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An Essay on Post-Keynesian Theory: A New Paradigm in Economics

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THE IMPACT OF Keynes's work in the 1930's has been viewed by some economists as a "revolution" in economic thinking (see Lawrence R. Klein [56, 1947]). Yet, to those who were most closely associated with Keynes at Cambridge during that period, the revolution proved largely abortive. Over the past 30 years, many of Keynes's critical insights into the workings of a modern, technologically advanced economy seem to have been ignored, with the result that there has been little fundamental change in the way economists perceive the world. Those one-time associates of Keynes, joined by a small number of the younger generation at Cambridge and elsewhere, have consistently tried to highlight the incompatibility of Keynes's views with orthodox theory even as they worked to develop more fully a "generalization of *The general theory*" (see Joan Robinson [78, 1952]).

This generalization may be said to represent, in Thomas Kuhn's sense [62, 1962], a new paradigm; and since it extends the analysis set forth in Keynes's *Treatise on money* (1930) and *The general theory,* it can be termed post-Keynesian.[1] Few American economists seem aware of the major works that have contributed to the development of this new paradigm[2] and fewer still, even among those likely to be sympathetic, seem to be aware of the

[1] The term neo-Keynesian has also been used. It should be added that Keynes's is only one of the contributions upon which the new approach is based. Certainly the work of Michal Kalecki has been no less important than that of Keynes; and to the extent that the new approach rests on the theory of value which grows out of the work of John von Neuman and Piero Sraffa, those names need to be mentioned as well. Indeed, to Marxists the work of Sraffa is seen as being the most fundamental of all, and they are likely, as a result, to refer to the new approach as neo-Ricardian.

[2] The American tradition is more representative of Keynesianism than of Keynes's own work. See, for example, the distinction set out by Axel Leijonhufvud [63, 1968]. Even he now admits that his own interpretation is based on Walrasian rather than Marshallian principles and, thus, not a valid representation of Keynes's work [64, Leijonhufvud, 1974]. The distinction he draws, however, still holds true.

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possible significance of the new approach.[3]

Part of the problem has been the diversion created by the "Cambridge controversy" over the theory of capital (see Geoffrey C. Harcourt [23, 1972]). While it is true that some of the elements of post-Keynesian theory became better known through the criticisms by Cambridge, England, of the treatment of capital in the neoclassical growth models favored by Cambridge, Mass., the debate has nonetheless left the misleading impression that the adversaries from across the Atlantic had only a negative critique to offer, one which applied only to highly abstract capital theory and which only persons skilled in mathematics could understand.

The purpose of this review article is to provide a guide to the post-Keynesian literature, not only noting the basic works but also bringing out the salient features of the new approach. The paper divides into four parts, each dealing with a separate distinguishing characteristic of the post-Keynesian approach, plus a brief concluding section. The four distinguishing characteristics emphasized are (1) growth dynamics, (2) distributional effects, (3) the Keynesian constraints, and (4) the microeconomic base. No attempt is made to provide a substitute for all the various aspects of the orthodox viewpoint in economics; nor indeed is the new theoretical structure meant to displace all of the old. Nonetheless, implicit in the paper is the view that post-Keynesian theory has the potential for becoming a comprehensive, positive alternative to the prevailing neoclassical paradigm. Trying to grasp this potential from the arguments about capital reversal and double-switching,[4] however, is likely to be just as treacherous as trying to understand the marginalist revolution of the late 19th century from the debate over the "wages fund" doctrine.

I. *Growth and Dynamics: History and Time*

Post-Keynesian theory, in contrast to other types of economic analysis, is concerned primarily with the depiction of an economic system expanding over *time* in the context of *history.* This point means that not only must time rates of change be included in the analysis but also the basis for change—the impact of both past history and expectations about the future on the current decisions that are bringing about the change—must be taken into account. It is through investment and savings behavior that this influence of past history and expectations about the future is felt. To incorporate this influence into the analysis, one must therefore make explicit allowance for the role of investment and savings, not only at the macroeconomic level but at the micro level as well. This first distinguishing characteristic of post-Keynesian theory—its being rooted in a dynamic process—is sufficient by itself to set the new approach apart from the neoclassical model, especially that variant found in most textbooks, the one which begins with the analysis of the individual household and the individual firm in static equilibrium.

The dynamic element in post-Keynesian theory can be traced to the influence of Roy Harrod,[5] in particular his fundamental equation. The equation is better

[3] However, one should point out the work of Sidney Weintraub as one of the few American economists to appreciate the extent of Keynes' contribution towards over-throwing the neoclassical orthodoxy. (See Weintraub [102, 1959; 103, 1966].)

[4] Many critics have mistakenly focused on these issues as being the central ones of post-Keynesian economics. (*Cf.* Mark Blaug [7, 1974] and Joseph Stiglitz [99, 1974].)

[5] See his *Economica* discussion [25, 1934; 26, 1934] with D. H. Robertson as well as the hints laid in his *Trade cycle* [27, 1936] and the final paragraph of his review [28, 1939] of Keynes's *General theory.* The publication of Keynes's correspondence with Harrod suggests that Harrod's dynamic theory grew out of discussions between Harrod and Keynes about the dynamic aspects of Harrod's book as applied to *The general theory.* (See Keynes [55, 1973, XIV, pp. 150–79, 298, 321–50].)

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known to Americans as the Harrod-Domar formula,[6] and in the form, $G = \frac{s}{v}$, with G as the rate of growth of national income, s as the average propensity to save and v as the capital/output ratio. This equation provides the starting point not only for the post-Keynesians but for the various neoclassical growth theorists as well. (See R. M. Solow [92, 1956; 93, 1970], T. W. Swan [100, 1956], and J. E. Meade [68, 1962]; all of whom have sought to make the neoclassical model more relevant to a world known to be experiencing continuous economic expansion, but with the analysis carried out at the macroeconomic level only.) Where the two approaches diverge is in how the fundamental equation is elaborated. The neoclassical growth model modifies the Harrod-Domar formula by insisting that at least two factors of production—homogeneous aggregate capital[7] and labor—be taken explicitly into account, with changes in their relative scarcities and prices in a long-period context the main explanatory variables.

The post-Keynesian approach modifies the assumption that the average propensity to save—s in the equation—is constant by allowing changes in the distribution of income and differences in the propensity to save out of different incomes to affect aggregate savings ratios.[8] This line of inquiry has been pursued by Mrs. Robinson [80, 1956; 81, 1962; 85, 1971], N. Kaldor [38, 1956; 40, 1959; 43, 1961], N. Kaldor and J. Mirrlees [46, 1962], and L. L. Pasinetti [75, 1962; 76, 1966]; and their work constitutes the main body of post-Keynesian literature. Professor Joan Robinson's *The accumulation of capital* is typical of this literature, making clear its concern with the problems of an economy expanding over time [80, 1956]. In order to emphasize the influence of clock-time and history on the process of growth, the argument is carried out through the method of comparing economies that have digested any short-period changes that might momentarily disturb their expansion path. By then showing how the expansion of one economy is affected over time relative to the other by differences in specific variables, Mrs. Robinson is able to isolate the most critical determinants of the long-run growth of a developed, market-oriented economy. These determinants are (1) the initial endowment of capital equipment, (2) the real wage rate (and thus, given the assumptions employed, the real savings rate), (3) the rate of growth of the labor force, and (4) the rate of technical progress [80, 1956, Book II].

