

THE MACROECONOMICS OF THE TREATISE ON MONEY

Robert W. Dimand*

John Maynard Keynes revolutionized the way that economists think about macroeconomics - on his second try. The great success of Keynes' **General Theory** (1936) discouraged economists from reading his **Treatise on Money** (1930), a work twice as long, written in terminology that is no longer familiar. Later economists have generally assumed that studying the **Treatise** would be unprofitable, since its lasting contributions would have been incorporated in the **General Theory**. This attitude fulfills Keynes' prediction in the preface of the **General Theory** that:

The relation between this book and my **Treatise on Money**, which I published five years ago, is probably clearer to myself than it will be to others; and what in my own mind is a natural evolution in a line of thought which I have been pursuing for several years, may sometimes strike the reader as a confusing change of view. This difficulty is not made less by certain changes in terminology which I have felt compelled to make. (1936, xxi-xxii)

Keynes wrote the **General Theory** for an audience already familiar with the **Treatise**, so his account of the liquidity preference theory of the interest rate and his treatment of investment in the later book take as given the much lengthier discussion of the portfolio balance approach to money demand and the pricing of capital goods in the earlier book. Keynes felt no need for extended restatement of aspects of monetary theory on which his views were well-known and basically unchanged. When the **General Theory** is read in isolation from Keynes' early work, there is a thus a danger of underestimating the extent to which money matters in Keynes' theory.

The **General Theory** would have been a different book had Keynes not written the **Treatise** first. The working out of the **General Theory** was a process of making good the gaps and omissions of the **Treatise**, especially the lack of a theory of the level of output and employment. To a large extent, this involved developing insights which had already been stated in the **Treatise** but which had not been integrated into the theoretical framework of that book. To understand the process of working out the **General**

*Department of Economics, Carleton University, Ottawa, Ontario, Canada K1S 5B6. I am grateful to James Tobin for his advice and encouragement. An earlier version of this paper shared first prize in the Royal Economic Society's essay competition on Keynes for members of the Society under the age of thirty.

Theory, a knowledge of the starting point is indispensable. Recent interpretations of the economics of Keynes as concerned with disequilibrium dynamics rather than with static equilibrium provide another incentive for turning to the **Treatise**, where Keynes was explicitly dealing with disequilibrium dynamics, stating in his preface that:

My object has been to find a method which is useful in describing not merely the characteristics of a static equilibrium, but also those of disequilibrium, and to discover the dynamical laws governing the passage of a monetary system from one position of equilibrium to another. (1930-I, v.)

THE FUNDAMENTAL EQUATIONS

The theoretical heart of the **Treatise** consists of Books III and IV, in which Keynes presents his Fundamental Equations for the value of money and discusses the dynamics of the price level. Keynes was motivated to compose a comprehensive study of monetary theory by his belief that a mistaken monetary policy, associated with the return to the gold standard at the prewar parity, was responsible for the high level of unemployment in Britain. Instead of directly constructing a theory of output and employment, however, Keynes approached his subject by way of a theory of money and prices, with profits, the difference between output prices and costs of production, influencing investment and output decisions.

Keynes' Fundamental Equations are variants of the Equation of Exchange $MV = PT$, presented by Irving Fisher in **The Purchasing Power of Money** (1911). Keynes' formulation in the **Treatise** differs from Fisher's version in emphasizing the distinction between the purchasing power of money and the average price level of transactions. This emerged from Keynes' view that a significant part of the money supply served to finance asset transfers rather than the sale of output. The Cambridge cash balance version of the quantity theory of money, the $M = kPT$ presented by Marshall and Pigou, and by Keynes in **A Tract on Monetary Reform** (1923), closely resembled Fisher's theory since it was primarily concerned with transactions demand for cash balances and with determination of a price level P that was not the reciprocal of the purchasing power of money.

Keynes' two Fundamental Equations for the price level of consumption goods and for the price level of output as a whole are tautologies, but are converted into equilibrium conditions by the imposition of behavioural constraints on the variables in the equations. Keynes himself noted, after deriving his Fundamental Equations, that:

These conclusions are, of course, obvious and may serve to remind us that all these equations are purely formal; they are mere identities; truisms which tell us nothing in themselves. In this respect they resemble all other versions of the Quantity Theory of Money. Their only point is to analyse and arrange our material in what will turn out to be a useful way for tracing cause and effect, when we have vitalised them by the introduction of extraneous facts from the actual world. (1930, I, 138)

