THE KALECKIAN ORIGINS OF THE KEYNESIAN MODEL

By SIMON CHAPPLE

New Zealand Institute of Economic Research, 8 Halswell Street,
P.O. Box 3479 Thorndon, New Zealand

1. Introduction

THE IS-LM/AGGREGATE Supply-Aggregate Demand (AS-AD) model, hereafter the Keynesian model for short, is the mainstream interpretation of Keynes's *General Theory* (see Patinkin 1982, 1990a, b). In addition to Keynes, the model owes much of its early formalisation to Hicks (1937), Harrod (1937), Meade (1937), and Lange (1938).

In a closely argued book, Patinkin (1982) has concluded that Michal Kalecki did not anticipate the theory of effective demand which underpins the IS curve. Further, according to Patinkin, Kalecki did not provide an integrated treatment of goods market equilibrium (the IS curve) with money market equilibrium (the LM curve) (together the AD curve). Nor did he go on to link aggregate demand with the maginalist theory of short-run aggregate supply. In short, Kalecki did not discover the Keynesian model.

This article shows that a 1934 article of Kalecki's, 'Three Systems', originally published in Polish and recently translated in volume one of his collected works, sets out a simple Keynesian model of a closed economy, which is used to examine the impact on aggregate activity of various shocks, first assuming perfectly flexible money wages and then that money wages are determined by a hysteresis-type wage equation.[1] Thus, Patinkin to the contrary, it is suggested that an early version of the mainstream Keynesian model was constructed and published by Kalecki before 1936.

Throughout the Keynesian interpretation of 'Three Systems' offered here, the reader should bear in mind Stigler's suggestions regarding textual exegesis in the history of economic analysis, summarised as follows:

> We increase our confidence in the interpretation of an author by increasing the number of his main theoretical conclusions which we can deduce from (our interpretation of) his analytical system.
> The test of an interpretation is its consistency with the main analytical conclusions of the system of thought under consideration. (Stigler 1982, p. 69)

This principle will be closely followed in the interpretation of 'Three Systems' presented below.

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[1] The standard Keynesian model assumes that money wages are determined exogenously. Kalecki's treatment is more modern.

2. Three systems

The central message of 'Three Systems' is easily devined. Kalecki begins by stating both his goals and assumptions. He makes the point that he wishes to consider how equilibrium is established with a given capital stock, focusing on production of investment goods and the rate of interest (Kalecki 1934, p. 201). '[T]he main subject of this essay', Kalecki continues, is to examine

> changes in the structure and volume of output against the background of the existing capital equipment characterized by rising marginal costs—which occur either under conditions of the preservation of purchasing power [his term for nominal expenditure], or when its creation and destruction is possible. (p. 203)

Kalecki further assumes that workers consume all their wages and that capitalists' consumption is a constant, unrelated to profits and interest rates. He divides the economy into two sectors, one producing investment and the other consumption goods, and assumes that stocks are negligible. Profit maximisation under perfect competition is then assumed as prices are equal to marginal costs (Kalecki 1934, pp. 202–3). Implicit assumptions include a closed economy and no government sector.

Kalecki uses these assumptions to build three versions of a model. The first, System I, is described as 'a system in which the preservation of purchasing power rules without exception . . . all income is immediately spent—directly or indirectly—for the purchase of consumer or investment goods' (Kalecki 1934, p. 203). System I is a classical real sector model, differing from today's by distinguishing between two classes (capitalists and workers), and two sectors (consumption and investment goods). System II introduces money into the classical real system. Kakecki shows how the resulting real equilibrium is re-attained after various shocks by disequilibrium interactions between goods and money markets. System III can be described as demand-determined as there are a range of equilibria ('quasi-equilibria' to Kalecki) in terms of production and employment, dependent on aggregate demand, that the economy may find itself in.

The shocks whose impact Kalecki examines within the model are a techno-logical shock which raises the incentive to invest due to a rise in expected profitability (Kalecki 1934, p. 206), a rise in saving by capitalists, and a rise in labour supply. The three shocks are examined in the first two systems, but System III only examines the demand shocks.

