The Economics of Public Policy
5. Market Failures due to Externalities

Prof George Alogoskoufis
The Kyoto Protocol and the Paris Agreement

- The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gas emissions, based on the premise that (a) global warming exists and (b) human-made CO2 emissions have caused it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew effective December 2012) to the Protocol.

- The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Art. 2). The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

- The Protocol’s first commitment period started in 2008 and ended in 2012. A second commitment period was agreed on in 2012, known as the Doha Amendment to the protocol, in which 37 countries have binding targets: Australia, the European Union (and its 28 member states), Belarus, Iceland, Kazakhstan, Liechtenstein, Norway, Switzerland, and Ukraine. Belarus, Kazakhstan and Ukraine have stated that they may withdraw from the Protocol or not put into legal force the Amendment with second round targets. Japan, New Zealand and Russia have participated in Kyoto’s first-round but have not taken on new targets in the second commitment period. Other developed countries without second-round targets are Canada (which withdrew from the Kyoto Protocol in 2012) and the United States (which has not ratified the Protocol). As of July 2016, 66 states have accepted the Doha Amendment, while entry into force requires the acceptances of 144 states. Of the 37 countries with binding commitments, 7 have ratified.

- Negotiations were held in the framework of the yearly UNFCCC Climate Change Conferences on measures to be taken after the second commitment period ends in 2020. This resulted in the 2015 adoption of the Paris Agreement, which is a separate instrument under the UNFCCC rather than an amendment of the Kyoto protocol.
Global Warming

Global Mean Estimates based on Land and Ocean Data

- Annual Mean
- Lowess Smoothing

Temperature Anomaly (°C)

NASA GISS

1880 1900 1920 1940 1960 1980 2000 2020
Externalities

- Global warming due to emissions of greenhouse gases is a classic example of an externality.
- An externality occurs whenever the actions of one party make another party worse or better off, yet that party neither bears the costs, nor receives the benefits of its actions on the other.
- Externalities occur in many everyday interactions, and in many types of economic activity.
- Externalities are a classic example of a market failure and present a case and a justification for governments to intervene.
- In the United States, 168,974 federal employees, 5% of the total, are charged with dealing with environmental externalities, in agencies such as the Environmental Protection Agency (EPA) and the Department of the Interior.
The Theory of Externalities

- Externalities can arise either from the production process, or from the consumption process.
- We thus distinguish between production externalities and consumption externalities.
- Externalities can be either negative (imposing costs on others) or positive (generating benefits for others).
- Externalities were first articulated by the Cambridge (England) philosopher Henry Sidgwick, and were first formally analyzed and given prominence by the Cambridge (England) economist Arthur Cecil Pigou.
Arthur Cecil Pigou (18 November 1877 – 7 March 1959) was an English economist. His work covered various fields of economics, particularly welfare economics, but also included Business cycle theory, unemployment, public finance, index numbers, and measurement of national output.

In 1908 Pigou was elected Professor of Political Economy at the University of Cambridge in succession to Alfred Marshall. He held the post until 1943. As a teacher and builder of the school of economics at the University of Cambridge, he trained and influenced many Cambridge economists who went on to fill chairs of economics around the world.

Pigou’s most enduring contribution was *The Economics of Welfare*, 1920, in which he introduced the concept of externality and the idea that externality problems could be corrected by the imposition of a Pigovian tax. The externality concept remains central to modern public economics.
The Steel Plant and the Fishermen

❖ Consider a steel plant located next to a river. It produces steel, but a by-product of the production process, is “sludge” which is dumped into the river. The more steel is produced, the more “sludge” is dumped into the river.

❖ Further downstream is a fishing village. Since the steel plant started dumping “sludge” into the river, the “catch” of the fishermen has been reduced to a trickle of their previous catch.

❖ This scenario is a classic example of a negative production externality. Steel production imposes a cost on the fishermen, which the steel plant does not take into account into its production decisions.
A Negative Production Externality

[Diagram showing supply and demand curves with social and private marginal costs, highlighting social deadweight loss and overproduction.]
Implications of Negative Production Externalities

- Negative production externalities imply that the social marginal cost of production is higher than the private marginal cost of production.
- Since producers decide on the basis of the private marginal cost of production, there is over-production relative to the socially optimal volume of output.
- Prices are lower than what would be socially optimal, and hence in equilibrium there is also over-consumption.
- This over-production and over-consumption implies a social deadweight loss, since the increase in producer and consumer surplus is not enough to fully compensate for the external costs imposed by the externality on third parties.
- Thus, a negative production externality implies a market failure. The free market does not result in the socially optimal combination of prices and quantities, but in higher production and consumption than would be socially optimal.
A Negative Consumption Externality
Implications of Negative Consumption Externalities

- Negative consumption externalities imply that the social marginal utility of consumption is lower than the private marginal utility of consumption.
- Since consumers decide on the basis of the private marginal utility of consumption, there is over-consumption relative to the socially optimal volume.
- Prices are higher than what would be socially optimal, and hence in equilibrium there is also over-production.
- This over-production and over-consumption implies a social deadweight loss, since the increase in producer and consumer surplus is not enough to fully compensate for the external costs imposed by the externality on third parties.
- Thus, a negative consumption externality implies a market failure. The free market does not result in the socially optimal combination of prices and quantities, but in higher consumption and production than would be socially optimal.
A Positive Production Externality
Implications of Positive Production Externalities