The equation for the price level of consumption goods and services is derived from the definition of saving as the difference between the normal (expected) earnings of factors of production, E , and consumption expenditure. Output, O , is the sum of the physical volume of new consumption goods, R , and of new capital goods, C , while I' , the cost of the flow of new capital goods, is $(C/O)E$, since the earnings of the factors of production are also the total cost of production.

$$P \cdot R = E - S$$

$$P \cdot R = \frac{E(R+C)}{O} - S \quad \text{since } O = R + C$$

$$P \cdot R = \frac{E \cdot R}{O} + I' - S \quad \text{since } I' = (C/O)E$$

$$P = \frac{E}{O} + \frac{I' - S}{R} \quad \text{First Fundamental Equation}$$

$$P = \frac{E}{O} + \frac{Q_1}{R}$$

This expression states that the price of consumption goods equals earnings per unit of output plus windfall profits in the consumption goods sector per unit of that sector's output. Earnings are equal to the quantity of Income Deposits and Business Deposits multiplied by their velocities of circulation, with the velocities being stable functions of the interest rate, the opportunity cost of holding money. While the first term of the Fundamental Equation is thus in the tradition of the Quantity Theory of Money, the second is not. Profits, Q , constitute a windfall, unexpected gain to entrepreneurs, and are the excess of the market value of current output over the earnings of the factors of production (including the return on capital). Since profits are $(PR+I) - E$, then $Q = I - S$ by the definition of saving as the difference between earnings and consumption expenditure. Q_2 , profits in the investment goods sector, will be $I - I'$, the excess of the market value of the current output of capital goods over their cost of production. Q is the sum of Q_1 and Q_2 , so that profits in the production of consumer goods, Q_1 , equals $I' - S$.

Q can differ from zero because of the separation of saving and investment decisions, a separation which is also important in the **General Theory**. Entrepreneurs must decide on the amount of investment they wish to carry out before they know how the public will allocate its earnings between consumption and saving. Unanticipated profits or losses provide new information to entrepreneurs, causing them to revise their expectations and so affecting investment decisions.

Keynes' Second Fundamental Equation for the price level of output as a whole is derived in a manner analagous to his first equation:

$$\pi O = PR + P'C$$

$$\pi = \frac{PR + P'C}{O}$$

$$\pi = \frac{(E - S) + I}{0}$$

$$\pi = \frac{E}{0} + \frac{I - S}{0}$$

$$\pi = \frac{E}{0} + \frac{Q}{0}$$

These "equations" are, of course, identifies which as yet have no economic content. Keynes provided such content by incorporating the functional dependence of investment, saving and velocity on the rate of interest, and of investment on windfall profits in the previous period. He explained the determination of the interest rate in terms of portfolio balance, emphasizing the demand for money as an asset. Windfall profits or losses are the difference between investment and saving in the current period, and, together with the interest rate, determine what investment will be in the next period. The Fundamental Equations thus provide the framework for a dynamic model of a capitalist economy.

Alvin Hansen criticized Keynes for implicitly assuming the same rate of technical progress in both sectors, so that there would be no ambiguity in comparing physical units of consumption goods and capital goods over time. Keynes accepted this criticism in an exchange of notes in the **American Economic Review** in 1932, and discussed alternative ways of resolving the index number problem without simply assuming it away. While Keynes' slip concerning index numbers was unfortunate in a work of which Book II was devoted to an exposition of the theory of index numbers, Hansen went much too far in claiming to have caught "A Fundamental Error in Mr. Keynes' **Treatise on Money**." The error had been noted before publication by Richard Kahn, (1984 p. 69) but Keynes did not get around to amending it.

A more serious problem was the absence of a theory of the level of output, or how output was divided between R and C. In the absence of any explicit theory, the implication was that the level of output was fixed in the short run by full employment of available resources, with each period's investment decisions affecting the full employment level of output in the next period by changing the capital stock.

CONCEPTS OF EQUILIBRIUM IN THE TREATISE

Equilibrium may be defined in three different ways in economics: in terms of satisfaction and mutual consistency of agents' expectations, as a position of rest (or steady-state growth path) or as a situation of market clearing. The **Treatise** links the first two senses of equilibrium. When entrepreneurs' expectations are satisfied, windfall profits will be zero and entrepreneurs will have no incentive to revise their investment decisions. If expectations turn out to be mistaken and windfall profits or losses occur, the resulting changes in investment will cause the economy to deviate from steady-state growth. Failure of markets to clear, although discussed in connection with credit rationing and two isolated passages on sticky wages, is not analyzed systematically or made a focus of attention

in the **Treatise**. This is a serious deficiency in a work which was motivated by concern with the persistence of high rates of unemployment in Britain in the 1920's, which Keynes interpreted as the protracted failure of a market to clear.

