mements. The existence proofs offer economists some reassurance that equilibrium models will eventually do the trick.

Perhaps equilibrium models will someday enable economists to explain the phenomena of capital and interest. Meanwhile, neoclassical economists remain unable to do so. Perhaps some alternative to equilibrium theory might enable economists to do better. Let us turn to Sraffa's work and examine the possibility of such an alternative.

**CHAPTER EIGHT**

**Sraffa and Neo-Ricardian Value Theory**

In Chapters 2 through 5 we traced neo-classical views of capital and interest and exchange values from their intuitive roots to their precise formulation in abstract general equilibrium models. The final product is logically rigorous and avoids the difficulties faced by capital theories like Clark's or the Austrians'. Yet, if the arguments and analyses of Chapters 6 and 7 are correct, that theoretical achievement cannot be regarded as an adequate theory of capital and interest or of exchange values. No existing general equilibrium theory explains even the principal phenomena of capital and interest. To reach this conclusion, we required both the economics and the philosophy of the previous chapters. We return now to the classical approach to problems of capital and interest, as revived and modified by Piero Sraffa. Perhaps the refurbished older approach will be better able to account for the relations between capital, interest, and prices. In examining Sraffa's work we shall also be probing more deeply into the Cambridge criticisms of chapter 4.

Sraffa's work is intriguing. His economics is strikingly different from neoclassical economics. Juxtaposing Sraffa's work and Marx's suggests the outlines of an alternative to the vision of economic life as the reconciling of the plans of self-interested individuals who only interact through exchange. In analyzing Sraffa's work and reactions to it, we shall uncover further philosophical assumptions underlying the commitment of most economists to general equilibrium models. Sraffa's achievement is modest, however. His work is interesting not for what it shows, but for the vision of economic theorizing that guides it.

1. **Sraffa's System**

Sraffa regards his work as a continuation and a development of the thought of the classical political economists, particularly Ricardo. He
presents a system of “physical cost” or production equations from which prices may be calculated as soon as the distribution of income is given. In this sense he presents what I called a physical cost cum distribution theory of exchange values. An easy example will be adequate for the purposes of this investigation. Although mathematical complexities are involved in its justification, Sraffa’s equation system is quite simple. For reasons which I will discuss later, I am uneasy calling Sraffa’s work a theory.

Sraffa’s system relies upon a much more compact set of assumptions than do intertemporal general equilibrium models. The assumptions may be listed as follows:

D1. There is no excess demand.
D6. Total expenditure equals total income.

New Givens:
E1: The size and composition of output.
E2: The technology used to produce that output—that is, exactly how much of which inputs were combined to produce each output.
E3. The economy is in a stationary state: prices, output, and technology are not changing.
E4. There are no joint products, no fixed capital, and no original factors of production except homogeneous labor.
E5. All commodities enter directly or indirectly into the production of all commodities.
E6. Wages are paid at the end of the production period.
F1. Economic generalization: The rate of profit in all productive activities is equal.

Assumptions E4, 5, and 6 are dispensable, although dispensing with

1 My presentation of Sraffa’s system involves a good deal of interpretation. Sraffa says nothing about demand or excess demand. Alessandro Roncaglia denies that Sraffa makes any assumptions concerning the clearing of markets or the existence of equilibrium. “There is no reason to suppose that prices of production should equate the quantity demanded with the quantity supplied for any commodity. ... It is then incumbent to try to understand the sense in which ‘prices of production’ represent a point of reference that increases the understanding of economic reality” (1978:16–17). “Sraffa has undertaken an examination of prices of production on the basis of an assumption of a uniform rate of profits in the various sectors of production. His book thus confronts a different problem from the marginalist problem of finding the ‘equilibrium prices’ which guarantee the equality between supply and demand” (1978:118). On Roncaglia’s view, the “values” Sraffa discusses are almost entirely disconnected from equilibrium prices. The text probably supports Roncaglia’s interpretation at least as well as mine. The problem is that if Sraffa’s values are not connected to equilibrium prices, then it is unclear what “point of reference” they are supposed to represent. On Roncaglia’s interpretation I do not see any but a purely mathematical point to Sraffa’s work. On my interpretation Sraffa’s work may help explain exchange values.