- Positive production externalities imply that the social marginal cost of production is lower than the private marginal cost of production.
- Since producers decide on the basis of the private marginal cost of production, there is under-production relative to the socially optimal volume.
- Prices are higher than what would be socially optimal, and hence in equilibrium there is also under-consumption.
- This under-production and under-consumption implies a social deadweight loss, because of a lower social producers and consumers surplus.
- Thus, a positive production externality implies a market failure. The free market does not result in the socially optimal combination of prices and quantities, but in lower production and consumption than would be socially optimal.
A Positive Consumption Externality
Implications of Positive Consumption Externalities

- Positive consumption externalities imply that the social marginal utility of consumption is higher than the private marginal utility of consumption.

- Since consumers decide on the basis of the private marginal utility of consumption, there is *under-consumption* relative to the socially optimal volume.

- Prices are lower than what would be socially optimal, and hence in equilibrium there is also under-production.

- This under-production and under-consumption implies a social deadweight loss, because of a lower social producer and consumer surplus.

- Thus, a positive consumption externality implies a *market failure*. The free market does not result in the socially optimal combination of prices and quantities, but in lower consumption and production than would be socially optimal.
Private Solutions to Negative Externalities: The Coase Theorem

- In the steel plant and the fishermen example, the river was supposed to be common property. It belonged to neither the steel plant nor the fishermen.

- What if the fishermen owned the river? Then, they could force the steel firm to compensate them for every ton of steel, and the concomitant “sludge”, produced. In equilibrium, this would raise the private marginal cost to the firm to the equal to the social marginal cost, and would make the deadweight loss disappear.

- Even if the firm owned the river, the fishermen could offer to compensate it for restricting its production of steel, and “sludge”, making its private marginal cost equal to the social marginal cost in equilibrium. Again, the externality problem would be solved.

- This solution to the problem of externalities was suggested in 1960 by Ronald Coase. He suggested that externalities can be internalized, by establishing appropriate property rights. This type of solution is known as the Coase Theorem. This theorem suggests that in many cases the problem of externalities can be internalized by establishing appropriate property rights. Thus the Coase Theorem suggests a very limited role for government policy, that of establishing property rights.
Ronald Coase (29 December 1910 – 2 September 2013) was a British economist and author. He was for much of his life the Clifton R. Musser Professor Emeritus of Economics at the University of Chicago Law School, where he arrived in 1964 and remained for the rest of his life.

After studying with the University of London External Programme in 1927–29, Coase entered the London School of Economics, where he took courses with Arnold Plant. He received the Nobel Prize in Economics in 1991.

Coase, who believed economists should study real markets and not theoretical ones, established the case for the corporation as a means to pay the costs of operating a marketplace. Coase is best known for two articles in particular: "The Nature of the Firm" (1937), which introduces the concept of transaction costs to explain the nature and limits of firms, and "The Problem of Social Cost" (1960), which suggests that well-defined property rights could overcome the problems of externalities (see Coase theorem). Additionally, Coase's transaction costs approach is currently influential in modern organizational economics, where it was reintroduced by Oliver E. Williamson.
Problems with the Coase Solution

❖ *The Assignment Problem*: Assigning blame and determining appropriate damages is fraught with difficulties, especially when there is uncertainty and absence of full information, and there are many agents creating or being harmed by the externality.

❖ *The Holdout Problem*: It arises when property rights are held by more than one party. The shared property rights give each owner power over all the others. This can lead to a breakdown in the negotiations as each property owner tries to hold out and achieve a better private outcome for herself. In such a case the Coase solution breaks down.

❖ *The Free Rider Problem*: When an investment has a private cost but a collective benefit, individuals will under invest. They will try to free ride, by not paying their share of the cost. In equilibrium, everybody may try to free ride, and the Coase solution will break down.

❖ *Transaction Costs and Negotiation Problems*: Finally, the Coasian approach ignores the fundamental problem that it is hard to negotiate when there are large numbers of individuals on one or both sides of the negotiation. Even for small scale localized externalities there are negotiation problems. Imagine trying to pay someone to stop smoking in a restaurant. Or offering your next door neighbor money to reduce the volume of his music.

❖ *Bottom Line*: Some externalities can be internalized, but many cannot.
Public Sector Remedies for Externalities

- **Corrective ("Pigouvian") Taxation**: By imposing an appropriate tax on a production or consumption activity associated with a negative externality, in principle the government can achieve the socially optimal outcome. Such a solution was first proposed by Pigou.

- **Corrective Subsidies**: By providing a appropriate subsidy to a production or consumption activity associated with a positive externality, in principle, the government can achieve the socially optimal outcome.

- **Regulation**: By setting production or consumption restrictions, or by mandating minimum production or consumption levels, the government can again in principle achieve the socially optimal outcome.

Which of these methods will lead to the most effective outcome depends on a number of factors, such as the heterogeneity of the firms being regulated, the flexibility embedded in quantity regulation, the uncertainty over the costs of the reduction of externalities. Typically governments engage in all of these activities, but the mix differs from case to case.