In System I, Kalecki shows that a labour supply increase reduces real wages, raises profits, increases output of investment and consumption goods, and raises employment. On the other hand a rise in capitalists' saving reduces the production of consumption goods and increases that of investment goods. This allows Kalecki to write his first equation as $i = f(R, S)$, where the production of investment goods i is an increasing function of labour supply R and a decreasing function of capitalists' consumption S.

Since labour supply and capitalists' consumption determine the price-wage relationship, Kalecki argues that the volume of investment projects can be represented by the function $\psi(R, S, p)$. Investment declines with the equilibrium real rate of interest p. The introduction of new production combinations will shift the function ψ upwards. Since saving is independent of interest rates, this will raise the interest rate to make unprofitable previously profitable projects and ensure that the fixed output of investment goods remains in equality with entrepreneurs' investment decisions (Kalecki 1934, pp. 206–7).

To give System II, a money market is added to System I in order to examine whether creation or destruction of purchasing power alters the conclusions. Kalecki first considers money demand:

> individual economic agents in System II hold cash reserves which can be increased or decreased. A cash reserve is necessary to run an enterprise at a given turnover smoothly. The volume of this reserve depends not only on the turnover of an enterprise, but also on the rate of interest. The higher the rate of interest, the smaller the cash reserve held by an enterprise at a given turnover. Hence if sales increase while the volume of money in circulation remains constant, that is, if the velocity of money circulation increases, the rate of interest rises, since there will be a tendency to increase reserves in the same relation, which must be counteracted by an increase in the rate of interest. (p. 207)

As in Keynesian model, money demand increases with income and declines with the rate of interest. However, Kalecki argues that the transactions demand for money is interest-sensitive along opportunity cost lines rather than introducing a theory of the speculative demand for money as did Keynes. The money supply is assumed to be given, although Kalecki discusses implications of it increasing with interest rates.

Kalecki first considers a rise in the incentive to invest. Investment activity increases, causing a cumulative rise in prices and wages until the money rate of interest rises by an amount sufficient to bring it back into equality with the new higher equilibrium rate of interest, at which point output is unchanged but prices are higher (Kalecki 1934, p. 209). He then considers a rise in capitalists' saving, which causes a reduction in output of consumer goods, a rise in unemployment and a cumulative reduction in wages and prices, until the drop in the money rate of interest induces investment sufficient to raise production of investment goods to the point where it again equals the real rate. Equilibrium in both cases is identical to that in System I. Finally Kalecki considers the impact of a rise in labour supply in his model. Excess supply causes wages to fall. As a result, production rises in the investment goods sector due to a lower real wage, but additional production is unsold, so a fall in prices and production occurs. A cumulative fall in prices and wages ensues:

> Every excess supply of labour in System II causes a fall in money wages and thereby touches off a mechanism eliminating unemployment. The main transmission mechanism is the money rate of interest, which falls along with the money volume of sales. This is the essence of arriving at an equilibrium identical with the one which would be established in System I. (pp. 214–15)

Kalecki summarises his arguments about the attainment of equilibrium:

> In the creation of purchasing power for investment purposes an increase in the money rate to the level of the equilibrium rate reduces the volume of investment projects to the former level. In cases of destruction of purchasing power with increased savings or a cut in wages, a fall in the money rate encourages entrepreneurs to invest, creating purchasing power in the amount previously 'lost'; in this way purchasing power is ultimately shifted from consumption to investments. (p. 213)

Thus far into his 1934 paper Kalecki has integrated monetary and value theory into a simple general equilibrium framework and analysed dynamics under various shocks around the unique full employment level of output with an equilibrium dichotomy between the real and monetary sectors. In an economy with a monetary sector he shows that money wage flexibility causes a convergence to full employment equilibrium via indirect effects on real money balances, the interest rate, and hence investment. All that remains to be done is for Kalecki to deal with unemployment and output variations, which he does in System III.

