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)**

(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

- **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 trasaction**
    - **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

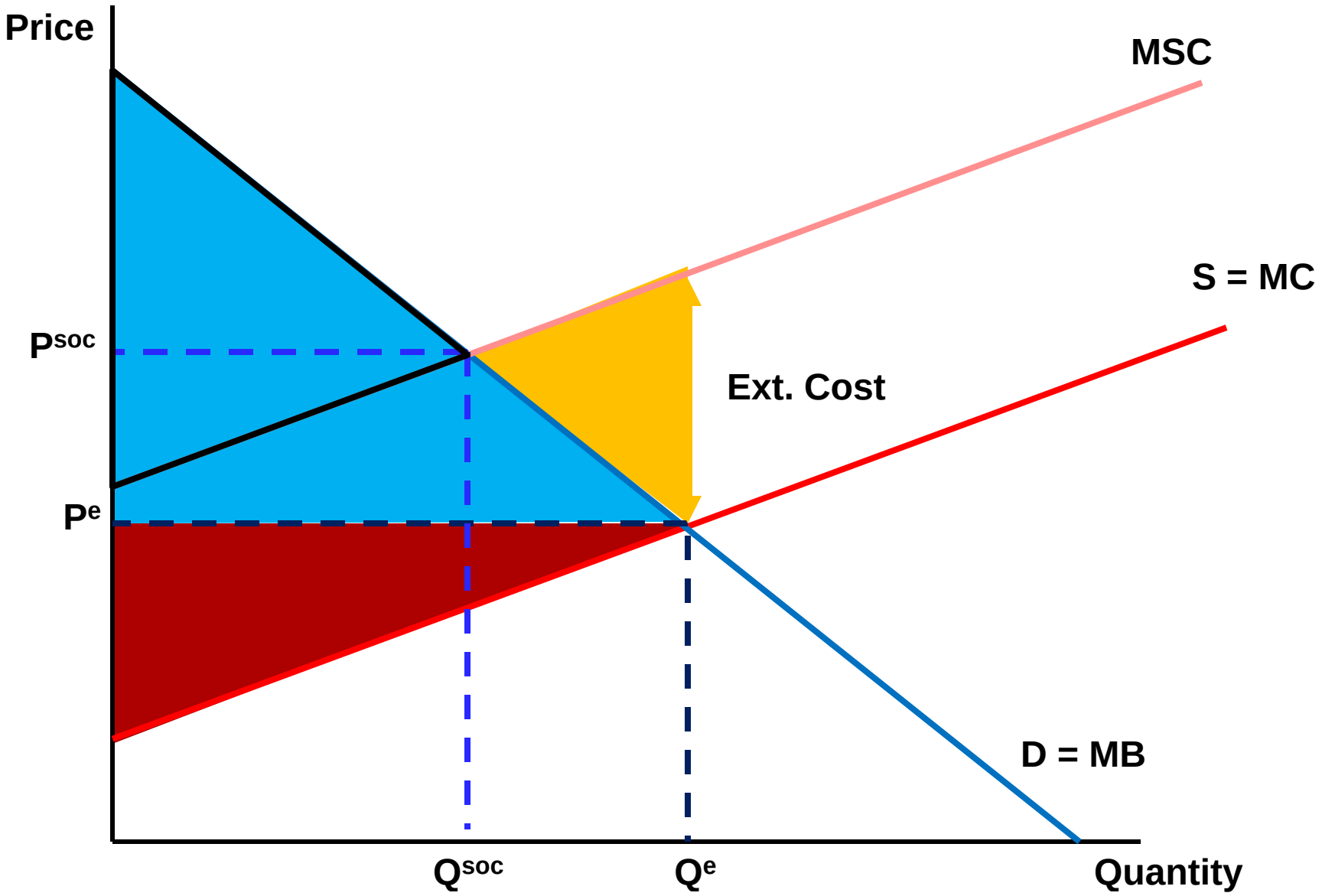
- **An external *cost* is a "negative externality"**
  - **A cost of an activity received by people other than those who pursue the activity**
- **Examples**
  - **Pollution, Noise, Congestion, Second-Hand Smoke**

