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CORN: A CLASSICAL LANDSCAPE

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Corn: A Classical Landscape

1. *Introduction*

The view taken in what follows is that production is a circular process in which the outputs of the process serve also as inputs to it: that is, production is viewed as a process of self-regeneration. The ancient adage that «howsoever ye sew, so shall ye reap» is invoked to constrain the relationship between inputs and outputs to bounds determined by the degree of development of human knowledge and the inherent physical limitations of nature. The whole of the process is meant to be conceived as proceeding under the superintendence of human beings interacting with each other and the material world for the purpose of satisfying their needs for survival and fulfillment.

Such a view was first followed out on a grand scale by Francois Quesnay, physician to the court of Louis XVI. Quesnay claimed to have been inspired by William Harvey's view that the circulation of blood maintains the life of the human body. In a like manner, we are to suppose, the circulation of wealth maintains the life of human society. A similar view runs through the work of a diverse group of economists, including Adam Smith, Jean Charles Leonard Simonde de Sismonde, David Ricardo, Karl Marx, Wassily Leontief, John von Neumann, and Piero Sraffa. It was Sraffa (1951, xxxi) who claimed to have spotted it at the core of Ricardo's *Essay on Profits* and Sraffa's followers who demurely christened its most elementary variant «the corn model».

The method that will be employed here is the hypothetico-deductive one favored by economists of many different stripes. The method of presentation will be that refined by Sraffa in his *Production of Commodities by Means of Commodities* (1960). The errors and absurdities are entirely my own. In a nutshell, the method is to create an imaginary world more simple than the actual. The task is then to determine, through the exercise of reason, what is true in it. The motivation and only justification for this brand of theorizing is the hope that what is true in the imaginary world may also have some measure of truth in the actual world.

It is the objective of this essay to show that this very simple conception of production allied with this most desiccated of methods can be taken a great distance in a short space, and that from it can be distilled a great number of the most fundamental features of capitalism. The essay is compressed for the sake of forcefully expressing the model's breadth. As a result, many matters that could be developed at length are swept past rather briskly, and some matters of interest are passed over entirely. It is the author's belief that the elaboration of such matters constitutes the theoretical research programme of Classical/Marxian Economics. The essay may be looked upon as an extended argument-by-example for this point of view.

In the short time that has passed since Sraffa's death the «corn model» interpretation that he gave to Ricardo's *Essay on Profits* has been subjected to sharp criticism¹. If these critics are correct then the corn model he attributed to Ricardo was, in the words of one critic, «a figment of Sraffa's imagination» (Peach 1984, 750). It also follows that the attribution of the point of view taken in this essay to the Classical economists as a group is also mistaken, or at the very least, exaggerated. There is, unfortunately, no way of «testing» whether the Sraffa interpretation or any other is correct in the sense that we can sometimes «test» one theoretical proposition against another using empirical data and statistical theory. Ultimately, the adequacy of Sraffa's interpretation of Classical economics may be «a matter of aesthetics»². At best one can try to demonstrate that the lines of thought pursued by the Classics can be successfully and elegantly formalized and focused through a Sraffian lens. If the attempt to do so strikes the reader as apt, as might an Impressionist landscape, then its author may well have succeeded as much as is possible. It is this kind of poesy that I attempt in this essay. If I am wrong, as I may very well be, and if I even misinterpret Sraffa, I would gladly take personal credit for all that follows.

The successive sections of this essay pursue the topics typically treated by the Classical economists and culminate in the topic that caused them the most difficulty and that has aroused, ever since, the

¹ See the articles by Dostaler, Faccarello, Groenewegan, and Porta in the *History of Political Economy*, Fall 1986, for relevant citations.

² That «interpretation» in intellectual history may often reduce to «aesthetics» was suggested to me by reading Leamer (1984) who argues that the archetypally scientific process of statistical inference may itself be «a matter of aesthetics» (xvi). That aesthetic and rhetorical methods have been unjustly short-scrifted in favor of an often specious scientificity is vigorously argued by McCloskey (1985).