Kalecki (1934, p. 215) begins his discussion by observing that 'as long as it remains unchanged, existing unemployment does not "pressure" the [labour] market'. He shows that for actual employment r, quasi-equilibrium is determined as $i = f(r, S)$ and $i = \psi(r, S, p)$. The model has three unknowns—employment r, production of investment goods i, and the rate of interest p—but only two equations. Kalecki is aware an equation is missing:

> [q]uasi-equilibrium is determined only when actual employment r is given. Hence in System III an infinite number of quasi-equilibria may correspond to any given labour supply R. This indeterminateness can be eliminated by introducing an additional assumption corresponding to reality. We assume that, when moving from one possible quasi-equilibrium to another at which unemployment will be smaller, money wage rates rise in a particular way. Namely, while the *existing* unemployment does not exert any pressure on the market, we postulate that *changes* in unemployment cause a definite increase or fall in money wages, depending on the direction or volume of these changes.
>
>   It follows from this assumption that a strictly determined level of money wages corresponds to every level of employment r at a given total supply of labour R. However, since any given values of r, S will determine the relation of prices of consumer and investment goods to wages as well as the respective volumes of output of these goods, the money volume of sales is a function of R, r, S. But, given the policy of the central bank [i.e. given a determined money supply], the money rate of interest is again a function of the volume of these sales, so that one can write the equation:

$$p = \eta(R, r, S) \qquad (3)$$

> where η is an increasing function of employment r, since with its increase the level of money wages, the relation of prices to wages, and the money volume of sales all simultaneously rise. (p. 215, emphasis in the original)

Thus System III has been closed by an assumption about money wage behaviour.

Kalecki examines what happens when investment rises. The price of invest-
ment goods rises and production expands, workers being absorbed from the
reserve army of labour. Higher employment raises consumer goods demand.
Prices, output, and employment in the consumer goods sector rise until profits
(saving) have risen by the amount of the investment increase. .Employment
increases cause a rise in money and reduction in real wages. Kalecki then turns
to money market interactions: 'the expansion [of investment] will continue as
long as the money rate does not reach the new quasi-equilibrium rate of
interest', concluding:

> the appearance of new production combinations causes a permanent increase in the
> output of investment goods in System III. This takes place with an increase of
> employment and simultaneous rise in the output of consumer goods. The real profit
> of capitalists increases on account both of the expansion of total output and the fall
> in real wage rates. . . . With constant capitalist consumption, this increase in real
> profits is equal to the increase in output of investment goods. (p. 217)

This, according to Kalecki, is not the end result: higher output and a higher
ratio of prices to wages increases profitability, stimulating investment, so
therefore 'quasi-equilibrium will be established at a higher level of output of
investment goods and interest rate p' (Kalecki 1934, p. 217).

Kalecki then considers the impact of rise in capitalists' saving: '[t]he less
capitalists spend on consumption, the smaller profits they earn' (Kalecki 1934,
p. 217), so saving drops by the consumption decline. Output and employment
fall in the consumer goods sector. The resulting rise in unemployment causes
a price and then an interest rate fall, encouraging investment:

> A new quasi-equilibrium is established as follows: such a number of workers dismissed
> in the consumer goods industry enter the reserve army of the unemployed that the
> accompanying reduction in the money rate of interest (together with the fall in the
> money volume of sales) suffices to increase the output of investment goods to a level
> allowing absorption of the rest of those dismissed . . . on account of increased savings
> System III moves to a new quasi-equilibrium which is characterised by a lower
> aggregate employment and output. (p. 218)

Lower output and higher real wages lowers profitability and hence investment,
establishing 'quasi-equilibrium at a lower level of output of investment goods
i, employment r and the rate of interest p' (Kalecki 1934, p. 218).

3. Kalecki's three equations

To analyse the meaning of System III's three equations and to enable a more
rigorous application of Stigler's exegetical criteria, consider the following
IS-LM/AS-AD model which is based only on explicit assumptions made by
Kalecki. The following notation applies (modern notation makes the model
accessible):

p_C the consumer goods price level
p_I the investment goods price level
pY nominal output

C   real consumption
I   real investment
S   real saving (Kalecki's i)
P   real profits
C_C real capitalists' consumption (Kalecki's S)
w   money wage rate
r   the equilibrium rate of interest (Kalecki's p)
i   the money rate of interest
$\bar{L}$ labour supply (Kalecki's R)
L   labour demand (Kalecki's r)
L_C labour demand by the consumer goods sector
L_I labour demand by the investment goods sector

