6. Production; Decreasing and Increasing Returns; Factor Proportions

Factors of Production

Classical economics identified three "factors of production": land, consisting of all natural resources; labor, consisting of productive human effort; and capital, usually defined as man-made objects used in production. These factors are primary, because all production requires some of each. Neoclassical economics nonetheless merged land into capital. Environmental and ecological economics have resurrected land in the form of "natural capital." Physical capital can have widely differing lifetimes. "Fixed" capital, like buildings or roads or dams, may last hundreds of years. When fixed capital wears out or becomes obsolete, it is said to "depreciate." "Working" capital, like inventories, "turns over" in short periods ranging from days to under a year.

The Firm

A business enterprise, a "firm", combines factors of production to generate products. Let's return to Jill's Organic Egg Farm, in Section 1. Here's Jill's supply curve for eggs. What accounts for the curve's shape?

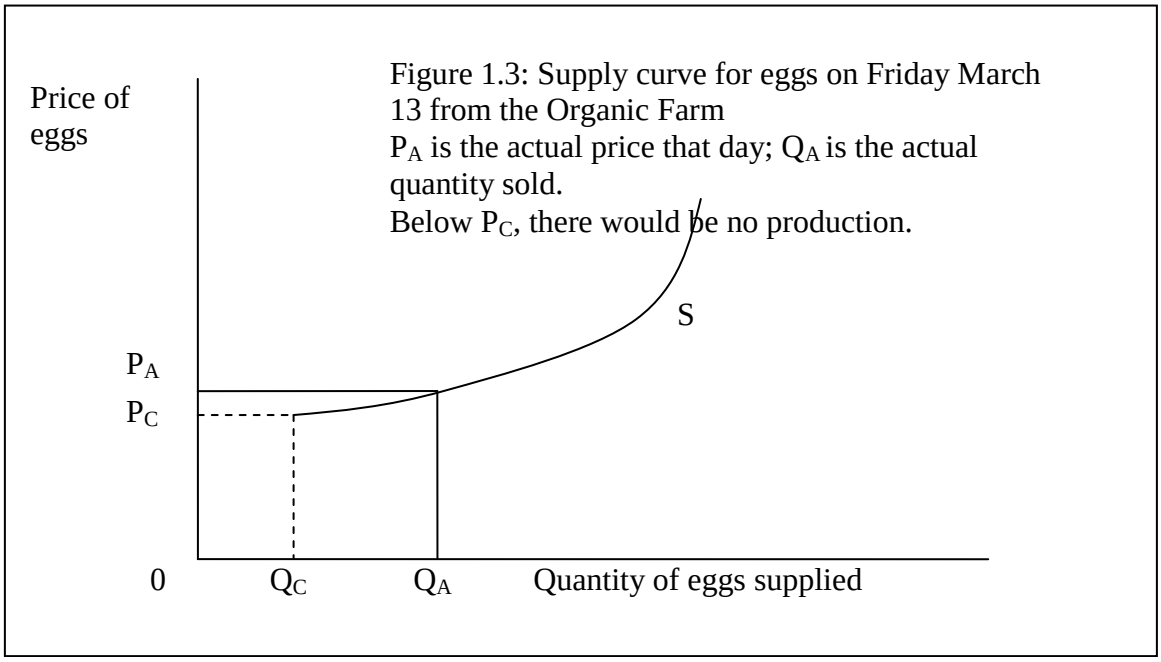

Figure 1.3: Supply curve for eggs on Friday March 13 from the Organic Farm
P_A is the actual price that day; Q_A is the actual quantity sold.
Below P_C, there would be no production.

Jill owns ten acres of land. She and her assistants supply labor. Her "fixed capital" takes the form of chicken coops, and a fence to keep out the neighbor's dogs. Her "working capital" is chicken feed, egg boxes and other supplies, as well as egg inventories ready for market. As for the flock of chickens, it probably counts as rather short-lived fixed capital.

Decreasing and Increasing Returns at the Firm Level

The more Jill feeds her chickens, the more eggs they lay, subject to decreasing returns. That is, each additional bag of feed produces fewer additional eggs. This is shown in Figure 6.1, plotting eggs against feed. How does Jill decide how much feed to buy? She compares the cost of feed to the additional value of eggs she can get, as shown in Figure 6.2. The more expensive the feed, the less she buys.