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most controversy, namely, the theory of value. This must surely seem ironic because the Classics, Ricardo and Marx in particular, typically *began* with value theory. That so much of Classical theory may be derived independently of the theory of value may be surprising but it is one of the chief implications of this essay.

The only exchange that needs to be accounted for in order to make sense of capitalism in its purest form is the exchange between the capitalist and laborer. It is that exchange and that relationship between those two agents that give form, meaning, and movement to the whole. The essential nature of that relationship is unaltered by the existence of a multiplicity of produced commodities and is therefore independent of whatever principles govern the rates at which commodities exchange, i.e. the traditional terrain of the theory of value.

2. Production

Imagine an economy in which a single product is produced by means of labor (productive activity) and itself. It is helpful to call this product «corn». Assume that production takes time (exactly one year), that there are constant returns to scale, that there exists only one method of production, that land of a uniform quality exists in abundance, and that food is necessary for human survival.

The process of production in such a society might be depicted symbolically in the following way:

$$\text{corn} + \text{human labor} \rightarrow \text{more corn,}$$

where the arrow means «produces in one year». The corn on the left hand side of the arrow is meant to include both the corn needed for the survival of those who labor and the corn required as seed.

The assumption that there are constant returns to scale means that if all inputs are increased proportionally then output can increase by the same proportion.

A method of production is to be thought of as a «recipe» detailing the technical relationship existing between products and means of production (outputs and inputs). In the corn world being imagined here, for example, the method of production may call for 5 t. of corn and the labor of two people for one year to yield 10 t. of corn. The actual quantities of corn and labor as inputs and corn as output in the whole

laborers. The capitalists, it shall be assumed, are the owners of the society's accumulated stock of corn. They hire laborers to sew, tend, and harvest their crop. They may also, at their discretion, participate directly in the production process. Or, they may do nothing, leaving even the labor of management, supervision, and accounting entirely to hired hands. It will also be assumed that the laborers are the owners of nothing except their own capacity to labor.

The wages of the laborers consist entirely of corn as does the profit of the capitalists. Specifically, the profit of the capitalist consists of the corn left over at the end of the harvest which is in excess of the corn which he lays out in the spring of the year for seed and wages. For the moment, let it also be assumed that the wages paid the laborers are the minimum necessary to keep them alive and fit to work from year to year. Wages, then, are like a technical datum. Food is necessary to keep laborers laboring just as feed is necessary to keep oxen plowing.

Under the assumptions made thus far, all of the surplus accrues to the capitalists as profit. Although the surplus originates in production through the productive activities of the laborers, it becomes the property of the capitalists by virtue of their ownership of the corn used as means of production. The laborers, being without access to means of production of their own, are forced to sell their capacity to work or cease to survive.

Before proceeding it may be helpful to briefly recapitulate the way in which the economy being studied in this essay operates. In the spring of the year capitalists are in possession of certain quantities of corn left over from the last year's harvest. This is their capital. Part of this capital they use to employ laborers. The other part they use as seed. The workers sew, tend, and harvest the crop. The whole of the harvest is the property of the capitalists. If they end up with more corn at the end of the year than they began with in the spring then they have made a profit; if not, they have incurred losses.

5. *Wages and Profits*

Thus far it has been assumed that the wage paid the laborers is the minimum necessary to keep them alive and fit to work from year to year. In this sense, the wage is as necessary for maintaining production as the corn used as seed. The whole of the surplus is thus engrossed by profit. The rate of profit (the ratio of profit to capital) thus also becomes, like the wage, a technical datum, determined entirely by the physical relationship between products and means of production.

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If all of the profit of one year is used to increase the production of corn in the next year, additional laborers will be required in the same proportion to the additional corn capital as the proportion of labor to capital in the economy as a whole (or the proportion of labor to corn in the «recipe» of the method of production in use). This follows from the assumptions of constant returns to scale and a single method of production, as every good cook knows.

The rate at which the annual product of society would grow from one year to the next in such circumstances would be given by the ratio of profit to capital (the rate of profit).