6 destroys the linear relationship between wages and the rate of profit Sraffa derives for the “standard system.” Assumption 4 is made by Sraffa only in part I of The Production of Commodities by Means of Commodities. Sraffa does not make assumption 5 at all (except briefly in his chapter I); but it simplifies the exposition to add it. Some economists misinterpret Sraffa as assuming constant returns to scale and only one primary factor of production.2 In fact in part II of The Production of Commodities, Sraffa explicitly considers land rent. Not only does he deny in the introduction that he is assuming constant returns to scale, but he never makes any reference to changes in the scale of any productive activity. The manipulations by which Sraffa derives the standard system do not involve changing the scale of any productive activity.

In Sraffa’s work F1, the assumption that there is an equal rate of profit in all productive activities, is primitive. Sraffa is not concerned with the institutional arrangements and psychological characteristics which explain why rates of profit will be equalized. One is trading depth of theoretical analysis for directness and possible applicability. It is, however, worth noting which of the assumptions of intertemporal equilibrium models are needed to prove that the rate of profit in all productive activities will be equal. These are:

B2. Entrepreneurs or firms seek to maximize their profits.
D1. There is no excess demand.
D2. No one is able to influence the prices of what he or she buys or sells.
D3. There is free mobility of labor and all commodity inputs.
D4. All parties on the market have complete and accurate information concerning all available commodities, the going prices, and all technological possibilities.

D2 is needed in standard proofs that rates of profit will be strictly equal. Yet Sraffa’s work need not presuppose such perfect competition. The rate of profit may be nearly equal with highly imperfect competition. From the perspective of an equilibrium theorist who insists that axioms of an economic model be “primitive,” F1 should be replaced by B2 and D1–D4. If the axioms of an economic model need not themselves be beyond further economic analysis, then there seems no

2 See for example Bliss (1975:251n). It is an appealing move to make, because having made it, one can invoke the nonsubstitution theorem (see Pasinetti 1977) to show that exchange values are independent of demand. With constant returns to scale Sraffa need not require stationary equilibrium (E3), but can permit steady state growth as well.
pressing reason to replace F1 with D1-4 and B2. In any event, Sraffa’s system, like neoclassical models, relies on simplifications and “unrealistic assumptions,” although the list of those Sraffa needs is shorter.

Given these assumptions Sraffa can write down a set of production equations. In what follows I shall assume that there are only two commodities, \( x \) and \( m \), wood and axes. \( L \) is labor, \( w \) wages, \( r \) the rate of profits. The superscripts will indicate, as before, the productive activity in which the input is used.

\[
\begin{align*}
(x^s p_x + m^s p_m)(1 + r) + L^s w &= xp_x \\
(x^m p_x + m^m p_m)(1 + r) + L^m w &= mp_m
\end{align*}
\]

Interest is not paid on wages, because they are paid at the end of the production period. \( x^s, x^m, m^s, m^m, m, L^s \), and \( L^m \) are all known. There are only four unknowns: \( p_x, p_m, r, \) and \( w \). Since one can take one price as a numeraire or otherwise fix a numeraire, there is one degree of freedom both in this simple example and in general. Sraffa accomplishes two things. First he systematically presents a relationship between prices and distribution. Second, he demonstrates that when \( r \) is fixed and less than some maximum value, a unique all-positive set of prices and a unique positive wage can be calculated.

If one substitutes some value for \( r \) in (8.1) and (8.2) and takes one price as numeraire, one has two linear equations in two unknowns and it seems, speaking unrigorously, that there should be no difficulty in solving them. To prove that a unique solution exists and that, if \( r \) is less than some maximum value, the other price and the wage are positive is a subtle but well understood mathematical task. To give such a proof as well as to show more systematically how prices and distribution are interrelated, Sraffa presents what he calls the standard system. I am concerned here with what Sraffa’s system has to say about the relations between interest and exchange values.

