

Economics of Innovation Lecture # 3 Market Failures

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The Invisible Hand

- A key reason why science and technology policy deserves our attention is that it often involves market failures.
- Types of market failures that occur in science and technology.
 - First, however, we look at how the market should function when working properly. Adam Smith's idea of an "Invisible Hand": a free market of individuals acting in their own self interest leads to a socially desirable result.
- Why does this occur?
 - Demand = Marginal Benefit (MB) that consumers receive from an additional unit of the good.
 - That is, it tells us how much they are willing to pay for the good.
 - Supply = Marginal Cost (MC) of production
 - That is, how much firms will sell the good for.

The Invisible Hand

- In equilibrium, $P = MB = MC$
 - No further beneficial transactions are possible.
 - Note: importance of marginal analysis. If we are not at the equilibrium, there is a welfare cost. This is the deadweight loss.
- The above analysis assumes that all costs and benefits are known and accounted for by each actor in the economy. If they are, and there is perfect competition, the free market will provide an efficient solution.
- When marginal private benefits do not equal marginal social benefits, or marginal private costs do not equal marginal social costs, there is a market failure. The efficient outcome is not reached.
- **A market failure is when the social and private values differ, so that the market is unable to provide an efficient solution.**

Market Failures in Knowledge

Three generic sources of market failure. Each affects knowledge.

1. Indivisibilities

Motivation: economics depends on $MC = MB$. Ideally, $P = MB$ to consumers = MC . However, when goods can not be divided into small units, such MC pricing might not be possible.

Application to knowledge:

- a. Knowledge is discrete.
Thus, it cannot be sold in small units.
- b. Knowledge requires large fixed costs (R&D). Thus, $MC < AC$
As a result, the price must be high enough to cover fixed costs.
Efficiency requires $P = MC$. However, in this case, $P = MC \Rightarrow P < AC$,
and the firm loses money.
Example: drug companies claim they need to sell their products at high prices to cover fixed costs of research. Generics don't have this fixed cost, and so can sell for less.

Market Failures in Knowledge

2. Uncertainty

It isn't uncertainty itself that is a market failure. Markets can rationally adjust for risk aversion.

However, there are market failures with how markets deal with uncertainty.

The key market failure here is moral hazard.

Moral hazard results from imperfect monitoring.

Since research often is unsuccessful, managers cannot tell if a project is unsuccessful because of the nature of the research or because of a lack of effort from the researcher.

Also makes it difficult to develop insurance markets for R&D

Market Failures in Knowledge

3. Public goods

Knowledge is a public good. This is the most important of the market failures. Public goods are goods that can benefit everyone, and from which no one can be excluded. Public goods have two key characteristics:

Nonrival – one person's enjoyment or consumption of the good does not prevent others from using it. Knowledge is not in short supply. One person using an idea does not preclude others from using the idea.

Nonexcludable – people cannot be prevented from using the good. Thus, it is difficult to collect money for the good. Nonexcludability leads to the free rider problem: A free rider is a consumer or producer that benefits from the actions of others without paying.

The public goods problem is related to the problem of positive externalities. An externality is an activity of one entity that affects the welfare of another and is not reflected in market prices. As a result of positive externalities, too little research is done.

Flows of Knowledge in the Economy

- Before considering how firms can (or cannot) capture the benefits of technology, we first discussed examples of how knowledge flows through the economy.
 - *Knowledge spillovers* are involuntary flows of knowledge between sectors. They are examples of positive externalities.
 - Note that they are involuntary to the inventor. They are not necessarily involuntary to the recipient of the spillover.
 - *Knowledge spillovers* occur when an idea gives rise to new inventions in other sectors.
- In contrast, if new knowledge is embodied in a firm's product, the price of that product should reflect, at least in part, the benefits of the technology.
 - *Embodied knowledge*: knowledge that is part of a product sold by the firm.
 - *Disembodied knowledge*: knowledge that spills over.
- Channels of knowledge flows
 - Publications and presentations
 - Human capital. For example, workers who change jobs may take knowledge from the first firm with them.
 - Reverse engineering

Appropriating the Returns to R&D

- **Market failures in knowledge exist because firms are unable to capture all the benefits to society from their innovation.**
 - Thus, it is important to ask how firms are able appropriate benefits from R&D, to see why they aren't able to capture all the benefits.
 - This will help us to think about how to correct the market failures.
- **Methods of appropriating knowledge**
 - *Patents*
- Provide firms with temporary monopolies for their inventions. The tradeoff is that the inventor makes the information public.
 - *Secrecy*
- Firms can keep new ideas secret. More likely to be successful for process innovations than product innovations. How do you keep a new product secret?
 - *Lead time*
- Being the first to bring a product to market at least provides a temporary monopoly. If network externalities are present, lead time can provide the advantage of having complementary products developed for your product.
 - *Learning curve advantages*
- Similar to lead time. If firms use knowledge more effectively as they gain experience, the first firm to come up with an idea will be the most effective user.
- Sales or marketing efforts
- Licensing/contracts

Appropriating the Returns to R&D

- **What determines the effectiveness of various methods?**
 - Effectiveness of legal enforcement systems
 - Firms are more likely to use patents when they are likely to be enforced by courts.
 - The nature of technology itself
 - Some knowledge (business ideas, engineering knowhow) may be difficult to patent.
 - Barriers to entry in the market
 - When there are few firms in an industry, it is easier to keep new ideas secret.
 - Ease of transmitting the knowledge embodied in an invention Is it tacit or codified?
 - Tacit knowledge may be embodied in human capital of workers.