It also follows that the maximum rate at which the annual product of society could grow from one year to the next is given by the ratio of profit to capital. For such a rate of growth to be sustainable it will also be necessary for the number of laborers to grow at this same yearly rate. (We note, however, that growth in this context does not improve the living standards of the employed, it only signifies growth in total employment and total annual gross output).

If it is assumed that the workers receive as wages a share of the surplus as well as the necessities for survival, profits will be reduced by the same amount. The corn capital that the capitalist needs to lay out in the spring to produce the same quantity of corn as in the previous year will increase by an equal amount.

Hence, any increase in wages will be connected with a fall of profits and a fall in the rate of profit.

If all of profit is used to expand production, higher wages which are entirely consumed by the laborers will reduce the rate of growth and provide for the employment of additional laborers at a slower rate. It will also be true that if part of profit is consumed by the capitalists the rate of growth will likewise be lowered. If the capitalists consume all of their profit and invest none in future production there will be no growth at all. Growth in this economy is the prerogative of the capitalists.

6. *Population*

When the wage paid the laborers is the minimum necessary for their survival the maximum sustainable rate of growth of the laboring population is the rate of growth of the gross annual output of corn. It is determined by technical conditions and the proportion of profits consumed by the capitalists. Conversely, the rate of growth of the class

of propertyless laborers fixes an upper limit to the rate of growth of gross output.

If the laborers share in the surplus, an increase in wages will reduce the sustainable rate of population growth just as would any increase in the part of profit consumed by capitalists.

If institutions exist whereby employed laborers provide the corn necessary to sustain the lives of the propertyless unemployed, a rate of growth of population greater than the maximum sustainable one could be maintained for several periods, but not permanently. If, under such circumstances, the actual rate were to remain above the rate sustainable by the rate of growth of capital, all of the surplus part of the wages of the employed would eventually be needed to sustain the unemployed. The society would have reached a melancholy state in which every birth beyond what is sustainable by the rate of growth of capital must be followed by a death brought on by want.

7. *Rent*

Until now, it has been assumed that land of a uniform quality exists in abundance. In such circumstances the ownership of land carries with it no particular distinction. Any landlord who attempted to extract a rent from his capitalist tenants would induce them to flee. Landlords could only extract a rent if they acted together as a cartel (by, for example, not accepting new tenants). In such a case the only limit to rent would be the size of profits. If landlords ceased acting in concert, competition for tenants would reduce rents to zero, or the minimum necessary to induce individual landlords to attend to the trouble of leasing their land.

If population were to advance to the point at which all of the land of the highest quality were brought under cultivation, any further advance in population would require recourse to land of a lesser quality. The annual production of society in such a case might be depicted as

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corn + labor + land of the second quality → corn.

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$$100 \text{ t. corn} + 100 \text{ labor} + \text{land of the highest quality} \rightarrow 120 \text{ t. corn}$$

$$100 \text{ t. corn} + 100 \text{ labor} + \text{land of the second quality} \rightarrow 110 \text{ t. corn.}$$

If land of the second quality exists in abundance, then its owners will receive no rent. If competition among capitalists equalizes the rate of profit that can be obtained on lands of both qualities, the owners of the land of the higher quality will be able to obtain a rent equal to the difference between the gross output obtainable on the better land and the necessary outgoings of production plus profit at the uniform rate. That uniform rate of profit will be determined by the ratio of surplus to capital on the land of the second quality.

In the above example, assuming that land of the second quality pays no rent, the rate of profit will be 10 t. corn divided by 100 t. corn = 10%. If this same rate of profit is obtained by the capitalists farming the better land, the landlords of the better land will obtain a rent of 10 t. of corn (the gross output on the better land is 120 t. of corn, the capital laid out by the capitalists on such land is 100 t. of corn, their profit, at a rate of 10%, will be 10 t. of corn, leaving the remaining 10 t. of gross output as rent).

If population continued to advance and it were necessary to bring land of a still lesser quality into cultivation a rent would arise on the land of the second quality and the rent of the land of the highest quality would rise. The rate of profit would fall to the ratio of surplus to capital on the land of the lowest quality (the land that yields no rent).

