Microeconomic effects of innovation

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Economics of innovation

Process innovation & product innovation

There are two main types of innovation:

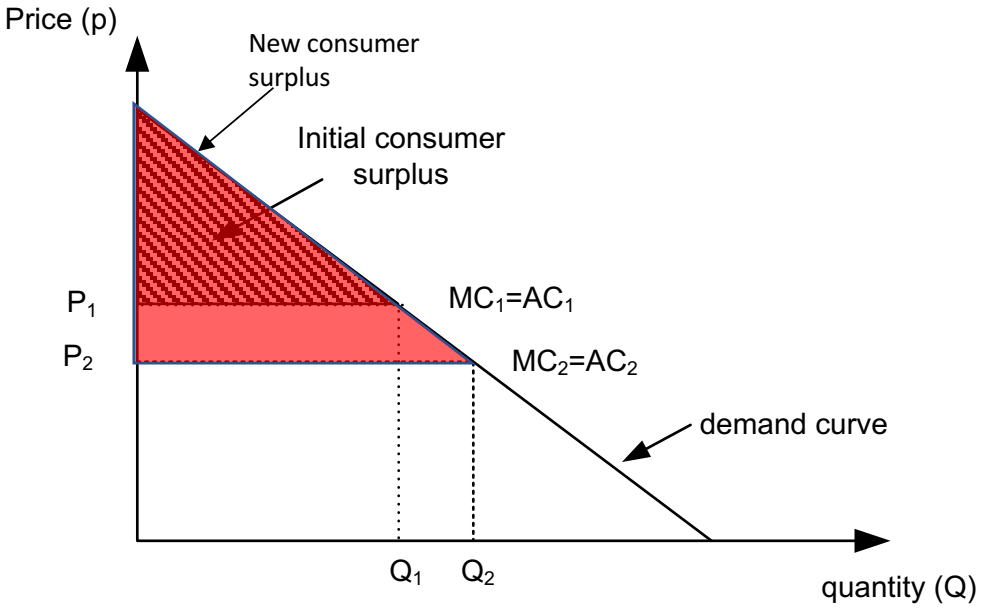
- *process innovation*, the introduction of new techniques for production
- *product innovation*, the offer for sale of a new type or design of a good or service product.

These two are not always independent: often it is the introduction of a new process that permits the design and development of a range of new products, while the introduction of a new intermediate product permits a purchasing firm to change its production process.

For the moment though, we will consider the different nature of the two kinds of innovation to examine how they impact on prices and costs.

Their impact will, in turn, depend on the "market structure" in which the firm operates. Market structure refers to the nature of competition between the firms in the market. The two polar cases are "perfect competition," where there are a larger number of firms, and monopoly, where one firm dominates the market.

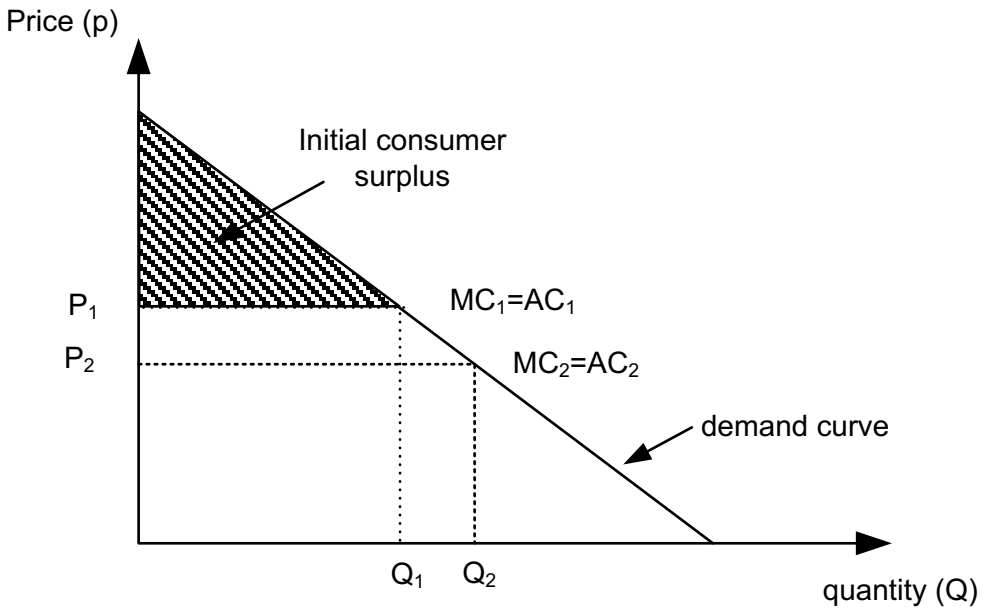
Figure 1. Process innovation in perfectly competitive market



