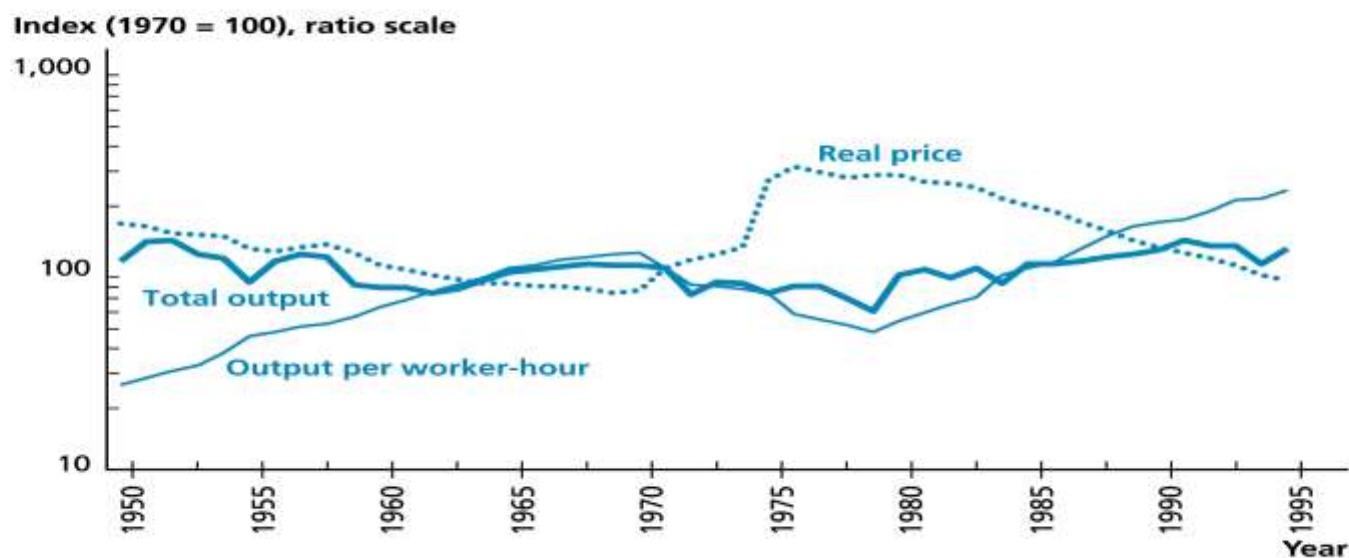
- ❑ The provision of **health care** services is subject to a huge amount of comparative research on efficiency.
- ❑ Enormous productivity differences have been measured between USA states.
- ❑ One study: Health care spending in Miami is 3X that of Honolulu (adjusted for age) with no noticeable difference in results.
- ❑ Such large differences can only be attributed to efficiency differences.
- ❑ Such efficiency diff. are attributed to diff. in health care provision organization, incentive schemes, etc.

6. Coal mines USA 1949-94

- ❑ 1969-78: Output per worker drops by half, i.e. same output with double the number of workers.
- ❑ Not due to technology. People don't forget how to produce.
- ❑ Drop in efficiency is sole answer. How can this happen?

FIGURE 10.2

U.S. Subsurface Coal Mining: Output, Price, and Output per Worker-Hour, 1949–1994



Coal mines USA 1949-94

Proposed explanation :

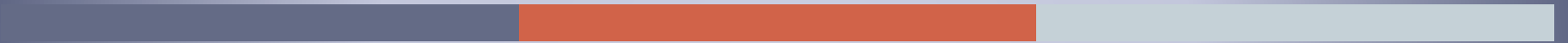
- The increase in oil prices led to higher coal prices, which led to higher profits in coal industry.
- Worker unions gained bargaining power: All else equal, when a firm makes more profits, a workers' strike causes larger losses to firm.
- It appears that unions in the coal sector have used this added power to increase the number of hired workers (instead of higher salaries).
- When oil prices dropped in the early 1980s, unions lost that negotiation power with threat of closing mines. Productivity increased thereafter.

