



Adam Smith
Economist and Philosopher
1723 - 1790

**“Virtue is more to be feared than vice,
because its excesses are not subject to
the regulation of conscience.”**

—Adam Smith

How Economics is Changing the Face of Engineering

Don Morris

The Migration of Engineering

- Why is it happening?
- What about jobs?
- What could or should be done?
- The future

Is this a new phenomenon?

What activity are we talking about?

- Invention
 - Design
 - Manufacturing
 - Support
 - Sales
-
- As professionals, we are involved in all of these activities, and they are not easily separable.

We are dealing with the movement of **knowledge**, **skills**, and **production** from an area of development to somewhere else.

Some History

- Ceramics & Porcelain
- Ships
- Iron and Steel Making (Results Only)
- Automobiles (Skip)
- Televisions

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Ceramics and Porcelain

- Developed first in China circa 200 C.E.
- Crude imitations in Europe 1500s and 1600s
- The “Formula” was discovered in Europe:
by J.F. Bottger in 1709
- China continued to restrict access to the
products and technology





Ceramics and Porcelain

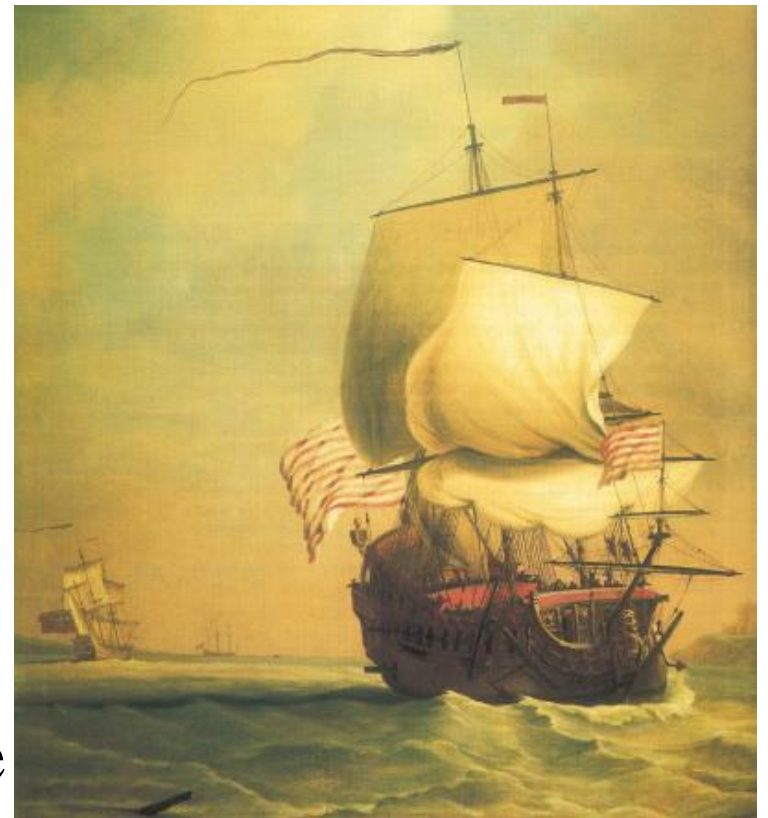
- Josiah Wedgwood creates a new process in England in 1763
- England became the source of the finest “china”
- The technology did move to be closer to the customers

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High Tech Ships of the times

- The East Indiaman
- Average speed was 3 to 4 knots
- With enough wind, 5 to 6 knots
- Heavily armed against pirates
- Huge cargo capacity
- “World Class” shipping rates
- Only built in the British Empire



Shipbuilding in 1700

- America (not yet the US) was becoming a shipbuilding outpost for the British Empire and the world.
- Not great ships, but adequate (for the price)
- Priced at 50% of European prices
- Cheap labor
- Lots of great timber supplies!

Shipping Laws

- In 1786 British Navigation Laws for US (to 1859)
- In 1793 US built ships barred from France
- In 1817 US version passed (until 1951)

American situation

- American ship builders are shut out by protectionist laws from most shippers
- Only American shippers for customers
- Could almost duplicate world class ships
- American shippers could not compete on cost or tonnage hauled and therefore not effective on the world markets

What Happened?