The driving force of the economic system of the **Treatise** is "profits", Q. Keynes restricts Q to unanticipated profits or losses of entrepreneurs, and excludes such windfalls from income or saving. Windfalls are treated, in effect, as entering directly into the capital accounts of entrepreneurs without appearing on their income accounts. The equation $Q = I - S$, intended by Keynes as a definitional identity, contains the behavioural implication that windfall profits or losses go entirely into changes in entrepreneurs' asset holdings, not into capitalists' consumption. Interest on capital, normal remuneration of entrepreneurs and anticipated monopoly gains are all considered part of the earnings of factors of production rather than part of profits.

Since investment decisions depend directly on the anticipated stream of earnings from a proposed investment and inversely on the interest rate (cost of capital), two interpretations of the role of Q are possible, though both are offered in the **Treatise** as though they were identical. Throughout most of the **Treatise**, Q is an ex post realization, a measure of surprise that serves entrepreneurs as an additional piece of information in forming expectations of profitability. If they regard their environment as stochastic, repeatedly mistaken expectations may be necessary before expectations are revised. Otherwise, the windfall profit or loss might be interpreted as simply a random shock without any implications for future profitability. Realized profits, as a measure of surprise, play the role in the **Treatise** that undesired changes in inventories play in the **General Theory**. Realized profits in the earlier book, and unintended inventory decumulation in the later one, are the difference between planned investment and planned saving. The crucial difference is windfall profits cause investment to increase and so windfall profits to increase further, while, in the **General Theory**, an unintended reduction in inventories leads firms to increase output, which would raise saving until the gap between output and desired expenditure was eliminated.

In one passage of the **Treatise**, however, Keynes switched from treating profits as realized windfalls to observe that:

We have spoken so far as if entrepreneurs were influenced in their prospective arrangements entirely by reference to whether they are making a profit or loss on their current output as they market it. In so far, however, as production takes time ... and in so far as entrepreneurs are able at the beginning of a production-period to forecast the relationship between saving and investment at the end of this production-period to forecast the relationship between saving and investment at the end of this production-period, it is obviously the anticipated profit or loss on new business just concluded, which influences them in deciding the scale on which to produce and the offers which it is worthwhile to make to the factors of production. Strictly speaking, we should say that it is the **anticipated** profit or loss which is the mainspring of change,

and that it is by causing anticipations of the appropriate kind that the banking system is able to influence the price-level. (1930, I, 159)

Windfall profit or loss, Q as a measure of surprise, cannot have an anticipated value other than zero. One cannot expect an unexpected gain. Clearly, this passage treats Q as an ex ante measure of above-normal profitability or quasi-rents to be obtained from an investment project because of the difficulty competitors have in swiftly increasing the stock of investment goods to a desired level. In his later work, Keynes dealt with the expected yield on investment goods, but in the *Treatise*, apart from the one isolated passage quoted above, profits are ex post windfalls. Q as expected profits resembles the q theory of investment: Keynes' Q_2 ($Q_2 = I - I'$) is greater than, equal to, or less than zero as Tobin's q , which is I/I' , the ratio of the market value of new investment goods to their cost of production, is greater than, equal to, or less than one. I am assured by James Tobin that he chose the symbol q without conscious reference to Keynes' Q .

According to Keynes:

The essential characteristic of the entity which we call **Profits** is that its having a zero value is the usual condition in the actual economic world of to-day for the equilibrium of the purchasing power of money. It is the introduction of this **fact** from the real world which gives significance to the particular Fundamental Equations which we have selected and saves them from the character of being mere identities. (1930, I, 156-157)

In this passage, the key equilibrium condition of the economic system of the *Treatise on Money* appears in the incongruous guise of an empirical fact. In equilibrium, Q , its components Q_1 and Q_2 , and, in an open economy, the balance of payments G are all equal to zero. (1930, I, 151) No unanticipated profits or losses are then experienced in either the capital goods or consumer goods sector, so expectations are satisfied, and entrepreneurs have no reason to alter their offers to hire factors of production. Expectational equilibrium coincides with equilibrium as a position of rest. Since investment is not constrained to equal depreciation, this equilibrium should be interpreted as a steady-state growth path, with the stock of investment goods and the level of production growing at rates set by the exogenous growth of population and technical knowledge. Keynes mentioned three per cent per annum as an example of a plausible steady rate of growth of output in a progressive community, and pointed out that for price stability the quantity of money would have to grow at the same rate of output, so that the first term of each Fundamental Equation would remain constant. (1930, I, 258) With a constant money supply, the price level would decline steadily and the nominal rate of interest lie below the real rate.