Since one knows the vector of inputs: \( a = (x^s + x^m, m^s + m^m) \) and the output \( b = (x, m) \), one also knows the net output, \( y = [x - (x^s + x^m), m - (m^s + m^m)] \). Suppose it were the case that \( y_x/a_x = y_m/a_m \) or equivalently that \( b_x/a_x = b_m/a_m \), where the subscript \( x \) indicates the first, \( x \), component of the respective vectors and the subscript \( m \) indicates the second component. If it were the case that \( b_x/a_x = b_m/a_m \), then, entirely independent of the prices of \( x \) and \( m \), one could calculate the ratio of surplus product to inputs or the maximum rate of profit. Let \( R \) be this maximum rate of profit. When \( r = R \), all net product goes to profits and wages are zero. To simplify, Sraffa treats the entire wage as variable. There is no minimum “subsistence” wage. Consumption goods which enter into the wage are thus in general “non-basics” (see §2). A more plausible treatment of the wage, which Sraffa outlines, but does not adopt, is to divide it into two components, a subsistence and a surplus wage. The subsistence wage could be incorporated into the production equations. One might, for example, add inputs like bread, shirts, or Christmas cards to one’s specifications of the technology employed for making steel. The surplus wage would then be treated in the way Sraffa treats the whole of the wage (1960:9–10).

If \( b_x/a_x = b_m/a_m \) and \( R \) is the maximum rate of profit, one has the following relations:

\[
\begin{align*}
(8.3) & \quad (x^s p_x + m^s p_m)(1 + R) = xp_x \\
(8.4) & \quad (x^m p_x + m^m p_m)(1 + R) = mp_m \\
(8.5) & \quad (1 + R) = \frac{x p_x + m p_m}{x^s p_x + m^s p_m + x^m p_x + m^m p_m} \quad \text{or} \quad \frac{x}{x^s + x^m} \frac{m}{m^s + m^m} \\
(8.6) & \quad (1 + R) = \frac{x^s + x^m}{x^s + x^m} \frac{m^s + m^m}{m^s + m^m} (m^s + m^m) p_m
\end{align*}
\]

If \( x/(x^s + x^m) = m/(m^s + m^m) = b_x/a_x = b_m/a_m \), then this ratio is equal to \((1 + R) \) and \( y_x/a_x = y_m/a_m = R \).

In general, of course, the ratio of the output of any commodity to the inputs of that commodity will not be the same for all commodities. But one can “notionally” change the scale of the productive activities until this condition is met. One is not actually changing the scale of production. What production would actually be if the scale were changed is entirely irrelevant; one is merely making use of a technique to find the maximum rate of profit and an interesting numeraire.

To change the scale of production in this notional way, one applies positive multipliers \( c_1 \) to (8.1) and \( c_2 \) to (8.2). These multipliers transform the actual system into the standard system only if, for \( w = 0 \), \( b_x/a_x \) now equals \( b_m/a_m \). In attempting the transformation one derives the following two equations in three unknowns:

\[
\begin{align*}
(8.7) & \quad (c_1 x^s + c_2 x^m)(1 + R) = c_1 x \\
(8.8) & \quad (c_1 m^s + c_2 m^m)(1 + R) = c_2 m
\end{align*}
\]
Since only the ratio of the multipliers is significant, Sraffa sets the scale of the standard system by stipulating

\[(8.9) \quad c_1L^a + c_2L^m = L^a + L^m = 1\]

It can be proven that such positive multipliers can always be found. Applying non-zero multipliers to equations does not change their solutions, so whatever values of the unknowns one finds in the standard system are the actual values.

Sraffa now selects the following numeraire:

\[(8.10) \quad p \cdot y^* = 1.\]

where the asterisk denotes values in the standard system and \(p\) is the (row) price vector. Since the standard net product, \(y^*\), is made the numeraire, prices will measure proportions of standard net product. Since \(L^a + L^m = 1\), \(w (= w^*)\) is the proportion of the standard net product going to labor. Thus in terms of this numeraire, when \(w = 1\), \(r = 0\). By the definition of the rate of profit

\[(8.11) \quad r = \frac{1 - w}{p \cdot a^*}\]

But \(R = [(p \cdot b^*)/(p \cdot a^*)] - 1\) from (8.5). Thus \(R = (p \cdot y^*)/(p \cdot a^*) = 1/(p \cdot a^*)\). From (8.11), one can thus conclude that

\[(8.12) \quad r = R(1 - w)\]

In terms of the chosen numeraire, there is thus a particularly simple wage profit line (Fig. 8.1).