More important than the specific conclusions reached, however, is the method of analysis employed: the comparison of alternative growth paths based on a difference in one of the underlying variables in one but not the other economy. The purpose behind this approach is to replace what Mrs. Robinson refers to as "pseudo-causal" models predicated on "logical" time with historical models that are empirically testable predicated on real time [81, 1962, pp. 23–29]. The key point is that causation is not the same as simultaneity of determination; one cannot infer the one from the other as the usual static equilib-

[6] See Harrod [28, 1939; 29, 1948; 30, 1973]. Pasinetti [77, 1974, pp. 93–95] makes clear the independent contribution of Domar.

[7] One of the first important questions raised by the post-Keynesians about neoclassical theory was whether it was possible to define any homogeneous set of goods as "capital," and this was before the appearance of the neoclassical models of growth which became the focal point of the capital controversy. (See Robinson [79,1954] and Sraffa [95,1960].) The first use of aggregate capital in a neoclassical production function as a basis for a model of growth is in Solow [92, 1956] and Swan [100, 1956], building on the earlier static use of aggregate capital found in Clark [8, 1899] and Wicksell [104, 1934].

[8] The effect on the savings ratio of the distribution of income and the association of a higher propensity to save out of profits than out of wages are both found in Keynes's *Treatise* and *The general theory*. Keynes, however, did not countenance the constancy of these values over time.

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rium analysis, based on the neoclassical model, attempts to do.[9]

The purpose of the exercise in comparative dynamics is not to show how some hypothetical economy can expand indefinitely over time given certain underlying conditions. It is rather to explain why, as the historical record bears such strong witness, the expansion path of a free enterprise economy is likely to be so erratic. Post-Keynesians are thus ultimately concerned with the analysis of the economy in disequilibrium, but this presents methodological problems not encountered when the concern is simply with what conditions would be consistent with the system being in a steady state of rest.[10]

To handle these problems, post-Keynesians first consider explicitly the conditions required for a steady rate of expansion, based on the warranted growth rate given by the Harrod-Domar formula. Once this has been done, the actual observed rate of growth can be analyzed in terms of (1) a change in the warranted growth rate due to a change in one of its underlying determinants and (2) the forces operating in the short run to divert the economy from its warranted growth path. Approaching the problem of disequilibrium in this manner gives rise to the distinction found in the post-Keynesian literature between long-period analysis, focusing on the determinants of the warranted growth rate; and the short-period analysis, focusing on cyclical deviations in the actual rate relative to the warranted rate. The methodological point is that the deviations cannot be understood except with respect to some reference growth path. The mistake that is all too frequently made is not just in confusing the long- and the short-period adjustments (or the difference between closed, equilibrium and open, causal models) but in leaving out the short-period altogether, thereby fusing the actual and warranted rates into one through the belief that technical substitutability is sufficient to establish the validity of Say's Law.

II. *Distributional Effects*

A second distinguishing characteristic of post-Keynesian theory is that the distribution of income is considered integral to the explanation of economic activity. Rather than ignoring this factor altogether or assuming that it can be derived from the technological nature of the production process, post-Keynesian theory treats the distribution of income as a variable directly linked to the rate of economic expansion—one which, moreover, may well be subject to political manipulation. Indeed, the simple versions of the post-Keynesian model have been set up to show how control over the rate of investment implies control over the distribution of income and the rate of profit (see Pasinetti [77, 1974, p. 113]).[11]

In these simple versions of the model, which can be traced back to Keynes's *Treatise* as well as Kalecki's work in the 1930's, but which were first fully elaborated by Mrs. Robinson and Kaldor independently of one another in 1956, the national income is divided into total wage income and total profits. This recalls the world of classical economics, with its two-fold class structure: (1) workers, whose income consists solely of the wages and salaries they receive for their labor services and which are entirely spent on personal consumption, and (2) capitalists, whose income consists solely of the profits obtained through their ownership of the means of production. It is because profits are the

[9] See L. L. Pasinetti [77, 1974, pp. 45–48]; F. H. Hahn [20, 1973, p. 15].

[10] See Robinson [81, 1962, pp. 6–7]. Thus Blaug [7, 1974, p. 82], in arguing that post-Keynesian theory is concerned only with long-run steady-state growth, has missed the essential point.

[11] Within the context of Keynes's own model, this requires that two of the three independent variables (liquidity preference and the propensity to consume) be taken as given, leaving the marginal efficiency of capital or the rate of aggregate investment as the one exogenously determined variable.

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only source of finance for capital expenditures that the capitalist class, in this model, controls the rate of investment. In other words, the workers consume all their income (their marginal propensity to save, s_w, is zero) and the capitalists carry out and finance all investment (their marginal propensity to save, s_p, is unity).[12] If this nineteenth century terminology seems inappropriate to the twentieth century, one can just as easily substitute the term nonworker for capitalist and the term nonwage income for profits. The essential point is that one group receives a wage determined by market forces, collective bargaining, or custom while the other receives the residual income of all the producing units in the system. This makes the argument considerably more general.

From the "classical" assumption that the workers do all the consuming and that the capitalists do all the investing and saving, it follows that the amount of wages and salary on the income side of the national income and product accounts must be equal to the amount of consumption goods enumerated on the product side as having been produced. Similarly, the amount of profits received as income will be equal to the amount of investment goods produced. A higher growth rate, given the same production techniques and money wage rate, will therefore, because of the implied increase in the rate of investment, imply a different distribution of income, with a higher ratio of profit (nonwage income) to wages. On the other hand, a lower growth rate, everything else unchanged, will mean a lower ratio of profits to wages.

The point can be further elaborated with the aid of an algebraic formula based on that given by Kaldor [38, 1956] (see also Kregel [58, 1971, chaps. 9–10]). With s_w and s_p as defined above, total savings in the system can be written as $S = s_w Y + (s_p - s_w)P$. That is, total savings at any point in time are equal to the savings rate of workers applied to the total national income plus the difference between the savings rate of capitalists and workers applied to that portion of the national income received as profit. Substituting the above relation for S into the Keynesian $S = I$ condition yields the following equation:

$$I = s_w Y + (s_p - s_w)P \tag{1}$$

Dividing through by Y and rearranging terms,

$$\frac{P}{Y} = \frac{1}{(s_p - s_w)}\frac{I}{Y} - \frac{s_w}{(s_p - s_w)} \tag{2}$$

When the classical assumptions hold (*i.e.*, $s_w = 0$, $s_p = 1$), the equation collapses to

$$\frac{P}{Y} = \frac{I}{Y} \tag{3}$$

This brings out most sharply the relationship between the share of investment in total output and the share of profit in total income. The greater the rate of economic expansion as a result of a higher level of investment, the greater will be the share of national income going to the capitalists (non–wage earners) in the form of profits (nonwage income) and the lower the share going to workers.