- Four young Americans, Nat Palmer, 37, Edward Collins, 34, John Griffiths, 27, and Donald McKay, 26, had some ideas about shipbuilding and shipping.
- Speed was the only open niche left for new entrants to the market

The Clipper Ship

- 15 to 20 knots
- 460 miles per day
- 80 days to Hong Kong
- End of the East Indiamen
- Later duplicated by the British and Australians, but too late!



Results

- America turned the world upside down!
- Protectionist moves by the great shipping powers sent their industries into decline
- Technology did move to the location of lowest production cost anyway
- In 1859 Britain had to relent on importing ships

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Historical Subroutine

- Iron and Steel Making
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Adam Smith

1723-1790



In the The Wealth of Nations he showed that all endeavors are subject to the “laws” of economics , and provided a strong foundation that is still the preeminent book on the subject.

*...every individual necessarily labours to render the annual revenue of the society as great as he can. ... and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an **invisible hand** to promote an end which was no part of his intention.*

Continued

By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.

-Adam Smith

The Director

- Most people refer to the “invisible Hand”
- When I think of “the hand”,
it is simply the



Cold, Dead Hand of Adam Smith

David Ricardo

1772-1823



- He read The Wealth of Nations in 1799
- Wrote papers on “comparative costs” in 1815
- He showed that trade between countries increased the wealth of both countries, even if *Poorland* is at a disadvantage on **all** products, or if they are the low cost producer of all products.

Some History

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- **Iron and Steel Making** (Skip to Results)
- Automobiles
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Iron & Steel Industry Results

- Most of the iron and steel making capacity has moved over time.
- Subsidies have hurt the countries using them.
- Investments made for national ego have been wasted.
- Ultimately, the cold, dead hand of Adam Smith has determined where the industries will survive!

Some History

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Television Production

- Now a mature industry
- Innovation brings unique products that are able to temporarily command a premium price.
- Televisions are, for the most part, a commodity item.

Results

- Innovative products will be produced in the place of Comparative Advantage
- Commodity products tend to differentiate only on price and will move to the location of lowest cost to the end user.

The Migration of Engineering

- **Why is it happening?**
 - What about jobs?
 - What could or should be done?
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The Controlling Factors

- **Economics** will rule under normal conditions and will not be ignored, no matter how hard anyone tries.
- **Innovation** will start a new sequence of economic development, as with new porcelain finishes or new and better designs such as the Clipper ships.

The Migration of Engineering

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engineering jobs?

Are the rules still the same for engineering?

- Can things simply dissipate from the rich country with no long term advantage?

The Problem

What if the poorer country begins trade with a richer country such that both benefit, but then technological progress in the poorer country allows them to begin producing the same products as bought from the richer country, except at a lower cost?

An example

- Computers are manufactured in China and sold in both China and the US.
- Semiconductors, especially VLSI, are produced in the US and are mostly exported to Asia.

What next?

- China begins producing more and more semiconductors at world's lowest costs.
- The complexity of the ICs increases with time
- Then a processor manufacturer (probably not the lead vendor) moves a design to China.

Does everybody still win?

- The market price of all semiconductors has now declined below the richer country's export product cost!

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- The market price of all semiconductors has now declined below the richer country's export product cost!
- Is the poorer country winning at the expense of the richer country?

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- The fear of “Win-Lose” is much more prevalent than the reality.
- Very few examples of the richer losing out

In the 1950s

- Europe was worried that American growth would forever stifle them... didn't happen.
- As the standards of living remained similar, the comparative advantage allowed all to trade with mutual gain.