Every advance in population, therefore, which requires recourse to land of an inferior quality will reduce profits and raise rents. If population were to advance to the point where it would be necessary to bring land into cultivation that yielded no surplus above what were necessary to maintain production, the rate of profit would fall to zero and all of surplus would accumulate in the hands of the landlords as rent. In such circumstances further growth of the economy would be impossible and an absolute limit to population would have been reached. In the absence of any changes in the methods of production or any decreases in wages the society would be unable to do more than reproduce itself on an unchanging scale year after year.

8. *Machines*

Suppose that an everlasting machine is invented, producible in one year by means of labor and natural resources such as iron, coal, and wood, which if produced and added to all or a portion of the remaining means of production (those means of production not exhausted in producing the machine) would increase surplus and hence the profits of the capitalists. If land equally suitable for mining coal and iron existed in abundance, and wood producing forests also existed in abundance, no rent could be obtained for the use of such mines and forests for the same reasons why no rent could be obtained for land existing in abundance suitable for producing corn. The only advances of the capitalists, were they to produce such machines, would consist of the corn necessary to hire laborers to mine, cut timber, and construct machines.

An example may be helpful to illustrate the nature of such machinery. Suppose that prior to its invention the annual production of society were

$$100 \text{ t. corn} + 100 \text{ labor} \rightarrow 120 \text{ t. corn.}$$

Secondly, suppose that during the year in which the machines were being constructed it became

$$50 \text{ t. corn} + 50 \text{ labor} \rightarrow 60 \text{ t. corn}$$

$$40 \text{ t. corn} + 50 \text{ labor} \rightarrow 90 \text{ machines.}$$

Finally, suppose that in the next year, the year in which the machines are put to use for the first time, the annual production became

$$60 \text{ t. corn} + 60 \text{ labor} + 90 \text{ machines} \rightarrow 90 \text{ t. corn}^3.$$

Notice that the profits of the capitalists have increased from 20 t. of corn to 30 t. of corn as a consequence of the introduction of the

³ It may appear that there has been «dissaving» on the part of capitalists during the year in which the machines were being constructed. But the argument of this section is a sequential one, with the gross output of one period providing for the inputs of the next. The year in which machines are being constructed may be viewed as a one step «traverse» between one balanced growth path and another. Cf. Ricardo «On Machinery» (1821, Ch. XXXI).

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machines. Notice also that in the year during which the machine was being produced the economy produced no surplus and that the whole of the gross output of that year is used as means of production in the next. It follows that in this example the capitalists consumed none of the produce of the second year. It should also be noticed that the employment of labor has been reduced after the introduction of the machines. This is because a part of the society's means for employing labor was exhausted in the production of the machine and because there has been no change in the proportion of corn used as seed and corn used to hire laborers between the old method of production and the new.

Whether the introduction of machines will reduce the employment of labor (as in the above example), leave it unchanged, or increase it depends upon the proportions of corn used as seed and corn used to employ labor in the old and new methods of production and upon the extent to which the capitalists diminish or augment their consumption of corn during the year in which the machines are being constructed. The greater the consumption of capitalists during the period of construction the smaller will be the employment of labor once the machines are brought into use. There will be a critical set of proportions of corn as seed to corn for hiring workers in the old and new methods of production, which will themselves depend upon the consumption propensities of the capitalists, which will determine whether the employment of labor is diminished, left unchanged, or increased.

The general conclusions of the preceding paragraphs do not depend upon the assumption of «everlasting» machines. The case of the everlasting machine was chosen for the sake of the relative ease of its analysis. Similar conclusions can be drawn from every other conceivable case (machines producible in one year that last for one year, machines producible in one year that last for several years, machines producible in several years that last for one year, and machines producible in several years that last for several years).

It was noted in a previous section that growth of the economy being considered here is entirely at the discretion of the capitalists. This section has shown that the same is true of the employment of labor. Advances in human knowledge and the introduction of machinery may or may not be in the interests of the laboring population.

