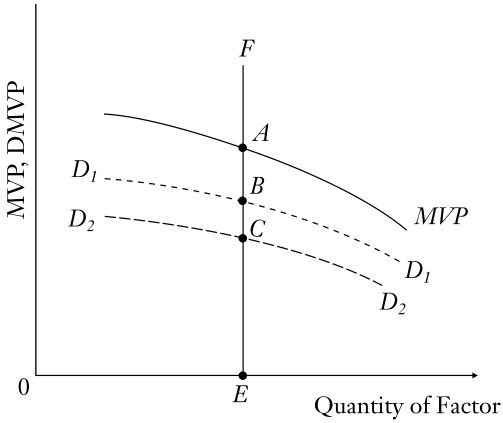

FIGURE 57. EFFECT OF CHANGES IN THE RATE OF INTEREST ON THE DISCOUNTED MARGINAL VALUE PRODUCT AS SUPPLY OF THE FACTOR VARIES

DMVP for supply *0E* equals *EB*. *EB* will be the price of the factor in the evenly rotating economy. Now suppose that the rate of interest in the economy rises, as a result, of course, of rises in time-preference schedules. This means that the rate of discount for every hypothetical MVP will be greater, and the absolute levels lower. The new DMVP schedule is depicted as the dotted line D_2D_2. The new price for the same supply of the factor is *EC*, a lower price than before.

One of the determinants of the DMVP schedule, then, is the rate of discount, and we have seen above that the rate of discount is determined by individual time preferences. The higher the rate of discount, the lower will tend to be the DMVP and, therefore, the lower the price of the factor; the lower the interest rate, the higher the DMVP and the price of the factor.

B. THE MARGINAL PHYSICAL PRODUCT

What, then, determines the position and shape of the MVP schedule? What is the marginal value product? It is the amount of revenue intake attributable to a unit of a factor. And this

revenue depends on two elements: (1) the physical product produced and (2) the price of that product. If one hour of factor *X* is estimated by the market to produce a value of 20 gold ounces, this might be because one hour produces 20 units of the physical product, which are sold at a price of one gold ounce per unit. Or the same MVP might result from the production of 10 units of the product, sold at two gold ounces per unit, etc. In short, *the marginal value product of a factor service unit is equal to its marginal physical product times the price of that product*.[6]

Let us, then, investigate the determinants of the marginal physical product (MPP). In the first place, there can be no general schedule for the MPP as there is for the MVP, for the simple reason that *physical* units of various goods are not comparable. How can a dozen eggs, a pound of butter, and a house be compared in *physical* terms? Yet the same factor might be useful in the production of any of these goods. There can be an MPP schedule, therefore, only in *particular* terms, i.e., in terms of each particular production process in which the factor can be engaged. For each production process there will be for the factor a marginal physical production schedule of a certain shape. The MPP for a supply *in that process* is the amount of the physical product imputable to one unit of that factor, i.e., the amount of the product that will be lost if one unit of the factor is removed. If the supply of the factor in the process is increased by one unit, other factors remaining the same, then the MPP of the supply becomes the additional physical product that can be gained from the addition of the unit. The supply of the factor that is relevant for the MPP schedules is not the total supply in the society, but the supply *in each process*, since the MPP schedules are established for each process separately.

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[6]This is not strictly true, but the technical error in the statement does not affect the causal analysis in the text. In fact, this argument is strengthened, for MVP actually equals MPP x "marginal revenue," and marginal revenue is always less than, or equal to, price. *See* Appendix A below, "Marginal Physical and Marginal Value Product."

(1) *The Law of Returns*

In order to investigate the MPP schedule further, let us recall the law of returns, set forth in chapter 1. According to the law of returns, an eternal truth of human action, if the quantity of one factor varies, and the quantities of other factors remain constant, there is a point at which the physical product per factor is at a maximum. Physical product per factor may be termed the *average physical product* (APP). The law further states that with either a lesser or a greater supply of the factor the APP must be lower. We may diagram a typical APP curve as in Figure 58.

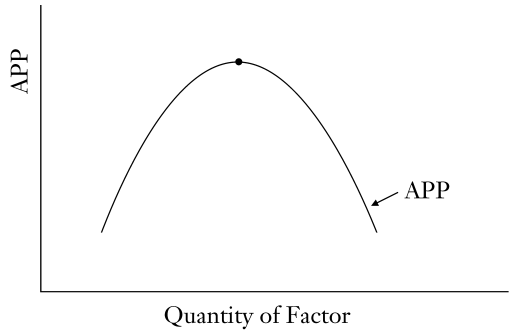

FIGURE 58. AVERAGE PHYSICAL PRODUCT IN RELATION TO THE SUPPLY OF A FACTOR

(2) *Marginal Physical Product and Average Physical Product*

What is the relationship between the APP and MPP? *The MPP is the amount of physical product that will be produced with the addition of one unit of a factor, other factors being given. The APP is the ratio of the total product to the total quantity of the variable factor, other factors being given.* To illustrate the meanings of APP and MPP, let us consider a hypothetical case in which all units of other factors are constant, and the number of units of one factor is variable. In Table 13 the first column lists the number of units of the variable factor, and the second column the total physical product produced when these varying units are combined with

fixed units of the other factors. The third column is the APP = total product divided by the number of units of the factor, i.e., the average physical productivity of a unit of the factor. The fourth column is the MPP = the difference in total product yielded by adding one more unit of the variable factor, i.e., the total product of the current row minus the total product of the preceding row:

TABLE 13

UNITS OF VARIABLE FACTOR	TOTAL PRODUCT	AVERAGE PHYSICAL PRODUCT	MARGINAL PHYSICAL PRODUCT
0	0	0	0
1	3	3	3
2	8	4	5
3	15	5	7
4	22	5.2	7
5	27.5	5.5	5.5
6	30	5	2.5
7	28	4	-2

In the first place, it is quite clear that *no factor will ever be employed in the region where the MPP is negative*. In our example, this occurs where seven units of the factor are being employed. Six units of the factor, combined with given other factors, produced 30 units of the product. An addition of another unit results in a loss of two units of the product. The MPP of the factor when seven units are employed is -2. Obviously, no factor will ever be employed in this region, and this holds true whether the factor-owner is also owner of the product, or a capitalist hires the factor to work on the product. It would be senseless and contrary to the principles of human action to expend either effort or money on added factors only to have the quantity of the total product decline.

In the tabulation, we follow the law of returns, in that the APP, beginning, of course, at zero with zero units of the factor, rises to a peak and then falls. We also observe the following from our chart: (1) *when the APP is rising* (with the exception of the very first step where TP, APP, and MPP are all equal) *MPP is higher than APP*; (2) *when the APP is falling, MPP is lower than APP*; (3) *at the point of maximum APP, MPP is equal to APP.* We shall now prove, algebraically, that these three laws always hold.[7]

Let F be any number of units of a variable factor, other factors being given, and P be the units of the total product yielded by the combination. Then P/F is the Average Physical Product. When we add ΔF more units of the factor, total product increases by ΔP. Marginal Physical Product corresponding to the increase in the factor is $\Delta P/\Delta F$. The new Average Physical Product, corresponding to the greater supply of factors, is:

$$\frac{P + \Delta P}{F + \Delta F}$$

Now the new APP might be higher or lower than the previous one. Let us suppose that the new APP is higher and that therefore we are in a region where the *APP is increasing*. This means that:

$$\frac{P + \Delta P}{F + \Delta F} > \frac{P}{F}$$

> is the symbol for "is greater than."

[7]It might be asked why we now employ mathematics after our strictures against the mathematical method in economics. The reason is that, in this particular problem, we are dealing with a purely *technological* question. We are not dealing with human decisions here, but with the necessary technological conditions of the world as given to human factors. In this external world, given quantities of cause yield given quantities of effect, and it is this sphere, very limited in the overall praxeological picture, that, like the natural sciences in general, is peculiarly susceptible to mathematical methods. The relationship between average and marginal is an obviously *algebraic*, rather than an ends-means, relation. Cf. the algebraic proof in Stigler, *Theory of Price*, pp. 44 ff.

or $\dfrac{P + \Delta P}{F + \Delta F} - \dfrac{P}{F} > 0$

Combining terms: $\dfrac{FP + F\Delta P - PF - P\Delta F}{F(F + \Delta F)} > 0$

Then, surely:

$$\begin{aligned} FP + F\Delta P - PF - P\Delta F &> 0 \\ F\Delta P - P\Delta F &> 0 \\ F\Delta P &> P\Delta F \\ \therefore \frac{\Delta P}{\Delta F} &> \frac{P}{F} \end{aligned}$$

Thus, the MPP is greater than the *old* APP. Since it is greater, this means that there exists a positive number k such that:

$$\frac{\Delta P}{\Delta F} = \frac{kP}{F}$$

Now there is an algebraic rule according to which, if:

$$\frac{a}{b} = \frac{c}{d},$$

then

$$\frac{a}{b} = \frac{c + a}{d + b}$$

Therefore,

$$\frac{\Delta P}{\Delta F} = \frac{kP + \Delta P}{F + \Delta F}$$

Since k is positive,

$$\frac{kP + \Delta P}{F + \Delta F} > \frac{P + \Delta P}{F + \Delta F}$$

Therefore,

$$\boxed{\frac{\Delta P}{\Delta F} > \frac{P + \Delta P}{F + \Delta F}}$$

In short, the MPP is *also* greater than the *new* APP.

In other words, *if APP is increasing, then the marginal physical product is greater than the average physical product* in this region. This proves the first law above. Now, if we go back in our proof and substitute "less than" signs for "greater than" signs and carry out similar steps, we arrive at the opposite conclusion: *where APP is decreasing, the marginal physical product is lower than the average physical product.* This proves the second of our three laws about the relation between the marginal and the average physical product. But if MPP is greater than APP when the latter is rising, and is lower than APP when the latter is falling, then it follows that *when APP is at its maximum, MPP must be neither lower nor higher than, but equal to, APP.* And this proves the third law. We see that these characteristics of our table apply to all possible cases of production.

The diagram in Figure 59 depicts a typical set of MPP and APP schedules. It shows the various relationships between APP

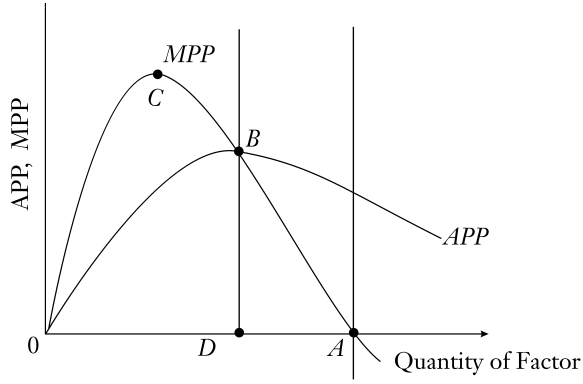

FIGURE 59. RELATION BETWEEN MARGINAL PHYSICAL PRODUCT AND AVERAGE PHYSICAL PRODUCT

and MPP. Both curves begin from zero and are identical very close to their origin. The APP curve rises until it reaches a peak at *B*, then declines. The MPP curve rises faster, so that it is higher than APP, reaches its peak earlier at *C*, then declines until

it intersects with APP at *B*. From then on, the MPP curve declines faster than APP, until finally it crosses the horizontal axis and becomes negative at some point *A*. No firm will operate beyond the *0A* area.

Now let us explore further the area of *increasing* APP, between 0 and *D*. Let us take another hypothetical tabulation (Table 14), which will be simpler for our purpose.

TABLE 14

UNITS OF FACTOR	TOTAL PRODUCT	AVERAGE PHYSICAL PRODUCT
2	10	5
3	18	6
4	25	6.2

This is a segment of the increasing section of the average physical product schedule, with the peak being reached at four units and 6.2 APP. The question is: What is the likelihood that this region will be settled upon by a firm as the right input-output combination? Let us take the top line of the chart. Two units of the variable factor, plus a bundle of what we may call *U* units of all the other factors, yield 10 units of the product. On the other hand, at the maximum APP for the factor, four units of it, plus *U* units of other factors, yield 25 units of the product. We have seen above that it is a fundamental truth in nature that the same quantitative causes produce the same quantitative effects. Therefore, if we halve the quantities of all of the factors in the third line, we shall get half the product. In other words, two units of the factor combined with *U*/2—with half of the various units of each of the other factors—will yield 12.5 units of the product.

Consider this situation. From the top line we see that two units of the variable factor, plus *U* units of given factors, yield 10 units of the product. But, extrapolating from the bottom

line, we see that two units of the variable factor, plus *U*/2 units of given factors, yield 12.5 units of the product. It is obvious that, as in the case of going beyond *0A*, any firm that allocated factors so as to be in the *0D* region would be making a most unwise decision. Obviously, no one would want to spend *more* in effort or money on factors (the "other" factors) and obtain *less* total output or, for that matter, the same total output. It is evident that if the producer remains in the *0D* region, he is in an area of *negative marginal physical productivity of the other factors.* He would be in a situation where he would obtain a greater total product by throwing away some of the other factors. In the same way, after *0A*, he would be in a position to gain greater total output if he threw away some of the present variable factor. *A region of increasing APP for one factor*, then, signifies a region of *negative MPP for other factors*, and *vice versa*. A producer, then, will never wish to allocate his factor in the *0D* region or in the region beyond *A*.

Neither will the producer set the factor so that its MPP is at the points *B* or *A*. Indeed, the variable factor will be set so that it has zero marginal productivity (at *A*) *only if it is a free good*. There is however, no such thing as a free good; there is only a condition of human welfare not subject to action, and therefore not an element in productivity schedules. Conversely, the APP is at *B*, its maximum for the variable factor, only when the *other* factors are free goods and therefore have zero marginal productivity at this point. Only if all the other factors were free and could be left out of account could the producer simply concentrate on maximizing the productivity of one factor alone. However, there can be no production with only one factor, as we saw in chapter 1.