Relaxing the assumption that $s_p = 1$ means that some income from profits is spent on consumption goods. The equation then becomes

$$\frac{P}{Y} = \frac{1}{s_p} \cdot \frac{I}{Y} \tag{4}$$

Under these circumstances the profit (nonwage) share of national income for a given ratio of investment to total output will be higher by a factor equal to the reciprocal of the marginal propensity to save out of profits. Thus, if the capitalist class uses half of its income to purchase

[12] This seems to be the kind of model Keynes had in mind when he gave his interpretation of the pre-World War I economic history. (See Keynes, [52, 1920, p. 16].)

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consumption goods, its share of the national income would be twice as high as it would be with $s_p = 1$. If the propensity to consume by capitalists (non–wage earners) is greater than 0.5, the share of profits (nonwage income) will be correspondingly higher. There are, then, two basic factors determining the relative shares of national income: (a) the ratio of investment to total output and (b) the propensity to consume out of profits.

It should be pointed out that what is being discussed here is the distribution of income, not the level of income. The two are not necessarily the same, and one of the insights that can be derived from the post-Keynesian theory is that it is possible for the level of income going to workers to be increasing at the same time that their share of the national income is declining. The determination of the level of income will be taken up in the next section.

Finally, if savings from wages are positive, that is, if $s_w > 0$, the correspondence with the classical categories of workers and capitalists is lost and, as Pasinetti emphasized [75, 1962], equation (2) above will not be an adequate representation of the distributional relationships of a system where $s_w > 0$ and $s_p < 1$. The relative shares of workers and capitalists (non–wage recipients) must be considered separately from that of wages and profits (nonwage income).

If workers save and are allowed a return on the investment of their savings, they will have both wage and nonwage income. It is then obvious that the distribution of income between wages and profits will not be the same as the distribution between workers and capitalists, since some of the profits must be paid to workers as a return on their savings. Pasinetti, however, has shown that when workers become entitled to a share of the profits as a result of their contributing to the financing of investment through their own direct savings (with the rate of return paid them equal to or less than the rate of profit), it makes no difference insofar as the distribution between wages and profits is concerned. The ratio of wages to total income is still determined by the share of investment in total output and the marginal propensity to consume by the capitalist (non–wage-earning) class. Only the distribution between workers as a social class and other income recipients will be affected, with the share going to workers increasing with their marginal propensity to save, s_w. As Pasinetti has noted, "These conclusions . . . shed new light on the old Classical idea . . . of a relation between the savings of that group of individuals who are in a position to carry on the process of production and the process of capital accumulation" [77, 1974, p. 113].

Thus the relationship given in equation (4) above can be considered adequate as a description of the distribution of income between wages and profits (nonwage income) if s_p is defined as the propensity to save by non–wage earners. Most importantly, it holds independently of the value assigned to s_w.[13] This goes back to another earlier point, namely, that what lies behind the post-Keynesian delineation of income shares is not so much a distinction

[13] It should be stressed that Pasinetti strictly confines his analysis to the long period; and that the main thrust of his argument, notwithstanding the response from critics (*e.g.*, Meade [68, 1963]; Meade and Hahn [70, 1965]; Samuelson and Modigliani [87, 1966]), was to show that the distribution of income between wages and profits as well as the rate of profit is "determined by the natural rate of growth divided by the capitalists' propensity to save, independently of any 'productivity' of capital (no matter how it may be defined) and indeed independently of anything else" [77, Pasinetti, 1974, p. 144]. Further analysis of the points at issue are dealt with by Harcourt [23, 1972] and Kregel [58, 1971]. Pasinetti, besides reprinting the earlier article, has now made a further clarified assessment [77, 1974, chaps. 5, 6] in which he says, "The most surprising outcome of all is that the long-run rate of profit is even independent of 'capital'! In the long run, capital itself becomes a variable; and it is capital that has to be adapted to an exogenously determined rate of profit, not the other way round" [77, 1974, p. 144].

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between social classes as a distinction between quasi-contractual and residual forms of income (see Kregel [60, 1973, chap. 11]). The point becomes clearer when, in addition to dropping the classical assumptions, the analysis is removed from the nineteenth century context of small, family-held business enterprises and brought into the world of the modern industrial corporation.

While there were early hints that the post-Keynesian arguments about income distribution applied just as well to an economy dominated by large industrial corporations,[14] systematic efforts to develop the theory along these lines are of relatively recent date (*e.g.*, Kregel [58, 1971]). In this type of formulation (found in Kregel [60, 1973] and Eichner [12, 1973]), the savings propensity of the capitalist class becomes the savings propensity of the corporate sector. With just this one change in nomenclature, all the conclusions that seem to apply only to an economic system in which the participants are divided into capitalists and workers applies to an economic system dominated by large corporations as well. The higher the level of investment that the corporate sector as a whole undertakes, the higher will be its share of the national income. And if there is consumption out of the profits earned by these corporations, whether it be as a result of distributing dividends to the rentier remnants of the earlier entrepreneurial group or as a result of expenditures by the corporations themselves on such non–capital-augmenting items as advertising, their relative share will be even higher. Savings by workers, especially if turned back over to the corporations for reinvestment, will improve the relative position of that group *vis à vis* the corporate sector, but it will not change the functional distribution of income between quasi-contractual payments (wages, fixed interest, and rent) and residual earnings (corporate profits). Indeed, these conclusions apply to any economic system in which some one group, private or public, receives a residual share depending on the level of economic activity—and it is hard to conceive of an economic system without that characteristic.[15]

With the focus on the savings behavior of a type of economic institution rather than a class of individuals or type of income, there is reason to inquire as to what, besides some undiscoverable indifference map, lies behind savings behavior. For Kregel, at least in this 1971 work, the explanation lies in the rate at which corporations decide to pay out dividends. The higher the dividend rate, and thus the lower the retention (of profits) rate, r, the lower will be the marginal propensity to save—s_p in the notation used up to now—of the group receiving nonwage income.[16] For Eichner, the key to the savings behavior of large corporations is their pricing policy. To generate a higher rate of savings, the large corporation—or megacorp, as he terms it—need only increase the margin above costs which it establishes as part of its price. While Kregel focuses on the retention rate, r, holding the price level constant, Eichner focuses on the price level, holding r constant. The two explanations are therefore comple-

[14] See Robinson [80, 1956, pp. 404–06]; Kaldor [38, 1956]; Pasinetti [77, 1974, p. 112, n. 2]. Kaldor went further in an appendix to his response [44, 1966] to Samuelson and Modigliani's critique [87, 1966] of Pasinetti [75, 1962]. To deal with one of the issues that had been raised, Kaldor explicitly introduced corporate share finance and the concept of the "valuation ratio" (*cf.* Marris [65, 1964] and Kahn [36, 1972] for further uses of this concept), but the intention was more to remove an anomaly from the analysis than to fully analyze the effect of a change in institutions on the performance of the model.

[15] Kregel entitles the appendix in which the corporate model is first laid out, "The Classless, Non-Income Differentiated Model," thereby hinting at its universal applicability.