The model's equations are

national income $\qquad$ $pY = p_C C + p_I I$ $\qquad$ (1)

profits $\qquad$ $P = C_C + S$ $\qquad$ (2)

consumption function $\qquad$ $C = C_C + \dfrac{w}{p_C} L$ $\qquad$ (3)

investment function $\qquad$ $I = I(P, r) \qquad 0 < I_1 < 1, I_2 < 0$ $\qquad$ (4)

goods market equilibrium $\qquad$ $I = S$ $\qquad$ (5)

money market equilibrium $\qquad$ $i = i(pY) \qquad i_1 > 0$ $\qquad$ (6)

interest rate equilibrium $\qquad$ $r = i$ $\qquad$ (7)

production function (1) $\qquad$ $C = f(L_C)$ $\qquad$ (8)

production function (2) $\qquad$ $S = g(L_I)$ $\qquad$ (9)

demand for labour (1) $\qquad$ $\dfrac{w}{p_C} = f'(L_C) \qquad f' > 0, f'' < 0$ $\qquad$ (10)

demand for labour (2) $\qquad$ $\dfrac{w}{p_I} = g'(L_I) \qquad g' > 0, g'' < 0$ $\qquad$ (11)

total employment $\qquad$ $L = L_C + L_I$ $\qquad$ (12)
full employment $\qquad$ $\bar{L} = L$ $\qquad$ (13a)

nominal wage equation $\qquad$ $w = w(\bar{L} - L) \qquad w_1 < 0$ $\qquad$ (13b)

There are 13 independent equations and 13 unknowns: p_C, p_I, pY, C, I, S, P, w, L, L_C, L_I, r and i. The model is therefore determinate. (13a) is the closure for System II and (13b) for System III.

   Kalecki's consumption function makes the same predictions as the simple Keynesian function. However unlike the Keynesian function it is based on class

behaviour—capitalists' consumption is constant and workers consume all their share of national income. The investment function relates investment to profits and the real rate of interest. The labour demand equations set real product wages equal to marginal products. The normal wage equation shows that money wage changes depend on unemployment changes. Changes in unemployment depend on changes in actual employment and in the available labour force. Therefore wage levels must be increasing with employment and decreasing with labour supply. In modern terminology the money wage equation exhibits pure hysteresis and static price expectations.

How can Kalecki's three equations for quasi-equilibrium be derived from this model?

For a pre-determined level of employment, eqs (3), (8), and (10) combine to give a consumer goods sub-sector which determines consumption, real consumption wages and consumer goods sector employment. Thus

$$C = C(C_C, L) \tag{14}$$

Via (12), investment goods sector employment is equal to pre-determined total employment less consumer sector employment, determined in the consumer goods sub-sector. This gives Kalecki's first equation

$$S = S(C_C, L) \tag{15}$$

This equation is a saving function, giving the level of saving necessary to support output of investment goods, something of which Kalecki (1934, p. 205; 1934b, p. 495, 496) is explicitly aware.

Equations (2), (4), and (15) combine to give

$$S = I(C_C, L, r) \tag{16}$$

Since $I = S$ from (5), this corresponds to Kalecki's second equation, the condition that investment equals pre-determined saving. Since his second equation 'expresses equality between the volume of investment decisions and accumulation of capital, [and] will therefore determine the level of the rate of interest p, while the output of investment goods i is already determined by eq. (1)' (Kalecki 1934, p. 206), Kalecki is aware that it incorporates goods market clearing. In addition, Kalecki (1934, p. 206; 1934b, p. 496) is aware that his equation is an investment function. Kalecki's first two equations are therefore saving and investment functions and together make up the goods market, or IS equation, in his model.