In the *Treatise*, Keynes was concerned with stabilization of the purchasing power of money and of the price level of output as a whole as a means to stabilize production and employment. The relevant equilibrium for Keynes' purposes in the *Treatise* is not a constant price level (if the supply of money is constant), but the $I = S$, $Q_1 = Q_2 = 0$ expectational

equilibrium which will prevail when the banking system sets the market rate of interest equal to the natural rate. Keynes refers to

equilibrium - i.e. when the factors of production are fully employed, when the public is neither bullish nor bearish of securities and is maintaining in the form of savings-deposits neither more nor less than the "normal" proportion of its total wealth, and when the volume of savings is equal both to the cost and to the value of the new investments. (1930, I, 146-47)

Here the equilibrium conditions that there are no windfall profits and that securities prices and hence interest rates are not expected to change are stated along with a reference to full employment, but the conditions under which factor markets clear are not explored.

FAILURE OF MARKETS TO CLEAR

While the *Treatise* presents no theory of output or employment, it does contain two isolated discussions of unemployment and wage rigidity which presage Keynes' later analysis. Keynes attributes unemployment, whether of labour or of other resources, to downward rigidity of the earnings of the factors of production. In so far as workers and the owners of other factors of production are able to reduce their earnings to the equilibrium level but stubbornly refuse to do so, their unemployment is voluntary. Keynes discusses the emergence of unemployment due to such rigidities in the course of examining the consequences of a decline in investment caused by an increase in the bank rate.

At this stage, therefore, we have a fall both in P and in P' , consequent losses to all classes of entrepreneurs, and a resulting diminution of the volume of employment which they offer to the factors of production at the existing rate of earnings. Thus a state of unemployment may be expected to ensue, and to continue, until the rise in the bank-rate is reversed or, by chance, something happens to alter the natural-rate of interest so as to bring it back to equality with the new market-rate.

Moreover, the longer this state of affairs continues, the greater is the volume of unemployment likely to be. For, at first, entrepreneurs may continue to offer employment on the old terms, even though it involves them in losses, partly because they are tied up with long-period contracts with the factors of production which they cannot quickly get out of, and partly because it will be worthwhile, so long as they hope and believe that the period of loss will be fairly short, to avoid the expenses of closing down and starting up again. But as time goes on, these motives will gradually lose their effect and cease to operate.

Finally, under the pressure of growing unemployment, the rate of earnings - though, perhaps, only at long last - will fall. (1930, I,

206-7)

In this passage of the *Treatise*, Keynes treats unemployment as the result of nominal factor price rigidity in the face of shocks to the demand for factors of production. He mentions contracts and doubt, in a stochastic world, about the permanence of demand shocks as barriers to speedy adjustment, but does not discuss the causes of wage rigidity at that point in his book. A possible explanation is offered sixty-four pages later: "If the money-rates of remuneration of the **different** factors could be reduced simultaneously and in an equal proportion, no one need suffer. ...But there is generally no means of securing this." (1930, I, 271) Keynes refers to differences in bargaining power and length of contracts (including debts) as reasons why all nominal incomes cannot be reduced to their new market-clearing levels in step with each other. Resistance to nominal wage cuts thus represents concern with relative wages, rather than irrational money illusion.

It is important to remember that this theory has been pieced together from two widely separated passages in a book which provides no formal analysis of the labour market and does not explain the determination of the level or duration of unemployment. The Fundamental Equations are formulae for the determination of the price level, not output or employment, and the only dynamic processes discussed at length in the *Treatise* are price fluctuations. Not until the second chapter of the *General Theory* does Keynes give appropriate emphasis in his published work to the explanation of the cause and consequences of downward rigidity of nominal wages in the two passages quoted from the *Treatise* above. As he puts the matter there,

the struggle about money-wages primarily affects the **distribution** of the aggregate real wage between different labour-groups, and not the average amount per unit of employment, which depends, as we shall see, on a different set of forces. The effect of combination on the part of a group of workers is to protect their **relative** real wage. ...Every trade union will put up some resistance to a cut in money-wages, however small. But since no trade union would dream of striking on every occasion of a rise in the cost of living, they do not raise the obstacle to any increase in aggregate employment which is attributed to them by the classical school. (1936, 14-15)