What corresponds to "capital" (ch. 4, §2), the slope of the wage-profit line, \(1/R (= p \cdot a^*)\), is the value of all commodity inputs to the standard system in terms of the standard net product. From (8.12) one can, for any value of \(r (\leq R)\) find \(w\) and \(a^*\) versa. Substituting into (8.1) and (8.2), one can solve for \(p\), and \(p_m\) which are proably positive and unique. (Sraffa 1960:26–29; Newman 1962:64–66; Schwartz 1961:17–27; Burmeister 1968:83–87). All ratios are the same in the actual economy as in the standard system, although after the calculations are complete, one might well want to pick a new numeraire. The simple straight-line relation between wages and profits does not survive a change of numeraire, but Sraffa does prove that, provided there are no joint products, \(w\) is smaller relative to the price of every commodity whenever \(r\) is larger (1960:38–39, 61–62).

2. Sraffa and the Critique of Neoclassical Theory

Sraffa subtitled his book, *A Prelude to a Critique of Economic Theory*. The economic theory is neoclassical or "marginalist" economics. Some of the Cambridge economists regard the criticisms based on Sraffa's work as showing that the whole neoclassical approach to
economic theory is a mistake (Garegnani 1970:427f; Eatwell 1975c). Distribution is not even ideally determined by voluntary exchanges. The theory of value should be separated from the theory of output or distribution. Profits are determined by macroeconomic considerations, including class struggle.

Two questions concerning Sraffa’s work are crucial: Has he provided the foundation or the material for some serious criticism of established economic theory? Has he pointed the way to any attractive alternative to equilibrium theory? Many economists believe that the answers to both questions are yes.

Some economists believe that Sraffa’s work strikes at the very heart of neoclassical theory, since it reveals that demand has no role to play in the determination of exchange values! John Eatwell, for example, writes, “Since the determination of the real wage is related to social and historical phenomena, and has nothing to do with the relation of supply with demand, and the structure of production may be taken as a datum, then the ‘forces’ of supply and demand have no role to play in the general analysis of value” (1974:288). Eatwell does not explicitly assert that the ‘forces of supply and demand’ do not affect exchange values, only that they have no role in the general analysis of value.” Alfredo Medio is more explicit. “Sraffa’s and Schwartz’s solutions have moreover the specific merit of showing that demand plays no role in determining the rate of profit and relative prices undermining the neoclassical theory of value and distribution based on the concept of demand and supply of commodities and of factors of production” (1972:325). Medio has since changed his mind (1977:392), but like Eatwell and, apparently Robinson (1965:31), was tempted to conclude that Sraffa had shown that demand has no role to play in determining exchange values.

Consider the rather different conclusions Maurice Dobb draws from Sraffa’s work:

Let me emphasize what we are confronted with here is . . . the much more general problem of the relativity of all price relations to income distribution: i.e. to the wage-profit relation. The latter cannot, therefore, be determined within the sphere of price-relations (what Marx called the sphere of circulation); for its determination one has to look beyond and outside it (or if you like, beneath it). This is “back to Marx” with a vengeance. (1970:350)

Dobb believes that Sraffa’s work shows that, contrary to the sketch in chapter 1 above and to the orthodox theory erected upon it, the wage-profit relation cannot be determined within the sphere of exchange. The rate of profit is not determined (causally) by individual exchanges constrained by technology and the availability of unproduced factors of production.

Dobb draws on another of Sraffa’s results to reinforce this conclusion. Sraffa shows that production processes for commodities that do not enter directly or indirectly into the production of all commodities have no influence on the wage rate, the rate of profit or prices (except of their own outputs). Sraffa calls such goods “nnonbasics.” Complications arise when several nonbasics are interconnected (1960:7–8). Unproduced resources like land are also nonbasic and introduce further difficulties. The precise specification of a nonbasic, once joint products and land are introduced, becomes quite complex (1960:47–52). Nonbasics are excluded from the simple cases I am considering by E5 above.

