

## CHAPTER 7 — PRODUCTION: GENERAL PRICING OF THE FACTORS

### CHAPTER SUMMARY

This chapter explains the determination of prices for *unit factor services* in the ERE. A capitalist will be willing to hire an additional unit of a productive resource so long as its rental price is lower than its *discounted marginal value product* (DMVP). The marginal value product (MVP) is the additional revenue that can be imputed to the marginal unit of a productive factor. The *discounted* MVP is then simply the *present market value* of the (future) MVP. For example, if an additional hour of labor will generate \$110 of additional revenue in one year's time, a prospective employer will pay no more than \$100 *today* to hire this worker if the interest rate is 10 percent.

Although many authors stress the importance of variability in the proportion of inputs, it is actually the relative *specificity* of factors that allows a unique determination of DMVP.

The MVP is determined by the marginal physical product (MPP) times the price of the product. That is, the prospective buyer estimates the increased physical output (i.e. quantity of the good to be sold) due to an additional unit of a factor, and multiplies this by the market price of these extra goods. (To the extent that the market price of the final product declines as additional units are produced, the true MVP will actually be less than this computation would suggest.)

Although *land* is usually defined as the original, nature-given factors, while *capital goods* are usually defined as "produced means of production," these are not the ideal definitions. It is better to classify any productive factor that is *reproducible* as a capital good, and all other factors as either land or labor. In particular, depletable natural resources such as oil and coal should be classified as land, even though they are nonpermanent. Note that an actual piece of geographic land may consist of both economic land and capital goods, to the extent that maintenance must be performed (to combat erosion, etc.). In the ERE we cannot deal with depletable resources, since stocks of goods are not allowed to change over time.

Because all productive assets possess a capitalized value (which is equal to the present discounted value of all future rental payments in the ERE), in a sense the only incomes in the ERE are labor and interest on invested financial capital. For example, even someone who discovers an unowned plot of land that yields \$10,000 in annual rents, is still (in the ERE) merely earning an implicit interest return on his capital "investment." This is because the market value of his land will be \$200,000 (assuming a 5 percent rate of interest), and thus if the man chooses to receive the annual rental payments, he is foregoing the potential \$200,000 in present goods.

## CHAPTER OUTLINE

### 1. *Imputation of the Discounted Marginal Value Product*

In this chapter we will explore the pricing of *unit services* as they would be in the evenly rotating economy (ERE), and hence as they *tend* to be in the real world.

A capitalist will be willing to hire an additional unit of a productive resource so long as its rental price is lower than its *discounted marginal value product* (DMVP). The marginal value product (MVP) is the additional revenue that can be imputed to the marginal unit of a productive factor. The *discounted* MVP is then simply the *present market value* of the (future) MVP. For example, if an additional hour of labor will generate \$110 of additional revenue in one year's time, a prospective employer will pay no more than \$100 *today* to hire this worker if the interest rate is 10 percent.

Additional units of supply are allocated to uses that are less and less urgent. Consequently, the MVP (and DMVP) of a factor declines as its supply increases.

A *nonspecific* factor (i.e. one used in several lines of production) will be priced according to DMVP, where each successive unit is assigned to the most productive, yet unfulfilled, use. A *specific* factor's DMVP is calculated as the difference between the unit price of the final product and the sum of the prices of the nonspecific factors used in its production. For example, the nonspecific factor of labor may have a DMVP of \$10 per hour. If one dose of a certain medicine can be created with one hour of labor and one pound of a certain type of berry, and this berry has no other economic use, then the DMVP of the pound of berries will be equal to the (discounted) price of the dose of medicine (as determined by marginal utility to consumers) minus the \$10 payment to the worker.

### 2. *Determination of the Discounted Marginal Value Product*

#### A. DISCOUNTING

If a prospective purchaser or employer knows what the marginal value product of a factor will be, he or she simply discounts this future sum by the prevailing market rate of interest in order to determine the *discounted* marginal value product. For example, if one hour of labor *now* will yield additional consumer goods that will fetch an additional \$105 of revenue *next year*, then the present market value of this labor (and hence its price in the ERE) will only be \$100 if the interest rate is 5 percent.

