China: Growth and Pollution

Growth – the Good

- Consistent growth rates of approximately 10% per year
- Vast improvement in per capita income
- Millions of people pulled out of poverty
- Increased choices and freedom
- Reduction in illiteracy
- Dramatic increase in post-secondary education
China: Growth and Pollution

- Growth – the Bad
  - Increasing income inequality
    - GINI coefficient rapidly increasing (World Bank)
      - 1981 (income) 31.0
      - 2003 (income) 45.3
      - 2003 (consumption) 47.4
      - U.S. 2000 (income) 38.0
  - Note: The GINI coefficient is a measure of the inequality of the distribution of income in a country in which 0 would indicate total equality and 1 would indicate total inequality. Examples from the CIA World Factbook, Sweden (23) and Nambia (70.7). It is an index and hence does not have a unit assigned.
China: Growth and Pollution

- Growth – the Bad
  - Forced migration of millions
    - 1.13 million displaced by Three Gorges Dam
  - Dislocation and rapid urbanization
  - 40% of mammal species endangered; 70% nonflowering plant and 86% flowering plant species threatened
China: Growth and Pollution

- Growth – the Ugly – Pollution (Picture from Google images)
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Environmental Issues in China

- Water – shortage

- Per-capita water supply about a quarter of the global average
- China has the most ambitious cloud-seeding program in the world
- Water was free until 1985, still conservation and efficiency are alien concepts
- Of 660 cities in China, more than 400 lack sufficient water and more than 100 suffer severe shortages
- 7% of world's water resources and about 20% of its population
- Water imbalance with approximately 80% in south
Water

- Water – Pollution
  - 25% of rivers, lakes and streams too contaminated to use for drinking water
  - 80% of rivers in Shanxi province rated unsuitable for human contact
  - 2010 Ministry of Environmental Protection said 43.2% of state-monitored rivers were classified as grade 4 or worse, which means unsuitable for human contact; it was 42.7% in 2009
  - 70% of China’s seven major rivers are severely polluted
  - Nearly 500 million lack access to safe drinking water
  - Polluted water used in irrigation costs 7 billion yuan annually
Air – Pollution

- Despite massive efforts, particulates in Beijing violated WHO standards more than 80% of the time in the last quarter 2008.
- Acid rain a problem in nearly 200 of 440 cities monitored.
- Acid rain costs 30 billion yuan in crop damage and 7 billion yuan in material damage annually (SEPA).
- Beijing residents buying on average 1,900 new cars a day in the first half of 2010.
- 16 of the world’s 20 most polluted cities in China (World Bank).
Cost of Pollution

- World Bank analyzed the cost of air and water pollution
  - 362 billion yuan in 2003
    - Using adjusted human capital approach, this is about 2.68% of GDP
    - Using the value of statistical life approach from studies in Shanghai and Chongqing, the amount goes up to 781 billion yuan or 5.78% of GDP
Growth and Pollution Costs in Lives

- World Bank study with China’s State Environmental Protection Agency (2007)
  - Outdoor Air Pollution 350,000 to 400,000 premature deaths per year
  - Indoor Air Pollution an addition 300,000 premature deaths
  - Diarrhea, bladder infections and other diseases that can come from water-borne pollution 60,000
  - 4,700 deaths from notoriously unsafe mines
  - 89,000 people killed in road accidents per year, the highest number of automobile-related deaths in the world
Markets and Efficiency

- Requirements for efficient markets to operate:
  - Buyers and sellers are well informed
    - No asymmetric information
  - Markets are perfectly competitive
    - No monopoly power in the market
  - Supply curve measures all relevant costs
    - No negative externalities
    - Not a Common Resource (Rivaled and Non-excludable)*
  - Demand curve measures all relevant benefits
    - No positive externalities
    - Not a Public Good (Non-rivaled and Non-excludable)*
Markets and Efficiency

* Note:

- Rivaled: the property of a good in which one person’s use diminishes other people’s use of that good
  - If I am eating a slice of pizza, you cannot be eating the same slice
  - If I am using the pen, you cannot be using the pen at the same time
- Excludable: the property of a good in which a person can be prevented from using the good
  - If you do not pay for your pizza, you will not receive it
  - If you do not pay for your cable TV, the company will turn it off
Externalities