[16] This linking of s_p to r establishes a direct relationship between post-Keynesian theory and the managerial theory of the firm developed by Marris [65, 1964; 66, 1973; 67, Marris and Wood, 1971].

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mentary rather than antithetical to one another.[17]

Even though considerable work still remains to be done in refining the above arguments, what the post-Keynesian paradigm has to say about the distribution of income is already far more easily verified empirically (see National Bureau of Economic Research [74, 1964]) than what can be gleaned from the marginal productivity analysis that lies at the heart of the prevailing neoclassical model. Still, as has been pointed out, explaining the distribution of income is not the same as explaining how much there is to be distributed. It is to the latter point that we now turn.

III. *The Keynesian Constraints*

The third distinguishing characteristic of post-Keynesian theory is that it retains the fundamental approach to a monetized production economy outlined by Keynes in his *Treatise* and *The general theory.* This implies more than just the use of a certain set of aggregate classifications and accompanying vocabulary—words like consumption function, multiplier, *etc.* It implies as well the following:

1. *The need to recognize that real commodity and labor flows are expressed in the system as monetary flows, the real aspect being reflected on the product side of the national accounts and the monetary flows on the income side.* Post-Keynesian theory is thus a theory of a monetized production economy, one in which commodities and labor exchange for something which, because of its unique characteristics—a zero, or negligible, cost of production together with a zero, or negligible, elasticity of substitution with respect to anything else able to serve as a store of value and/or a medium of exchange—can be called money.[18] While this would seem to set post-Keynesian theory apart only from the basic Walrasian variant of the neoclassical model,[19] it actually involves a considerably greater degree of differentiation, as can be seen once all the implications of a monetized economy are fully spelled out. Among these corollary features are a full panoply of financial institutions ranging from commercial banks to investment brokers; the ability of these financial institutions, acting together, to sterilize or activate the available monetary stocks and thereby provide a cushion against exogenous shocks to the system; and the possibility that, as a result of these monetary adjustments to the real commodity and labor flows, the money wage rate will vary independently of the real wage rate.[20]

2. *The division of the national product and of the national income into discretionary and nondiscretionary components.* On the product side, the relevant distinction is between discretionary expenditures and nondiscretionary expenditures. (Keynes himself used the terms "non-available" and "available" goods in the *Treatise* and the terms "investment" and "consumption" in *The general theory.* The three sets of terms are broadly interchangeable.) Nondiscretionary expenditures represent the flow of goods and services required to keep economic units functioning at a given level of output, whether they be the material and labor inputs used by business firms in the production process or the food and other

[17] The difference in approaches taken by Kregel and Eichner can be attributed to the different national contexts in which they were writing. U.S. corporations have much less to fear from international competition if they should raise their prices than do U.K. companies. When Kregel considers the possibility of the price being varied, he introduces international considerations into the analysis [60, 1973].

[18] *Cf.* Keynes [54, 1936, chaps. 16, 17]. The necessity of these requirements is explained by P. Davidson [9, 1972] and Kregel [61, 1974].

[19] See Bent Hansen [21, 1970, chaps. 5–7.]

[20] The essential features of the type of monetized economy that is the subject of post-Keynesian theory have been perhaps best discribed by Paul Davidson [9, 1972]. See also Kregel [60, 1973, chap. 11]. The influence of financial institutions is stressed in the work of Hyman Minsky [71, 1972; 72, 1975].

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items consumed on a daily basis by households. Even in a monetized economy, these expenditures are so closely linked to the corresponding monetary flows that there is no need to distinguish between the two. Those making the purchases are the same as those with the currently earned and disposable income. The situation is somewhat different, however, in the case of discretionary expenditures. One of the most important of Keynes's insights was that those with the power to determine the level of discretionary expenditures, or investment, were not the same as, nor need they be limited by what they can obtain from, those with the discretionary income, or savings. Thus the level of discretionary expenditures can deviate from the level of discretionary income—at least in an *ex ante*, anticipatory or planned sense.

3. *An* ex post *equality between discretionary expenditures (investment) and discretionary income (savings) as the sole condition for aggregate equilibrium.* This gives greater freedom to the analysis because, with only one set of flows that must be brought into balance before the chain of causal explanation can be considered complete, many other things—like the flow of those who would like to obtain employment or the desired portfolios of wealth holders—can remain out of balance. It should be stressed that in setting up an *ex post* equality between discretionary expenditures (investment) and discretionary income (savings) as the one condition which must be met before the analysis can be considered complete, no causal relationship is implied by what is essentially an accounting identity. The causal relationship follows from the next, quite separate point.

4. *Discretionary expenditures (investment) as the primary factor determining the level of economic activity.* This means that if the level of economic activity or—shifting into a post-Keynesian framework—the rate of economic expansion is to be increased, it can only be accomplished by increasing the rate at which discretionary expenditures are being undertaken. A corollary proposition is that when, as a result of any such change in the rate of discretionary spending, there develops an *ex ante* imbalance between the two flows, it is the discretionary income (savings) that will necessarily have to adjust to the level of discretionary expenditures (investment), and not *vice versa.* This decisive role played by discretionary expenditures needs to be kept firmly in mind when considering the distributional effects pointed out in the preceding section.[21] The capitalist class (or, if you prefer, the non–wage-earning group, the corporate sector, the state or whoever else is viewed as receiving the residual income) in effect determines its own relative share of the national product in the process of deciding what the rate of discretionary expenditures will be. The more it invests (and consumes), the greater will be the share it obtains of the total output.[22]

Because of the importance placed on it in their analysis, post-Keynesians have, quite naturally, been concerned with what determines the rate of discretionary expenditures. Most of the attention has been given to discretionary expenditures (investment) in the narrow sense of spending by business firms on capital equipment. Here the starting point has usually been Keynes's own emphasis on the "animal spirits" of entrepreneurs and the volatility of their expectations. To the extent that any formal model of investment

[21] See Kregel [58, 1971, pp. 148–49].

[22] This is what lies behind Kalecki's pithy observation so often quoted by post-Keynesians, that "the workers spend what they get and the capitalists get what they spend." The phrase is not to be found in any of Kalecki's English works, but the essence of the argument is to be found in Kalecki [48, 1939, p. 76]. Another of Kalecki's epigrams is that "the capitalists cannot decide to earn more; they can only decide to invest more" [51, 1971].