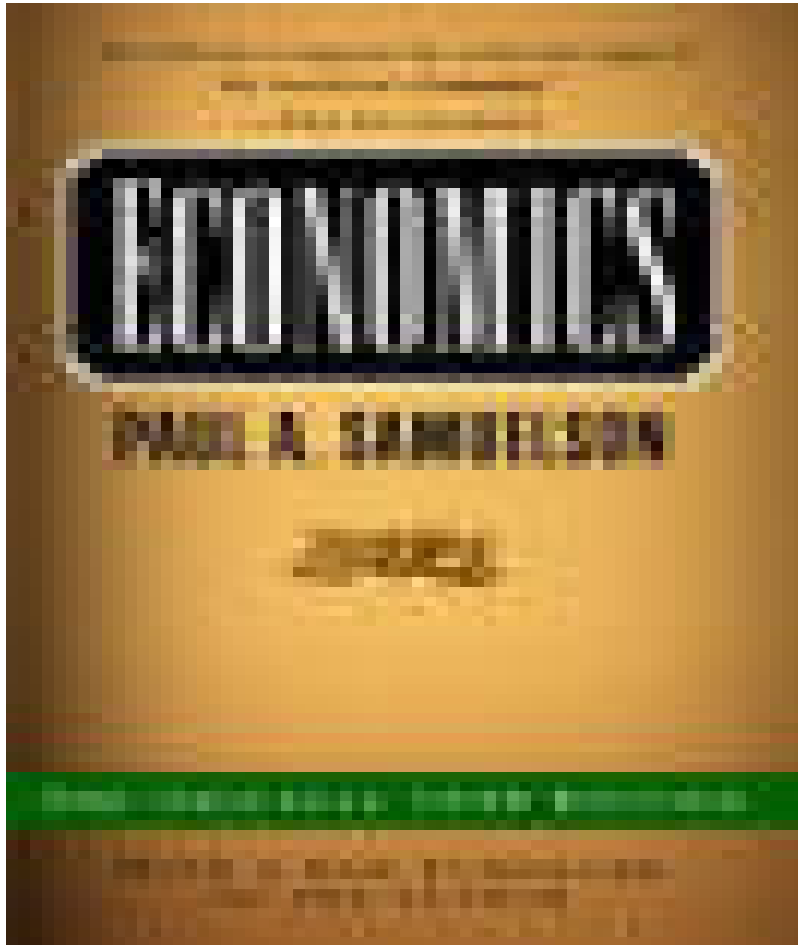
Note: Ricardo's comparative cost is now comparative advantage.

In the 1960s and 1970s

- America was worried that Japan was taking every manufacturing job in sight...
- Even Japan began to believe their economy was invincible (The Japan That Can Say No)
- Then along comes the hand of Adam Smith!
- Once again, trade is mutually beneficial.

Paul Samuelson

1915- .



Paul Samuelson

- Ricardo was right, even these modern methods of trade will yield overall gain
- It is possible for one side to lose totally, but it can be avoided.
- The economists don't say how to avoid it...

Who wins, who loses?

- This is a current debate amongst economists
- The fear of “Win-Lose” is much more prevalent than the reality.
- Very few examples of the richer losing out
- The loser in the Win-Lose game may have lost for other reasons