Essential effect-> cost reduction in production.
-> a simple case where, before the innovation, firms have costs AC1 = MC1, so we assume that there are no fixed costs.
If the industry is perfectly competitive, there are many firms, and each of these will set their price equal to MC1, hence the output produced and sold is *Q*1 (at price *P*1).
The process innovation is assumed to reduce the average or marginal cost of production so we can illustrate the impact of the process innovation by a fall to AC2 = MC2.

The price to consumers has fallen (to *P*2) and the consumer surplus has risen, it is now the area above *P*2 and below the demand curve. Economists refer to the consumer surplus as a measure of benefit.
It is important to note that there are no IPRs in this example. If the market is perfectly competitive, all knowledge about production is assumed to be known by all firms.
This case considered a perfectly competitive market with many firms selling an identical product. Given this situation, and the assumption of immediate knowledge diffusion, there is no financial incentive to develop a process innovation. Process innovations could occur if they originated by chance or were made by those unmotivated by financial incentives.

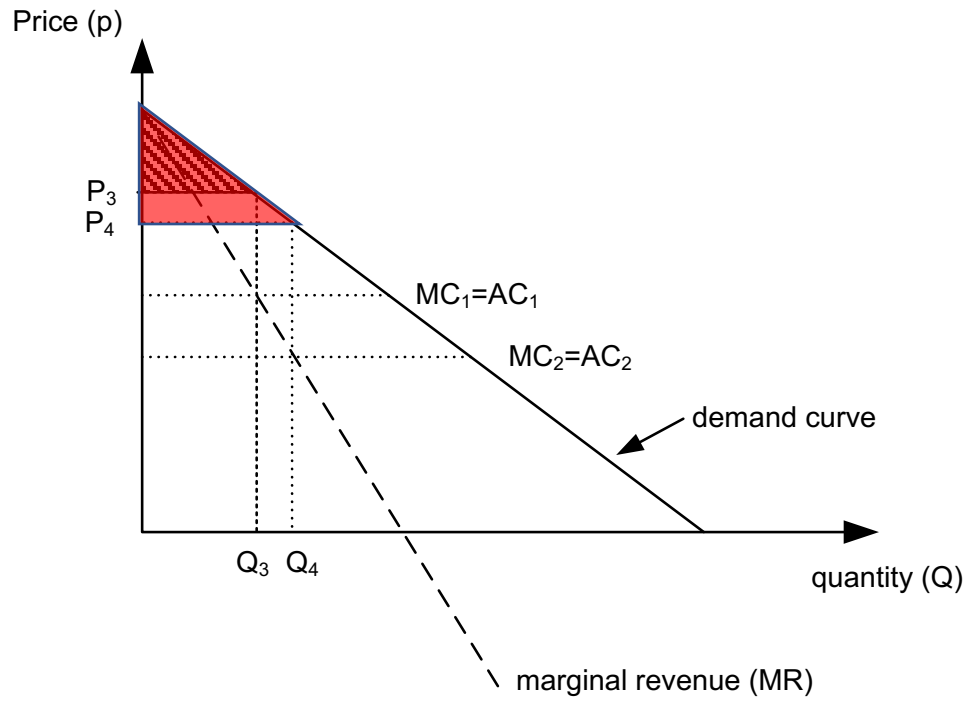
Process innovation in perfectly competitive market with IPR