Don't forget!

People react to incentives!

- This is true for all: CEOs, fishers, Wall street traders, union leaders, doctors, politicians, students, peasants, development aid receivers and givers, ...
- If a firm owner can make more profits by blocking entry to competitors, we have to expect that he will try to do it. This is why our competition laws forbid this.
- If firm profits increase, we can expect union leaders to ask more from firm owners.

A taxonomy of inefficiencies



A taxonomy of inefficiencies

The following classification is neither perfect, nor comprehensive. But it can help us recognize inefficiencies.

1. Unproductive activities
2. Under-used resources
3. Misallocation of factors between sectors
4. Misallocation of factors between firms
5. Technology blocking

1. Unproductive activities

Activities that do not create any new wealth, but are nonetheless undertaken in order to enrich someone.

- They seek to redistribute wealth.
- For any individual, there are essentially two ways of becoming richer:
 1. By creating new wealth, i.e. increase the size of the pie.
 2. By appropriating someone else's wealth, i.e. take a larger share of an existing pie.

Unproductive activities

Such activities are often illegal.

- ❑ Thieves redistribute wealth without creating any.
- ❑ Resources are wasted because their time could be used to produce additional wealth.
- ❑ Potential victims also waste resources in protecting themselves: leave work before dark, lock doors, bars on windows, etc. Such activities seek to redistribute wealth towards their “rightful” owner; they are unproductive nonetheless.
- ❑ Crime can lead to large inefficiency losses.

Unproductive activities

- ❑ Estimation Russia 1992: A typical retailer spends 20% of his income to “protection” (usually against those that are being paid for it).
- ❑ Angola: 25 years of civil war fuelled by control over natural resources.
- ❑ FARC et paramilitaries in Colombia fighting over territorial control.

Unproductive activities

Not necessarily illegal.

- ❑ *Rent seeking activities* : When individuals influence the law or the government for personal gains.
- ❑ There is a “rent” when the return from a factor is above the normal return. For instance, when a firm has a right of monopoly over a market or a unique license to exploit a resource.

Unproductive activities

- Example: An import quota can bring large benefits to its owner.
- Firm managers can spend a lot of resources in trying to influence governments:
 - Trips to the capital
 - Hiring a member of the presidential family
 - Hiring a former civil servant
 - Bribes
- A lot of scarce *human capital* can be wasted in lobbying activities.
- In a way, the more the state controls the economy, the more opportunities for lobbying there will be.

Unproductive activities

The Chicago School

- ❑ Any type of government intervention becomes suspicious, even when there is a real problem to fix.
- ❑ The argument is based on the idea that regulation generates lobbying opportunities.
- ❑ This opens the door for corruption, arbitrary redistribution of wealth, etc.
- ❑ In this view, the cure may be worse than the disease.
- ❑ It even applies to competition laws.
- ❑ (NY Times 2006) *Vague Law and Hard Lobbying Add Up to Billions for Big Oil*

2. Under-used resources

1. Unemployment
2. Unused capital: Stores in Moscow in the early 1990's had "too many owners".
3. Agricultural land in Zimbabwe left unused after reform.

Under-used resources

Depression in the 1930s:

- ❑ USA: GDP decreased by 30% between 29 and 33.
- ❑ Efficiency 1933 = 70% that of 1929 (same factors and technology).
- ❑ Recessions keep occurring.

Under-used resources

Large state enterprises

- ❑ Often used by politicians in LDCs for political favors.
- ❑ They end up with too many employees.
- ❑ The competence of directors is not being questioned.
- ❑ Those who gain are usually not the poorest, rather those who have connections with state officials, i.e. the elites.
- ❑ Deficits are frequent and borne by the whole population: inflation, taxes, import quotas, eviction of international aid, etc.
- ❑ This type of inefficiency causes a transfer of wealth from one person to another.
- ❑ Those who benefit may be better off, but the rest of society loses.