The effects of alternative sets of economic institutions can be clearly evidenced here. Consider the situation of the Feudal Lord

contemplating the construction and introduction of machinery such as described in the above example. By introducing such machines the Lord could increase the surplus at his disposal, just as would the capitalist. Like the capitalist, he too might need to reduce his consumption during the period of construction. But while he could increase his own consumption by introducing the machine, he would also reduce the food available to maintain his Serfs. Because Feudal Lords were duty bound to look after the welfare of their Serfs, the decision of whether to introduce the machines or not would be problematical. The Lord, in deciding whether or not to introduce such machinery, would need to make a moral decision. The capitalist needs make no such moral decision: his only dilemma is whether the sacrifice, if any, that *he* must make is worthwhile or not.

9. *Non-Basics*

In a previous section it was noted that growth of the economy depends upon the proportion of the net output of corn consumed by the capitalists. Similar conclusions hold in circumstances in which capitalists employ a portion of the corn surplus to employ laborers to produce luxuries.

Consider the extreme case in which wages are at subsistence and capitalists use all of the corn surplus to produce cakes (according, of course, to some particular one year, constant returns to scale recipe for cakes). Suppose that before the production of cakes the society's annual production had been

$$100 \text{ t. corn} + 40 \text{ labor} \rightarrow 200 \text{ t. corn,}$$

and that afterwards it became

$$100 \text{ t. corn} + 40 \text{ labor} \rightarrow 200 \text{ t. corn}$$

$$100 \text{ t. corn} + 10 \text{ labor} \rightarrow 40 \text{ cakes.}$$

In such circumstances, the economy could not grow at all. All of the 200 t. of corn being produced is necessary to maintain production in the succeeding year. It might also be noted that additional labor is employed in the production of cakes, and that, as a consequence, the

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production and consumption of luxuries appears to be in the interests of the laboring population. If the laboring population were not increasing, this would certainly be the case. But if the labor force is growing, the increased employment occasioned by the production of luxuries is at the expense of all future increases in employment.

If less than the entire corn surplus is used to produce luxuries then the economy may grow. That is, the gross annual output of both corn and cakes can expand at a rate determined by the proportion of the corn surplus not consumed either directly as corn or indirectly as cakes and by the rate of growth of the laboring population.

Hence there is a trade-off between the production of luxuries (cakes) and the attainable rate of growth. This conclusion is more general than has just been stated. The production of luxuries such as cakes reduces the potential for growth because while means of production are used up in their production they themselves can make no contribution to production. The same conclusion holds in the case of any thing or service that requires labor to produce but which is not itself used in production. The term «non-basic», coined by Sraffa, is a convenient one for such products.

10. *Exchangeable Value*

When corn is the only produced commodity (something that is bought and sold) the only exchanges of property rights take place between laborers and capitalists. The laborers exchange the right to direct their activity for property rights to enough corn in order to survive. The capitalists exchange property rights to certain quantities of corn for the sake of acquiring command over the productive activities of the laborers. The only advantage that the ownership of corn and its employment as means of production confers upon the capitalist is the command over the productive activity of the laborer and the increase in the command over the product of labor (corn) that results from it. A measure of that advantage is the annual rate at which the capitalist's command over property (corn) may be increased (the rate of profit).

If one seeks a reason why property rights to corn are exchanged for the right to direct the productive activity of laborers, it is that both the laborers and capitalists find it advantageous to do so. To the capitalist such exchange is advantageous because through directing the productive activity of laborers he is able to increase his command of

property. To the laborer such exchange is advantageous because it allows him to continue to survive.

Consider now the case in which some capitalists employ corn and labor to produce a non-basic such as cakes which they exchange with other capitalists for corn. If, by so doing, the cake capitalist could command through exchange as much of the product of labor (corn or cakes) as he could by employing his capital in the production of corn, then the employment of capital in the production of cakes will appear to him just as advantageous as employing it in the production of corn. Whether the production of cakes is as advantageous, less, or more advantageous than the production of corn will depend upon the rate at which the cake capitalists can exchange cakes for corn.