#### B. THE MARGINAL PHYSICAL PRODUCT

The marginal physical product (MPP) of a unit factor service is simply the *additional* units of goods that it yields. For example, the MPP of the tenth textile worker might be 50 shirts, because (say) nine workers produce 700 shirts, while ten workers produce 750 shirts. The average physical product (APP), in contrast, is the total quantity of product divided by the total units of the factor. In our example, the APP would be 75 shirts (750 shirts divided by 10 workers).

The law of returns implies that the APP curve will reach a maximum; i.e. at some point, further units of the factor will *lower* APP. In ranges of the quantity of factor where MPP is higher than APP, APP tends to rise. In ranges where MPP is lower than APP, APP falls. (Consider a student who has test scores of 80, 80, 90, and 90. If the student's fifth test is *higher* than his current average of 85, it will pull up his *new* average. If the student's fifth test score is *lower* than his current average, then his new average will be lower than 85.) Because of these facts, APP is maximized at that quantity of factor where MPP equals APP.

### C. MARGINAL VALUE PRODUCT

Once the MPP is known, the MVP is determined by multiplying the MPP by the market price of the final good. To continue with the example from above, if shirts sell for \$20 each, then the MVP of the tenth worker is  $\$20 \times 50 \text{ shirts} = \$1000$ . (However, note the caveats in Appendix A.)

#### 3. *The Source of Factor Incomes*

What is the source of income—capital or consumption? In one sense, the goal of all capitalistic production is consumption. Furthermore, all producers are ultimately guided by the spending decisions of final consumers. However, except for direct processes (such as picking berries), production requires prior savings. In particular, workers demand payment *now* even though their efforts will only yield consumer goods in the future. Only the capitalists, who have accumulated the “wages fund” (to use the classical terminology), can allow the workers to be paid in advance for their product.

#### 4. *Land and Capital Goods*

Although the conventional definition of capital goods is that they are “produced means of production,” it is better to define them as *reproducible* means of production. Recall that the primary analytical purpose for the distinction between capital and land is that, in the ERE, capital goods earn no *net* return, precisely because they can be (re)produced with land and labor factors.

*Geographic* land is actually a combination of land (in the economic sense) and capital goods. For example, farms require deliberate maintenance to combat erosion, etc.

#### 5. *Capitalization and Rent*

The market price or *capitalized value* of a durable asset will, in the ERE, be equal to the sum of its future rental earnings (due to the asset's flow of services), discounted appropriately by the rate of interest. In one sense, only laborers earn “pure rent” in the ERE, and the only types of income are wages and interest. This is true because even land factors have a capitalized value, and hence the rental payments accruing to their owners are (if only implicitly) interest returns due to time preference. For example, even someone who discovers an unowned plot of land that yields \$10,000 in annual rents, is still (in the ERE) merely earning an implicit interest return on his capital “investment.”

This is because the market value of his land will be \$200,000 (assuming a 5 percent rate of interest), and thus if the man chooses to receive the annual rental payments, he is foregoing the potential \$200,000 in present goods.

#### 6. *The Depletion of Natural Resources*

As we have seen, permanent, nonreproducible factors are classified as *land*, while goods that can wear out but are reproducible are classified as *capital goods*. But what of nonpermanent, nonreproducible productive resources, such as diamond mines? The crucial test is whether such resources can be reproduced by land and labor factors, and the answer is no. Hence depletable resources (oil, natural gas, etc.) are to be classified as land. (Note that we cannot deal with such resources in the ERE, since by definition stocks of resources cannot change over time.)

### APPENDIX A MARGINAL PHYSICAL AND MARGINAL VALUE PRODUCT

Strictly speaking, it is not true that MVP equals MPP times price. This is because, as the quantity of goods increases, the Law of Demand requires that the price consumers will pay for them declines. In general, then, MVP will be *less* than MPP times price. To continue with our example from above, suppose that nine workers produce 700 shirts, and that the firm can charge \$21 per shirt if it wants consumers to purchase 700 of them. Suppose that hiring a tenth worker will allow a total of 750 shirts to be produced, but that the firm can only charge \$20 per shirt if it wants consumers to purchase 750 of them. In this case, the total increase in revenue (from hiring the tenth worker) is only \$300 (i.e. \$15,000 – \$14,700), and not \$1000. Thus the firm would only pay up to \$300 to hire the tenth worker (ignoring discounting). In effect, the lower product price is causing the firm to “lose” \$1 on the first 700 units, and this offsets the direct \$1000 in revenue attributable to the tenth worker’s MPP.