The conclusion, therefore, is inescapable. A factor will always be employed in a production process in such a way that *it is in a region of declining APP and declining but positive MPP*—between points *D* and *A* on the chart. In every production process, therefore, every factor will be employed in a region of

diminishing MPP and diminishing APP *so that additional units of the factor employed in the process will lower the MPP, and decreased units will raise it.*

C. Marginal Value Product

As we have seen, the MVP for any factor is its MPP multiplied by the selling price of its product. We have just concluded that every factor will be employed in its region of diminishing marginal physical product in each process of production. What will be the shape of the marginal *value* product schedule? As the supply of a factor increases, and other factors remain the same, it follows that the total physical output of the product is greater. A greater stock, given the consumers' demand curve, will lead to a lowering of the market price. The price of the product will then fall as the MPP diminishes and rise as the latter increases. It follows that the MVP curve of the factor will always be falling, and falling at a *more rapid* rate than the MPP curve. *For each specific production process, any factor will be employed in the region of diminishing MVP.*[8] This correlates with the previous conclusion, based on the law of utility, that the factor in general, among various production processes, will be employed in such a way that its MVP is diminishing. Therefore, its *general MVP* (between various uses and within each use) is diminishing, and its various *particular MVPs* are diminishing (within each use). Its DMVP is, therefore, diminishing as well.

The price of a unit of any factor will, as we have seen, be established in the market as equal to its discounted marginal value product. This will be the DMVP as determined by the general schedule including all the various uses to which it can be put. Now the producers will employ the factor in such a way *that its DMVP will be equalized among all the uses.* If the DMVP in one use is greater than in another, then employers in the former line of production will be in a position to bid more for the factor and will use more of it until (according to the principle

[8]This law applies to all factors, specific and nonspecific.

of diminishing MVP) the DMVP of the expanding use diminishes to the point at which it equals the increasing DMVP in the contracting use. The price of the factor will be set as equal to the general DMVP, which in the ERE will be uniform throughout all the particular uses.

Thus, by looking at a factor in all of its interrelations, *we have been able to explain the pricing of its unit service without previously assuming the existence of the price itself*. To focus the analysis on the situation as it looks from the vantage point of the firm is to succumb to such an error, for the individual firm obviously finds a certain factor price given on the market. The price of a factor unit will be established by the market as equal to its marginal value product, discounted by the rate of interest for the length of time until the product is produced, provided that this valuation of the share of the factor is isolable. It is isolable if the factor is nonspecific or is a single residual specific factor in a process. The MVP in question is determined by the general MVP schedule covering the various uses of the factor and the supply of the factor available in the economy. The general MVP schedule of a factor diminishes as the supply of the factor increases; it is made up of particular MVP schedules for the various uses of the factor, which in turn are compounded of diminishing Marginal Physical Product schedules and declining product prices. Therefore, if the supply of the factor increases, the MVP schedule in the economy remaining the same, the MVP and hence the price of the factor will drop; and as the supply of the factor dwindles, *ceteris paribus*, the price of the factor will rise.

To the individual firm, the price of a factor established on the market is the signal of its discounted marginal value product elsewhere. This is the opportunity cost of the firm's using the product, since it equals the value product that is forgone through failure to use the factor unit elsewhere. In the ERE, where all factor prices equal discounted marginal value products, it follows that factor prices and (opportunity) "costs" will be equal.

Critics of the marginal productivity analysis have contended that in the "modern complex world" all factors co-operate in producing a product, and therefore it is impossible to establish any sort of imputation of part of the product to various co-operating factors. Hence, they assert, "distribution" of product to factors is separable from production and takes place arbitrarily according to bargaining theory. To be sure, no one denies that many factors do co-operate in producing goods. But the fact that most factors (and all labor factors) are nonspecific, and that there is very rarely more than one purely specific factor in a production process, enables the market to isolate value productivity and to tend to pay each factor in accordance with this marginal product. On the free market, therefore, the price of each factor is not determined by "arbitrary" bargaining, but tends to be set strictly in accordance with its discounted marginal value product. The importance of this market process becomes *greater* as the economy becomes more specialized and complex and the adjustments more delicate. The more uses develop for a factor, and the more types of factors arise, the more important is this market "imputation" process as compared to simple bargaining. For it is this process that causes the effective allocation of factors and the flow of production in accordance with the most urgent demands of the consumers (including the nonmonetary desires of the producers themselves). In the free-market process, therefore, there is no separation between production and "distribution." There is no heap somewhere on which "products" are arbitrarily thrown and from which someone does or can arbitrarily "distribute" them among various people. On the contrary, individuals produce goods and sell them to consumers for money, which they in turn spend on consumption or on investment in order to increase future consumption. There is no separate "distribution"; there is only production and its corollary, exchange.

It should always be understood, even where it is not explicitly stated in the text for reasons of exposition, that the MVP schedules used to set prices are *discounted* MVP schedules,

discounting the final MVP by the length of time remaining until the final consumers' product is produced. It is the DMVPs that are equalized throughout the various uses of the factor. The importance of this fact is that it explains the market allocation of nonspecific factors among various productive *stages* of the same or of different goods. Thus, if the DMVP of a factor is six gold ounces, and if the factor is employed on a process practically instantaneous with consumption, its MVP will be six. Suppose that the pure rate of interest is 5 percent. If the factor is at work on a process that will mature in final consumption five years from now, a DMVP of six signifies an MVP of 7.5; if it is at work on a 10-year process, a DMVP of six signifies an MVP of 10; etc. The more remote the time of operation is from the time when the final product is completed, the greater must be the difference allowed for the annual interest income earned by the capitalists who advance present goods and thereby make possible the entire length of the production process. The *amount* of the discount from the MVP is greater here because the higher stage is more remote than the others from final consumption. Therefore, in order for investment to take place in the higher stages, their MVP has to be far higher than the MVP in the shorter processes.[9]

3. The Source of Factor Incomes

Our analysis permits us now to resolve that time-honored controversy in economics: Which is the source of wages—capital or consumption? Or, as we should rephrase it, which is the source of original-factor incomes (for labor and land factors)? It is clear that the ultimate goal of the investment of capital is future consumption. In that sense, consumption is the necessary requisite without which there would be no capital. Furthermore,

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[9]See the excellent discussion in Böhm-Bawerk, *Positive Theory of Capital*, pp. 304–12. For a further discussion of DMVP as against MVP, *see* Appendix B below, "Professor Rolph and the Discounted Marginal Productivity Theory."

for each particular good, consumption dictates, through market demands, the prices of the various products and the shifting of (nonspecific) factors from one process to another. However, consumption by itself provides nothing. Savings and investment are needed in order to permit any consumption at all, since very little consumption could be obtained with no production processes or capital structure at all—perhaps only the direct picking of berries.[10]

In so far as labor or land factors produce and sell consumers' goods *immediately*, no capital is required for their payment. They are paid directly by consumption. This was true for Crusoe's berry-picking. It is also true in a highly capitalistic economy for labor (and land) in the final stages of the production process. In these final stages, which include pure labor incomes earned in the sale of personal services (of doctors, artists, lawyers, etc.) to consumers, the factors earn MVP directly without being discounted in advance. All the other labor and land factors participating in the production process are paid by saved capital in advance of the produced and consumed product.

We must conclude that in the dispute between the classical theory that wages are paid out of capital and the theory of Henry George, J.B. Clark, and others that wages are paid out of the annual product consumed, the former theory is correct in the overwhelming majority of cases, and that this majority becomes more preponderant the greater the stock of capital in the society.[11]

4. Land and Capital Goods

The price of the unit service of every factor, then, is equal to its discounted marginal value product. This is true of *all* factors, whether they be "original" (land and labor) or "produced"

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[10]*See* Wicksell, *Lectures on Political Economy*, I, 108.

[11]See the excellent analysis in *ibid*., pp. 189–91, 193–95.

(capital goods). However, as we have seen, there is no *net* income to the owners of capital goods, since their prices contain the prices of the various factors that co-operate in their production. Essentially, then, *net* income accrues only to owners of land and labor factors and to capitalists for their "time" services. It is still true, however, that the pricing principle—equality to discounted MVP—applies whatever the factor, whether capital good or any other.

Let us revert to the diagram in Figure 41. This time, let us assume for simplicity that we are dealing with one unit of one consumers' good, which sells for 100 ounces, and that *one unit* of each particular factor enters into its production. Thus, on Rank 1, 80 refers to one unit of a capital good. Let us consider the first rank first. Capitalists_1 purchase one capital good for 80 ounces and (we assume) one labor factor for eight ounces and one land factor for seven ounces. The joint MVP for the three factors is 100. Yet their total price is 95 ounces. The remainder is the *discount* accruing to the capitalists because of the time element. The sum of the discounted MVPs, then, is 95 ounces, and this is precisely what the owners of three factors received in total. The discounted MVP of the labor factor's service was eight, the DMVP of the land's service was seven, the DMVP of the capital good's service was 80. Thus, each factor obtains its DMVP as its received price. But what happens in the case of the capital good? It has been sold for 80, but it has had to be produced, and this production cost money to pay the income of the various factors. The price of the capital good, then, is reduced to, say, another land factor, paid eight ounces; another labor factor paid 8 ounces, and a capital-goods factor paid 60 ounces. The prices, and therefore the incomes, of all these factors are discounted again to account for the time, and this discount is earned by Capitalists_2. The sum of these factor incomes is 76, and once again each factor service earns its DMVP.

Each capital-goods factor must be produced and must continue to be produced in the ERE. Since this is so, we see that

the capital-goods factor, though obtaining its DMVP, does not earn it *net*, for *its* owner, in turn, must pay money to the factors that produce it. Ultimately, only land, labor, and time factors earn net incomes.

This type of analysis has been severely criticized on the following grounds:

This "Austrian" method of tracing everything back to land and labor (and time!) may be an interesting historical exercise, and we may grant that, if we trace back production and investment far enough, we shall ultimately reach the world of primitive men, who began to produce capital with their bare hands. But of what relevance is this for the modern, complex world around us, a world in which a huge amount of capital already exists and can be worked with? In the modern world there is no production without the aid of capital, and therefore the whole Austrian capital analysis is valueless for the modern economy.

There is no question about the fact that we are not interested in historical analysis, but rather in an economic analysis of the complex economy. In particular, acting man has no interest in the historical origin of his resources; he is acting in the *present* on behalf of a goal to be achieved *in the future*.[12] Praxeological analysis recognizes this and deals with the individual acting at present to satisfy ends of varying degrees of futurity (from instantaneous to remote).

It is true, too, that the presentation by the master of capital and production theory, Böhm-Bawerk, sowed confusion by giving an historical interpretation to the structure of production. This is particularly true of his concept of the "average period of production," which attempted to establish an average length of production processes operating at present, but stretching back to the beginning of time. In one of the weakest parts of his theory, Böhm-Bawerk conceded that "The boy who cuts a stick

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[12]This was realized by Carl Menger. *See* F.A. Hayek, "Carl Menger" in Henry W. Spiegel, ed., *The Development of Economic Thought* (New York: John Wiley, 1952), pp. 530 ff.

with his knife is, strictly speaking, only continuing the work of the miner who, centuries ago, thrust the first spade into the ground to sink the shaft from which the ore was brought to make the blade."[13] He then tried to salvage the relevance of the production structure by averaging periods of production and maintaining that the effect in the present product of the early centuries' work is so small (being so remote) as to be negligible.

Mises has succeeded, however, in refining the Austrian production theory so as to eliminate reliance on an almost infinitely high production structure and on the mythical concept of an "average period of production."

As Mises states:

> Acting man does not look at his condition with the eyes of an historian. He is not concerned with how the present situation originated. His only concern is to make the best use of the means available today for the best possible removal of future uneasiness. . . . He has at his disposal a definite quantity of material factors of production. He does not ask whether these factors are nature-given or the product of production processes accomplished in the past. It does not matter for him how great a quantity of nature-given, i.e., original material factors of production and labor, was expended in their production and how much time these processes of production have absorbed. He values the available means exclusively from the aspect of the services they can render him in his endeavors to make future conditions more satisfactory. The period of production and the duration of serviceableness are for him categories in planning future action, not concepts of academic retrospection. . . . They play a role in so far as the actor has to choose between periods of production of different length. . . .
>
> [Böhm-Bawerk] . . . was not fully aware of the fact that the period of production is a praxeological category

[13] Böhm-Bawerk, *Positive Theory of Capital*, p. 88.

> and that the role it plays in action consists entirely in the choices acting man makes between periods of production of different length. The length of time expended in the past for the production of capital goods available today does not count at all.[14]

But if the past is not taken into account, how can we use the production-structure analysis? How can it apply to an ERE if the structure would have to go back almost endlessly in time? If we base our approach on the present, must we not follow the Knightians in scrapping the production-structure analysis?

A particular point of contention is the dividing line between land and capital goods. The Knightians, in scoffing at the idea of tracing periods of production back through the centuries, scrap the *land* concept altogether and include land as simply a part of capital goods. This change, of course, completely alters production theory. The Knightians point correctly, for example, to the fact that present-day land has many varieties and amounts of past labor "mixed" with it: canals have been dug, forests cleared, basic improvements have been made in the soil, etc. They assert that practically nothing is pure "land" anymore and therefore that the concept has become an empty one.

As Mises has shown, however, we can revise Böhm-Bawerk's theory and still retain the vital distinction between land and capital goods. We do not have to throw out, as do the Knightians, the land baby with the average-period-of-production bathwater. We can, instead, reformulate the concept of "land." Up to this point we have simply assumed land to be the original, nature-given factors. Now we must modify this, in keeping with our focus on the present and the future rather than the past. Whether or not a piece of land is "originally" pure land is in fact economically immaterial, so long as whatever alterations have been made are permanent—or rather, so long as these alterations do not have to be reproduced or

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[14]Mises, *Human Action*, pp. 477, 485 f. *Also see* Menger, *Principles of Economics*, pp. 166–67.

replaced.[15] Land that has been irrigated by canals or altered through the chopping down of forests has become a present, permanent *given*. Because it is a present given, not worn out in the process of production, and not needing to be replaced, it becomes a *land* factor under our definition. In the ERE, this factor will continue to give forth its natural powers unstinted and without further investment; it is therefore *land* in our analysis. Once this occurs, and the permanent are separated from the nonpermanent alterations, we see that the structure of production no longer stretches back infinitely in time, but comes to a close within a relatively brief span of time.[16] The capital goods are those which are continually wearing out in the process of production and which labor and land factors must work to replace. When we consider physical wearing out and replacement, then, it becomes evident that it would not take many years for the whole capital-goods structure to collapse, if no work were done on maintenance and replacement, and this is true even in the modern, highly capitalist economy. Of course, the higher the degree of "capitalist" development and the more stages in production, the longer will it take for all the capital goods to wear out.[17]

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[15]"Nonreplaceable" as a criterion for *land*, in contrast to *capital goods*, is *not* equivalent to "permanent." "Permanent" is a subdivision of "nonreplaceable." It is clear that permanent improvements do not have to be replaced. However, *depletable* natural resources, such as coal, ores, etc., are not permanent, but are also nonreplaceable. The key question is whether a resource has to be *produced*, in which case it earns only *gross* rents. If it does not or cannot, it earns *net* rents as well. Resources that are being depleted obviously *cannot* be replaced and are therefore *land*, not capital goods. See the section on depletable resources below.