Following von Bortkiewicz (1906–7), Dobb argues that the irrelevance of nonbasics to the rate of profit shows that profits must originate in the relation of wage-labor to capital, not in the ability of capital to increase production (1970:358). Dobb is implicitly arguing as follows. Since the productivity of capital does not influence the general rate of profit or prices, when that capital is employed in producing nonbasics, the productivity of capital cannot be responsible for profits. The origin of profits must lie in the relation between wage-labor and capital, because capital only has an influence on profits or interest when it is employed in producing basic commodities. The size of the wage compared to the price of wage goods is, of course, affected by the productivity of inputs employed in producing wage goods, regardless of whether wage goods are basic or not. The rate of profit is, however, independent of the methods employed in producing nonbasics. Strictly speaking, in Sraffa’s system wage goods are nonbasic, but with the minor emendation discussed in §1, they become basic.

According to Edward Nell, Sraffa’s work and the criticisms of capital theories based on it show us that “the payments to capital are dispositions of a surplus and do not involve any kind of exchange” (1967:17–18). He continues

But in the market for factors, income is paid out to those who have property rights in the productive process, in accordance with the nature and extent of their property. Of course, . . . both capital and labor will shift in response to differentials in earnings between industries. But such movement does not imply that any exchange takes place between the recipient of net income and the source of income. The only service the owner of capital renders to industry is the service of permitting it to be
-owned by him. Labor receives wages in exchange for work, but the level of wages, which cannot fall below a basic cost of living, is determined by bargaining power and not, as in the case of ordinary commodities, by a relationship between cost of production and value of product. (1967:21)

The rate of profits is not determined by exchanges and not related to the productivity of capital. Furthermore, the interactions which result in a payment of profits are not exchanges at all. Nell draws the last conclusion because he believes that capitalists supply no commodity or service in return for the profits they receive.

What Nell may mean by this strong and puzzling claim is not clear. He may intend several or all of the following:

(1) Capital is not a commodity or service.
(2) Capital is not productive.
(3) The long-term interest elasticity of investment is near zero and not uniformly negative (in the long run investment is not sensitive to the rate of interest).
(4) The rate of profit is not causally determined through voluntary market exchanges of commodities, but through the general relation between wage-labor and capital.
(5) It is unjust that capitalists receive profits.

The Cambridge criticisms may be regarded as supporting (1). Since Sraffa’s system never mentions “capital,” one might regard it as supporting (2), although the arguments the Cambridge critics use seem to refute (2). Recall that equations (4.8) and (4.1) suggest that an increase in capital increases output. Although the second clause of (3) gains some support from the capital reversing phenomenon, (3) appears to be a straightforward empirical claim which is potentially testable. If true, (3) would give one reason to regard profits as similar to rents and might provide some reason to accept (5). (3) is not a serious criticism of equilibrium economics. (4) is Dobb’s claim. It is consistent with (1)–(3), but not supported by them nor supportive of them. (5) finally is an important normative thesis that lurks in the background of much of the argument concerning capital and interest. It belongs to a different, but not completely unrelated sphere of discourse.

With the exception of the normative claim, it seems to me that the conclusions critical of neoclassical theory which economists have drawn from Sraffa’s work are the following four:

(I) Capital is not a commodity or service, and interest is not the price of capital.

(II) Exchange values are determined by costs of production; demand has little or no role to play.

(III) The rate of profit is not causally determined by individual exchanges as constrained by technology and the availability of factors of production.

(IV) The distribution of income is determined by the relations between workers and capitalists including possibly their relative bargaining power.

The two questions I am concerned with are whether Sraffa provides the basis for a serious critique of neoclassical economics and whether he provides the elements of a reasonable alternative approach. As shown in chapter 5, conclusion (I) does not pose any challenge to fundamental neoclassical theory. Conclusions (II)–(IV) are serious challenges. Their assessment is rather complicated. I shall argue that Sraffa’s work alone does not support them.