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behavior can be said to be favored, it is Kalecki's in which the level of spending on new capital equipment is a function of past profits.[23] Together with a macrodynamic model in which the level of profits is a function of the rate of investment, it makes for an economy which is cyclically unstable. However, this type of explanation for investment behavior is not intrinsic to post-Keynesian theory; and indeed, almost from the beginning, Kaldor has given at least equal place to the endogenous factors emphasized in the alternative "accelerator" model.[24] Eichner [13, 1976] has shown how Robert Eisner's [14, 1963; 15, 1967] lagged-sales accelerator model can be made consistent with Kaldor's approach to investment determination. The point is that post-Keynesian theory is compatible with a number of different models of investment behavior, the main exception being the so-called "neoclassical" model developed by Dale W. Jorgenson [34, 1963].[25] The latter makes the rate of spending on new capital equipment a function of the change in the returns to capital relative to wages, and thus it reverses what, according to post-Keynesian theory, are cause and effect.[26]

Just as there is nothing inherent in post-Keynesian theory that would limit the determinants of investment, narrowly defined as expenditures on new capital equipment, to past profits as a proxy variable for entrepreneurial expectations or "animal spirits," so, too, there is nothing inherent in the theory that would limit investment itself to spending by business enterprises on capital equipment. Eichner has shown how the argument can be generalized, so that not just the business sector but the household and government sectors as well are capable of discretionary spending [13, 1975]. Besides leading to a multi-sector analysis of investment-savings equilibrium, with deficits in one sector being offset by surpluses in others, this extension of post-Keynesian theory opens up the question of what are the separate, and perhaps quite distinct, determinants of discretionary expenditures in the several sectors. Part of the answer can be found in the quite substantial work which has been done by economists over the past 20 years on the determinants of spending by households on consumer durables[27] and by government on public and quasi-public goods[28]—work that has clearly been inspired by *The general theory* and which can now be incorporated back into the mainstream of post-Keynesian developments in economic theory. Clearly, however, much still remains to be done in synthesizing these disparate elements before a fully satisfactory explanation of what determines the overall rate of discretionary spending will have been produced.

The rate of growth of discretionary expenditures is but one of three rate-of-change variables required for the analysis of macrodynamic disequilibrium. Another is the warranted growth rate given by the Harrod-Domar formula. Should the rate of growth of discretionary expenditures, $\overset{*}{I}$, not be equal to the warranted growth rate, $\overset{*}{G}_w$, the economy will move off its secular

[23] The model first appeared in Polish [47, Kalecki, 1933] but has since been reprinted in English [50, 1966; 51, 1971]. See also Kalecki [48, 1939; 49, 1954].

[24] See Kaldor [39, 1957; 43, 1961] and Kaldor and Mirrlees [46, 1962].

[25] See also Jorgenson [35, 1971], especially pp. 1116–1117, 1126–1127, and the sources cited therein.

[26] It is on this point, of course, that the post-Keynesian arguments about double-switching and capital reversal apply.

[27] See Michael Evans [16, 1969, chaps. 6–7].

[28] Since government expenditures are usually considered to be an exogenous variable entirely subject to political control, less empirical work has been done on that component of discretionary spending. But see the various econometric models, Duesenberry [10, 1965], Evans and Klein [17, 1967], and Hickman [32, 1972]. The progress in developing a theory of public goods has been more impressive. See Head [31, 1962], Schultze [89, 1968], Eatwell [11, 1971], Asimakopulos and Burbidge [4, 1974], and Kregel [60, 1973, Italian ed., Latarza, Rome].

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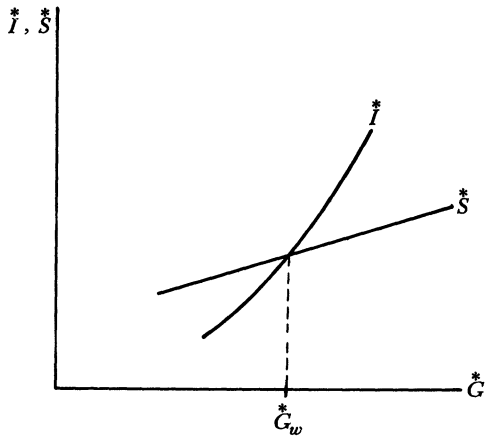


Figure 1a.

growth path and begin tracing out a cyclical pattern around that trend line. Thus, the post-Keynesian analysis of macrodynamic disequilibrium begins by looking at the current or actual growth rate, whether it be of the economy as a whole, $\dot{G}_a$, or of some component thereof, say investment, $\dot{I}$, relative to the warranted growth rate. Whenever there is a difference between the two, that is, $\dot{G}_a$ or $\dot{I} \neq \dot{G}_w$, the analysis ceases to be that of long-run steady-state expansion and instead becomes that of a shorter-period cyclical movement.

Pasinetti has provided an algebraic framework [77, 1974, chap. 3] and Eichner [13, 1976, chap. 6] a geometric one for considering the possible dynamic growth paths that may be traced out once an economy has been dislodged from its warranted growth path. The Eichner diagram measures the rate of growth of discretionary expenditures, $\dot{I}$, and the rate of growth of discretionary income, $\dot{S}$, on the same vertical axis. Separate curves can then be drawn showing how each of these two rate-of-change variables will respond as the aggregate growth rate, $\dot{G}$, itself varies. The curves can be drawn so as to depict either the type of cyclically unstable situation that ensues when a Kalecki-type investment demand model is postulated or, alternatively, the type of economy that, when pushed off its steady-state expansion path by some exogenous factor, is subject to forces from within that will cause it to return to the warranted growth rate. It all depends, as can be seen from the accompanying diagrams, on the slope of the savings curve, $\dot{S}$, relative to that of the investment demand curve, $\dot{I}$.[29] *Figure* 1a depicts an unstable situation and *Figure* 1b a stable one. What, in fact, are the slopes of the two curves, as well as what are their respective parameters, is therefore of crucial importance, but these are questions which need to be dealt with empirically, not *a priori*. The answers will depend on the values of the savings propensities, the composition of discretionary expenditures, *etc.* While this type of analysis may at first seem unfamiliar, it is actually implicit in the large-scale econometric models that have been developed for the American and other economies based on the pioneering work of Jan Tinbergen

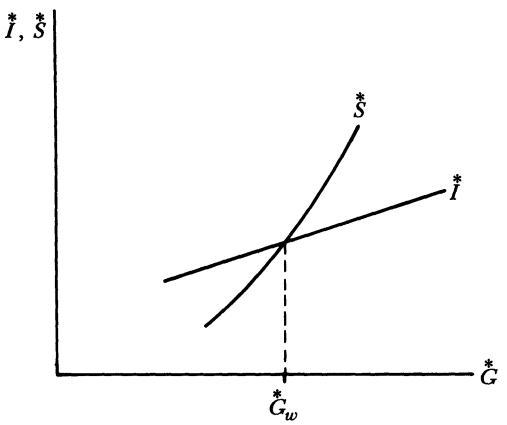


Figure 1b.

[29] The fact that the investment demand curve, $\dot{I}$, has any slope at all reflects a point brought out by Asimakopulos [2, 1971]—namely, that current economic conditions are likely to cause some revision in planned investment. In Pasinetti's algebraic analysis, the slopes of the two curves are identified as the marginal propensity to save and the marginal propensity to invest. Pasinetti's use of algebra makes his analysis more general [77, 1974, pp. 59–61].

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and Lawrence R. Klein.[30] One need only reduce the equations in these models to two: one attempting to explain or predict discretionary expenditures and the other attempting to explain or predict discretionary income.