INVESTMENT, SAVING AND THE RATE OF INTEREST

In the *Treatise*, investment decisions depend on the expected stream of earnings and the interest rate by which they are discounted. Expectations of profitability depend on past values of Q_1 and Q_2 , windfall profits in the two sectors, with different weights in the investment function reflecting the differing capital intensities of the sectors. "Surprises", represented by nonzero profits, are the channel through which entrepreneurs absorb information about market conditions. Changes in the level of investment can thus be written as a function of windfall profits and of the change in the rate of interest:

$$\Delta I_t = I_t - I_{t-1} = f(r_t - r_{t-1}, Q_{1t-1}, Q_{2t-1}) \quad (1)$$

with an increase in the long-term interest rate reducing investment, and windfall profits increasing investment by making entrepreneurs more optimistic. Saving depends positively on the interest rate.

The *Treatise's* treatment of saving suffers from the absence of a recognition of the functional dependence of the rate of saving on the level of income. This is seen most clearly in Keynes' parable of the effects of the introduction of a "Thrift Campaign" (increase in saving) in a community devoted entirely to the production and consumption of bananas, a parable which also appears in Keynes' private evidence to the Macmillan Committee. Such a campaign reduces the selling price of bananas and causes unexpected losses for entrepreneurs. Since attempts by entrepreneurs to reduce their losses by cutting wages or laying off workers will reduce spending on bananas by exactly as much as costs of production are reduced, losses will be unchanged, and saving still exceeds investment. Curtailment of investment, which occurs as losses make entrepreneurs pessimistic about future profitability, will increase losses by making $I - S$ even more negative.

Thus there will be no position of equilibrium until either (a) all production ceases and the entire population starves to death; or (b) the thrift campaign is called off or peters out as a result of the growing poverty; or (c) investment is stimulated by some means or other so that its costs no longer lags behind the rate of saving. (1930, I, 78 cf. 1981, XX, 78, 80)

Keynes' consideration of what Don Patinkin termed a "coroner solution" (1982, 15) shows that he failed to grasp the implications of saying that the thrift campaign could peter out because of growing poverty: saving falls as income falls. Instead, in the parable Keynes implicitly assumes that the marginal propensity to consume is one, and that the quantity of planned saving is independent of the level of income. This problem may explain why the *Treatise* does not repeat the case for public works projects to reduce unemployment put forward by Keynes and Hubert Henderson in their 1929 pamphlet *Can Lloyd George Do It?* Their argument, a crude version of the multiplier, rested on the rounds of secondary employment generated when the workers on the public works projects spent their wages, but without a theory of leakages of income into saving, taxes and imports it appeared that government spending of one farthing might suffice to employ all of Britain's one million unemployed.

Investment, saving and the velocities of circulation are all functions of the rate of interest: "A change in bank-rate may in itself modify the velocities of circulation by changing the amount of sacrifice involved in holding balances." (Keynes, 1930, I, 268) P', the price of investment goods, clears asset markets: "The price-level of investments as a whole, and hence of new investments, is that price-level at which the desire of the public to hold savings-deposits is equal to the amount of savings-deposits which the banking system is willing and able to create." (1930, I, 26) Given the rate of new investment and its cost of production, the price level of consumption goods is determined by the public's disposition to save, since investment decisions determine what resources remain available

to produce consumption goods, while saving decisions determine how much of income is spent on them.

At this point, it is possible to write down the model implicit in Books III and IV of the *Treatise*.¹ The variables taken as exogenous as the interest rate r and the reserves of the banking system, both under the effective control of the central bank, output O set by full employment of inherited factors of production, and the foreign interest rate and price level, r_F and π_F .

$$I \equiv S + Q \quad (2)$$

$$I(r, Q_{t-1}) = S(r) \quad (3)$$

$$\pi O \equiv E + Q \quad (4)$$

$$PR \equiv E - S \quad (5)$$

$$O \equiv C + R \quad (6)$$

$$I \equiv P'C \quad (7)$$

$$E \equiv M_1V_1 + M_2V_2 \quad (8)$$

(M_1 is income-deposits, M_2 business-deposits.)

$$V_i = V_i(r) \quad i = 1, 2. \quad (9)$$

$$M_3 = m(P') \quad (10)$$

(M_3 is savings-deposits.)

$$\text{Reserves} = h(M_1, M_2, M_3) \quad (11)$$

$$L \equiv B + G \quad (12)$$

(Foreign lending = the trade balance + gold outflow.)

$$L(r/r_F) = B(\pi/x\pi_F) \quad (13)$$

(x is the exchange rate, the domestic currency price of foreign exchange.)