[16]We may use "permanent" and "nonpermanent" in this section, because resources that are being depleted obviously cannot be included in any evenly rotating equilibrium. For more on depletable resources, see below. With depletable resources left aside, "permanent" becomes identical with "nonreproducible."

[17]Cf. Wicksell, *Lectures on Political Economy* I, 186 and *passim*; and Hayek, *Pure Theory of Capital*, pp. 54–58.

The "permanence" with which we are dealing refers, of course, to the *physical* permanence of the goods, and *not* to the permanence of their value. *The latter depends on the shifting desires of consumers and could never be called permanent.* Thus, there might be a land factor uniquely and permanently suitable as a vineyard. It is *land* and remains so, therefore, indefinitely. If, at some time, the consumers should completely lose their taste for wine, and the land becomes valueless and no longer used, it is *still* a permanent factor, and therefore is land, although now submarginal. It should be noted that the "permanence" is relevant to present considerations of human action. A piece of land might give forth a permanent marginal (physical) product, without necessity of maintenance, and suddenly a volcano might erupt or a hurricane strike in the area, and the permanence could be destroyed. Such conceivable natural events, however, are not *ex ante* relevant to human action, and therefore from the point of view of action this land is rightly considered as "permanent," until the natural changes occur.[18,19]

The concept of "land" as used throughout this book, then, is entirely different from the popular concept of land. Let us, in this section, distinguish between the two by calling the former *economic land* and the latter *geographic land*. The economic concept includes *all* nature-given sources of value: what is usually

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[18]Neither is there any relation between the present issue of permanence or nonpermanence and the cosmological question of the permanence of matter and energy. *See* Mises, *Human Action*, p. 634.

[19]Stigler charges that the various distinctions between land and capital goods based on permanence or origin, such as are discussed herein, are physical rather than economic. These strictures miss the point. No one denies that these homogeneous factors can change greatly in *value* over time. But whether or not a given factor is original or improved, or permanent or needing to be maintained, *is* a physical question, and one that is very relevant to economic analysis. Certainly, the Knightian argument that all land is capital goods, because no land is original, is also an argument in the *physical* realm. Stigler, *Production and Distribution Theories*, p. 274.

known as natural resources, land, water, and air in so far as they are not free goods. On the other hand, a large part of the value of what is generally considered "land"—i.e., that part that has to be maintained with the use of labor—is really a capital good.

That agricultural land is an example of the latter may surprise the reader who is likely to think of it as permanently productive. This is completely wrong; the marginal physical productivity of (geographic) land varies greatly in accordance with the amount of labor that is devoted to maintaining or improving the soil, as against such use or nonuse of the soil as leads to erosion and a lower MPP. The basic soil (and here we are referring to the soil that would remain *now* if maintenance were suspended, *not* to the soil as it was in the dim past before cultivation) is the *land element*, while the final product—which is popularly known as agricultural land—is usually a capital good containing this land element.

And Van Sickle and Rogge say about the soil:

> Land, as the top 12 to 18 inches from which grains, vegetables, grasses, and trees draw almost their entire nourishment, is highly destructible. Top soil can be washed or blown away (eroded), or its organic and mineral content can be dissolved and drawn down out of reach of plant life (leached) in a relatively few years, unless great care is exercised in its use. It can also be rebuilt by careful husbandry. Hence it can be said of all soils . . . that their maintenance requires saving.[20]

The indestructibility of land is much more clearly exemplified in what is commonly called "urban land." For land in urban areas (and this includes suburban land, land for factories, etc.) clearly evinces one of its most fundamentally indestructible features: *its physical space*—its part of the surface of the earth. For

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[20]John V. Van Sickle and Benjamin A. Rogge, *Introduction to Economics* (New York: D. Van Nostrand, 1954), p. 141.

the surface area of the earth is, except in rare cases, eternally fixed, as is the geographic position of each piece of geographic land on the surface. This eternally fixed, permanent, *positional* aspect of geographic land is called the *site* aspect of the land, or as Mises aptly puts it, "the land as standing room." Since it is permanent and nonreproducible, it very clearly comes under the category of economic land. The permanence, once again, refers to its physical spatial aspect; its site *values*, of course, are always subject to change.[21] Midtown Manhattan is on the same site—the same geographical location—now as it was in the 1600's, although the monetary values accruing to it have changed.

Suppose that a piece of currently unused land can be used for various agricultural purposes or for urban purposes. In that case, a choice will be made according to its alternative values as nonreplaceable economic land: between its discounted MVP as a result of the fertility of its basic soil and its discounted MVP as an urban site. And if a decision must be made whether land *now* used in agriculture and being maintained for that purpose should remain in agriculture or be used as a site for building, the principles of choice are the same. The marginal value return to the agricultural or urban land is broken down by the owner of the land—the "landlord"—into the interest return on the capital maintenance and improvement and the discounted marginal value return to the basic economic land.

"Basic land" (or "ground land") in this treatise refers to the *soil without maintenance*, in the case of agriculture, or the *pure site without depreciating superstructure*, in the case of urban land. The basic land, therefore, whether it be soil or site, earns for its owner an ultimate unit price, or rent, equaling its DMVP. Working on this basic land, labor and investment create a finished capital good. This capital good, like all capital goods, also

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[21]But while the position is permanent, even the land itself was necessarily altered by man to prepare it for urban use. See chapter 2 above.

earns unit rents equal to its DMVP. However, this earning is broken down (and relevantly so in the *current* market, not as an historical exercise) into basic land rent and interest return on the capital invested (as well, of course, as returns to labor that works on the basic land, i.e., labor's wage or "rent-price," equaling its DMVP). This capital-good land we have variously termed "geographic land," "land in the popular sense," "final land," "finished land." When we speak simply of "land," on the other hand, we shall always be referring to the true economic land—the currently nature-given factor.

5. Capitalization and Rent

The subject of "rent" is one of the most confused in the entire economic literature. We must, therefore, reiterate the meaning of rent as set forth above. We are using "rent" *to mean the unit price of the services of any good.* It is important to banish any preconceptions that apply the concept of rent to land only. Perhaps the best guide is to keep in mind the well-known practice of "renting out." Rent, then, is the same as *hire*: it is the sale and purchase of the *unit services* of any good.[22] It therefore applies as well to prices of labor services (called "wages") as it does to land or to any other factor. The rent concept applies to all goods, whether durable or nondurable. In the case of a completely nondurable good, which vanishes fully when first used,

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[22]This concept of rent is based on the original contribution of Frank A. Fetter. Cf. Fetter, *Economic Principles*, pp. 143–70. Fetter's conception has, unfortunately, had little influence on economic thought. It is not only in accord with common usage; it provides a unifying principle, enabling a coherent explanation of the price determination of unit services and of the whole goods that embody them. Without the rental-price concept, it is difficult to distinguish between the pricing of unit services and of whole goods.

Fetter used the rental concept to apply only to the services of durable goods, but it is clear that it can be extended to cover cases of nondurable goods where the unit service *is* the whole good.

its "unit" of service is simply identical in size with the "whole" good itself. In regard to a durable good, of course, the rent concept is more interesting, since the price of the unit service is distinguishable from the price of the "good as a whole." So far, in this work, we have been assuming that no durable producers' goods are ever bought outright, that only their *unit services* are exchanged on the market. Therefore, our entire discussion of pricing has dealt with rental pricing. It is obvious that *the rents are the fundamental prices.* The marginal utility analysis has taught us that men value goods in *units* and not as wholes; the *unit price* (or "rent") is, then, the fundamental price on the market.

In chapter 4 we analyzed rental pricing and the price of the "good as a whole" for durable consumers' goods. The principle is precisely the same for producers' goods. The rental value of the unit service is the basic one, the one ultimately determined on the market by individual utility scales. The price of the "whole good," also known as *the capital value of the good*, is equal to the sum of the expected future rents discounted by what we then vaguely called a time-preference factor and which we now know is the *rate of interest*. The capital value, or price of the good as a whole, then, is completely dependent on the rental prices of the good, its physical durability, and the rate of interest.[23] Obviously, the concept of "capital value" of a good has meaning only when that good is durable and does not vanish instantly upon use. If it did vanish, then there would only be pure rent, without separate valuations for the good as a whole. When we use the term "good as a whole," we are not referring to the aggregate supply of the whole good in the economy. We are referring, e.g., not to the total supply of housing of a certain type, but to *one* house, which can be rented out over a period of time. We are dealing with *units of "whole goods,"* and these units,

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[23]See chapter 4 above. On capitalization, *see* Fetter, *Economic Principles*, pp. 262–84, 308–13; and Böhm-Bawerk, *Positive Theory of Capital*, pp. 339–57.

being durable, are necessarily larger than their constituent unit services, which can be rented out over a period of time.

The principle of the determination of "capital values," i.e., prices of "whole goods," is known as *capitalization*, or the capitalizing of rents. This principle applies to *all* goods, not simply capital goods, and we must not be misled by similarity of terminology. Thus, capitalization applies to durable consumers' goods, such as houses, TV sets, etc. It also applies to all factors of production, including basic land. The rental price, or rent, of a factor of production is equal, as we have seen, to its discounted marginal value product. *The capital value of a "whole factor" will be equal to the sum of its future rents, or the sum of its DMVPs.*[24] This capital value will be the price for which the "whole good" will exchange on the market. It is at this capital value that a unit of a "whole good" such as a house, a piano, a machine, an acre of land, etc., will sell on the market. There is clearly no sense to capitalization if there is no market, or price, for the "whole good." The capital value is the appraised value set by the market on the basis of rents, durability, and the interest rate.

The process of capitalization can encompass many units of a "whole good," as well as one unit. Let us consider the example of chapter 4, section 7, and generalize from it to apply, not only to houses, but to all durable producers' goods. The good is a 10-year good; expected future rents are 10 gold ounces per year (determined by consumer utilities for consumers' goods, or by MVPs for producers' goods). The rate of interest is 10 percent per annum. The present capital value of this good is 59.4 gold ounces. But this "whole good" is itself a unit of a larger supply; one of many houses, machines, plants, etc. At any rate, since all units of a good have equal value, the capital value of two such houses, or two such machines, etc., added together equals precisely twice the amount of one, or 118.8 ounces. Since we are

[24]It is often more convenient to define *rent* as equal to the MVP, rather than the DMVP. In that case, the capital value of the whole factor is equal to the *discounted* sum of its future rents.

adding rents or DMVPs in money terms, we may keep adding them to determine capital values of larger aggregates of durable goods. As a matter of fact, in adding capital values, *we do not need to confine ourselves to the same good.* All we need do is to add the capital values in whatever bundle of durable goods we are interested in appraising. Thus, suppose a firm, Jones Construction Company, wishes to sell all its assets on the market. These assets, necessarily durable, consist of the following:

3 machines. Each machine has a capital value (based on the sum of the DMVPs) of 10 ounces. Therefore, total capital value is *30 ounces.*

1 building, with a capital value of *40 ounces.*

4 acres of land. Each acre has a capital value of *10 ounces*. Total is *40 ounces.*

Total capital value of these assets: *110 ounces*.

But we must always remember, in adding capital values, that these are relevant only in so far as they are expressed in market price or potential market price. Many writers have fallen into the trap of assuming that they can, in a similar way, add up the entire capital value of the nation or world and arrive at a meaningful figure. Estimates of National Capital or World Capital, however, are completely meaningless. The world, or country, cannot sell all its capital on the market. Therefore, such statistical exercises are pointless. They are without possible reference to the very goal of capitalization: correct estimation of potential market price.

As we have indicated, capitalization applies to *all* factors of production, or rather, to all factors where there are markets for the whole goods that embody them. We may call these markets *capital markets.* They are the markets for exchange of ownership, total or partial, of durable producers' goods. Let us take the case of capital goods. The rent of a capital good is equal to its DMVP. The capitalized value of the capital good is the sum of the future DMVPs, or the discounted sum of the future

MVPs. This is the *present* value of the good, and this is what the good will sell for on the capital market.

The process of capitalization, because it permeates all sectors of the economy, and because it is flexible enough to include different types of assets—such as the total capital assets of a firm—is a very important one in the economy. Prices of shares of the ownership of this capital will be set at their proportionate fraction of the total capital value of the assets. In this way, given the *MVPs*, *durability*, and the *rate of interest*, all the prices on the capital market are determined, and these will be the prices in the ERE. This is the way in which the prices of individual capital goods (machines, buildings, etc.) will be set on the market, and this is the way in which these values will be summed up to set the price of a bundle of capital assets, similar and dissimilar. Share prices on the stock market will be set according to the proportion that they bear to the capitalized value of the firm's total assets.

We have stated that *all* factors that can be bought and sold as "whole goods" on the market are capitalized. This includes capital goods, ground land, and durable consumers' goods. It is clear that capital goods and durable consumers' goods can be and are capitalized. But what of ground land? How can this be capitalized?

We have seen in detail above that the ultimate earnings of factors go to the owners of labor and of ground land and, as interest, to capitalists. If land can be capitalized, does this not mean that land and capital goods are "really the same thing" after all? The answer to the latter question is No.[25] It is still emphatically true that the earnings of basic land factors are ultimate and irreducible, as are labor earnings, while capital goods have to be constantly produced and reproduced, and therefore their earnings are always reducible to the earnings of ground land, labor, and time.

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[25]Fetter's main error in capital theory was his belief that capitalization meant the scrapping of any distinction between capital goods and land.

Basic land can be capitalized for one simple reason: it can be bought and sold "as a whole" on the market. (This cannot be done for labor, except under a system of slavery, which, of course, cannot occur on the purely free market.) Since this can be and is being done, the problem arises how the prices in these exchanges are determined. These prices are the capital values of ground land.