The third rate-of-change variable required for the analysis of macrodynamic disequilibrium is what is usually referred to, following Harrod [29, 1948], as the "natural" growth rate but which, following Mrs. Robinson [80, 1956, p. 405], is perhaps better thought of as the "potential" growth rate. Both the actual growth rate, $\overset{*}{G}_a$, and the warranted growth rate, $\overset{*}{G}_w$, reflect the constraints on the growth process that derive from the endogenous forces at work within the economic system itself. On the other hand, the potential growth rate, $\overset{*}{G}_p$, reflects the constraints imposed by the availability of resources from without, as well as by technological possibilities. While these limiting, exogenously supplied resources could just as well be natural ones, in line with the recently revived Malthusian sensitivity to what are the true limits on economic growth, the emphasis within the post-Keynesian literature has been almost entirely on human resources, together with changes in technology. In the simplest formulation, then, the potential growth rate, $\overset{*}{G}_p$, is identified with the growth of the work force, $\overset{*}{N}$. Compounding this variable by the rate of growth of output *per* worker as most post-Keynesians would do or substituting for it the skill matrix of the work force as suggested by Eichner [13, 1975] makes the analysis somewhat more refined but does not change the essential point. This is that comparing the actual growth rate, $\overset{*}{G}_a$, with the warranted growth rate, $\overset{*}{G}_w$, to determine whether a steady-state rate of expansion can be maintained on the basis of the endogenous forces at work within the system is not enough. In addition, the warranted growth rate, $\overset{*}{G}_w$, must be compared with the potential growth rate, $\overset{*}{G}_p$, to determine whether the availability of exogenously supplied resources—*viz.*, manpower—makes that steady-state rate of expansion either feasible or desirable.

Within this framework, there if no fixed point of "full employment." All that one can say, based on the model, is whether the amount of unemployed human resources is decreasing or increasing, depending on whether $\overset{*}{G}_w$ is greater or less than $\overset{*}{G}_p$. It is on this basis that Mrs. Robinson [81, 1962] has defined the several possible variants to the Golden Age whose existence neoclassical growth theorists are so fond of demonstrating. There is, of course, the true Golden Age in which not only is the warranted growth rate, $\overset{*}{G}_w$, the desired growth rate but, even more important, $\overset{*}{G}_a = \overset{*}{G}_w = \overset{*}{G}_p$. In addition, however, there is the "limping" Golden Age in which, although $\overset{*}{G}_a = \overset{*}{G}_w$ and this is the desired growth rate, it turns out that $\overset{*}{G}_w < \overset{*}{G}_p$. This implies a growing class of unemployed workers. The obverse of the limping Golden Age is the restrained Golden Age. Here $\overset{*}{G}_w > \overset{*}{G}_p$, implying an eventual slowing down of the growth process as the economy bumps against the upward limit on the rate of expansion set by the availability of manpower and technological progress. Finally, there is the "bastard" Golden Age. This occurs when, even though $\overset{*}{G}_a = \overset{*}{G}_w = \overset{*}{G}_p$ and this is the desired growth rate, the real wage dictated by the rate of economic expansion is less than what workers are willing to accept. The result, as workers seek to push up their money wage rates, is the now all too familiar wage-price inflationary spiral, with its resulting effect on $\overset{*}{G}_w$ as well as on the share of wages in national income. This brings us to the last of the four points to be taken up.

[30] In addition to the sources cited in fn. 28 above, see Tinbergen [101, 1939] and Klein and Goldberger [57, 1955].

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IV. *The Microeconomic Base*

The fourth distinguishing characteristic of post-Keynesian theory is its microeconomic base. It is necessary to assume neither that the individual firms are price takers equating marginal cost with marginal revenue nor that wages reflect the "marginal productivity" of labor. Indeed, post-Keynesians view both prices and wages as being determined by a quite different set of considerations.

The real wage is, of course, set in the manner already indicated—by the rate of discretionary expenditures that has been opted for by the society and the relative distribution of income between residual and nonresidual income recipients which that rate of expansion requires. There is, however, still the nominal wage to be explained, the difference between the two being crucial to the macro adjustment process. Post-Keynesian theory accepts Keynes's view that the nominal wage is for the most part exogenously determined. It may depend on the type of Malthusian population dynamic, which in the classical model keeps wages at the subsistence level. Or it may depend, as Keynes himself emphasized, on the bargaining strength of the trade union movement.[31] In either case what is being put forward is something other than a strictly economic explanation for the nominal wage rate. A corollary proposition is that the major role played by the level of money wages is in the determination of the level of money prices. While some economists may be uncomfortable with an exogenously determined money wage rate, this approach has two advantages. First, it seems to agree with the situation that is observable in most countries. Second, it introduces another instrumental variable for influencing the aggregate price level. To understand what is implied by that, one must turn to the post-Keynesian pricing model.

The competitive conditions assumed in post-Keynesian theory are far less stringent than those postulated in the conventional neoclassical analysis. There is no need to stipulate that the individual firm is a price taker, with little or no ability to affect the price prevailing at the industry level. All that is required is that there be sufficient rivalry among firms, whether in the same industry or not, so that no potentially profitable investment opportunity is eschewed. In other words, the rivalry among firms need only be sufficient to assure that the expected rate of return on investment will tend to be equalized for all firms. This means that competition is focused around investment, or discretionary expenditures, rather than around the price variable.

Post-Keynesian theory also employs far less stringent assumptions about the technical conditions of production in the short run. Kaldor early raised the question of why the firm should be thought of as encountering diseconomies, or increasing costs, over the range of output at which it tends to find itself producing [37, 1934].[32] Today the accepted view among post-Keynesian economists, based both on the empirical evidence available on the subject and on the theoretical implications of assuming fixed technical coefficients in the short run, is that the firm actually faces constant prime or direct costs over the relevant range of output, with the zone of increasing costs lying to the right of that (*cf.* Robinson and Eatwell [86, 1974, p. 168], Kregel [60, 1973, p. 139], Davidson [9, 1972, pp. 37–40], and Eichner [13, 1976, chap. 2]. This gives rise to the set of cost curves depicted in *Figure* 2, rather than the U-shaped cost curves of the conventional neoclassical analysis. Two sig-

[31] There is a third possibility pointed out by post-Keynesians, this being that the nominal wage may actually reflect the degree of tightening in the labor market. But this does not alter the main point.

[32] He has by no means dropped the point. See Kaldor [45, 1972].