Kalecki's third equation is a money market equilibrium (LM) equation which also incorporates aggregate supply (AS) conditions. Equations (1), (6), and (7) give

$$r = i(p_C C + p_I I) \tag{17}$$

The wage eq. (13b) can be substituted into the labour demand functions

(11, 12) and rearranged to give

$$p_C = \frac{w(\bar{L} - L)}{f'(L_C)}, \qquad p_I = \frac{w(\bar{L} - L)}{g'(L_I)} \tag{18}$$

which are aggregate supply curves in price-employment space, defining prices consistent with a profit maximising level of employment. Thus substituting the price equations, in conjunction with (8) and (14), into (17) gives the money market equilibrium equation

$$r = r(C_C, \bar{L} - L) \tag{19}$$

Which is Kalecki's third equation, an LM curve, incorporating the AS conditions.[2] As Kalecki argues, closure is via the wage equation.

Can Kalecki's conclusions regarding the impact of changes in investment and saving on output and employment be formally derived from the model based on his assumptions? One expositional simplification is made to the above model. It is assumed that consumer and investment goods sectors have identical Cobb–Douglas production functions so that $Y = L^{1-\alpha}$ (Y is real output) and there is only a single price p. Since only capitalists save, the profit share gives the saving propensity. The following equation gives goods market equilibrium

$$Y = C_C + (1 - \alpha)Y + I(\alpha Y, r) \tag{20}$$

Money market equilibrium is $r = i(pY)$. Taking total differentials of goods and money market equations and rearranging gives the aggregate demand curve's slope

$$\frac{dp}{dY} = \frac{(1 - I_1)\alpha - I_2 i_1 p}{I_2 i_1 Y} < 0 \tag{21}$$

This slope is negative due to the so-called Keynes effect.

Now consider aggregate supply. As output expands the marginal product of labour falls, raising prices. Higher output also raises money wages and thus prices.[3] As a reduced form

$$p = p(Y) \, p_1 > 0 \tag{22}$$

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[2] The standard Keynesian LM curve slopes upwards from left to right since as real output expands money demand and therefore the interest rate rise. Changes in prices resulting from movements of or along the AS curve cause the LM curve to shift bodily. Kalecki's third equation incorporates movements in prices (for a determined money wage) into the LM curve, so that it does not shift as the economy moves along the AS curve.

[3] Kalecki (1934, p. 216) writes:

Demand for consumer goods rises due to increased employment, their prices rise in relation to wages. . . . Money wages—in line with our assumptions—also increase during these processes in connection with the reduction in unemployment. This naturally affects the movement of prices: besides the initial increase, which caused a rise in the relation of prices to wages, making the increase in employment possible, prices must now rise additionally in the same proportion as wages.

From (21) and the total differential of (22) the following system multipliers for dS and dA are derived

$$\frac{dY}{dS} = \frac{dY}{dA} = \frac{1}{(1 - I_1)\alpha - I_2 i_1(p + p_1 Y)} > 0 \qquad (23)$$

Real output will expand to a new quasi-equilibrium if there is a rise in investment and fall to a new quasi-equilibrium with a rise in capitalists' saving. Employment will move in the same direction as real output through the production function. Kalecki's quasi-equilibrium conclusions regarding output and employment are consistent with a formal Keynesian model based on his assumptions.

Kalecki draws two other conclusions from System III: a rise in saving may cause investment to rise or fall and a rise in saving will always reduce profits (Kalecki 1934, p. 218). Are such conclusions also consistent with the formal model drawn from Kalecki's work? The profit share has been assumed to be a constant proportion of output. Thus when output falls when saving rises, profits must decline with a rise in saving, as Kalecki concludes. What about Kalecki's conclusion that a rise in saving may cause investment to rise or fall? Substituting for profits in the investment function and taking differentials gives $dI = I_1\alpha \, dY + I_2 \, di$. The change in the money interest rate is equal to $di = (p + p_1 Y)i_1 \, dY$, so

$$\frac{dI}{dS} = [I_1\alpha + I_2(p + p_1 Y)i_1] \frac{dY}{dS} \lesseqgtr 0 \qquad (24)$$

as $I_1\alpha + I_2(p + Yp_1)i_1$ cannot be signed *a priori*. Again, Kalecki's conclusion follows.

Finally, in a manner consistent with the Keynesian model, Kalecki (1934, pp. 216–18) concludes that the interest rate rises with the positive and falls with the negative demand shock and the real wages are anti-cyclical.