3. Sraffa’s System and Equilibrium Models

What has Sraffa accomplished? He forged critical tools which the Cambridge critics have used to attack simplified aggregative capital theories. To show that, given D1, D6, E1–E6 and F1, a unique all positive price vector can be calculated [once r (≤ R) is given] is a substantial result, as is the demonstration of an inverse relation between r and w and of a maximum rate of profit. Like general equilibrium models, Sraffa’s avoids aggregation, but unlike them, demand has no explicit role and the rate of profit is not endogenously determined. The maximum rate of profit is related to purely technological characteristics of the system.

Do these results show that demand has no role in value determination, that individual exchanges do not determine the rate of profit, or that the distribution of income is determined by the relations between workers and capitalists? Do these results enable one to erect an alternative to equilibrium theory? From the perspective of fundamental and rigorous equilibrium models, Sraffa’s work appears to present no challenge or criticism whatsoever. Everything Sraffa shows is consistent with a suitably restricted general equilibrium model. Indeed, Sraffa’s production equations appear to be a fragment of a general equilibrium model.

Suppose one adds E3–E6 to the assumptions of the model in chapter 5. D9 (that the wage is paid at the beginning of the period) must be
deleted. Doing so is not a serious change. Since one is changing to stationary equilibrium analysis, the time subscripts disappear. If one knew the utility and production functions and the various initial conditions, one could solve for equilibrium outputs, prices, consumption, inputs, wage, and rate of profit. Since all own rates of return are equal \( p_{x} = \hat{p}_{x} = p_{x} \) and similarly for \( p_{m} \), and since wages are paid at the end of the period of production, \( 5.15 \) and \( 5.16 \) become \( 8.1 \) and \( 8.2 \). Given the equilibrium solution one can fill in the values of \( x, x^{t}, x^{m}, m, m^{t}, m^{m}, L, L^{t} \) and we have Sraffa’s production equations.

Sraffa can then, if he likes, perform his manipulations on these equations and find \( R \), the maximum rate of profit, and determine the standard system. For any given value of \( r \), he can solve for all relative prices. Since the general equilibrium system satisfies all of the assumptions of \( E \) and \( F \), and since the system is formally valid, the quadruple \( (r^{*}, w^{*}, p_{x}, p_{m}) \) must be solutions to Sraffa’s production equations, where \( e \) denotes the general equilibrium value. Moreover, from the perspective of intertemporal equilibrium theory, a solution to Sraffa’s production equations \( (r, w, p_{x}, p_{m}) \) has economic meaning only if it is an equilibrium solution. All other solutions would set in motion economic changes and violate the assumption of a stationary state, as well as the assumption of market clearing and no excess demand.

Once one recognizes the intimate and intricate relations between Sraffa’s system and equilibrium models, one should realize that Sraffa’s work does not establish conclusions II, III or IV of \( 8.2 \). It does not show that demand has no role in determining exchange value, that the rate of profit is not determined through exchanges, nor that the distribution of income is determined by the relations between capitalists and workers. To take size and composition of output and market clearing as given is to take demand as given. It is then hardly surprising that one can calculate prices without any explicit mention of demand. Whatever else Sraffa may show, he does not demonstrate that demand is irrelevant to price determination.

That the rate of profit is not determined through voluntary exchanges is also not supported by Sraffa’s work. Appearances to the contrary, one cannot take technology and size and composition of output as given, arbitrarily fix the distribution of income, and expect the calculated prices to bear any relation to the actual exchange values that would prevail in the given economy. As Sraffa himself notes (1960:816), not all of any wage-profit line can be taken seriously. Robinson puts the point nicely. “Some readers have interpreted the calculation of the movement up and down of the rate of profit and the share of wages

as a story about class war. But that is a complete misunderstanding. . . . the movement is only the movement of the eye running up and down a curve on the blackboard” (1977:58). If a wage-profit pair is chosen that is not on the wage-profit frontier, changes in which technology is employed will be induced. Since the economy will not be in a stationary state, one will not be able to calculate net output by subtracting inputs in any given year from outputs in that year. The whole Sraffa apparatus breaks down. It provides no information about the results.