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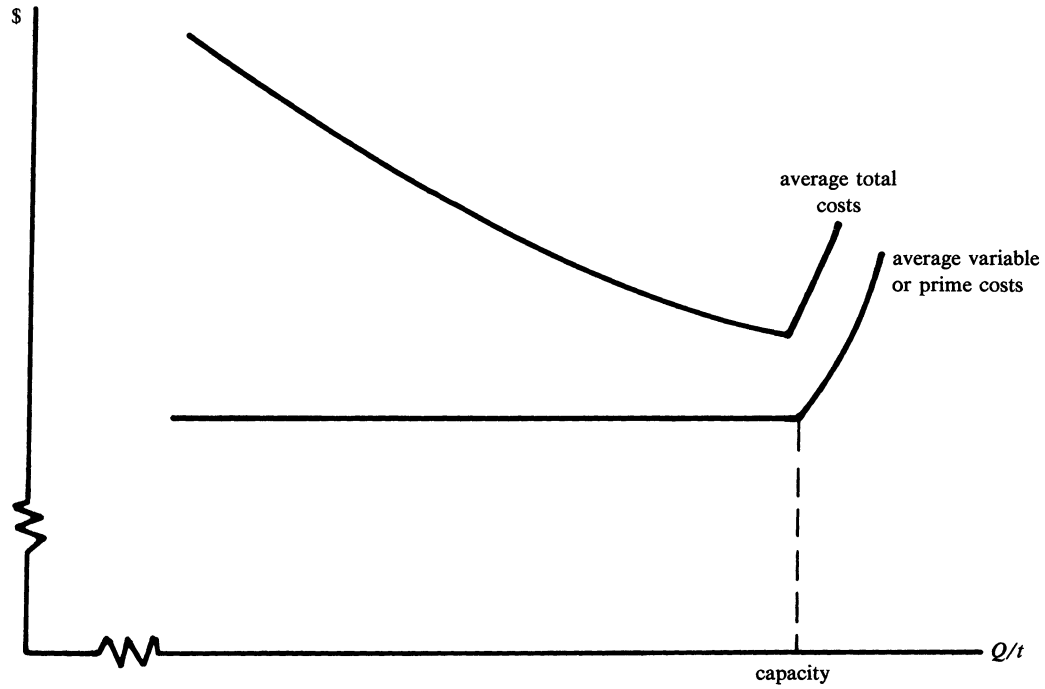


Figure 2.

nificant propositions follow from this formulation. The first is that the firm is not subject to any pressure on the cost side to raise its price solely as a result of an increase in the demand for its product. This lends support to the argument that it is the firm's supply curve—and not its demand curve as assumed in Walrasian-type models—that is perfectly elastic in the short run. The other significant proposition that follows from cost curves as drawn above is that the profits, or residual income, of the firm will be an increasing function of the rate of capacity utilization or—what is essentially the same thing—the level of demand. This is because, while prime or direct costs remain constant as output expands, the *per* unit overhead costs are continuously falling, leaving a growing gap between a fixed price and average total costs, even when the latter include a certain "normal" or anticipated profit. This disproportionate increase in the firm's residual income as the level of demand rises produces at the micro level the same redistributive effects already described at the macro level. It thus demonstrates the consistency of the theory at the two levels.

Putting these various elements together leads inexorably to the formulation of a pricing model based on a certain mark-up or margin above costs. This type of "cost-plus" pricing model goes back to Kalecki's writings in the 1930's,[33] although the empirical work being carried out contemporaneously by Andrews at Oxford pointed in the same direction.[34] While the connection between the mark-up above costs in Kalecki's model and the savings out of which investment is financed was pointed

[33] See Kalecki [50, 1966; 51, 1971]. It is only recently that these earlier writings by Kalecki have been translated into English. For the first source in English, see Kalecki [49, 1954]. For a full explication of Kalecki's contributions, see Feiwel [18, 1975] and Asimakopulos [3, 1974].

[34] See Andrews [1, 1949] and Wilson and Andrews [105, 1951].

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out by Steindl as early as 1952,[35] it is only recently that post-Keynesians have turned their attention to what actually determines the size of the mark-up, and hence the savings rate, in the business sector.

Donald J. Harris [24, 1974] has pointed to two factors—besides the "monopoly power" stressed by Kalecki—upon which the margin above costs may depend. One is the "normal" or expected rate of capacity utilization. In the resulting model, which Harris attributes to Mrs. Robinson [83, 1969, p. 260], the expected rate of capacity utilization becomes the basis for estimating the average total costs upon which the margin is figured. The model has the important short-run property, already mentioned, that above average levels of aggregate demand lead to above average profits and/or business savings, and *vice versa*. The other factor pinpointed by Harris is the planned level of investment. In the alternative model based on this second factor, a model attributed to Harcourt [23, 1972, p. 211], the planned level of investment serves as a measure of business confidence, including confidence in the ability to maintain a given margin above costs. Thus the higher the planned level of investment, the higher will be the margin that prevails.

While Harris sets up these two models as alternatives to one another, there is no reason why they need be treated as such. Eichner has combined the two models into one, at the same time offering a somewhat different interpretation of the relationship between planned investment and the margin above costs [12, 1973; 13, 1976]. He has also given a more specific meaning to Kalecki's "degree of monopoly" by positing three separate constraints on the individual firm's pricing discretion. One of these is the substitution effect, reflecting the influence exerted by the elasticity of industry demand, the same factor emphasized in the conventional pricing models except that greater weight is placed on the impact of that variable over time. A second constraint is what is termed the entry factor, this being the probability of new firms entering the industry as the margin above costs is increased. Inclusion of this factor serves to make much of the work that has been done over the years in industrial organization a central part of microeconomic theory rather than the *corpus* of anomalies it is viewed as being from the perspective of orthodox price theory.[36] The third constraint is the fear of government intervention in all its possible forms. This incorporates an exogenous political factor into the analysis.[37] The three constraints each impose a certain long-run cost on the firm if it should decide to exercise its pricing power to increase the margin above costs, m. Together, the three constraints give rise to a supply curve for internally generated funds—S_I' in quadrant I of the accompanying diagram—which is positively sloped, indicating that the higher the mark-up above costs, the greater will be the cost to the firm—transformed into an implicit interest rate, R—of obtaining additional investment funds, F, internally. This supply curve, after taking into account the possibility of obtaining additional investment funds at a market rate of interest, i, can be compared with the firm's marginal efficiency of investment schedule, D_I,[38] to indicate what is the optimal change in mark-up. (Quadrant II shows how the implicit interest rate, R,

[35] Steindl's work, in relation to post-Keynesian theory, is surveyed in Kregel [59, 1972]. For an early post-Keynesian model based on this point, see Harcourt [22, 1965].

[36] See Bhagwati and the sources cited therein [6, 1970]. See also Scherer [88, 1970].

[37] A fourth constraint would be the fear of market inroads by foreign-produced goods. *Cf.* Glyn and Sutcliffe [19, 1973] and Kregel [60, 1973, chap. 12]. Although Eichner encompasses this factor as part of the substitution effect, it perhaps deserves separate treatment, especially when examining open types of economies [13, 1976].

[38] It is important to distinguish this *ex ante* demand curve for investment from the *ex post* demand curve (*cf.*, Asimakopulos [2, 1971]).

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increases as the mark-up, m, is increased, while quadrant IV shows how the additional funds being generated internally, F, increases simultaneously as a result of a change in the same factor.)

The essential point here is that the mark-up above costs depends on the demand for investment funds relative to the cost of obtaining those funds internally rather than externally. Thus, while the conventional theory of the firm emphasizes the importance of external funds—the availability of internal funds except to replace worn-out capital equipment being viewed as necessarily the result of some disequilibrium situation—the post-Keynesian microeconomic model takes internal fund generation as the rule and external financing as the exception.