4. The achievements of 'Three Systems'

'Three Systems' contains a simple integrated general equilibrium treatment of goods and money markets and links with marginalist short-period pricing theory in a fashion analytically superior to anything that Keynes or the Stockholm school had published by 1934. In a monetary economy the mechanism ensuring maintenance of full employment equilibrium is a fully flexible wage and price level reacting back on money demand, then interest rates, and hence investment—the so-called Keynes effect. This form of simple general equilibrium equilibrating mechanism is not consistently maintained in other pre-1936 analyses of the macroeconomic impact of a rise in saving. For example, when Keynes (1930, pp. 159–60) and Myrdal (1939, pp. 106–7) tackle the same question the analysis is an exercise in period analysis rather than simple general equilibrium comparative statics with flexible wages and prices.

However, Kalecki does not discuss the possibility of insufficiently interest-responsive investment, or the possibility of a 'liquidity trap', or dynamic interactions between falling wages and prices, and expectations, feeding back into the investment and/or money demand functions. Certainly Keynes's (1936) analysis of money wage cuts and the interactions with liquidity preference, the marginal efficiency of capital and consumption is more sophisticated than the mechanical interactions that Kalecki allows.

Underlying Kalecki's work is a consumption function, an investment function and a money demand function along Keynesian lines. If this was all the article contained it would be an achievement. Kalecki goes further however, introducing the possibility of 'quasi-equilibrium' at less than full employment when money wages are not fully flexible. Under such circumstance Kalecki shows that a rise in investment will result in a new higher equilibrium level of production, employment, and interest rates and lower real wages. A rise in saving will have the opposite effect. He uses summary equations which are saving, investment, and money market equilibrium functions (incorporating aggreate supply). Thus by integrating the treatment of goods and money markets with marginalist price theory, and by incorporating into this the theory of effective demand and 'quasi-equilibrium', it would seem that in most respects Kalecki anticipates the Keynesian model.

It might be argued that while Kalecki's essay logically contains the theory of effective demand, that chronologically he does not consistently understand the role of output adjustment in goods market clearing, embodied in the IS curve. The question of whether Kalecki had a theory of the equilibrating role of changes in output in the chronological (as opposed to logical) sense in 1934 depends on what he himself understood and intended to communicate at the time. Such questions cannot be answered with absolute conviction. An answer requires utilising available evidence to form a reasonable conjecture about whether Kalecki understood what was logically implied by his theory.

All System III's conclusions regarding changes in output, employment, investment, interest rates, and real wages in response to the shocks follow logically from Kalecki's explicit assumptions and from an IS-LM/AS-AD interpretation of his model. Examining changes in output and employment is stated by Kalecki as part of his central message. It is difficult to maintain that a scientist does not understand his model when conclusions follow consistently from explicit assumptions and relate directly to the stated central message.

Consider now external evidence on whether effective demand was included in Kalecki's other writings of the time, or whether it was just an isolated instance in 'Three Systems'. Kalecki's 1933 *Essay on the Business Cycle Theory* defines saving (solely from profits) equal to investment (like the 1934 article) and focuses on goods market interactions, neglecting the money market. While effective demand and unemployment equilibrium is not the central message of the *Essay*, the goods market does clear by output variations in Kalecki's model and this is drawn out where he examines the impact of a rise in investment and a fall in money wages (in the case where prices are fixed this corresponds to a

positive saving shock since all saving comes from profits) (see Chapple 1993). Changes in output also equilibrate income and expenditure in an open economy setting with an explicit mathematical multiplier in excess of one in Kalecki's 1933 article 'On Foreign Trade and "Domestic Exports"' (see Chapple 1991; Flanders 1989, p. 260, 267, who supports a Keynesian interpretation of that article).

On the balance of probabilities evidence suggests Kalecki understood the goods market model contained in his 1934 essay. However, Kalecki (1934) does not explicitly utilise a mathematical multiplier to show that the rise in investment or saving is self-limiting in terms of goods market equilibrium. Unlike Keynes, he does not make explicit use of the stability properties of a propensity to consume between zero and one, although this is logically implied when he shows that a rise in investment has a multiplier effect on output in excess of the initial impulse by an amount sufficient to generate an equal rise in saving and maintain goods market equilibrium (Kalecki 1934, pp. 216–17).