Furthermore, demand is sensitive to the distribution of income. Demand disrupts the relationship between \( p \) and \( r \), because even small changes in the distribution of income will generally affect aggregate amounts demanded. Since prices change, the quantities demanded change. The size and composition of output must, however, match demand. Otherwise there will be market imbalances, shifting of resources and changes in production, or changes in technology employed. In any of these three cases the initial conditions for the application of Sraffa’s apparatus are not satisfied and his apparatus is mute. Furthermore, capitalists and workers have different tastes. Changes in the distribution of income will shift the aggregate demand curves. Indeed, one might value Sraffa’s apparatus because it allows one to see how sensitive prices, output, and the structure of production are to changes in distribution. In general, if \( r \) changes, one needs an entirely new set of givens. The rate of profit is exogenous in Sraffa’s system only in the sense that one cannot calculate what it is from the information that Sraffa considers. To leap to the conclusion that the rate of profit is not calculable from any information relevant to exchanges and thus not determined by any features of constrained voluntary exchange is without justification.

Dobb’s conclusion that the rate of profit must be determined by the relations between workers and capitalists, since the productivity of capital in producing nonbasics does not affect wages, profits, or distribution, also does not follow. Consider the production equation for a nonbasic luxury good, \( v \) (“velvets”):

\[
8.13 \quad p \cdot c(1 + r) + w^l = v_p.
\]

As before, \( p \) is a row vector of prices, \( c \) is the vector of all of the inputs produced to produce velvets, \( w \) is the wage, \( l \) the amount of labor needed,
the quantity of velvets produced and \( p_v \) the price of velvets. Suppose that the technique for producing velvets changes so that (8.13) becomes

\[
p \cdot c(1 + r) + wL = 2wp_v'.
\]

Sraffa shows that \( p_v' \) must equal \( \frac{1}{2} p_v' \). Profits and wages are thus undisturbed. Of course, this result depends on certain axioms— including D1, that there is no excess demand. The new quantity of velvets produced, \( 2v \), must be sold at \( \frac{1}{2} p_v' \). The market may clear at this price. In general, however, after the change in technique, market and equilibrium price will not be the same and some inputs will have to be transferred to restore an equilibrium. If there are constant returns to scale in the production of basics, it may be possible to transfer inputs without disturbing the rate of profits or the wage.

Thus a change in technique (and therefore of the “productivity of capital”) in producing a nonbasic will fail to affect wages or profits only in special circumstances. But this is only a partial response to Dobb. His argument can be revised in two ways. First, it remains possible that with a change in “the productivity of capital” in producing nonbasics, profits and wages will be unchanged. Is not this possibility enough to refute neoclassical views of the rate of interest? Second one might argue that the change in the rate of profit that will normally result is secondary, the result of a demand-induced change in the production of basics, not the direct reaction to a change in the productivity of capital that neoclassical theory demands.

The second argument is unconvincing. We have seen (chapter 2) that marginal productivity theory does not assert that the marginal productivity of an input causes (let alone causes directly) its recompense. Both are supposedly determined by the various economic givens in equilibrium models. Although I shall have more to say about the philosophical ramifications of this view (chapter 9), nothing I shall say will salvage this attempt to reinterpret Dobb’s argument.

In order to see whether the possible irrelevance to profits of the productivity of capital in producing nonbasics refutes any claims of marginal productivity or equilibrium theory, we need to be clear about what neoclassical theory asserts. At first glance it might seem as if neoclassical theory requires that the return to a factor of production be larger if its marginal physical product, in any process of production, is larger. But such is not the case. The return to an input must be larger if its marginal physical productivity in producing itself (or its own technical interest rate) is larger (see ch. 5, §2). The return to an input need not be larger if its increased marginal physical productivity in a particular process does not imply an increase in its own technical interest rate. This is possible only when the input’s marginal physical productivity increases only in the production of a nonbasic. The value of the marginal product must remain constant. The increased physical productivity must thus lower the scarcity or marginal utility of the nonbasic output or it must be possible to transfer the input with constant returns to the production of other outputs. These are precisely the cases in which an increase in the productivity of “capital” fails to have an effect on profits. The possibility that a change in the productivity of any commodity in producing a nonbasic will have no effect on profits or wages does not refute neoclassical theory or show that the origin of profit lies in the relations between workers and capitalists.