A major characteristic of land as compared to capital goods is that its series of future rents is generally *infinite*, since, whether as basic soil or site, it is physically indestructible. In the ERE, the series of future rents will, of course, always be the same. The very fact that any land is ever bought and sold, by the way, is a demonstration of the universality of time preference. If there were no time preference for the present, then an infinite series of future rents could never be capitalized. A piece of land would have to have an infinite present price and therefore could never be sold. The fact that lands *do* have prices is an indication that there is always a time preference and that future rents are discounted to reduce to a present value.

As in the case of any other good, the capital value of land is equal to the sum of its discounted future rents. For example, it can be demonstrated mathematically that if we have a constant rent expected to be earned in perpetuity, the capital value of the asset will equal the annual rent divided by the rate of interest.[26] Now it is obvious that on such land, the investor annually obtains the market rate of interest. If, in other words, annual rents will be 50, and the rate of interest is 5 percent, the asset will sell for 50/.05, or 1,000. The investor who purchases the asset for 1,000 ounces will earn 50 ounces a year from it, or 5 percent, the market rate of interest.

Ground land, then, is "capitalized" just as are capital goods, shares in capital-owning firms, and durable consumers' goods. All these owners will tend to receive the same rate of interest return, and all *will* receive the same rate of return in the ERE.

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[26]Cf. Boulding, *Economic Analysis*, pp. 711–12.

In short, all owned assets will be capitalized. In the ERE, of course, the capital values of all assets will remain constant; they will also be equal to the discounted sum of the MVPs of their unit rents.

Above, we saw that a key distinction between land and capital goods is that the owners of the former sell future goods for present money, whereas the owners of the latter *advance* present money, buy future goods, and later sell their product when it is less distantly future. This is still true. But then we must ask the question: How does the landowner come to own this land? The answer is (excepting his or his ancestors' finding unused land and putting it to use) that he must have bought it from someone else. If he did so, then, in the ERE, he must have bought it *at its capitalized value*. If he buys the piece of land at a price of 1,000 ounces, and receives 50 ounces per annum in rent, then he earns *interest*, and *only* interest. He sells future goods (land service) in the production process, but *he too first bought the whole land with money*. Therefore, he too is a "capitalist-investor" earning interest.

"Pure rent," i.e., rent that is *not* simply a return on previous investment and is therefore not capitalized, *seems*, therefore, to be earned only by those who have *found* unused land themselves (or inherited it from the finders). But even *they* do not earn pure rent. Suppose that a man finds land, unowned and worth zero, and then fences it, etc., until it is now able to yield a perpetual rental of 50 ounces per annum. Could we not say that *he* earns pure rent, since he did not buy the land, capitalized, from someone else? But this would overlook one of the most important features of economic life: *implicit earnings*. Even if this man did not buy the land, the land is *now* worth a certain capital value, the one it *could obtain* on the market. This capital value is, say, 1,000. Therefore, the man could sell the land for 1,000 at any time. *His forgone opportunity cost of owning the land and renting out its services is sale of the land for 1,000 ounces.* It is true that he earns 50 ounces per year, but this is only at the sacrifice of not selling

the whole land for 1,000 ounces. His land, therefore, is really as much capitalized as land that has been bought on the market.

We must therefore conclude that *no one* receives pure rent except laborers in the form of wages, that the *only* incomes in the productive ERE economy are *wages* (the term for the prices and incomes of labor factors) and *interest*. But there is still a crucial distinction between land and capital goods. For we see that a fundamental, irreducible element is the *capital value of land.* The capital value of capital goods still reduces to wages and the capital value of land. In a *changing* economy, there is another source of income: *increases in the capital value of ground land.* Typical was the man who found unused land and then sold its services. Originally, the capital value of the land was zero; it was worthless. Now the land has become valuable because it earns rents. As a result, the capital value has risen to 1,000 ounces. His income, or gain, consisted of the *rise* of 1,000 ounces in capital value. This, of course, cannot take place in the ERE. In the ERE, all capital values must remain constant; here, we see that a source of monetary gain is a *rise* in the capital value of land, a rise resulting from increases in expected rental yields of land.[27] If the economy becomes an ERE after this particular change from zero to 1,000, then this income was a "one-shot" affair, rather than a continuing and recurring item. The capital value of the land rose from zero to 1,000, and the owner can reap this income at any time. However, after this has been reaped once, it is never reaped again. If he sells the land for 1,000, the next buyer receives no gain from the increase in capital value; he receives only market interest. Only interest and wages accrue continuously. As long as the ERE continues, there will be no further gains or losses in capital value.[28]

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[27]In the *long run*, increases in the capital value of *capital goods* are unimportant, since they resolve into increases in wages and increases in the capital value of ground land.

[28]The problem of gains from changes in capital values will be treated further below.

6. The Depletion of Natural Resources

One category has been purposely omitted so far from the discussion of land factors. At first, we defined land as the *original, nature-given factor*. Then we said that land which had been improved by human hands but which is now permanently given must also be considered as *land*. Land, then, became the catallactically permanent, nonreproducible resource, while capital goods are those that are nonpermanent and therefore must be produced again in order to be replaced. But there is one type of resource that is nonreplaceable but also nonpermanent: the natural resource that is being depleted, such as a copper or a diamond mine. Here the factor is definitely original and nature-given; it cannot be produced by man. On the other hand, it is not permanent, but subject to *depletion* because any use of it leaves an absolutely smaller amount for use in the future. It is original, but nonpermanent. Shall it be classed as land or as a capital good?

The crucial test of our classificatory procedure is to ask: Must labor and land factors work in order to reproduce the good? In the case of permanent factors this is not necessary, since they do not wear out. But in this case, we must answer in the negative also, for these goods, though nonpermanent, *cannot* be reproduced by man despite their depletion. Therefore, the natural resource comes as a special division under the "land" category.[29]

Table 15, adapted from one by Professor Hayek, reveals our classification of various resources as either land or capital goods.[30]

Hayek criticizes the criterion of *reproducibility* for classifying a capital good. He declares: "The point that is relevant . . . is not

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[29]Cf. Fred R. Fairchild, Edgar S. Furniss, and Norman S. Buck, *Elementary Economics* (New York: Macmillan & Co., 1926), II, 147.

[30]Hayek, *Pure Theory of Capital*, p. 58 n.

TABLE 15

RESOURCES	PERMANENT	NONPERMANENT (CONSUMABLE)
Original (nonproducible)	Land	Land
Produced (producible)	Land	Capital Goods

that certain existing resources *can* be replaced by others which are in some technological sense similar to them, but that they have to be replaced by something, whether similar or not, if the income stream is not to decline."[31] But this is confusing *value* with *physical* considerations. We are attempting to classify *physical* goods here, not to discuss their possible values, which will fluctuate continually. The point is that the resources subject to depletion *cannot* be replaced, much as the owner would like to do so. They therefore earn a *net rent.* Hayek also raises the question whether a stream is "land" if a new stream can be created by collecting rain water. Here again, Hayek misconceives the issue as one of maintaining a "constant income stream" instead of classifying a physical concrete good. The stream is land because it does not *need* to be physically replaced. It is obvious that Hayek's criticism is valid against Kaldor's definition. Kaldor defined capital as a reproducible resource which it is *economically* profitable to produce. In that case, obsolete machines would no longer be capital goods. (Would they be "land"?) The definition should be: *physically* reproducible resources. Hayek's criticism that then the possibility of growing artificial fruit, etc., would make all land "capital" again misconceives the problem, which is one of the physical *need and possibility* of reproducing

[31] *Ibid.*, p. 92.

the agent. Since the basic *land—not* its fruit—needs no reproduction, it is excluded from the capital-good category.

The fact that the natural resources *cannot* be reproduced means that they earn a *net rent* and that their rent is not absorbed by land and labor factors that go into their production. Of course, from the net rents they earn the usual interest rate of the society for their owners, interest earnings being related to their capital value. Increases in capital values of natural resources go ultimately to the resource-owner himself and are not absorbed in gains by other land and labor factors.

There is no problem in capitalizing a resource that is subject to depletion, since, as we have seen, capitalization can take place for either a finite or an infinite series of future rental incomes.

There is, however, one striking problem that pervades any analysis of the resource subject to depletion and that distinguishes it from all other types of goods. This is the fact that there can be *no* use for such a resource in an evenly rotating economy. For the basis of the ERE is that all economic quantities continue indefinitely in an endless round. But this cannot happen in the case of a resource that is subject to depletion, for whenever it is used, the total stock of that good in the economy decreases. The situation at the next moment, then, cannot be the same as before. This is but one example of the insuperable difficulties encountered whenever the ERE is used, not as an auxiliary construction in analysis, but as some sort of ideal that the free economy must be forced to emulate.

There can be a reserve demand for a depletable resource, just as there is speculative reserve demand for any other stock of goods on the market. This speculation is not simple wickedness, however; it has a definite function, namely, that of allocating the scarce depletable resource to those uses *at those times* when consumer demand for them will be greatest. The speculator, waiting to use the resources until a future date, benefits consumers by shifting their use to a time when they will be more in demand than at present. As in the case of ground land, the permanent

resource belongs to the first finder and first user, and often some of these initial capital gains are absorbed by interest on the capital originally invested in the business of resource-finding. The absorption can take place only in so far as the finding of new resources is a regular, continuing business. But this business, which by definition could not exist in the ERE, can never be completely regularized.

Minerals such as coal and oil are clearly prime examples of depletable resources. What about such natural resources as forests? A forest, although growing by natural processes, can be "produced" by man if measures are taken to maintain and grow more trees, etc. Therefore, forests would have to be classified as capital goods rather than depletable resources.

One of the frequent attacks on the behavior of the free market is based on the Georgist bugbear of natural resources held off the market for speculative purposes. We have dealt with this alleged problem above. Another, and diametrically opposite, attack is the common one that the free market wastes resources, especially depletable resources. Future generations are allegedly robbed by the greed of the present. Such reasoning would lead to the paradoxical conclusion that *none* of the resource be consumed at all. For whenever, at any time, a man consumes a depletable resource (here we use "consumes" in a broader sense to include "uses up" in production), he is leaving less of a stock for himself or his descendants to draw upon. It is a fact of life that *whenever* any amount of a depletable resource is used up, less is left for the future, and therefore *any* such consumption could just as well be called "robbery of the future," if one chooses to define robbery in such unusual terms.[32] Once we grant *any* amount of use to the depletable resource, we have to discard the robbery-of-the-future argument and accept the individual preferences of the market. There is then no more reason to assume

[32]Unusual terms because robbery has been distinctively defined as seizure of *someone else's* property without his consent, not the use of one's *own* property.

that the market will use the resources too fast than to assume the opposite. The market will tend to use resources at precisely the rate that the consumers desire.[33]

Having developed, in Volume I, our basic analysis of the economics of the isolated individual, barter, and indirect exchange, we shall now proceed, in Volume II, to develop the analysis further by dealing with "dynamic" problems of a changing economy, particular types of factors, money and its value, and monopoly and competition, and discussing, in necessarily more summary fashion, the consequences of violent intervention in the free market.

Appendix A
Marginal Physical and Marginal Value Product

For purposes of simplification, we have described *marginal value product* (MVP) as equal to *marginal physical product* (MPP) times *price*. Since we have seen that a factor must be used in the region of declining MPP, and since an increased supply of a factor leads to a fall in price, the conclusion of the analysis was that every factor works in an area where increased supply leads to a decline in MVP, and hence in DMVP. The assumption made in the first sentence, however, is not strictly correct.

Let us, then, find out what *is* the multiple of MPP that will yield an MVP. MVP is equal to an increase in revenue acquired from the addition of a unit, or lost from the loss of a unit, of a factor. MVP will then equal the difference in revenue from one position to another, i.e., the change in position resulting from an increase or decrease of a unit of a factor. Then, *MVP equals*

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[33]As Stigler says in discussing the charge of "wasted" resources on the market, "It is an interesting problem to define 'wasteful' sensibly without making the word synonymous with 'unprofitable.'" Stigler, *Theory of Price*, p. 332 n. For a discussion of natural resources and a critique of the doctrines of "conservation," *see* Anthony Scott, *Natural Resources: The Economics of Conservation* (Toronto: University of Toronto Press, 1955).

$R_2 - R_1$, where R is the gross revenue from the sale of a product, and a higher subscript signifies that *more* of a factor has been used in production. The *MPP* of this increase in a factor is $P_2 - P_1$, where P is the quantity of product produced, a higher subscript again meaning that more of a factor has been used.

So: $\text{MVP} = R_2 - R_1$ by definition.

$\text{MPP} = P_2 - P_1$ by definition.

Revenue is acquired by sale of the product; therefore, for any given point on the demand curve, total revenue equals the quantity produced and sold, multiplied by the price of the product.

Therefore, $R = P \cdot p$, where p is the price of the product.

So: $R_2 = P_2 \cdot p_2$

$R_1 = P_1 \cdot p_1$

Now, since the factors are economic goods, any increase in the use of a factor, other factors remaining constant, must *increase* the quantity produced. It would obviously be pointless for an entrepreneur to employ more factors which would not increase the product. Therefore, $P_2 > P_1$.

On the other hand, the price of the product falls as the supply increases, so that:

$$p_2 < p_1$$

Now, we are trying to find out what multiplied by MPP yields MVP. This unknown will be equal to:

$$\frac{\text{MVP}}{\text{MPP}} = \frac{R_2 - R_1}{P_2 - P_1}$$

This may be called the *marginal revenue*, which is the change in revenue divided by the change in output.

It is obvious that this figure. which we may call *MR*, will not equal either p_2 or p_1, or any average of the two. Simple multiplication of the denominator by either of the *p*'s or both will reveal that this does not amount to the numerator. What *is* the relation between *MR* and price?

A price is the *average revenue*, i.e., it equals the total revenue divided by the quantity produced and sold. In short,

$$p = \frac{R}{P}$$

But above, in the discussion of marginal and average product, we saw the mathematical relationship between "average" and "marginal," and this holds for revenue as well as for productivity: namely, that in the range where the average is increasing, marginal is greater than average; in the range where average is decreasing, marginal is less than average. But we have established early in this book that the demand curve—i.e., the price, or average revenue curve—is always *falling* as the quantity increases. Therefore, the marginal revenue curve is falling also and is always below average revenue, or price. Let us, however, cement the proof by demonstrating that, for any two positions, p_2 is greater than *MR*. Since p_2 is smaller than p_1, as price falls when supply increases, the proposition that *MR* is less than both prices will be proved.