Consider now a world where IPRs exist and where any process innovation could receive perfect protection. If one firm in the industry developed the process innovation discussed before, and secured a patent on it, it would be possible for that firm to undercut the price charged by any other firm. The innovator could produce and sell the good for a price *P*1 - a small number. At this price it would sell almost *Q*1. Even if the innovator did not want to produce all of the market demand, in principle it could license its process innovation to all other firms and receive royalties equal to these profits.

- **Introducing patents certainly increases the financial incentive to innovate.**

Figure 2 Process innovation for a monopoly



Perfect competition is unlikely to occur in many industries so economists are interested in studying the other extreme form of market structure: **monopoly**. Assuming there is a permanent monopoly supplier with the demand and initial cost conditions specified, would it have any incentive to make a process innovation?

The figure shows the same demand curve and initial costs as in figure 1 **but in the case of a monopolist it will maximize profit by producing where marginal revenue (MR) is equal to MC1**. This means the price is *P*3 and the output produced and sold is *Q*3—less than when there is perfect competition—and the profits are *(P*3 –AC1*)* ×*Q*3. If the monopolist develops a process innovation, it lowers marginal cost to MC2. The new, lower marginal cost means that the monopolist will produce where MR = MC2.

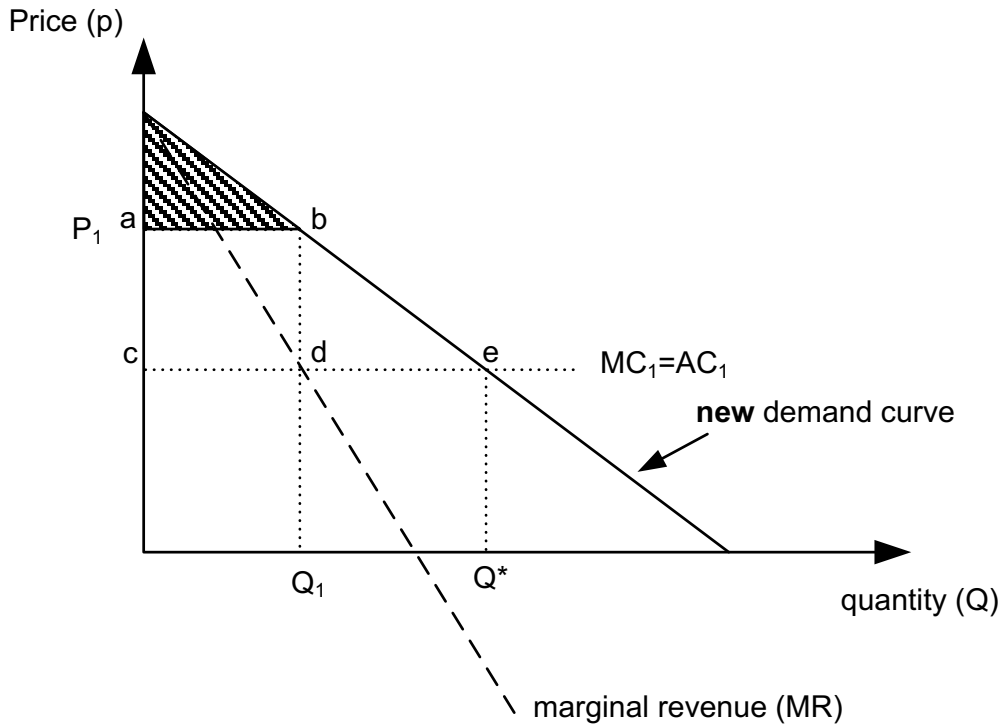
This means a lower price (*P*4), more output (*Q*4), higher consumer surplus, and also higher profits for the monopolist. Thus, even with a monopolist, a process innovation will lower prices and benefit consumers. However, if the monopolist is not threatened with entry, there is no role for IPRs: the monopolist will receive additional profits since it is the only seller in the market. This finding assumes that monopolists will always seek to maximize profits by cutting costs and making innovations, an assumption that many economists think is too strong.