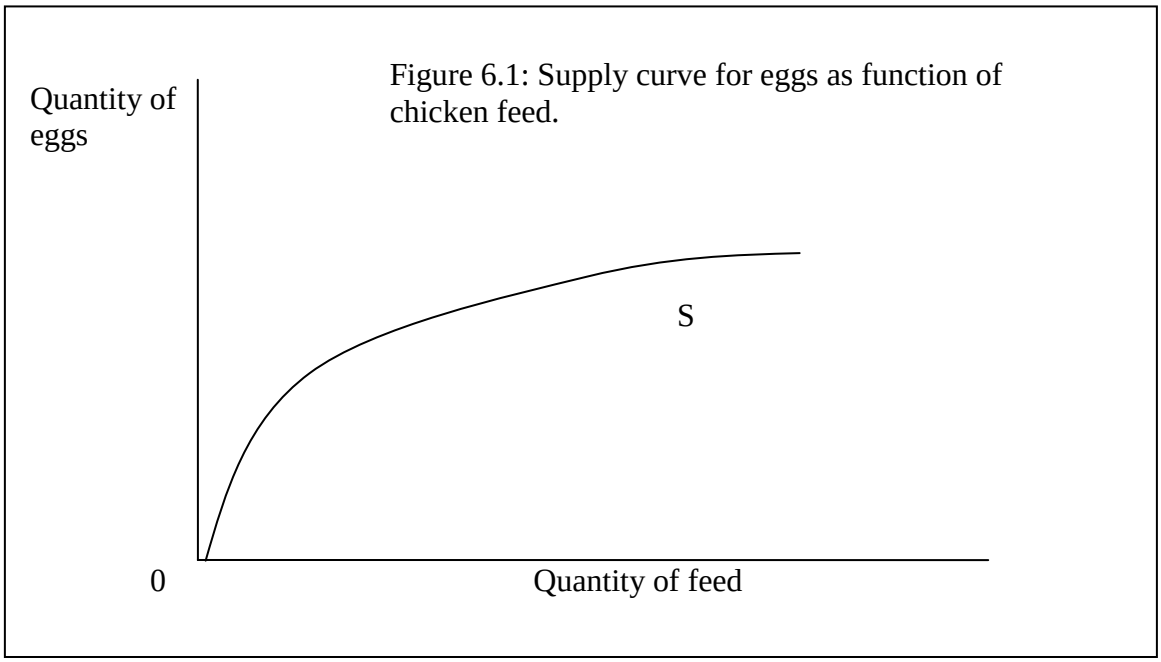

Figure 6.1: Supply curve for eggs as function of chicken feed.

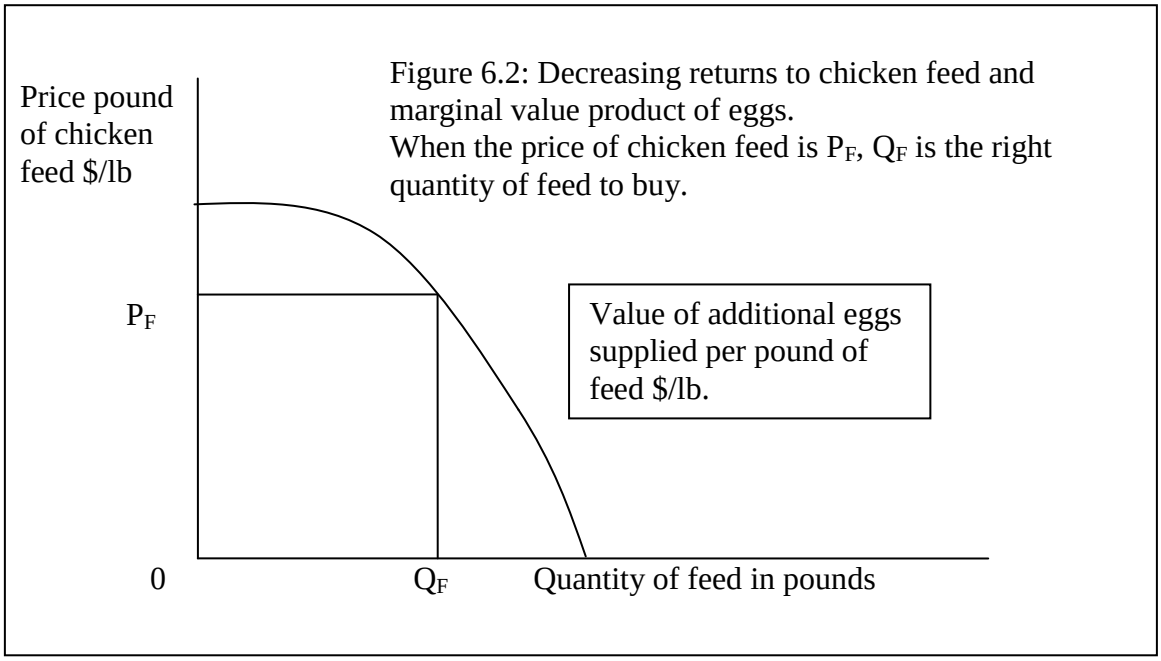

Figure 6.2: Decreasing returns to chicken feed and marginal value product of eggs.
When the price of chicken feed is P_F, Q_F is the right quantity of feed to buy.

What about labor? Labor is different from chicken feed in that workers can cooperate and specialize, as dramatized by Adam Smith in his story of the pin factory in Book I Chapter I. Assuming Jill's operation is large enough to employ, say, around twenty workers, she will experience increasing returns, that is, economies of scale, for the first few workers hired, as shown in Figure 6.3. Notice that the marginal product of labor curve rises before falling.