First, we know that $p_2 < p_1$, which means that

$$\frac{R_2}{P_2} < \frac{R_1}{P_1}$$

Now, we may take point one as the starting point and then consider the change to point two, so that:

$$\frac{R + \Delta R}{P + \Delta P} < \frac{R}{P}$$

thus translating into the same symbols we used in the productivity proof above. Now this means that

$$\frac{R}{P} - \frac{R+\Delta R}{P+\Delta P} > 0$$

Combining the two fractions, and then multiplying across, we get

$$R\Delta P - P\Delta R > 0$$

or

$$R\Delta P > P\Delta R,$$

so that $$\frac{R}{P} > \frac{\Delta R}{\Delta P}$$

(We have here proved that *MR* is less than p_1, the higher of the two prices.)

Now this means that there is some unknown, constant positive *fraction* $1/k$ which, multiplied by the larger, will yield the smaller ratio (*MR*) in the last inequality. Thus,

$$\frac{R}{kP} = \frac{\Delta R}{\Delta P}$$

Now, by algebra,

$$\frac{\Delta R}{\Delta P} = \frac{R+\Delta R}{kP+\Delta P}$$

and since k is a positive number,

$$\frac{R+\Delta R}{P+\Delta P} > \frac{R+\Delta R}{kP+\Delta P}$$

But this establishes that

$$\frac{R+\Delta R}{P+\Delta P} > \frac{\Delta R}{\Delta P}$$

i.e., *that MR is less than* p_2. Q.E.D.

Hence, when we consider that, strictly, *MR*, and not price, should be multiplied by MPP to arrive at MVP, we find that our conclusion—that production always takes place in the zone of a falling MVP curve—is *strengthened* rather than weakened. MVP

falls even more rapidly in relation to MPP than we had been supposing. Furthermore, our analysis is not greatly modified, because no new basic determinants—beyond MPP and prices set by the consumer demand curve—have been introduced in our corrective analysis. In view of all this, we may continue to treat MVP as equaling MPP times price as a legitimate, simplified approximation to the actual result.[34]

Appendix B
Professor Rolph and the Discounted Marginal Productivity Theory

Of current schools of economic thought, the most fashionable have been the Econometric, the Keynesian, the Institutionalist, and the Neo-Classic. "Neo-Classic" refers to the pattern set by the major economists of the late nineteenth century. The dominant neoclassical strain at present is to be found in the system of Professor Frank Knight, of which the most characteristic feature is an attack on the whole concept of time preference. Denying time preference, and basing interest return solely on an alleged "productivity" of capital, the Knightians attack the doctrine of the *discounted* MVP and instead advocate a pure MVP theory. The clearest exposition of this approach is to be found in an article by a follower of Knight's, Professor Earl Rolph.[35]

Rolph defines "product" as any *immediate* results of "present valuable activities." These include work on goods that will be consumed only in the future. Thus,

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[34]A curious notion has arisen that considering *MR*, instead of price, as the multiplier somehow vitiates the optimum satisfaction of consumer desires on the market. There is no genuine warrant for such an assumption.

[35]Earl Rolph, "The Discounted Marginal Productivity Doctrine" in W. Fellner and B.F. Haley, eds., *Readings in Theory of Income Distribution* (Philadelphia: Blakiston, 1946), pp. 278–93.

> workmen and equipment beginning the construction of a building may have only a few stakes in the ground to show for their work the first day, but this and not the completed structure is their immediate product. Thus, the doctrine that a factor receives the value of its marginal product refers to this immediate product. The simultaneity of production and product does not require any simplifying assumptions. It is a direct appeal to the obvious. Every activity has its immediate results.

Obviously, no one denies that people work on goods and move capital a little further along. But is the immediate result of this a *product* in any meaningful sense? It should be clear that the product is the end product—the good sold to the consumer. The whole purpose of the production system is to lead to final consumption. All the intermediate purchases are based on the expectation of final purchase by the consumer and would not take place otherwise. Every activity may have its immediate "results," but they are not results that would command any monetary income from anyone if the owners of the factors themselves were joint owners of all they produced until the final consumption stage. In that case, it would be obvious that they do not get paid immediately; hence, their product is not immediate. The only reason that they *are* paid immediately (and even here there is not strict immediacy) on the market is that capitalists *advance* present goods in exchange for those *future* goods for which they expect a premium, or interest return. Thus, the owners of the factors are paid the *discounted* value of their marginal product.

The Knight-Rolph approach, in addition, is a retreat to a real-cost theory of value. It assumes that present efforts will somehow always bring present results. But when? In "present valuable activities." But how do these activities *become* valuable? Only if their *future product* is sold, as expected, to consumers. Suppose, however, that people work for years on a certain good and are paid by capitalists, and then the final product is not

bought by consumers. The capitalists absorb monetary losses. Where was the immediate payment according to marginal product? The payment was only an investment in future goods by capitalists.

Rolph then turns to another allegedly heinous error of the discount approach, namely, the "doctrine of *nonco-ordination of factors.*" This means that some factors, in their payment, receive the *discounted* value of their product and some do not. Rolph, however, is laboring under a misapprehension; there is no assumption of nonco-ordination in any sound discounting theory. As we have stated above, *all* factors—labor, land, and capital goods—receive their discounted marginal value product. The difference in regard to the owners of capital goods is that, in the ultimate analysis, they do not receive any *independent* payment, since capital goods are resolved into the factors that produced them, ultimately land and labor factors, and to interest for the time involved in the advance of payment by the capitalists.[36] Rolph believes that nonco-ordination is involved because owners of land and labor factors "receive a discounted share," and capital "receives an undiscounted share." But this is a faulty way of stating the conclusion. Owners of land and labor factors

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[36]Rolph ascribes this error to Knut Wicksell, but such a confusion is not attributable to Wicksell, who engages in a brilliant discussion of capital and the production structure and the role of time in production. Wicksell demonstrates correctly that labor and land are the only ultimate factors, and that therefore the marginal productivity of capital goods is reducible to the marginal productivity of labor and land factors, so that money capital earns the interest (or discount) differential.

Wicksell's discussion of these and related issues is of basic importance. He recognized, for example, that capital goods are fully and basically coordinate with land and labor factors *only from the point of view of the individual firm*, but not when we consider the total market in all of its interrelations. Current economic theorizing is, to its detriment, even more preoccupied than writers of his day with the study of an isolated firm instead of the interrelated market. Wicksell, *Lectures on Political Economy*, I, 148–54, 185–95.

receive a discounted share, but owners of capital (money capital) receive *the discount*.

The remainder of Rolph's article is largely devoted to an attempt to prove that no time lag is involved in payments to owners of factors. Rolph assumes the existence of "production centers" within every firm, which, broken down into virtually instantaneous steps, produce and then implicitly receive payment instantaneously. This tortured and unreal construction misses the entire point. Even if there were atomized "production centers," the point is that some person or persons will have to make advances of present money along the route, in whatever order, until the final product is sold to the consumers. Let Rolph picture a production system, atomized or integrated as the case may be, with no one making the advances of present goods (money capital) that he denies exist. And as the laborers and landowners work on the intermediate products for years without pay, until the finished product is ready for the consumer, let Rolph exhort them not to worry, since they have been implicitly paid simultaneously as they worked. For this is the logical implication of the Knight-Rolph position.[37]

[37]Rolph ends his article, consistently, with a dismissal of any time-preference influences on interest, which he explains in Knightian vein by the "cost" of producing new capital goods.

8

PRODUCTION: ENTREPRENEURSHIP AND CHANGE

1. Entrepreneurial Profit and Loss

HAVING DEVELOPED IN THE PREVIOUS chapters our basic analysis of the market economy, we now proceed to discuss more dynamic and specific applications, as well as the consequences of intervention in the market.

In the evenly rotating economy, there are only two ultimate categories of producers' prices and incomes: interest (uniform throughout the economy), and "wages"—the prices of the services of various labor factors. In a changing economy, however, wage rates and the interest rate are not the only elements that can change. Another category of both positive and negative income appears: *entrepreneurial profit and loss.* We shall concentrate on the *capitalist-entrepreneurs*, economically the more important type of entrepreneur. These are the men who invest in "capital" (land and/or capital goods) used in the productive process. Their function is as we have described: the advance of money to owners of factors and the consequent use of the goods until the *more nearly present* product is later sold. We have worked out the laws of the ERE in detail: factor prices will equal DMVP, every factor will be allocated to its most value-productive uses, capital values will equal the sums of the DMVPs, the interest rate will be uniform and governed solely by time preferences, etc.

The difference in the dynamic, real world is this. None of these future values or events is known; all must be *estimated*, guessed at, by the capitalists. They must advance present money in a speculation upon the unknown future in the expectation that the future product will be sold at a remunerative price. In the real world, then, quality of judgment and accuracy of forecast play an enormous role in the incomes acquired by capitalists. As a result of the arbitrage of the entrepreneurs, the *tendency* is always toward the ERE; in consequence of ever-changing reality, changes in value scales and resources, the ERE never arrives.

The capitalist-entrepreneur buys factors or factor services in the present; his product must be sold in the future. He is always on the alert, then, for discrepancies, for areas where he can earn more than the going rate of interest. Suppose the interest rate is 5 percent; Jones can buy a certain combination of factors for 100 ounces; he believes that he can use this agglomeration to sell a product after two years for 120 ounces. His *expected* future return is 10 percent per annum. If his expectations are fulfilled, then he will obtain a 10-percent annual return instead of 5 percent. The difference between the general interest rate and his actual return is his *money profit* (from now on to be called simply "profit," unless there is a specific distinction between money profit and psychic profit). In this case, his money profit is 10 ounces for two years, or an extra 5 percent per annum.

What gave rise to this realized profit, this *ex post* profit fulfilling the producer's *ex ante* expectations? The fact that the *factors of production in this process were underpriced and undercapitalized*—underpriced in so far as their unit services were bought, undercapitalized in so far as the factors were bought as wholes. In either case, the general expectations of the market erred by underestimating the future rents (MVPs) of the factors. This particular entrepreneur saw better than his fellows, however, and acted on this insight. He reaped the reward of his superior foresight in the form of a profit. His action, his recognition of

the general undervaluation of productive factors, results in the eventual elimination of profits, or rather in the tendency toward their elimination. By extending production in this particular process, he increases the demand for these factors and raises their prices. This result will be accentuated by the entry of competitors into the same area, attracted by the 10-percent rate of return. Not only will the rise in demand *raise* the prices of the factors, but the increase in output will *lower* the price of the product. The result will be a tendency for a fall in the rate of return back to the pure interest rate.

What function has the entrepreneur performed? In his quest for profits he saw that certain factors were underpriced vis-à-vis their potential value products. By recognizing the discrepancy and doing something about it, he shifted factors of production (obviously nonspecific factors) from other productive processes to this one. He detected that the factors' prices did not adequately reflect their potential DMVPs; by bidding for, and hiring, these factors, he was able to allocate them from production of lower DMVP to production of higher DMVP. He has served the consumers better by anticipating where the factors are more valuable. For the greater value of the factors is due solely to their being more highly demanded by the consumers, i.e., being better able to satisfy the desires of the consumers. That is the meaning of a greater discounted marginal value product.

It is clear that there is no sense whatever in talking of a going *rate of profit.* There is no such rate beyond the ephemeral and momentary. For any realized profit tends to disappear because of the entrepreneurial actions it generates. The basic *rate*, then, is the *rate of interest*, which does not disappear. If we start with a dynamic economy, and if we postulate given value scales and given original factors and technical knowledge throughout, the result will be a wiping out of profits to reach an ERE with a pure interest rate. Continual changes in tastes and resources, however, constantly shift the final equilibrium goal and establish a new goal toward which entrepreneurial action is

directed—and again the final tendency in the ERE will be the disappearance of profits. For the ERE means the disappearance of uncertainty, and profit is the outgrowth of uncertainty.

A grave error is made by a host of writers and economists in considering only profits in the economy. Almost no account is taken of *losses*. The economy should not be characterized as a "profit economy," but as a "profit and loss economy."[1]

A *loss* occurs when an entrepreneur has made a poor estimate of his future selling prices and revenues. He bought factors, say, for 1,000 ounces, developed them into a product, and then sold it for 900 ounces. He erred in not realizing that the factors were *overpriced* and *overcapitalized* on the market in relation to their discounted marginal value products, i.e., to the prices of his output.

Every entrepreneur, therefore, invests in a process because he expects to make a profit, i.e., *because he believes that the market has underpriced and undercapitalized the factors* in relation to their future rents. If his belief is justified, he makes a profit. If his belief is unjustified, and the market, for example, has really *overpriced* the factors, he will suffer losses.

The nature of loss has to be carefully defined. Suppose an entrepreneur, the market rate of interest being 5 percent, buys factors at 1,000 and sells their product for 1,020 one year later. Has he suffered a "loss" or made a "profit"? At first, it might seem that he has not taken a loss. After all, he gained back the principal plus an extra 20 ounces, for a 2-percent net return or

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[1]"One thing I miss . . . in discussion generally in the field, is any use of words recognizing that profit means profit *or loss* and is in fact as likely to be a loss as a gain." Frank H. Knight, "An Appraisal of Economic Change: Discussion," *American Economic Review, Papers and Proceedings*, May, 1954, p. 63. Professor Knight's great contributions to profit theory are in sharp contrast to his errors in capital and interest theory. See his famous work, *Risk, Uncertainty, and Profit* (3rd ed.; London: London School of Economics, 1940). Perhaps the best presentation of profit theory is in Ludwig von Mises, "Profit and Loss" in *Planning for Freedom* (South Holland, Ill.: Libertarian Press, 1952), pp. 108–51.

gain. However, closer inspection reveals that he could have made a 5-percent net return anywhere on his capital, since this is the going interest return. He could have made it, say, investing in any other enterprise or in lending money to consumer-borrowers. In this venture he did not even earn the interest gain. The "cost" of his investment, therefore, was not simply his expenses on factors—1,000—but also his forgone opportunity of earning interest at 5 percent, i.e., an additional 50. He therefore suffered a loss of 30 ounces.