The development of a new product

The successful development of a new product results in a different configuration of changes in costs and rewards.

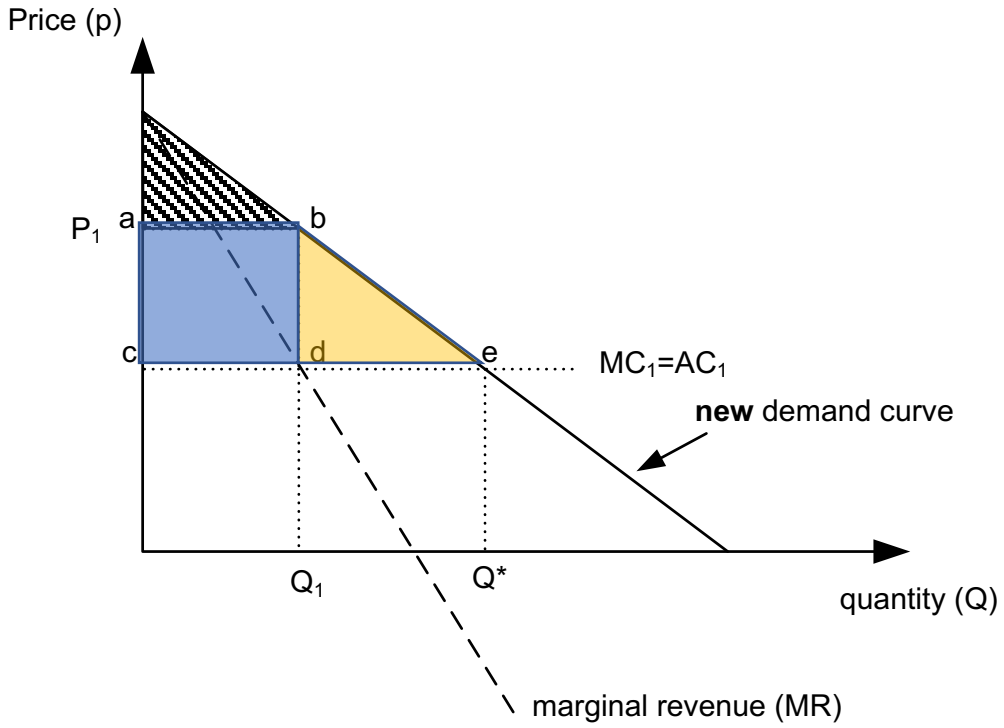
- In a perfectly competitive market, and in the absence of IPRs over the new product (i.e., we assume that any product innovation can be immediately copied), there is no gain to the innovator. This case of immediate imitation by all other firms in the market is very unlikely.
- More realistically, the innovator uses some form of IPR or, failing this, relies on secrecy or first-mover advantages to delay imitation .

Figure 3 New product demand curve



We can represent the introduction of the new product with a new demand curve.
Figure 3 shows the demand curve for a new consumer good.
The position and elasticity of the demand curve depends on how much the **new product is valued, which in turn depends on the availability of substitute products.** If we assume that the firm has an IPR that prevents imitators, the firm acts like a monopolist and maximizes profits. Hence, figure 3 is the same as figure 2 except that it represents a new product.