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

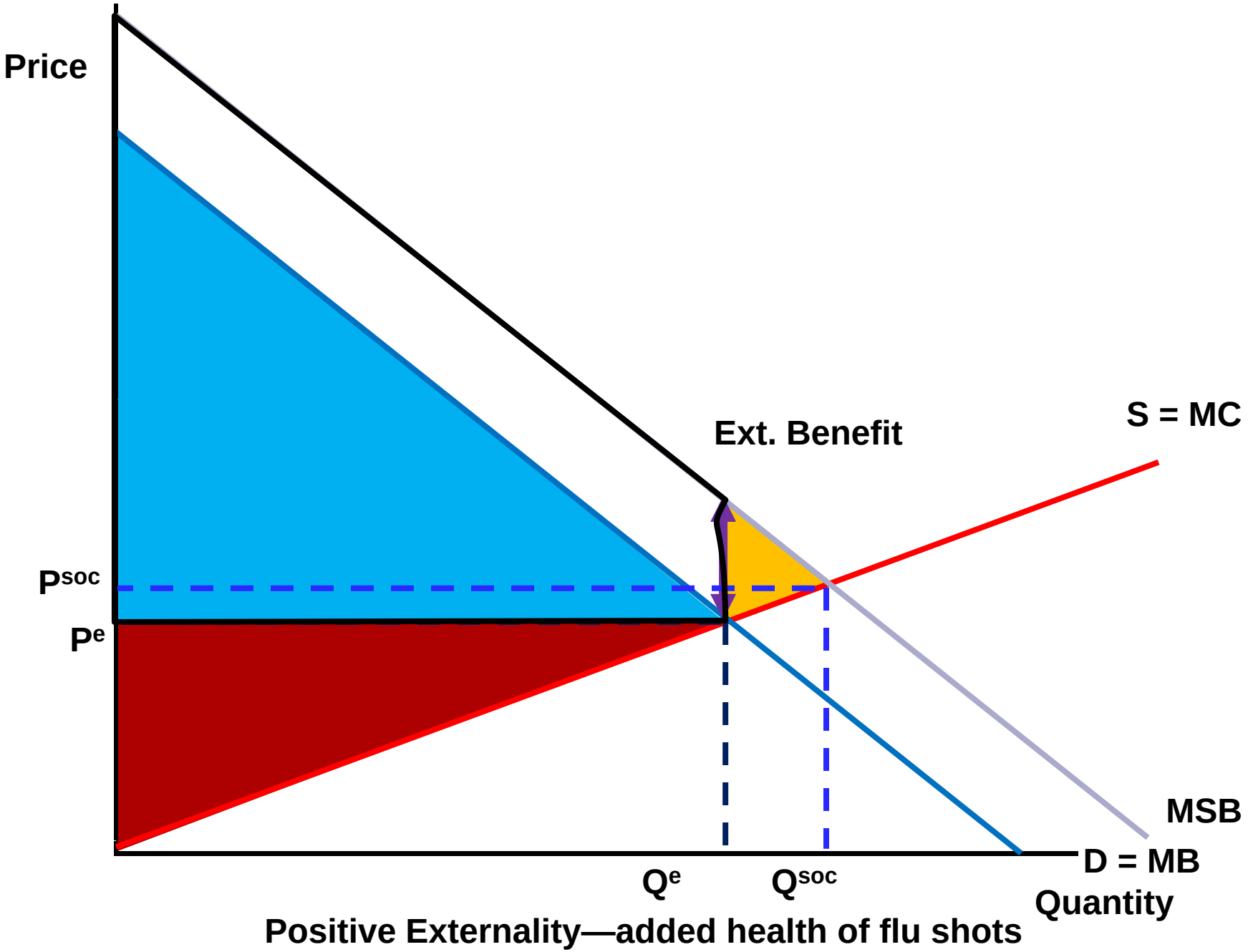
- **If the market is left alone, the quantity produced will be too high from society's point of view**
- **If the producer of a negative externality is required to "internalize" the externality, we would move to the socially optimal price and quantity**
- **Typical solutions involve**
  - **Regulation**
  - **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**



Positive Externality—added health of flu shots

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 <u>efficiency</u> to the market by proper intervention**