The absurdity of the concept of "rate of profit" is even more evident if we attempt to postulate a *rate of loss*. Obviously, no meaningful use can be made of "rate of loss"; entrepreneurs will be very quick to leave the losing investment and take their capital elsewhere. With entrepreneurs leaving the line of production, the prices of the factors there will drop and the price of the product will rise (with reduced supply), until the net return in that branch of production will be the same as in every branch, and this return will be the uniform interest rate of the ERE. It is clear, therefore, that the process of equalization of rate of return throughout the economy, one that results in a uniform rate of interest, *is the very same process that brings about the abolition of profits and losses in the ERE*. A real economy, in other words, where line A yields a net return of 10 percent to some entrepreneur, and line B yields 2 percent, while other lines yield 5 percent, is one in which the rate of interest is 5 percent, A makes a pure profit of 5 percent, and B suffers a pure loss of 3 percent. A correctly estimated that the market had underpriced his factors in relation to their true DMVPs; B had incorrectly guessed that the market had underpriced (or, at the very least, correctly priced) *his* factors, but found to his sorrow that they had been overpriced in relation to the uses that he made of the factors. In the ERE, where all future values are known and there is therefore no underpricing or overpricing, there are no entrepreneurial profits or losses; there is only a pure interest rate.

In the real world, profits and losses are almost always intertwined with interest returns. Our separation of them is conceptually valid and very important, but cannot be made easily and quantitatively in practice.

Let us sum up the essence of an evenly rotating economy. It is this: all factors of production are allocated to the areas where their discounted marginal value products are the greatest. These are determined by consumer demand schedules. In the modern world of specialization and division of labor, it is almost always the consumers alone who decide, and this in effect excludes the capitalists, who rarely consume more than a negligible amount of their own products. It is the consumers, then, given the "natural" facts of stocks of resources (particularly labor and land factors), who make the decisions for the economic system. The consumers, through their buying and abstention from buying, decide how much of what will be produced, at the same time determining the incomes of all the participating factors. And every man is a consumer.

One obvious exception to this "rule" occurs when either capitalists or laborers have strong preferences or dislikes for a particular line of production. The equilibrium rate of return in the ERE for a strongly disliked line will be considerably higher than the uniform rate, and the equilibrium rate of return for a strongly liked line will be lower. These preferences, however, have to be strong enough to affect the investment or productive actions of a considerable number of potential investors or laborers in order to register as a change in the rate of return.

Do profits have a social function? Many critics point to the ERE, where there are no profits (or losses) and then attack entrepreneurs earning profits in the real world as if they were doing something mischievous or at best unnecessary. Are not profits an index of something wrong, of some maladjustment in the economy? The answer is: Yes, profits are an index of maladjustment, but in a sense precisely opposed to that usually meant. As

we have seen above, *profits are an index that maladjustments are being met and combatted by the profit-making entrepreneurs.* These maladjustments are the inevitable concomitants of the real world of change. A man earns profits only if he has, by superior foresight and judgment, uncovered a maladjustment—specifically an undervaluation of certain factors by the market. By stepping into this situation and gaining the profit, he calls everyone's attention to that maladjustment and sets forces into motion that eventually eliminate it. If we must condemn anyone, it should not be the *profit-making* entrepreneur, but the one that has suffered losses. For losses are a sign that he has added further to a maladjustment, through allocating factors where they were overvalued as compared to the consumers' desire for their product. On the other hand, the profit-maker is allocating factors where they had been undervalued as compared to the consumers' desires. The greater a man's profit has been, the more praiseworthy his role, for then the greater is the maladjustment that he alone has uncovered and is combatting. The greater a man's losses, the more blameworthy he is, for the greater has been his contribution to maladjustment.[2]

Of course, we should not be too hard on the bumbling loser. He receives his penalty in the form of losses. These losses drive him from his poor role in production. If he is a consistent loser wherever he enters the production process, he is driven out of the entrepreneurial role altogether. He returns to the job of wage earner. In fact, the market tends to reward its efficient entrepreneurs and penalize its inefficient ones proportionately. In this way, consistently provident entrepreneurs see their capital and resources growing, while consistently imprudent ones find

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[2]We may make such value judgments, of course, only to the extent that we believe it is "good" to correct maladjustments and to serve the consumers, and "bad" to create such maladjustments. These value judgments, therefore, are not at all praxeological truths, though most people would probably subscribe to them. Those who *prefer* maladjustments in serving consumers will adopt the opposite value judgments.

their resources dwindling. The former play a larger and larger role in the production process; the latter are forced to abandon entrepreneurship altogether. There is no inevitably self-reinforcing tendency about this process, however. If a formerly good entrepreneur should suddenly made a bad mistake, he will suffer losses proportionately; if a formerly poor entrepreneur makes a good forecast, he will make proportionate gains. The market is no respecter of past laurels, however large. Moreover, the size of a man's investment is no guarantee whatever of a large profit or against grievous losses. Capital does not "beget" profit. Only wise entrepreneurial decisions do that. A man investing in an unsound venture can lose 10,000 ounces of gold as surely as a man engaging in a sound venture can profit on an investment of 50 ounces.[3]

Beyond the market process of penalization, we cannot condemn the unfortunate capitalist who suffers losses. He was a man who voluntarily assumed the risks of entrepreneurship and suffered from his poor judgment by incurring losses proportionate to his error. Outside critics have no right to condemn him further. As Mises says:

> Nobody has the right to take offense at the errors made by the entrepreneurs in the conduct of affairs and to stress the point that people would have been better supplied if the entrepreneurs had been more skillful and prescient. If the grumbler knew better, why did he not himself fill the gap and seize the opportunity to earn profits? It is easy indeed to display foresight after the event.[4]

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[3]On all this, *see* Mises, "Profit and Loss." On the role of the fallacy of capital's automatically yielding profit in public utility regulation, *see* Arthur S. Dewing, *The Financial Policy of Corporations* (5th ed.; New York: Ronald Press, 1953), I, 308–53.

[4]Mises, *Planning for Freedom*, p. 114.

2. The Effect of Net Investment

Having considered the ERE and its relation to specific entrepreneurial profit and loss, let us now turn to the problem: When will there be *aggregate* profits or losses in the economy? This is connected with the question: What is the effect of a change in the level of aggregate saving or investment in the economy?

Let us begin with an economy in the equilibrium depicted in chapters 5 and 6. Production occurs in processes up to six years in total length; total gross income is 418 gold ounces, gross savings-investment is 318 ounces, total consumption 100 ounces, net savings-investment is zero. Of the 100 ounces of income, 83 ounces of net income are earned by land and labor owners, 17 ounces by capital owners. The production structure remains constant because the natural rates of interest coincide, and the resulting price spreads conform to the aggregate of individual time-preference schedules in the economy. As Hayek states:

> Whether the structure of production remains the same depends entirely upon whether entrepreneurs find it profitable to reinvest the usual proportion of the return from the sale of the product in turning out intermediate goods of the same sort. Whether this is profitable, again, depends upon the prices obtained for the product of this particular stage of production on the one hand and on the prices paid for the original means of production and for the intermediate products taken from the preceding stage of production on the other. The continuance of the existing degree of capitalistic organization depends, accordingly, on the prices paid and obtained for the product of each stage of production, and these prices are, therefore, a very real and important factor in determining the direction of production.[5]

[5]Hayek, *Prices and Production*, pp. 48–49.

What happens if, in a certain period, there are now net savings as a result of a lowering of time-preference schedules? Suppose, for example, that consumption decreases from 100 to 80 and that the saved 20 ounces enter the time market. Gross savings have increased by 20 ounces. During the transition period, net saving has changed from zero to 20; after the new level of saving has been reached, however, there will be a new equilibrium with gross savings equalling 338 and net savings equalling zero. To the superficial, it might seem that all is lost. Has not consumption decreased from 100 to 80 ounces? What, then, will happen to the whole complex of productive activities that rest on final consumption sales? Will this not lead to a disastrous depression for all firms? And how can a *reduced* consumption profitably support an *increased* volume of expenditures on producers' goods? The latter has aptly been termed by Hayek the "paradox of saving," i.e., that saving is the necessary and sufficient condition for increased production, and yet that such investment seems to contain within itself the seeds of financial disaster for the investors.[6]

If we observe the diagram in Figure 40 above, it is clear that the volume of money incomes to Capitalists_1 will be drastically reduced. Capitalists_1 will receive a total of 80 instead of 100 ounces. The amount that they have to apportion to original factors and to Capitalists_2 is therefore also considerably decreased. Thus, from the side of final consumers' spending, an impetus toward declining money incomes and prices is sent along the production structure. In the meanwhile, however, *another force* has concurrently come into play. The 20 ounces have not been lost to the system. They are in the process of being invested in the economy, their owners ranging throughout the economy looking for maximum interest returns on their investment. The new savings have changed the ratio of gross

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[6]*See* Hayek, "The 'Paradox' of Saving" in *Profits, Interest, and Investment*, pp. 199–263.

investment to consumption from 318:100 to 338:80. A "narrower" consumption base must support a larger amount of producers' spending. How can this happen, especially since the lower-rank capitalists must also receive a lower aggregate income? The answer is: in only one way—by shifting investment further up the ladder to the higher-order production stages. Simple investigation will reveal that the only way that so much investment can be shifted from the lower to the higher stages, while preserving uniform (lowered) interest differentials (cumulative price spreads) at each stage, is *to increase the number of productive stages in the economy*, i.e., to lengthen the structure of production. The impact of net saving on the economy, i.e., of increased total savings, is to lengthen and narrow the structure of production, and this procedure is viable and self-supporting, since it preserves essential price spreads from stage to stage. The diagram in Figure 60 illustrates the impact of net saving.

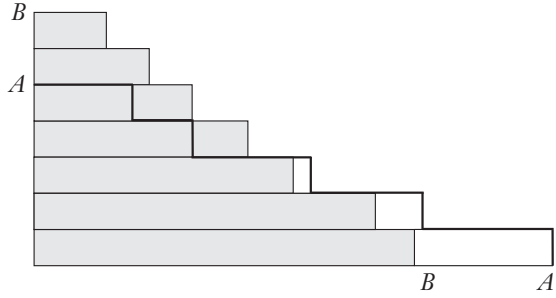

FIGURE 60. THE IMPACT OF NET SAVING

In this diagram we see the narrowing and the lengthening of the structure of production. The heavy line *AA* outlines the original structure. The bottom rectangle—consumption—is narrowed with the addition of new savings. As we go up in stepwise fashion—the steps in these diagrams accounting for the

interest spreads[7]—the new production structure *BB* (the shaded area) becomes relatively less and less narrow compared to the original structure, until it becomes wider in the upper registers, and finally adds new and higher stages.

The reader will notice that the steps (differentials between stages) in the new production structure *BB* are considerably narrower than the ones in *AA*. This is not an accident. If the steps in *BB* were of the same width as in *AA*, there would be no lengthening of the structure, and total investment would diminish instead of increase. But what is the significance of the narrowing steps in the structure? On the assumptions on which we have drawn the diagram, it is equivalent to a lowering of the interest spreads, i.e., a lowering of the natural rate of interest. But we have seen above that the consequence of lower time-preference rates in the society is precisely a lowering of the rate of interest. Thus, lowered time preferences mean an increased proportion of savings-investment to consumption and lead to smaller price spreads and an equivalent lowering of the rate of interest.

The lowering of interest spreads may be portrayed by another diagram, as in Figure 61.

In this diagram, cumulative prices are plotted against stages of production, and the further right we go, the lower the stage of production, until consumption is reached. *AA* is the original curve with the topmost dot representing the highest cumulative price—the one for the final product consumed. The dots next to the left are the lower cumulative prices of the higher stages, and the differences between the dots represent the interest spread and therefore the rate of interest return from stage to stage. *BB* is the curve applicable to the new situation, after saving has increased. Consumption has declined; hence

[7]This production structure diagram differs from our usual ones; it presents both the capital structure and the payment to owners of original factors as amalgamated in the same bar, to represent total investment at each stage. The steps in the diagram, then, represent the interest spreads to the capitalists (in rough, not exact, fashion).

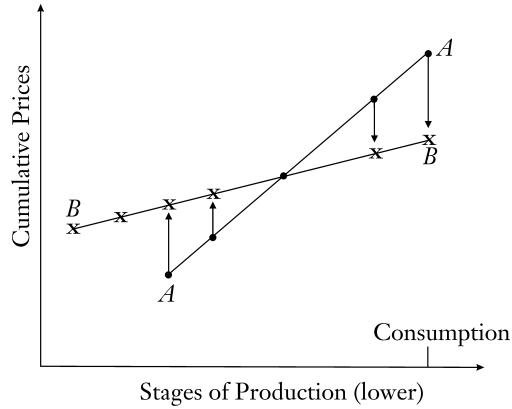

FIGURE 61. LOWERING OF INTEREST SPREADS

the rightmost dot in *B* is lower than the one in *A*, and the arrow depicts the change. The point next to the left on the *BB* curve is, of course, lower than the rightmost dot, but lower by a smaller amount than the corresponding dot in *AA*, because the lower interest rate signifies a smaller spread between the cumulative prices of the two stages. The next dot to the left, having the same rate of interest return, will be on approximately the same slope. Therefore, since the *BB* curve is flatter than the *AA* curve—because of the lower interest spread—it crosses the *AA* curve and from that point leftward, i.e., in the higher productive stages, its prices are higher than *A*'s. Arrows depict this change as well.

In Figure 60 we saw the effect of additional saving, i.e., positive net savings, on the structure of production and on the rate of interest. Here we see that the change in the rate of interest lessens the spreads of cumulative prices, so that aggregate consumption is lower, the immediate next higher stages are less and less lower, until the lines cross, and the prices in the higher stages are higher than before. Let us consider the price changes in the various stages and the processes by which they occur. In the lower stages, prices fall because of the lower consumer demand and the resulting shift of investment capital from the

stages nearest consumption. In the higher stages, on the other hand, demand for factors increases under the impact of the new savings and the shift in investment from the lower levels. The increased investment expenditure in the higher levels raises the prices of the factors in these stages. It is as if the impact of lower consumer demand tends to die out in the higher stages and is more and more counteracted by the increase and shift in investment funds.

The process of readjustment to lower price spreads caused by increased gross saving has been lucidly described by Hayek. As he states:

> The final effect will be that, through the fall of prices in the later stages of production and the rise of prices in the earlier stages of production, price margins between the different stages of production will have decreased all round.[8]

The changes in cumulative prices in the various sectors will lead to changes in the prices of the particular goods that enter into the cumulation of factors. These factors are, of course, the capital goods, land, and labor factors, and are ultimately reducible to the latter two, since capital goods are produced (and reproduced) factors. It is clear that lower aggregate demand in the lower stages will cause the prices of the various factors there to decline. The *specific* factors will have to bear the brunt of the decline, since they have nowhere else to go. The nonspecific factors, on the other hand, *can* and do go elsewhere—to the earlier stages, where the monetary demand for factors has increased.