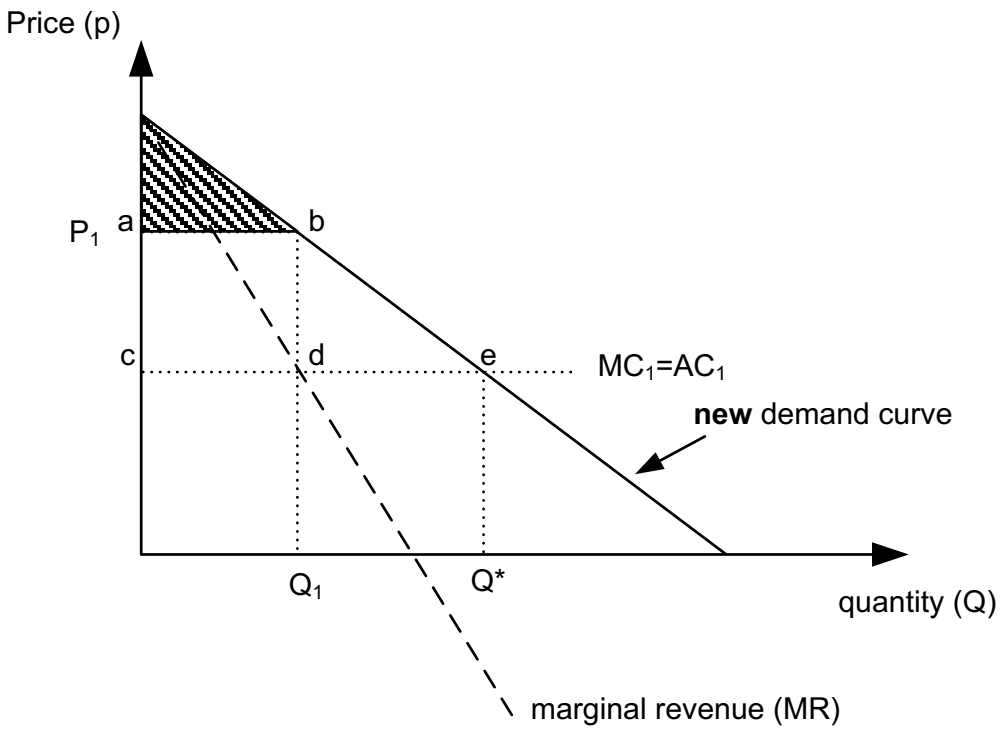
Figure 3. New product demand curve



The new product creates "consumer surplus": the triangular area above the price but below the demand curve. This is a measure of the surplus value to the consumers over and above the price they have to pay.

However, because price (*P*1) is greater than marginal cost (MC1), consumer surplus is not maximized, since this would occur at *Q*∗. It is clear that rewarding innovations with profits (i.e., allowing *P* to be greater than MC) creates a further problem. Looking at figure 3, we can see that some of the lost consumer surplus is, in fact, profits to the innovator (i.e., area ABCD), but some of the lost consumer surplus is wasted (i.e., area BDE). For this reason, area BDE is called the "deadweight loss" associated with monopoly pricing.