The rate of exchange between corn and cakes that will render each employment equally advantageous is unique and will be determined by the relationships between inputs and outputs in the recipes for producing corn and cakes. If 1 t. of corn (as seed and wages) is necessary to produce 1.2 t. of corn, and 1 t. of corn (as flour and wages) is needed to produce 1000 cakes, then the production of corn and cakes will be equally advantageous only if 1.2 t. of corn can be exchanged for 1000 cakes. The capitalist may compute the advantage (rate of profit) which would be his by employing his capital in producing cakes by comparing the corn that he could command through the exchange of his gross output of cakes for corn with the corn which is required to produce it. In the circumstances supposed above, his gross output of 1000 cakes can be exchanged for 1.2 t. of corn, which exceeds, by 20%, the corn required to produce them. Hence his rate of profit is 20%, the same as the rate of profit enjoyed by the capitalists producing corn.

(The rates of profit in the production of corn and in the production of cakes would be unchanged and the comparative advantage to employing capital in the production of corn and cakes unaltered were the capitalists to compute their advantages (rates of profit) by considering the cakes (or labor) that they could command through exchange of their corn capital with the cakes (or labor) that they could command with their gross outputs. If production is advantageous in terms of its augmentation of the capitalists' command over one commodity it will appear equally advantageous in terms of its augmentation of the capitalists' command over any other commodity).

Imagine now that a machine, taking one year to produce and lasting for one year, is invented and introduced which is used in the production of corn and in producing itself.

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Capitalists who formerly produced corn by means of corn and labor alone would find it to their advantage to exchange a portion of their corn capital for the new machines if by so doing their gross output of corn could be increased. Their corn profit after introducing the machine would be calculated by subtracting from their gross output the corn used as seed and the amounts of corn exchanged for labor and machines. The rate of profit would be the ratio of the corn profit to the corn used as seed plus the corn exchanged for machines and labor.

No capitalist would produce such machines unless doing so were at least as advantageous to him as producing corn or cakes. To calculate the advantages of producing corn, cakes, and machines the capitalists would need to know the recipes for producing the three commodities and the rates at which corn can be exchanged for labor, cakes, and machinery. As before, the advantages to employing capital in the various branches of production are determined by the extent to which the capitalist's command over labor and the product of labor are increased by such employments.

As before, there will be a unique set of exchange rates which would render the employment of capital in the three branches of production equally advantageous.

The greatest of Classical authorities defined the exchangeable value of a commodity as the power which *it* has to command other commodities in exchange. At the expense of some circumlocution the use of the term has been avoided thus far in this exposition. The reason has been the opinion of the author that it is inappropriate to attribute such a power to commodities. As was once observed, «So far no chemist has ever discovered exchangeable value either in a pearl or a diamond». The power to command commodities in exchange is a power possessed by the owners of commodities, not by the commodities themselves. The extent of that power is determined, in general, by the rates at which commodities can be exchanged, not by any intrinsic property of commodities. The owner of commodities may compute the extent of his command over other commodities only if he has a knowledge of the rates at which the commodities that he possesses can be exchanged for others. The need to make such computations is essential if the capitalist is to make the most advantageous use of his command over the productive activity of the propertyless.

If competition among capitalists equalizes the rates of profit in all branches of production, as our Classical masters assumed, then the rates at which commodities can be exchanged and the exchangeable

values that they imply will be uniquely determined. Their precise magnitudes will depend upon the technical relationships existing among and between inputs and outputs in the recipes for production. Given these recipes, they may be calculated straight-forwardly⁴. If, in such circumstances, 1.2 t. of corn can be exchanged for 1000 cakes it will only be because at such rates of exchange capitalists will find it equally advantageous to produce them. It will also be true that the ownership of 1000 cakes and 1.2 t. of corn, in such circumstances, will be equally advantageous, that is, each will enable its owner to command the same quantity of labor and the same quantities of the products of labor. No intrinsic property or power need be attributed to commodities in order to explain the determination of their exchangeable values.

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⁴ Extensive and insightful mathematical treatments of the determination of prices and the distribution of income as well as many other topics discussed in this essay can be found in Abraham-Frois and Berrebi (1979) and in Pasinetti (1977).

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