The pricing of capital goods is ultimately unimportant in this connection, because it is reducible to the prices of land, labor, and time, and because the slopes of the curves, the interest spread, indicate the mode of pricing of the capital goods. The ultimately important factors, then, are land, labor, and time.

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[8]Hayek, *Prices and Production*, pp. 75–76.

The time element has been extensively considered and accounts for the interest spread. It is the land and labor elements that constitute the fundamental resources being shifted or remaining in production. Some land is specific and some nonspecific; some can be used in several alternative types of productive processes; some can be used in only one type. Labor, on the other hand, is almost always nonspecific; very rare indeed is the person who could conceivably perform only one type of task.[9] Of course, there are different *degrees* of nonspecificity for any factor, and the less specific ones will be more readily shifted from one stage or product to another.

Those factors which are specific to only one particular stage and process will therefore fall in price in the later stages and rise in the earlier stages. What of the nonspecific factors, which include all labor factors? These will tend to shift from the later to the earlier stages. At first, there will be a difference in the price of each nonspecific factor; it will be lower in the lower stages and higher in the higher stages. In equilibrium, however, as we have seen time and again, there must be a uniform price for any factor throughout the economy. The lower demand in the lower stages, and the consequent lower price, coupled with the higher demand and higher price in the higher stages, causes the shift of the factor from later to earlier stages. The shift ceases when the price of the factor is again uniform throughout.

We have seen the impact of new saving, i.e., a shift from consumption to investment, on the prices of goods at various levels. What, however, is the *aggregate* impact of a change to a higher level of gross savings on the prices of factors? Here we reach a paradoxical situation. *Net income* is the total amount of money that ultimately goes to factors: land, labor, and time. In

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[9]Of course, the productivity of a labor factor will differ from one task to another. No one disputes this; indeed, if this were not so, the factor would be *purely nonspecific*, and we have seen that this is an impossibility. "Specific" is here used to mean pure specificity for one production process.

any equilibrium situation, net saving is zero by definition (since net saving means a change in the level of gross saving over the previous period of time), and net income equals consumption and consumption alone. If we look again at Figure 41 above, we see that the total income for original factors and interest can come only from net, rather than gross, income. Let us consider the new ERE *after* the change has taken place to a higher level of saving (ignoring for a moment the relevant conditions *during* the period of change). Gross savings = gross investment has increased from 318 to 338. But consumption has declined from 100 to 80, and it is consumption that provides the net income in the equilibrium situation. Net income is, as it were, the "fund" out of which money prices and incomes are paid to original factors. And this fund has *declined*.

The recipients of the net income fund are the original factors (labor and land) and interest on time. We know that the interest rate declines; this is a corollary of the increased saving and investment in the productive system, caused by lowered time preference. However, the absolute amount of interest *income* is gross investment multiplied by the rate of interest. Gross investment has increased, so that it is impossible for economic analysis to determine whether interest *income* has fallen, increased, or remained the same. Any of these alternatives is a possibility.

What happens to total original-factor income is also indeterminate. Two forces are pulling different ways in a *progressing economy* (an economy with *increasing* gross investment). On the one hand, the total net income money fund is falling; on the other hand, if the interest decline is large enough, it is possible that the fall in interest income will outstrip the fall in total net income, so that total factor income actually increases. For this to occur is possible but empirically highly unlikely.

The one certain prospect is that total net income for factors *and* interest will fall. If the total original-factor income falls, then, since we have implicitly been assuming a given supply of original factors, the prices of these factors, as well as the interest rate, will "in general" also decline.

That the general trend of original-factor incomes and prices may well be downward is a startling conclusion, for it is difficult to conceive of a *progressing* economy as one in which factor prices, such as wage rates and ground rents, steadily *decline*. What interests us, however, is not the course of *money* incomes and prices of factors, but of *real* incomes and prices, i.e., the "goods-income" accruing to factors. If money wage rates or wage incomes fall, and the supply of consumers' goods increases such that the prices of these goods fall even more, the result is a rise in "real" wage rates and "real incomes" to factors. That this is precisely what does happen solves the paradox that a progressing economy experiences falling wages and rents. There may be a fall in money terms (although not in all conceivable cases); but there will always be a *rise in real terms.*

The rise in real rates and incomes is due to the increase in the marginal physical productivity of factors that always results from an increase in saving and investment.[10] The increased productivity of the longer production processes leads to a greater physical supply of capital goods, and, most important, of consumers' goods, with a consequent fall in the prices of consumers' goods. As a result, even if the money prices of labor and land fall, those of consumers' goods will *always* fall farther, so that real factor incomes will rise. That this is always true in a progressing economy can be seen from the following considerations.

At any time, the wage or rent of the service of an original factor of production will equal its DMVP, the discounted marginal value product. This DMVP is equal to the MVP (marginal value product) divided by a discount factor, say d, which is directly dependent on the rate of interest. The MVP, in turn, is approximately equal to the MPP (marginal physical product) of the factor times the selling price, i.e., the final price of the consumers' good product. Hence,

$$\text{Price of factor service} = \frac{\text{MPP} \times P}{d}$$

[10]See below for discussion of this point.

In this discussion, we are considering the prices of consumers' goods "in general" or in the aggregate. The "real" prices of the original factors equal the money prices divided by the prices of consumers' goods. Strictly, there is no precise praxeological way of measuring these aggregates, or "real" income, based on changes in the purchasing power of money, but we can make qualitative statements about these elements even though we cannot make precise quantitative measurements.

The *real* price of factor service, then, $= \frac{\text{MPP} \times P}{d \times P}$

The *P*'s cancel, and the result:

Real price of factor service $= \frac{\text{MPP}}{d}$ (roughly)

Now the progressing economy consists of two leading features: an increase in the MPP of original factors resulting from more productive and longer production processes, and a fall in the discount or interest rate concomitant with falling time preference and increasing gross investment. Both elements—the increase in MPP and the fall in *d*—impel an increase in the real prices of factor services in a progressing economy.

The conclusion is that in a progressing economy, i.e., in an economy with increases in gross savings and investment, money wages and ground rents may well fall, but *real* wages and rents will rise.[11]

One question that immediately presents itself is: How can the prices of factors decline while the gross income remains the

[11]Historically, the advancing capitalist economy has coincided with an expanding money supply, so that we have rarely had an empirical illustration of the above "pure" process described in the text. We must remember that we have throughout been making the implicit assumption that the "money relation"—the demand for, and particularly the supply of, money—remains unchanged. Effects of changes in this relation will be considered in chapter 11. The only relaxation of this assumption here is that the number of stages increases, and this tends to increase the demand for money to that extent.

same and gross investment even increases? The answer is that the increase in investment goes into increasing the number of stages, pushing back the stages of production and employing longer production processes. It is this increasing "roundaboutness" that causes every increase in capital—even if unaccompanied by an advance in technological *knowledge*—to lead to higher physical productivity per original factor. The increase in gross investment, in particular, raises the prices of capital goods at the highest stages, encouraging new stages and inducing entrepreneurs to shift factors into this new and flowering field. The larger gross investment fund is absorbed, so to speak, by higher prices of high-order capital goods and by the consequent new stages of turnover of these goods.[12]

3. Capital Values and Aggregate Profits in a Changing Economy

Net saving, as we have seen, increases gross investment in the economy. This increase in gross investment at first accrues as profits to the firms doing the increased business. These profits will accrue particularly in the higher stages, toward which old capital is shifting and in which new capital is invested. An accrual of profits to a firm increases, by that amount, the capital value of its assets, just as the losses decrease the capital value. The first impact of the new investment, then, is to cause *aggregate profits* to appear in the economy, concentrated in the new production processes in the higher stages. As the transition to the new ERE begins to take place, however, these profits more and more become *imputed* to the factors for which these entrepreneurs must pay in production. Eventually, if no other interfering changes occur, the result will be a disappearance of profits in the economy, a settling into the new ERE, an increase in real wages and other real rents, and an

[12]The demand for money increases to the extent that each gold unit must "turn over" more times in the increased number of stages, thus tending to lower the "general level" of prices.

increase in the real capital value of ground land. This latter result, of course, is in perfect conformity with the previous conclusion that a progressing economy will lead to an increase in the real rents of ground land and a fall in the rate of interest. These two factors, in conjunction, both impel a rise in the real capital value of ground land.

Future rises in the real values of rents can be either anticipated or not anticipated. To the extent that they are *anticipated*, the rise in future rents is already accounted for, and discounted, in the capital value of the whole land. A rise in the far future may be anticipated, but will have no appreciable effect on the present price of land, simply because time preference places a very distant date beyond the effective "time horizon" of the present. To the extent that rises in the real rate are *not* foreseen, then, of course, entrepreneurial errors have been made, and the market has undercapitalized in the present price.[13] Throughout the whole history of landholding, therefore, income from *basic land* can be earned in only three ways (we are omitting *improving* the land): (1) through entrepreneurial profit in correcting the forecasting errors of others; (2) as interest return; or (3) by a rise in the capital value to the *first* finder and user of the land.

The first type of income is obvious and not unique. It is pervasive in any field of enterprise. The second type of income is the general income earned by ground land. Because of the market phenomenon of capitalization, income from ground land is largely interest return on investment, just as in any other business. The only unique component of income that ground land confers, therefore, is (3), accruing to the first user, whose land value began at zero and became positive. After that, the buyer of the land must pay its capitalized value. To earn rent on ground land, in other words, a man must either buy it or find it, and in the former case he earns only interest, and not pure rent.

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[13]For a view of capitalized gains similar to the one presented here, *see* Roy F. Harrod, *Economic Essays* (New York: Harcourt, Brace & Co., 1952), pp. 198–205.

The capitalized value can increase from time to time and not be discounted in advance only if some new and unexpected development occurs (or if better knowledge of the future comes to light), in which case the previous owner has suffered an entrepreneurial loss in profit forgone for not having anticipated the new situation, and the current owner earns an entrepreneurial profit.

The only unique aspect to ground land, then, is that it is found and first put on the market at some particular time, so that the *first user* earns pure rent as a result of his initial discovery and use of the land. All later increases in the capital value of the land are accounted for in the value, either as entrepreneurial profits resulting from better forecasting or as interest return.

The first user earns his gain only at first and not at whatever later date he actually sells the land. After the capital value has increased, his refusal to sell the land involves an opportunity cost—the forgone utility of selling the land for its capital value. Therefore, his true gain was reaped earlier, when the capital value of his land increased, and not at the later date when he "took" his gain in the form of money.

If we set aside uncertainty and entrepreneurial profits for a moment, and assume the highly unlikely condition that all future changes can be anticipated correctly by the market,[14] then all future increases in the value of ground rents will be capitalized back into the land when it is first found and put into use. The first finder will reap the net gain immediately, and from then on all that will be earned by him and by successive heirs or purchasers is the usual interest return. When future rises are too remote to enter into the capitalized price, this is simply a phenomenon of time preference, not a sign of some mysterious breakdown in the market's process of adjustment. The fact that complete discounting never takes place is due to the presence of

[14]This is not the same as assuming an ERE, for in the ERE there are *no changes* to be foreseen.

uncertainty, and the result is a continual accretion of entrepreneurial gains through rising capital values of land.

Thus, we see, this time from the landowner's point of view, that aggregate gains in capital value are synonymous with aggregate profits. Aggregate profits begin with the higher-order firms, then filter down until they increase real wages and the aggregate profits of landowners, particularly owners of land specific to the higher-order stages of production. (Land specific to the lower stages will, of course, bear the brunt of decreases in capital value, i.e., losses, in the progressing economy.)

As the only income to ground land that is not profit or interest, we are left with the original gains to the first finder of land. But, *here again*, there is capitalization and not a pure gain. Pioneering—finding new land, i.e., new natural resources—is a business like any other. Investing in it takes capital, labor, and entrepreneurial ability. The expected rents of finding and using are taken into account when the investments and expenses of exploration and shaping into use are made. Therefore, these gains are also capitalized backward in the original investment, and the tendency will be for them too to be the usual interest return on the investment. Deviations from this return will constitute entrepreneurial profits and losses. Therefore, we conclude that there is practically nothing unique about incomes from ground land and that all net income in the productive system goes to wages, to interest, and to profit.

A progressive economy is marked by aggregate net profits. When there is a shift from one savings-investment level to a higher one (therefore, a progressing economy), aggregate profits are earned in the economy, particularly in the higher stages of production. The increased gross investment first increases the aggregate capital value of firms that earn net profits. As production and investment increase in the higher stages, and the effects of the new saving continue, the profits disappear and become imputed to increases in real wage rates and in real ground rents. The latter effect, added to a fall in the rate of interest, leads to a rise in the real capital values of ground land.

What happens when there is a shift in the reverse direction—a changed proportion such that gross saving and investment *decline* and consumption *increases*? For the most part, we may simply trace the above analysis in reverse—that is, consider the shift from a 338:80 situation to a 318:100 situation. During the transition to a new equilibrium, there would be a *net dissaving* of 20 ounces, since gross saving decreases from 338 to 318. There would also be a *net disinvestment* of the same amount. The cause of such a shift would be an increase in the time-preference schedules of the individuals on the market. This would increase the rate of interest and widen the interest spread between cumulative prices in the production stages. It would broaden the consumption base, but leave less money available for saving and investment. We may simply reverse the diagrams above and consider the reverse shift, e.g., to a shorter and wider structure of production, to a steeper price curve with a smaller number of productive stages. The interest spread goes up, but the investment base declines. There would be higher prices for consumers' goods and therefore a greater demand for factors in this and other lower stages; on the other hand, there would be general abandonment of the higher stages in the face of the monetary attractions of the later stages, the decline in investment funds, and the shift of these funds from the higher to the lower stages. Specific factors will bear the brunt of lowered incomes and sheer abandonment in the higher stages, and they will gain in the lower stages.