5. Kalecki's later treatment of 'Three Systems'

Kalecki never referred to 'Three Systems' after 1934 or developed its ideas. Clues to why can be found in his concluding discussion of weaknesses of the static method. He faults the method for not considering capital stock changes and the time lag in capital goods' production (Kalecki 1934, p. 219). In his *General Theory* review Kalecki (1936, pp. 230–1) criticises the static equilibrium method from another tack, again drawing on his business cycle theory. On this occasion he argues that Keynes's theory of investment is deficient in not distinguishing between decisions to invest and actual investment, a distinction which causes a rise in investment in Kalecki's cycle models to generate a cumulative upswing. Finally Kalecki (1939) footnoting Hicks (1937), Meade (1937), and Lange (1938), all of whom Young (1987) shows produced IS-LM variants, makes the following observations about static equilibrium models:

> Many writers who have constructed simplified models of the Keynesian theory have focussed their attention on the 'equilibrium'. . . . This was due to the fact that they did not distinguish between investment decisions and investment. . . . In addition, they did not consider the influence of changes in capital equipment. . . . When at last 'equilibrium' is reached, it cannot last long because of the change in capital equipment. (pp. 139–40)

'Equilibrium' here is the point at which decisions to invest, which become future investment expenditure in Kalecki's business cycle model, are equal to current investment expenditure, so activity shows no tendency to change between this period and next. Kalecki believes that such a situation holds only at cyclical peaks and troughs. These criticisms of IS-LM writers are identical to the shortcomings of his own static method that Kalecki had pointed out in 'Three Systems' and thus indirectly reinforce a Keynesian interpretation of that article. Therefore it is likely that Kalecki's dissatisfaction with static equilibrium

theorising was the reason why no further use was made of his 'Three Systems' framework.

6. Conclusion

This article has argued that Kalecki's 1934 'Three Systems' presents a Keynesian model of the economy, prior to Keynes (1936), while including a hysteresis-style money wage equation that was not to become fashionable for another 50 years. The basis for his conclusion is as follows:

(i) Kalecki begins by assuming that the capital stock is constant and that marginal costs are increasing. Prices are assumed to be equal to marginal cost. This is the starting point for the short-period analysis that underlies the Keynesian model.
(ii) Kalecki states that his main aim is to provide a theory of output, investment and employment under such assumptions. Thus he is interested in explaining the Keynesian aggregates.
(iii) A set of expenditure, money market and aggregate supply equations can be written down based on Kalecki's assumptions which comprise an IS-LM/AS-AD set of equations.
(iv) Kalecki is aware that to close his model and to generate a 'quasi-equilibrium' are below full employment requires a money wage equation. Again, so does a Keynesian model.
(v) Kalecki bases his quasi-equilibrium model on three equations for three unknowns—the rate of interest, investment, and employment. Each of these three equations is derivable from an IS-LM/AD model constructed based on Kalecki's assumptions. One equation is a saving function, the second an investment function (together being an IS curve) and the third a money market equilibrium equation incorporating the aggregate supply conditions (the LM curve and AS curve).
(vi) All Kalecki's analytical conclusions regarding the impact of saving and investment shocks follow logically from the Keynesian model based on his assumptions.
(vii) The notion that variations in output clear the goods market, the basis of the IS curve, is also present in other work published by Kalecki before 1936, suggesting that he understood his goods market model.

The interpretation offered here of Kalecki's work accords with Stigler's principle of scientific exegesis: all analytical conclusions are derivable from an IS-LM/AS-AD interpretation of 'Three Systems'.

However, prior discovery of the Keynesian model in no way makes Keynes's book or the following mainstream interpretations retrospectively redundant. Keynes's treatment of how a stable goods market equilibrium is arrived at is more detailed than Kalecki's and his analysis is deeper in a number of other areas. Later Keynesian writers fleshed out with a greater elegance the mathematical properties of the model. Nevertheless, consideration of 'Three Systems'

should result in significant revisions to the conclusion that Kalecki did not discover the Keynesian model.

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