Figure 3. New product demand curve

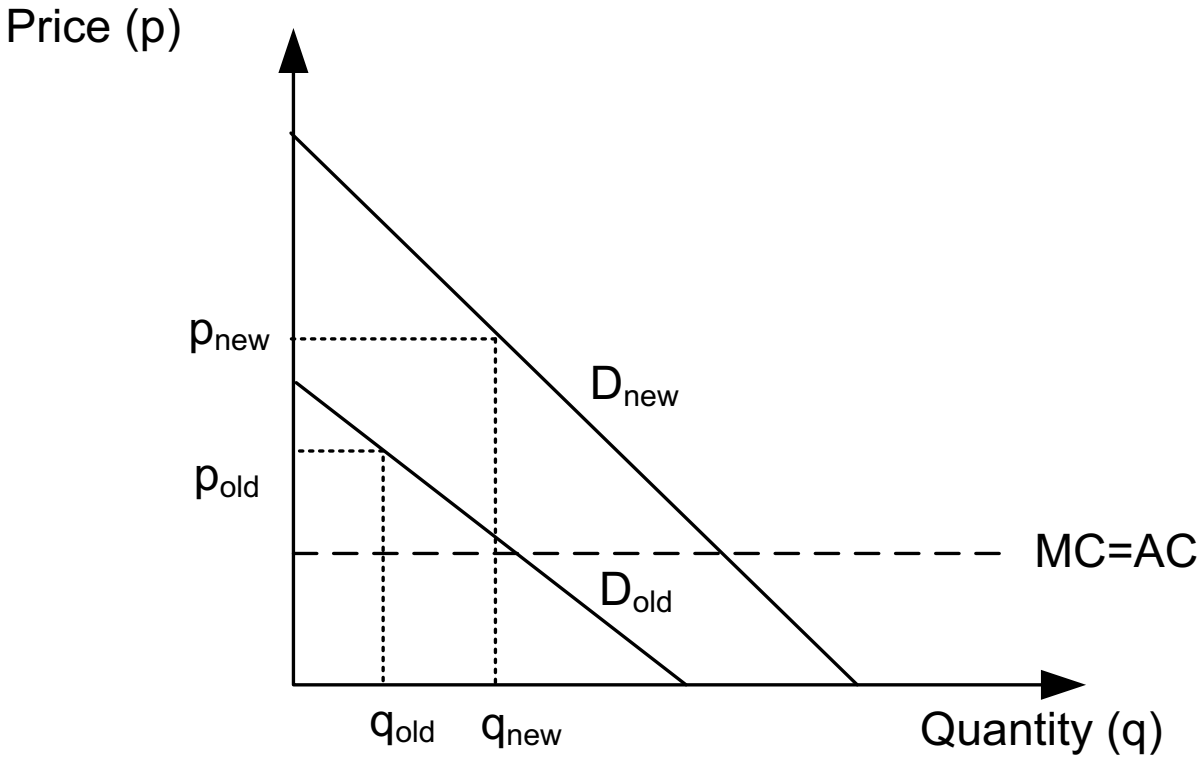


Consider as an example the situation where an important new drug, that can treat a serious disease, is developed.

During the period of protection by a patent, it is sold at a higher price than its marginal cost of production. Some sufferers who could afford the drug if priced at marginal cost are not able to obtain it at this higher price;

the number of people affected is proportional to the distance $Q* - Q1$.

Figure 4 A product innovation represented by a shift in existing demand curve



If the product innovation creates a new variety or improves the quality of an existing product, then drawing a new demand curve is not the best way to conceptualize the change.

Suppose the market is imperfectly competitive before this product innovation, hence the firm already faces a downward-sloping demand curve. By introducing a new product the firm aims to achieve an outward shift and steeper slope to the demand for its product (analogous to the effect of advertising, increasing product loyalty to the firm).