There will be a rise in net income and consumption, in monetary terms, and therefore a rise in aggregate factor income. The interest rate increases, while the gross investment base declines. In real terms the important result is a lowering in the physical productivity of labor (and of land) because of the abandonment of the most productive processes of production—the lengthiest ones. The lower output at every stage, the lower supply of capital goods, and the consequent lower output of consumers' goods leads to a lowering in the "standard of living." Money wage rates and money rents may rise (although

this possibly might not occur because of the higher interest rate), but the prices of consumers' goods will rise further because of the reduced physical supply of goods.[15]

The case of decreasing gross capital investment is defined as a *retrogressing economy*.[16] The decreased investment is first revealed as aggregate losses in the economy, particularly losses to firms in the highest stages of production, the firms which are now losing customers. As time proceeds, these losses will tend to disappear, as firms leave the industry and abandon the now unprofitable production processes. The losses will thereby be imputed to factors in the form of lower real wage rates and lower real rents, which, combined with a higher interest rate, cause lower real capital values of ground land. Particularly hard hit will be the factors specific to these lines of production.

The reason why there are aggregate profits in the progressing economy and aggregate losses in the retrogressing economy, may be demonstrated in the following way. For profits to appear, there must be undercapitalization, or overdiscounting, of productive factors on the market. For losses to appear, there must be overcapitalization, or underdiscounting, of factors on the market. But if the economy is stationary, i.e., if from one period to another the total gross investment remains constant, the total value of capital remains constant. There might be an increase of investment in one line of production, but this is

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[15]The rise in general money prices, in monetary terms, is accounted for by the decreased demand for money as a result of the lower number of stages for the monetary unit to "turn over" in.

[16]The definitions of the progressing and the retrogressing economy differ from those of Mises in *Human Action*. They are defined here as an increase or a decrease in capital in society, while Mises defines them as an increase or a decrease in total capital *per person* in the society. The present definitions focus on the analysis of saving and investment, population growth or decline being a very different phase of the subject. When we are making an historical "welfare" assessment of the conditions of the economy, however, the question of production *per capita* becomes important.

made possible only by a decrease elsewhere. Aggregate capital values remain constant, and therefore any profits (the result of mistaken undercapitalization) must be offset by equal losses (the result of mistaken overcapitalization). In the progressing economy, on the other hand, there are additional investment funds made available through new savings, and this provides a source for new revenue not yet capitalized anywhere in the system. These constitute the aggregate net profits during this period of change. In the retrogressing economy, investment funds are lowered, and this leaves net areas of overcapitalization of factors in the economy. Their owners suffer aggregate net losses during this period of change.[17]

Thus, another conclusion of our analysis is that aggregate profits will equal aggregate losses in a *stationary economy*, i.e., profits and losses will equal zero. This stationary economy is not the same construct as the evenly rotating economy that has played such a large role in our analysis. In the stationary economy, uncertainty does not disappear and no unending constant round pervades all elements in the system. There is, in fact, only *one* constancy: total capital invested. Clearly, the stationary economy (like all other economies) tends to evolve into the ERE, given constant data. After a time, market forces will tend to eliminate all *individual* profits and losses as well as aggregate profits and losses.

We might pause here to consider briefly the old problem: Are "capital gains"—increases in capital value—*income*? If we fully realize that profits and capital gains, and losses and capital

[17]It is possible that the changes in investment were anticipated in the market. To the extent that an increase or a decrease was anticipated, the aggregate profits or losses will accrue in the form of a gain in capital value before the actual change in investment takes place. Losses arise during retrogression because previously employed processes have to be abandoned. The fact that the highest stages, already begun, have to be abandoned is an indication that the shift was not fully anticipated by the producers.

losses, are identical, the solution becomes clear. No one would exclude business profits from money income. The same should be true of capital gains. In the ERE, of course, there are neither capital gains nor capital losses.

Let us now return to the case of the retrogressing economy and a decrease in capital investment. The greater the shift from saving to consumption, the more drastic will the effects tend to be, and the greater the lowering of productivity and living standards. The fact that such shifts can and do happen serves to refute easily the fashionable assumption that our capital structure is, by some magical provision or hidden hand, permanently and eternally self-reproducing once it is built. No positive acts of saving by capitalists are deemed necessary to maintain it.[18,19] The ruins of Rome are mute illustrations of the error of this assumption.[20]

Refusal to maintain the value of capital, i.e., the process of net dissaving, is known as *consuming capital*. Granting the

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[18]It is this assumption, coupled with a completely unjustifiable dichotomizing of "consumers' goods industries" and "capital goods industries" (whereas, in fact, there are *stages* of capital goods leading to consumers' goods, and not an arbitrary dichotomy) that is at the bottom of Nurkse's criticism of the structure of production analysis. *See* Ragnar Nurkse, "The Schematic Representation of the Structure of Production," *Review of Economic Studies* II (1935).

[19]The popular assumption now, in fact, is that a hidden hand somehow guarantees that capital will automatically increase continually, so that factor productivity will increase by "2–3 percent per year."

[20]An illustration from modern times:

> Austria was successful in pushing through policies which are popular all over the world. Austria has most impressive records in five lines: she increased public expenditures, she increased wages, she increased social benefits, she increased bank credits, she increased consumption. After all those achievements she was on the verge of ruin. (Fritz Machlup, "The Consumption of Capital in Austria," *Review of Economic Statistics* II [1935], p. 19)

impossibility of measuring the value of capital in society with any precision, this is still a highly important concept. "Consuming capital" means, of course, not "eating machines," as some critics have scoffingly referred to it, but failing to maintain existing gross investment and the existing capital goods structure, using some of these funds instead for consumption expenditure.[21]

Professor Frank H. Knight has been the leader of the school of thought that assumes capital to be automatically permanent. Knight has contributed a great deal to economics in his analysis of profit theory and entrepreneurship, but his theories of capital and interest have misled a generation of American economists. Knight succinctly summed up his doctrine in an attack on the "Austrian" investment theory of Böhm-Bawerk and Hayek. Knight said that the latter involved two fallacies. One is that Böhm-Bawerk viewed production as the production of concrete goods, whereas "in reality, what is produced, and consumed, is services." There is no real problem here, however. It is not to be denied—in fact it has been stressed herein—that goods are valued *for their services*. Yet it is also undeniable that the concrete capital goods structure must be produced before its services can be obtained. The second alleged correction, and here we come directly to the problem of capital consumption, is that "the production of any service includes the maintenance of things used in the process, and this includes reproduction of any which are used up . . . really a

[21]It is often assumed that only depreciation funds for durable capital goods are available for capital consumption. But this overlooks a very large part of capital—so-called "circulation capital," the less durable capital goods which pass quickly from one stage to another. As each stage receives funds from its sale of these or other goods, it is not necessary for the producer to continue to repurchase circulation capital. These funds too may be immediately spent on consumption. *See* Hayek, *Pure Theory of Capital*, pp. 47 ff., for a contrast between the correct and the fashionable approaches toward capital.

detail of maintenance."[22] This is obviously incorrect. Services are yielded by things, at least in the cases relevant to our discussion, and they are produced through the using up of *things*, of capital goods. And this production does not necessarily "include" maintenance and reproduction. This alleged "detail" is a completely separate area of choice and involves the building up of more capital at a later date to replace the used-up capital.

The case of the retrogressing economy is our first example of what we may call a *crisis situation.* A crisis situation is one in which firms, in the aggregate, are suffering losses. The crisis aspect of the case is aggravated by a decline in production through the abandonment of the highest production stages. The troubles arose from "undersaving" and "underinvestment," i.e., a shift in people's values so that they do not *now* choose to save and invest enough to enable *continuation* of production processes begun in the past. We cannot simply be critical of this shift, however, since the people, given existing conditions, have decided voluntarily that their time preferences are higher, and that they wish to consume more proportionately at present, even at the cost of lowering future productivity.

Once an increase to a greater level of gross investment occurs, therefore, it is not maintained automatically. Producers have to maintain the gross investment, and this will be done only if their time preferences remain at the lower rates and they continue to be willing to save a greater proportion of gross monetary income. We have demonstrated, further, that this maintenance and further progress can take place without any increase in the money supply or other change in the money relation. Progress can occur, in fact, with falling prices of all products and factors.[23]

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[22]Frank H. Knight, "Professor Hayek and the Theory of Investment," *Economic Journal*, March, 1935, p. 85 n. *Also see* Knight, *Risk, Uncertainty, and Profit*, pp. xxxvii–xxxix.

[23]Very few writers have realized this. *See* Hayek, "The 'Paradox' of Saving," pp. 214 ff., 253 ff.

4. Capital Accumulation and the Length of the Structure of Production

We have been demonstrating that investment lengthens the structure of production. Now we may consider some criticisms of this approach.

Böhm-Bawerk is the great founder of production-structure analysis, but unfortunately he left room for misinterpretation by identifying capital accumulation with adopting "more roundabout" methods of production. Thus, consider his famous example of the Crusoe who must first construct (and then maintain) a net if he wishes to catch more than the number of fish he can catch without any capital. Böhm-Bawerk stated: "The roundabout ways of capital are fruitful but long; they procure us more or better consumption goods, but only at a later period of time."[24] Calling these methods "roundabout" is definitely paradoxical; for do we not know that men strive always to achieve their ends in the most direct and shortest manner possible? As Mises demonstrates, rather than speak of the higher productivity of roundabout methods of production, "it is more appropriate to speak of the higher physical productivity of production processes requiring more time" (longer processes).[25]

Now let us suppose that we are confronted with an array of possible production processes, based on their physical productivities. We may also rank the processes in accordance with their *length*, i.e., in terms of the waiting time between the input of the resources and the yielding of the final product. The longer the waiting period between first input and final output, the greater the disutility, *ceteris paribus*, since more time must elapse before the satisfaction is attained.

The first processes to be used will be those most productive (in value and physically) *and* the shortest. No one has maintained that *all* long processes are more productive than *all* short

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[24]Böhm-Bawerk, *Positive Theory of Capital*, p. 82.

[25]Mises, *Human Action*, pp. 478–79.

processes.[26] The point is, however, that all short *and* ultraproductive processes will be the first ones to be invested in and established. Given any present structure of production, a new investment will not be in a *shorter* process because the shorter, more productive process would have been chosen first.

As we have seen, there is only one way by which man can rise from the ultraprimitive level: through investment in capital. But this cannot be accomplished through short processes, since the short processes for producing the most valuable goods will be the ones first adopted. Any increase in capital goods can serve only to lengthen the structure, i.e., to enable the adoption of longer and longer productive processes. Men will invest in longer processes more productive than the ones previously adopted. They will be more productive in two ways: (1) by producing *more* of a previously produced good, and/or (2) by producing a new good that could not have been produced at all by the shorter processes. Within this framework these longer processes *are the most direct* that must be used to attain the goal—not more roundabout. Thus, if Crusoe can catch 10 fish per day directly without capital and can catch 100 fish per day with a net, building a net should not be considered as a "more roundabout method of catching fish," but as the "most direct method for catching 100 fish a day." Furthermore, no amount of labor and land without capital could enable a man to produce an automobile; for this a certain amount of capital is required. The production of the requisite amount of capital is the shortest and most direct method of obtaining an automobile.

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[26]*See* Hayek, *Pure Theory of Capital*, pp. 60 ff. Similarly, there are numerous long processes which are not productive at all or which are less productive than shorter processes. *These* longer processes will obviously not be chosen at all. In sum, while all new investment will be in longer processes, it certainly does not follow that all longer processes are more productive and therefore worthy of investment. For Böhm-Bawerk's strictures on this point, *see* Eugen von Böhm-Bawerk, *Capital and Interest*, Vol. 3: *Further Essays on Capital and Interest* (South Holland, Ill.: Libertarian Press, 1959), p. 2.

Any new investment will therefore be in a longer and more productive method of production. Yet, if there were no time preference, the most productive methods would be invested in *first*, regardless of time, and an increase in capital would not cause more productive methods to be used. The existence of time preference acts as a brake on the use of the more productive but longer processes. Any state of equilibrium will be based on the time-preference, or pure interest, rate, and this rate will determine the amount of savings and capital invested. It determines capital by imposing a limit on the length of the production processes and therefore on the maximum amount produced. A lowering of time preference, therefore, and a consequent lowering of the pure rate of interest signify that people are now more willing to wait for any given amount of future output, i.e., to invest more proportionately and in longer processes than heretofore. A rise in time preference and in the pure interest rate means that people are less willing to wait and will spend proportionately more on consumers' goods and less on the longer production processes, so that investments in the longest processes will have to be abandoned.[27]

One qualification to the law that increased investment lengthens production processes appears when investment turns to a type of good which is less useful than the goods previously acquired, yet which has a shorter process of production than some of the others. Here the investment in this process was

[27]It should be clear that, as Mises lucidly put it,

> Originary [pure] interest is not a price determined on the market by the interplay of the demand for and the supply of capital or capital goods. Its height does not depend on the extent of this demand and supply. It is rather the rate of originary interest that determines both the demand for and the supply of capital and capital goods. It determines how much of the available supply of goods is to be devoted to consumption in the immediate future and how much to provision for remoter periods of the future. (Mises, *Human Action*, pp. 523–24)

checked, not by the length of the process, but by its inferior (value) productivity. Yet even here the structure of production was lengthened, since people have to wait longer for the new *and* the old goods than they previously did for the old good. New capital investment always lengthens the overall structure of production.

What of the case where a technological invention permits a more productive process with a lesser amount of capital investment? Is this not a case in which increased investment *shortens* the production structure? Up to this point we have been assuming technological knowledge as given. Yet it is not given in the dynamic world. Technological advance is one of the most dramatic features of the world of change. What then of these "capital-saving" inventions? One interesting example was cited by Horace White in a criticism of Böhm-Bawerk.[28] Oil was produced first by ships hunting in the Arctic for whales, the whale oil being processed from the whales, etc., an obviously lengthy production process. Later an invention permitted people to bore for oil in the ground, thereby immeasurably shortening the production period.

Aside from the fact that, empirically, most inventions do not shorten physical production processes, we must reply that the limits at any time on investment and productivity are a *scarcity of saved capital*, *not* the state of technological knowledge. In other words, there is always an unused shelf of technological projects available and idle. This is demonstrable by the fact that a new invention is not immediately and instantaneously adopted by all firms in the society. Therefore, any further investment will lengthen production processes, many of them more productive because of superior technique. A new invention does not automatically impel itself into production, but first joins the

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[28]Eugen von Böhm-Bawerk, "The Positive Theory of Capital and Its Critics, Part III," *Quarterly Journal of Economics*, January, 1896, pp. 121–35. *See also idem*, *Further Essays on Capital and Interest*, pp. 31ff.