From this microeconomic base—a nominal wage rate that is exogenously determined and a mark-up above costs that reflects the rate of growth of investment—post-Keynesian theory has little trouble interpreting what has been unfathomable to the alternative, neoclassical paradigm. The recent inflationary experience in the United States and other Western nations can be simply described as the bastard Golden Age outlined by Mrs. Robinson. At the heart of the inflationary process is the question of relative income distribution; and because the neoclassical model is not able to take this aspect into account, it is not able to offer any viable solution to the problem of inflation. Just as Keynes had pointed out how difficult it was for a market-oriented economy to avoid unemployment, so now the post-Keynesians are bringing out how difficult it is for such an economy to escape an inflation-prone bastard Golden Age. Indeed, the tendency,

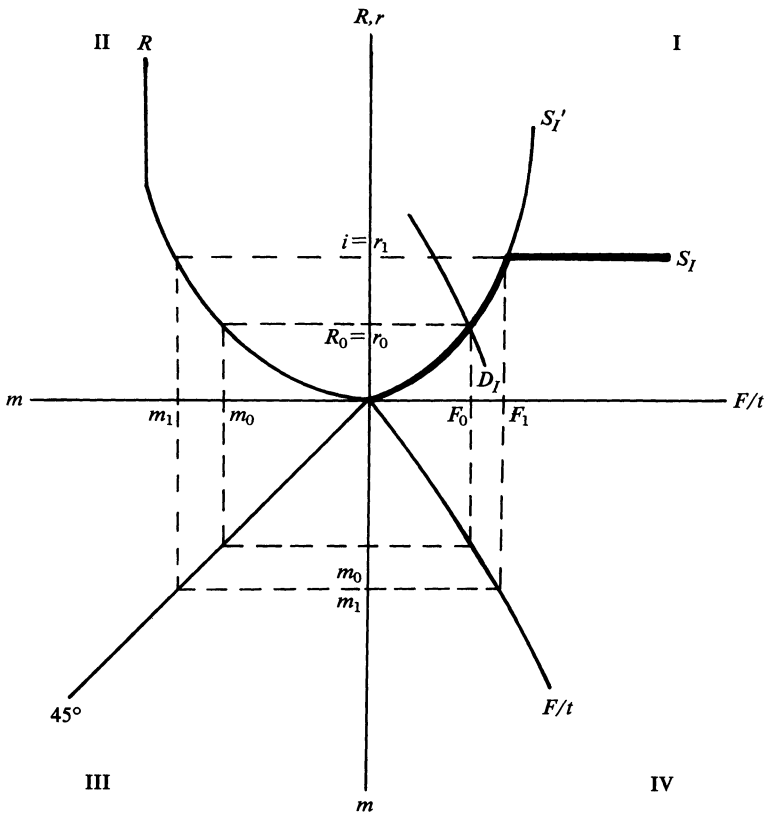


Figure 3.

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TABLE I

Aspect	*Post-Keynesian Theory*	*Neoclassical Theory*
Dynamic properties	Assumes pronounced cyclical pattern on top of a clearly discernible secular growth rate	Either no growth, or steady-state expansion with market mechanisms assumed to preclude any but a temporary deviation from that growth path
Explanation of how income is distributed	Institutional factors determine a historical division of income between residual and non-residual shareholders, with changes in that distribution depending on changes in the growth rate	The distribution of income explained solely by variable factor inputs and the marginal productivity of those variable factor inputs
Amount of information assumed to be available	Only the past is known, the future is uncertain	Complete foresight exists as to all possible events
Conditions that must be met before the analysis is considered complete	Discretionary income must be equal to discretionary expenditures	All markets cleared with supply equal to demand in each of those markets
Microeconomic base	Imperfect markets with significant monopolistic elements	Perfect markets with all micro units operating as price takers
Purpose of the theory	To explain the real world as observed empirically	To demonstrate the social optimality if the real world were to resemble the model

given the reluctance of the economists who advise governments to abandon the neoclassical model, is to convert the bastard Golden Age into a limping one.

V. *A Concluding Thought*

In this brief review of post-Keynesian theory, a number of aspects—such as money,[39] technological change—have been touched on only tangentially. Others—such as value,[40] international trade[41] —have not been dealt with at all. Still, enough should have been said to indicate the scope of post-Keynesian theory as well as its most essential features. For some readers, the important question will be how this body of theory differs, if at all, from the prevailing neoclassical model. It is a question that can readily be answered —indeed has already been dealt with obliquely—but which needs to be approached, if confronted directly, with care lest the issues become muddled. It must first be pointed out that there is no single neoclassical model with which post-Keynesian theory can be compared. The Arrow-Debreu elaboration of the basic Walrasian model is different from the Marshallian partial equilibrium model emphasized in intermediate price theory courses, and the latter is different from the Swan-Solow aggregate growth model. All of these neoclassical models share certain features in common. Indeed, it is these common features that make a comparison with post-Keynesian theory possible. Still, not all the different versions display every

[39] On the view presented here, that post-Keynesian theory deals with a monetized production economy in Keynes's sense, there can be no analysis of money separate from the analysis of the overall actions of the system.

[40] Here one would need to trace a line of development going back to Sraffa [94, 1926; 95, 1960].

[41] In some ways, this has been the least developed area in post-Keynesian theory. But see Steedman [96, 1971], Steedman and Metcalfe [97, 1973] and Kregel [60, 1973, chap. 12].

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one of the common features, just as not all post-Keynesian models have every one of the characteristics outlined above. This means that only a rough comparison can be made between the post-Keynesian group of models and the neoclassical, or orthodox, group; and even then the comparison runs the risk of misrepresenting some particular variant. None the less, TABLE I may serve at least a heuristic purpose:

All but the last of the several aspects in TABLE I have already been touched on in the earlier discussion, and there is no need to dwell on them further. The last point, however, has not previously been brought out. It reflects the distinction made by Kornai between theory as that term is understood by the natural sciences, meaning some general statement about the empirically observable world, and theory as the basis for an optimal decision rule [57a, 1971]. The distinction is an important one for understanding why those who use the one type of model often seem to be talking past—that is, failing to communicate with—those who use the other type. The problem of communication is, of course, compounded when the neoclassical theory is used for a purpose for which it is not suited, that of explaining the real world.[42]

Once the quite different purposes which post-Keynesian and neoclassical theory are meant to serve are clearly understood, certain other differences between the two theories begin to fall into place. For example, the willingness to make assumptions so at variance with the available evidence is less clearly a fault when the objective is to define an optimal decision rule rather than to explain the world as it is. At the same time, however, the quite different purposes that post-Keynesian and neoclassical theory are meant to serve makes even more problematical the already difficult task of determining which of these two models is the better one for analyzing a modern, market-oriented economy. As Kuhn's work brings out, it is difficult to choose between alternative paradigms—especially when the newer one is still in an inchoate state—even if there is agreement that the purpose of a theory is to explain the empirically observable world. When there are two alternative paradigms, each designed to serve a quite different purpose, the task of choosing between them is further complicated.

[42] The best example of this is the use of the Swan-Solow growth model to "measure" the importance of technological change in economic growth. Actually, all that is measured is what the relative importance of technological change would be if the marginal productivity theory were empirically valid. But since the empirical validity of the marginal productivity theory has never been rigorously tested—indeed, considered simply as the basis for an optimal decision rule for the distribution of income there is no need to test its "realism"—it is not clear what meaning is to be attached to the estimates derived from plugging data into a Swan-Solow growth model.

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