Under-used resources

Large state enterprises

- Those problems tend to be less serious within free, democratic, developed societies.
 1. Democracy: Politicians are made accountable for bad management.
 2. Freedom of press and opposition spot the troubles.
 3. Educated population cannot be fooled for long.
- Note the similarity between democracy and competition:
 - With democracy, political competition replaces bad politicians.
 - Economic competition does the same with firms.

Under-used resources

Misallocation of resources

- ❑ In some countries, unproductive land can be confiscated for redistribution to landless peasants.
- ❑ Un-cleared land was declared unproductive.
- ❑ In order to secure ownership, land owners reacted by cutting down the trees.
- ❑ A lot of past deforestation of tropical forests can be explained this way. Often, the standing forest had more value than the cleared land.
- ❑ Clearing the land was a way to ascertain ownership. This is a redistributive activity because it does not create new wealth. It can even destroy wealth.

3. Misallocation of factors between sectors

- How should labor be distributed between urban and rural sectors?
- (Take note.)
- Efficiency calls for equality of marginal products. Otherwise, there is a deadweight loss.
- A well functioning, competitive labor market should get close to that outcome:
 - Firms pay labor at its marginal productivity.
 - Workers go where salaries are highest. (freedom)
 - In equilibrium, salaries and productivities will be equalized between sectors.
 - Adam Smith's *invisible hand*...

Misallocation of factors between sectors

- ❑ So what can prevent a good allocation of labor between sectors?
 - ❑ A look at **sharing rules** within the family farms.
 - Formal salaried work.
- versus
- Farm income divided equally between family members.

Misallocation of factors between sectors

Sharing rules within the family farms

- When farm income divided equally between family members, income is expressed in terms of *average income*.
- Data concerning production function on family farm:

number of workers	total output	marginal output	average output
1	100\$	100	100
2	175	75	87,50
3	225	50	75,00

- With decreasing returns to labor, average output exceeds marginal output.

Misallocation of factors between sectors

Sharing rules within the family farms

- ❑ Assume urban salary is 65\$.
- ❑ Question: How many workers should stay on the farm?
- ❑ In order to maximize family total income, it is the marginal income that matters.
- ❑ Question: Will the 3rd worker go to town?

Misallocation of factors between sectors

- ❑ Movements of workers can have a large effect on growth.
- ❑ Taiwan 66-91: For an average per capita income growth of 5.4%, 0.7% would be caused by rural workers moving to the city.
- ❑ Rural out-migration may have a large effect on growth.
 - USA 1880: 50% of labor is rural and receives a salary 20% that of manufacturing sector.
 - USA 1980: 3% of labor is rural and receives 69% of manufacturing sector salary.
 - In China, average income in coastal provinces is twice higher than interior provinces.
 - Rural-urban migration may explain a lot of China's recent growth.

Misallocation of factors between sectors

- ❑ A similar argument has been made regarding the segregation of the labor market in favor of white males and against women and African Americans.
- ❑ According to a recent study, “20% of the growth of average wages in the USA over the period 1960-2008 was the result of the reduction in barriers to the efficient allocation of labor for women and African Americans.”

4. Misallocation of factors among firms

- For various reasons, some firms tend to be more productive than others:
 - better technology
 - better organization
 - better management
- In a truly competitive environment, less productive firms must improve or they will disappear.
- This insures that factors are used efficiently.
- Sometimes, conditions impede this type of resource allocation to take place. Three examples:
 - i. Collusion between firms to keep prices high.
 - ii. Monopoly position of a firm, i.e. no competitor.
 - iii. Government help in the form of subsidies, favorable contracts, protection against foreign competitors, etc.

Misallocation of factors among firms

Collusion: By distorting competition, less productive firms “hang on” to resources that could be made available to more productive firms.