### APPENDIX B PROFESSOR ROLPH AND THE DISCOUNTED MARGINAL PRODUCTIVITY THEORY

Rolph, a follower of Knight, disputes the DMVP approach and instead insists that every productive factor receives its payment directly. For example, workers who begin construction on a factory are paid at the end of the day, in exchange for the “product” that they have produced during the day; there is no discounting involved. However, this begs the question as to why an unfinished factory commands any price at all. It is clearly only because a higher order producer anticipates revenues from lower order producers, who in turn expect to sell goods to final consumers. If the factory turns out to be worthless (perhaps because it is located on a major fault line and is destroyed by an earthquake), it will be clear that the workers really didn’t “produce” anything valuable at all, and were paid on the basis of entrepreneurial error.

### NOTABLE CONTRIBUTIONS

- Rothbard (pp. 454-456) clarifies the importance of *specificity*, rather than fixed vs. variable proportions, in the determination of factor prices.
- Rothbard's treatment of the definition of *land* (pp. 483-484) is an important clarification. Earlier definitions relied on backward-looking measures and could not handle odd cases (such as lightning striking a tree limb and creating a perfect spear).

### TECHNICAL MATTERS

- The mainstream worry over “fixed proportions” (pp. 454-455) is due to the apparent difficulty of using a marginal productivity approach in these cases. As an analogy, how can we determine the relative importance of members of The Beatles? If you take away Paul McCartney, the quality of the music suffers tremendously, but if you take away Ringo, the same is true; without a drummer, even the other three members wouldn't sound very good. Yet this would lead us to conclude that the entire value of The Beatles' music is due to Ringo. (This apparent problem doesn't arise with *variable* proportions of inputs. For example, if 10 tractors and 5 workers yield \$1000 of crops, while 10 tractors and 4 workers yield \$900 of crops, then the marginal value product of the 5<sup>th</sup> worker is obviously \$100.)
- Going along with the above note, Rothbard deals with such an example on pp. 459-460. The mainstream economist would probably object to Rothbard's conclusion that the MVP of one unit of *X* is 25 gold oz. For by the same reasoning, Rothbard would have to conclude that the MVP of 2.5 *Y*, as well as the MVP of .5 *Z*, were *also* both equal to 25 gold oz. There is thus a suspicion that the application of the marginal productivity approach leads to “double (or triple) counting.” However, notice that Rothbard is *not* saying that the firm, initially starting in a position of owning 3*X*, 7.5*Y*, and 1.5*Z*, would pay up to 25 gold oz. to acquire an additional unit of *X*. Rather, Rothbard is saying that the firm starting out with 4*X*, 10*Y*, and 2*Z* would be willing to pay up to 25 gold oz. to *retain* the fourth unit of *X*. Also, if Rothbard had included the decrease in expenditures that would be possible from buying fewer units of *Y* and *Z* (when the firm loses one unit of *X*), then the loss of gold would be mitigated and there would be no question of “double counting.” So long as care is taken to correctly specify the actual circumstances facing the decision-maker, the marginal productivity approach gives the correct answer.
- Although everything Rothbard says in Appendix B is correct, the Austrian should remember that a typical employer might not view himself as paying a discounted

MVP. If the structure of production is not vertically integrated, then each producer buys inputs and sells his output to the next producer in line. These lower order producers in effect are the “consumers,” and it doesn’t really matter to the seller of iron ore what eventually happens to it. But the fundamental point is that the prices of higher order goods are causally determined by the prices of lower order goods, not vice versa.

### STUDY QUESTIONS

- (1) What is a production process characterized by *fixed proportions*? (pp. 454-455)
- (2) Why must a factor’s MVP be discounted?
- (3) Give an example of a highly specific factor. (p. 456)
- (4) Why does DMVP diminish as the supply of a factor increases? (p. 461)
- (5) What is the difference between the “general” and “particular” DMVP schedules for a factor? (p. 464)
- (6) Why will a factor always be employed in a region of declining APP? (p. 474)
- (7) Why does the Knightian reject the distinction between land and capital goods? (p. 483)
- (8) Under what circumstances would a forest be classified as land, or as a capital good?
- (9) Is Rothbard saying that land earns no rents in the ERE? (p. 495)
- (10) If MVP is not actually equal to MPP times price, what *is* its precise definition? (pp. 501-503)