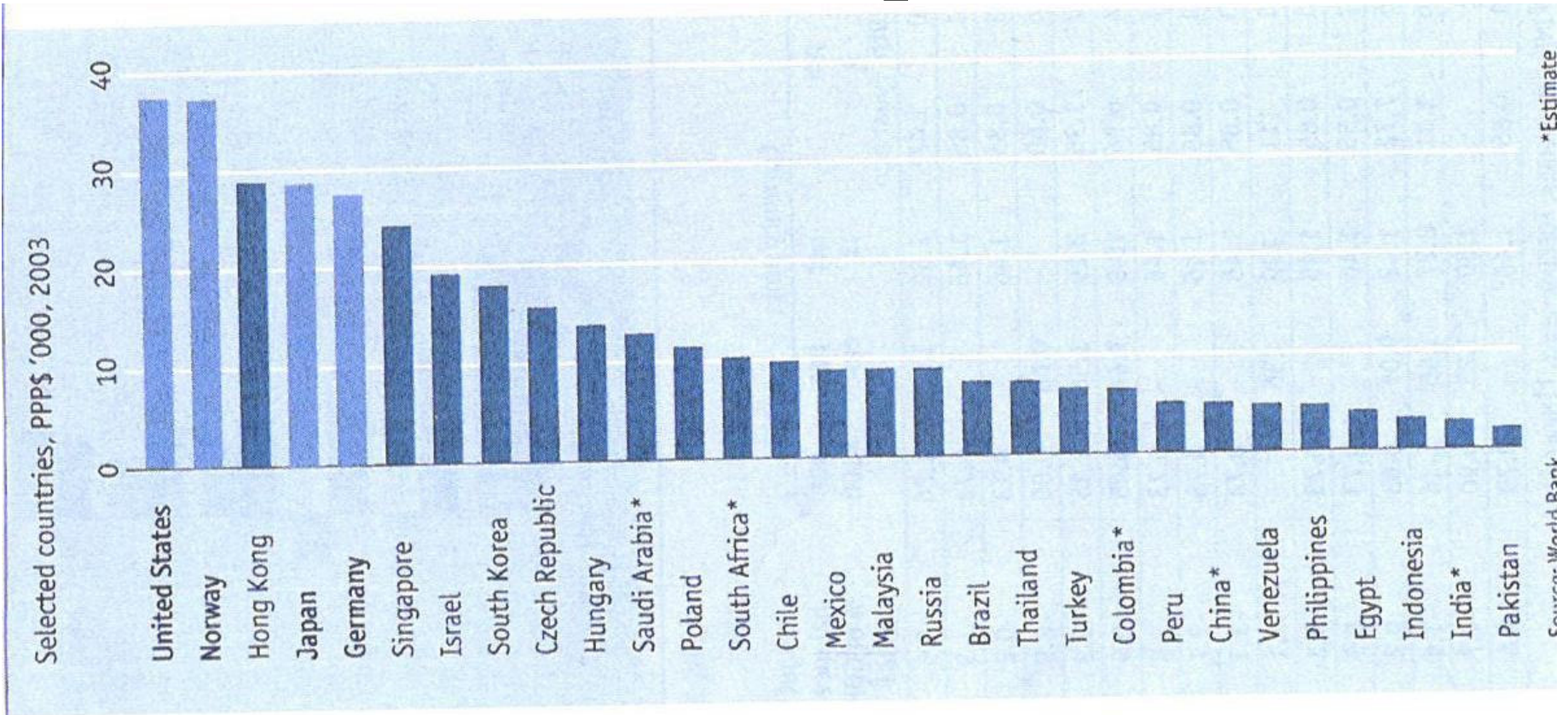
How to fail

- Protectionist regulations
- Tariffs
- Refuse to change
- Ignore legitimate economic issues
- Quit growing, learning, and improving

Innovation is the key

- When a job is transferred a new one must appear which is of greater comparative value.
- Companies will layoff unneeded workers.
- Companies will hire workers for new needs.
- The solution is for the current workers to be the best candidates available.