- An indirect or unintended cost or benefit that producers and consumers don't take into account
  - The cost or benefit affects a third party—not involved in the transaction
    - An electric utility creates an external cost by burning coal that creates acid rain
      - People downwind experience “costs” such as lower crop yields, higher health costs, etc.
      - The utility doesn’t consider this cost when it chooses the quantity of power to produce
      - The customer doesn’t consider this cost when it chooses the quantity of power to consume
Externalities

- An external cost is a “negative externality”
  - A cost of an activity received by people other than those who pursue the activity

- Examples
  - Pollution, Noise, Congestion, Second-Hand Smoke
Externalities

- An external *benefit* is a “positive externality”
  - A benefit of an activity received by people other than those who pursue the activity
- Examples
  - Education, yard beautification, immunizations
  - A homeowner plants trees and flowers that the neighbors get to enjoy
Effect of a Negative Externality

- How do we measure the economic impact?
  - How do we know that there is an inefficiency?

- Marginal Costs
  - Marginal Private Cost = Cost to producer (MC or MPC)
  - Marginal External Cost = Cost that is not borne by producer
    - Pollution cleanup costs or health care costs
  - Marginal Social Cost (MSC) is marginal private cost + marginal external cost
    - The total costs borne by the entire society
      - The producer + everyone else
Negative Externality – Coal Generated Electricity
Effect of a Negative Externality

■ If the market is left alone, the quantity produced will be too high from society’s point of view.

■ If the producer of a negative externality is required to “internalize” the externality, we would move to the socially optimal price and quantity.

■ Typical solutions involve
  ■ Regulation
  ■ Taxes on the product or the externality
  ■ Selling pollution permits
China-Solutions: Negative Externalities

- China has used regulations – but enforcement is poor

- February 2010 when the Pollution Census was reported, Chinese officials said they were “studying the possibility of a pollution tax.”

- October 2010, *The Wall Street Journal* reported PetroChina entered the carbon trading market

- It appears that the tools China is employing to control pollution are evolving
Effect of a Positive Externality

- Marginal Social Benefit
  - Marginal Private Benefit = Direct benefit to the consumer
    - Example: Education leads to better pay
      - Studies show that each additional year of school increases a worker’s wage rate by as much as 12-16%
  - Marginal External Benefit = Benefit to society (or at least part of society) that is not directly received by the consumer
    - Better communication skills
    - Lower crime rates and higher tolerance levels
- Marginal Social Benefit (MSB) is marginal benefit + external benefit
- Example: Flu Shots
Price

Positive Externality—added health of flu shots

Quantity

Ext. Benefit

$S = MC$

$D = MB$

$MSB$

$P^e$

$P^{soc}$

$Q^e$

$Q^{soc}$

$Q_e$

$Q_{soc}$
Effect of a Positive Externality

- If the market is left alone, the quantity produced will be too low from society’s point of view.

- To move from the market equilibrium to the socially optimal price and quantity requires some method to encourage an increase in production.

- Typical solutions involve:
  - Regulation / Public provision
  - Subsidy
  - Voucher
  - Patent and copyright
Solutions: Positive Externalities

- Public provision
  - The production of a good or service by a public authority that receives the bulk of its revenue from the government
- Subsidy
  - A payment that the government makes to private producers to cover part of the costs of production
- Voucher
  - A token that the government provides to households that can be used to buy specified goods or services
- Patent or copyright
  - A government-sanctioned exclusive right granted to the inventor of a good, service, or productive process to produce, use, and sell the invention for a given number of years
China-Solutions: Positive Externalities

- **Education**
  - Nine years of mandatory education
  - Dramatic expansion of post-secondary education opportunities

- **Beautification**
  - Large numbers of trees have been planted in the cities, improving the appearance and the environment

- **Health Care**
  - China’s recent move toward privatization of health care, may be moving in the opposite direction and lowering the positive externality effects
Externalities

- Externalities result in a failure of the *free market* to allocate efficiently
  - Results: overproduction of goods that produce negative externalities
  - Results: underproduction of goods that produce positive externalities
- Without intervention, the Market Equilibrium will occur where MC or Marginal PRIVATE Cost (supply) equals MB or Marginal PRIVATE Benefit (demand)
- Efficiency, however, occurs where Marginal SOCIAL Cost, MSC, equals Marginal SOCIAL Benefit, MSB
- The government can add efficiency to the market by proper intervention