Figure 4 A product innovation represented by a shift in existing demand curve

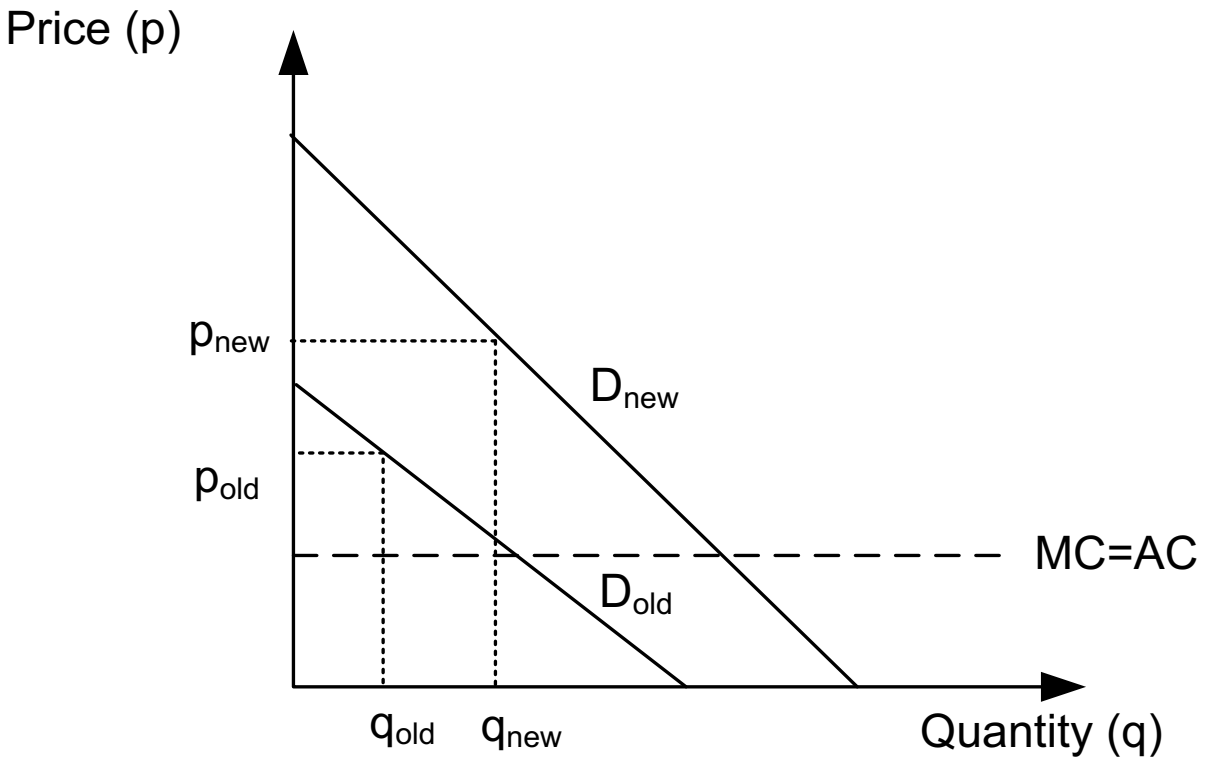


Figure 4 shows such a demand shift. Note that even though consumers are charged a higher price, they buy more and have more consumer surplus. Of course, over time the market may become more competitive as more product innovation occurs and this may reduce prices.

A general way of describing this situation is to say that consumers benefit from the increase in product variety and/or the rise in the quality of the products on offer.

Even if a new product is more expensive than existing ones, if it has exactly the right set of characteristics to match the customers' tastes, they may be happier to buy this item. If the product has a broader and more favorable set of characteristics than an earlier variety, then, even with a higher price, it can still be seen as good value for money.

Can Product and Process Innovations Be Distinguished?

Conceptually yes, but in practical measurement terms it is often difficult to make this distinction.

The basic reason is that in many cases of innovation, one firm's finished product can become part of another firm's production process.

Innovation measurement at the level of the firm suggests that product innovations are in the majority, while in the context of the economy they result in a large amount of process innovation.

Some examples are new fertilizers that improve the productivity of agricultural production; new weaving machinery that enables the textile industry to create superior fabrics; cash dispensers that allow the banking industry to offer people access to their money at any time of day or night; and new computer software that permits firms in many sectors to organize information more efficiently.

Can Product and Process Innovations Be Distinguished?

Although economic theory often analyzes supply as if there was a single-stage production process, transforming raw materials directly into final goods and services sold to consumers, this is an extreme simplification.

In reality, much economic activity is devoted to the production of intermediate goods and services, which are supplied to other firms as semifinished products.

In fact, the gross output of each sector, reflecting economic activity before netting out the amount reabsorbed as inputs, is much bigger than its contribution to gross domestic product (GDP).

Flows of Innovation Round the Economy

Every process innovation within a sector causes lower costs of inputs supplied to user firms.

Every product innovation within a sector causes new product varieties of inputs for user firms.

These can lead to new processes of production in the user industry, due either to new intermediate products A, to new investment products B, or to cost changes that make different techniques more profitable.