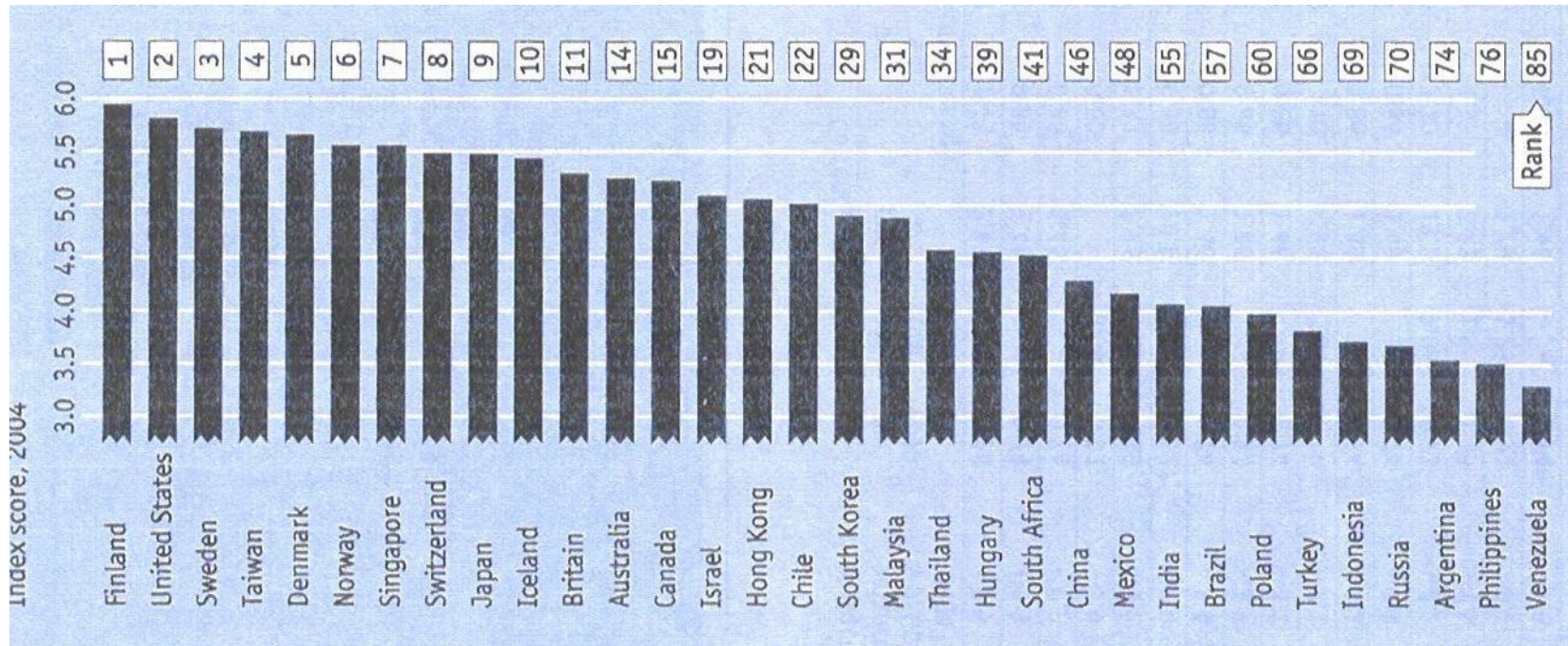
Relative Costs per Person



GDP per person

Measured on a purchasing power parity (PPP) basis, which takes account of exchange-rate fluctuations, Singapore's GDP per head in 2003 was only around 14% less than Germany's, according to recent estimates from the World Bank. Hong Kong remains the richest emerging economy regularly tracked by *The Economist*. It had an income per head in 2003 of \$28,810, compared with America's \$37,500. China has leapfrogged Venezuela since last year's estimates were published. Its income per head now stands at almost \$5,000. India, despite rapid growth, still trails Indonesia.

Overall Competitiveness



Growth competitiveness

Finland again tops the World Economic Forum's league table of global competitiveness, followed by the United States. Of the ten highest-ranked countries, five are Nordic. Despite high taxes, these countries receive high marks for the quality of their public services and macroeconomic policy, including budget surpluses, areas in which America mostly scores lower. Thanks partly to its economic recovery, Japan moved up to ninth place from 21st in 2001.

How to survive

- An example company I know and respect greatly

How to survive

- Transfer jobs out before the competition

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- Utilize the freed capacity and incremental profit to develop the next product that is too sophisticated to transfer yet.

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- Transfer out before the competition does
- Make money from the change
- Utilize the freed capacity and incremental profit to develop the next product that is too sophisticated to transfer yet.
- Build products and services that span the geographies and exploit the comparative advantage of each site!

The World Changes

... and you must either react successfully to these changes or disappear.

My solution

- Initiate change yourself

My solution

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- Go into the marketplace, kick ass, and take charge. This means continual renewal of your skills base, technology and product offering.

My solution

- Initiate change yourself
- Go into the marketplace, kick ass, and take charge.
- Then the competition will be reacting to you! Not you reacting to them.

Summary

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- Jobs, technology, and commercial activities will always be moving towards the comparative advantage.
- Never fight with these inevitable changes.
- Foresee the trends and position your new skills and products to be useful and competitive.

There is a tide in the affairs of men,
Which taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and miseries.

Julius Caesar Act IV
by William
Shakespeare

There is a tide in the affairs of men,
Which taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and miseries.
On such a full sea are we now afloat,
And we must take the current when it serves,
Or lose our ventures."

Julius Caesar Act IV
by William
Shakespeare

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The title is actually longer (An Inquiry into the Nature and Causes of the Wealth of Nations), but the shortened title is normally used.

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