Sraffa’s work thus does not establish that demand does not affect exchange values, that profits are not determined within the process of exchange, or that profits depend on the relations between workers and capitalists. Yet it would be a mistake to conclude that Sraffa’s work cannot possibly present an alternative to general equilibrium models or function as part of a criticism of them. The relations between Sraffa’s work and general equilibrium models need to be made more precise. In what sense are the two consistent with one another?

This question is not an easy one to answer. If we look at the two theories formally and treat all the assumptions of the models in this chapter and in chapter 5 as assertions, then it is clear that the two structures have some inconsistent consequences. Suppose one is comparing stationary general equilibrium states in which the distribution of income differs. Examining one stationary equilibrium, one can use both Sraffa’s system and general equilibrium theories to predict prices in the others. These predictions will generally differ, since in Sraffa’s system there is no allowance for changes in technology employed. To give another example, one might well find an economy in which, to some degree of approximation, the relationship between distribution and prices Sraffa identifies holds, but in which the claims of general equilibrium theory about prices and interest rates are falsified—perhaps because of some sort of generalized monopolistic competition.

The difficulty with the above observation is that Sraffa’s apparatus is misapplied in the first example, and, general equilibrium theory is misapplied in the second. As mentioned above, Sraffa recognizes that with changes in the distribution of income, techniques which are more or less labor intensive will be introduced. He is only analyzing a single stationary state. On the other hand, few general equilibrium models
apply to situations involving imperfect competition. The question of the consistency of Sraffa’s work and general equilibrium models is not so straightforward as it might appear to be.

I argued that the heart of equilibrium theory consists of the nine “laws” discussed in the second section of chapter 6. We might then plausibly conclude that a theoretical claim is inconsistent with equilibrium theory if and only if it is inconsistent with the conjunction of those nine laws. Sraffa’s work by this test is not inconsistent with equilibrium theory. One might wonder what the identity of Sraffa’s work turns on. F1 is surely not sufficient. It seems to me that something is a Sraffa model if and only if it includes assumptions D1, D6, E1–E3, and F1. I am not sure how to justify this claim. Fortunately nothing depends on it, since all of the assumptions of §1 of this chapter are consistent with the nine “laws” of chapter 6.

Yet Sraffa’s work also is consistent with contrarieties to the basic assumptions concerning utilities and production, (1)–(7) of Chapter 6, §2. One may thus combine Sraffa’s work with further models which are inconsistent with equilibrium theory. Sraffa’s work can, through such a combination, have applications which are incompatible with equilibrium theory. There are various possible applications. One might explain why, with a very small change in distribution, goods produced in a labor-intensive way grew cheaper. One might assume fixed proportions and constant returns to scale and offer quantitative predictions. For some interesting (and curious) possibilities see Bose (1975, part II). One might join Sraffa’s account of the determination of exchange values to a Marxian theory of profits or exploitation. Through such expansion and development, one may find in Sraffa part of an alternative to equilibrium theory. It is not possible to know whether a physical cost cum distribution theory of exchange value presents an alternative to a constrained balancing of marginal utilities theory of exchange value, until one sees how Sraffa’s work combines with other theoretical claims.

At least we can see why so much dispute remains concerning the significance of the Cambridge controversy. In the whole Cambridge enterprise neoclassical theorists see nothing but some peculiar equilibrium models that make vivid some of the unsolved problems posed by capitalist and interest. The Cambridge critics, on the other hand, see their work as part of or as leading to an alternative kind of economic theory.

This conviction of the critics has not yet been explained. Sraffa shows that if one takes output, the technology employed to produce that output and the distribution of income between wages and profits as given, one can calculate prices. This demonstration does not establish that demand has no effect on exchange values, or that distribution is not determined by individual exchange. Indeed one might question whether Sraffa’s work has any interesting economic content at all. That many talented economists find in Sraffa’s work the germ of an alternative approach to economics may seem puzzling. I shall now solve this puzzle by emphasizing the contrasts between the method or strategy of equilibrium theorizing and the method or strategy implicit in Sraffa’s work.