- Monopoly: More of the same.
- Types of inefficiencies:
 - Inefficiently low output to keep prices high.
 - Low incentives to innovate.
 - Low incentives to offer good quality products, reliable service, friendly service, etc.
 - Power to influence the politicians

Note the similarities between monopoly and state firms.

Misallocation of factors between firms

Keep in mind:

- ❑ “Market economy” does not signify “protection of large, dominant firms”. Much the contrary.
- ❑ Substantially, it means that all firms must be facing the **threat of entry** by potential competitors.
- ❑ This means that through competition (free entry), the presence of a large, dominant firm can only be justified by its higher efficiency.
- ❑ Activities that seek to distort competition are illegal. (Criminal in the USA and EU.)

What is the Competition Bureau?

(http://www.competitionbureau.gc.ca/cic/site/cb-bc.nsf/eng/h_00125.html)

- ❑ Its role is to promote and maintain fair competition so that all Canadians can benefit from competitive prices, product choice and quality services.
- ❑ The basic operating assumption of the Competition Bureau is that competition is good for both business and consumers.
- ❑ According to the CB, “fair” competition:
 - makes the economy work more efficiently;
 - strengthens businesses' ability to adapt and compete in global markets;
 - gives small and medium businesses an equitable chance to compete and participate in the economy;
 - provides consumers with competitive prices, product choices and the information they need to make informed purchasing decisions; and
 - balances the interests of consumers and producers, wholesalers and retailers, dominant players and minor players, the public interest and the private interest.

Misallocation of factors among firms

The financial system

- The same argument that has been made regarding the misallocation of labor between sectors can be made for the allocation of capital between firms.
- The main **function of the financial system** is to pool the savings of people who have no good project and redirect it to people who have the projects that are most valuable to society.
- The principal actors are the **banking sector** and the **stock market**.

Misallocation of factors among firms

The financial system

- A well-functioning financial system cannot be taken for granted. It must resolve the following problems:
 1. Make it possible for investors/lenders to identify the best projects. (information problem)
 2. Make it possible to monitor the outcomes. (asymmetric information problem)
 3. Lenders/investors have the incentive to seek the best projects. (moral hazard)
 4. Make sure savers/investors are remunerated for their investment and risks. (property rights)
- The 2007-08 crisis is largely explained by a failure in point 3 (moral hazard). Those who decided on mortgage lending did not suffer the consequences of lending to people who could not pay back.

5. Technology blocking

- History is replete with examples of individuals trying to block adoption of better technology.
- Gutenberg printing press (1453):
 - Threatens scribes' jobs.
 - Printed Bibles were 5X cheaper.
 - Their introduction was delayed 20 years in Paris.
- Luddites: Textile workers in England.
 - Mechanization threatens jobs in 1793.
 - Riots in 1811: 800 looms destroyed.
 - 1812:
 - machine destruction is punished by death penalty
 - 12,000 soldiers required to control riots and 17 Luddites were hanged.
- Microsoft was accused of doing similar stuff...

Technology blocking

- Technology improvements bring about social benefits.
- Nevertheless, some groups may try to block it because they stand to lose. (creative destruction)
- Typical problem:
 - Losing groups are small, pre-existing, well identified, and lose a lot individually. They have large incentives to organize blockage. They include firms as well as workers.
 - Gainers are not well identified, come in the future (might not even exist yet), diluted among large population. Incentives to respond are low.

People react to incentives.

- Outcome will also depend on relative power.

Conclusion

- The problem of inefficiency is important.
- It is difficult to observe and thus difficult to provide a good, all-encompassing theory for it.
- From the examples seen, we know that *institutions* play a crucial role.
- Institutions define the rules of the game:
 - People are not fundamentally different: No-one is happy to see resources being wasted.
 - People just react to incentives provided by laws, regulations, norms, culture, etc.

Differences come from the way institutional arrangements remunerate unproductive activities relative to productive ones.