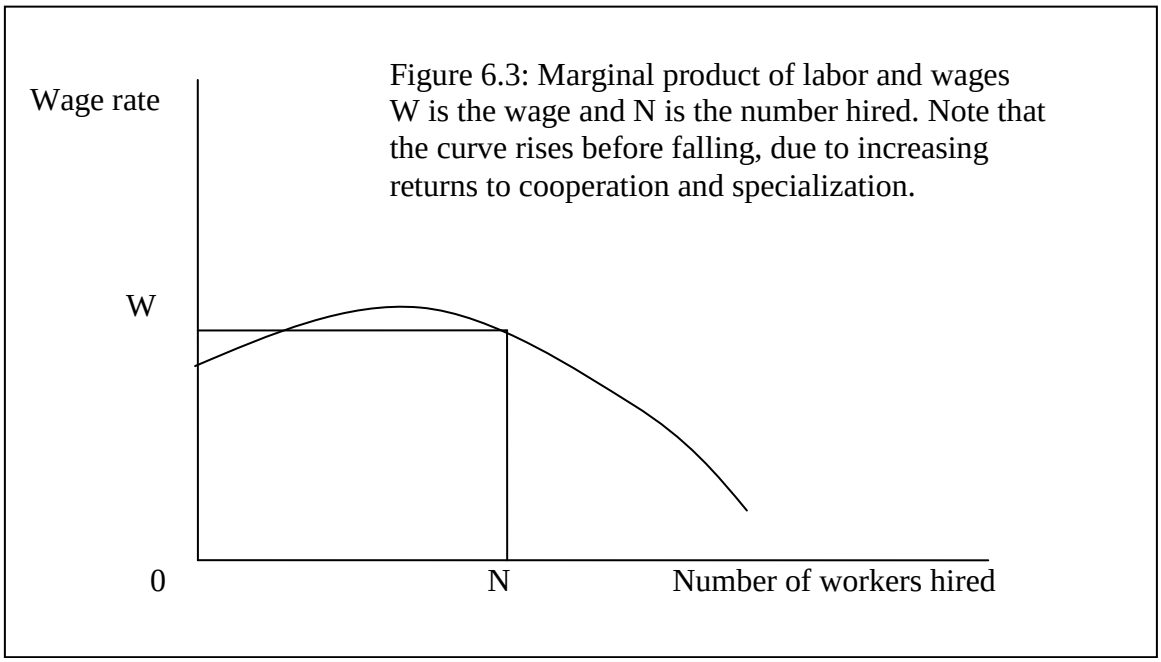

Figure 6.3: Marginal product of labor and wages
W is the wage and N is the number hired. Note that the curve rises before falling, due to increasing returns to cooperation and specialization.

What about land? Land comes in arbitrary sizes that may not be optimal. If Jill wants to expand her operations, her neighbors may refuse to sell or rent additional land. Transportation costs may be too great for her to open a second location. Land is usually the most serious obstacle to expanding operations.

Jill's egg supply curve, Figure 1.3, turns upwards because she runs into decreasing returns on land, labor, and capital inputs.

Factor proportions at the firm level.

Jill also chooses the factor proportions in production. As an organic farmer, she lets her chickens run around outdoors, returning to lay eggs in the coops. Every day, she and her helpers must snatch the eggs one by one from under the angry birds. This is a land and labor-intensive operation. If Jill were a factory-farmer, by contrast, she would keep her chickens in cages. Their eggs would drop through a grate onto a conveyor belt. Such an operation would require far fewer workers per hundred dozen eggs produced, less land, but much more physical capital.

Prices affect the choice of technology. In the USA, where labor costs are relatively high, most eggs come from capital-intensive factory farms. To compensate for high labor costs and small scale, prices are higher for organic eggs from free-range chickens.

Tax and subsidy policy also affects choice of technology. In the US, payroll taxes discourage labor-intensive production.

Firm size

Some factories, notably natural-resource processing operations like steel mills and oil refineries, must be huge to obtain available technological economies of scale. However at any given location, decreasing returns eventually set in, limiting the size of the operation. Today's multinational firms may operate in literally thousands of locations around the world. Do they enjoy some sort of organizational economies of scale? Perhaps, but they also enjoy economies of monopoly, tax and subsidy favors, and political influence. In the recent financial crisis, most of the biggest banks would have failed without government assistance. The same goes for General Motors, Chrysler and their suppliers.

Decreasing and Increasing Returns at the Economy Level

Individual operations and even individual firms are eventually limited by decreasing returns. As Adam Smith points out in Book I Chapter III, the economy as a whole faces no such limits. The division of labor—bringing cooperation, specialization, and technical innovation—also generates increasing returns where large number of small firms are connected by a market. As Smith says, these benefits are limited only by "the extent of the market." From this it follows that increases in population density or decreases in cost of transportation and communication will lead to economic growth. This is one of George's central themes. This is also why, as Jane Jacobs argues in *The Economy of Cities*, that most innovation and growth happens in cities.