(3) and (13) are the internal and external equilibrium conditions. A noteworthy feature of this model is that the $I = S$, $Q = 0$ equilibrium will be achieved only if the monetary authority sets the appropriate interest rate. If the market rate of interest is not set equal to the natural rate, cumulative inflation or deflation would occur. Keynes urged that in the that in the event of inconsistency between conditions for internal and external equilibrium, the exchange rate be allowed to change so that monetary policy could be used for purposes of domestic stabilization.

CONCLUSION

The development of Keynes' thought towards the *General Theory* can be better understood in light of his starting point, the *Treatise on Money*. The portfolio approach to money demand and the pricing of capital goods in the *General Theory* draws heavily on the earlier book. When working out the *General Theory*, Keynes and his younger colleagues at Cambridge started from the *Treatise*, and attempted to remedy its weaknesses: the absence of a theory of output and employment, the lack of a functional dependence of saving on income, and the emphasis on realized windfall profits or losses rather than on the expected yields of investments. Much of this process consisted of recognizing the implications of isolated insights in the *Treatise*, and integrating them into Keynes' theoretical framework, notably the passages on relative wage concerns as a source of nominal wage rigidity, anticipated profit or loss as the mainspring of economic change, and the possibility of a thrift campaign petering out because of growing poverty. The *Treatise* is worth reexamining, because the *General Theory* would have been a different book had Keynes not written the *Treatise* first.

NOTES

- (1) Klein (1947), 189-92 differs from this model principally by omitting the dependence of I on Q , and by taking M_1 , M_3 and V_1 as each being exogenous, resulting in an overdetermined model.

REFERENCES

- Hansen, Alvin H. (1932), "A Fundamental Error in Mr. Keynes' *Treatise on Money*," *American Economic Review* 22, with reply by Keynes, both reprinted in Keynes, *Collected Writings*, Vol. XIII, *The General Theory and After: Preparation*, London: Macmillan for the Royal Economic Society, 1973.
- Kahn, Richard F. (Lord) (1984), *The Making of the General Theory*, Raffaele Mattioli Lectures, Cambridge: Cambridge University Press.
- Keynes, John Maynard (1923), *A Tract on Monetary Reform*, London: Macmillan.
- Keynes, John Maynard (1930), *A Treatise on Money*, two volumes, London: Macmillan.
- Keynes, John Maynard (1936), *The General Theory of Employment, Interest and Money*, London: Macmillan.
- Keynes, John Maynard (1981). *Collected Writings*, Vol. XX, *Activities 1929-31*, London: Macmillan for the Royal Economic Society.
- Klein, Lawrence R. (1947), *The Keynesian Revolution*, New York: Macmillan.
- Patinkin, Don (1982), *Anticipations of the General Theory? and Other Essays*, Chicago: University of Chicago Press.

Keynes and the Origins of Macroeconometric Modelling

Ronald G. Bodkin*
Lawrence R. Klein**
Kanta Marwah***

Econometric models have already had a long and interesting history, now spanning more than half a century. For this reason, it is relevant to return to the origins, and note some of the important antecedents of this intellectual construct. We have examined four major antecedents of current-day macroeconomic models: Walrasian-Paretian models of general equilibrium, work on classical statistics around the turn of the current century, John Maynard Keynes's **General Theory** and the subsequent development of this approach, and finally the empirical literature on Keynesian macroeconomic concepts (particularly on consumption functions) which flourished between the publication of Keynes' **General Theory** (in 1936) and the Second World War (or the publication of Tinbergen's **Business Cycles in the U.S.A., 1919-1932**) late in 1939. In this paper, we examine only the third major antecedent, namely Keynes' **General Theory** and the subsequent development of this approach.¹ This narrowing of focus may be justified by the current interest in a half century retrospective look at Keynes's monumental work, as the operational legacy of this book has been enormous. Indeed, it is no exaggeration to say, that originally, macroeconomic models were designed to implement the Keynesian system, however much these models may have evolved in the succeeding half century.²

It is reasonable to argue that the most important single antecedent for the construction of macroeconomic models is John Maynard Keynes' **The General Theory of Employment, Interest, and Money** (1936), a point that appears to command wide agreement. Thus Richard Stone asserted, in his Keynes Lecture in Economics of 1978,

Furthermore, and most important in the present context, the desire to quantify the **General Theory** provided the major impetus for the exponentially-growing [sic] econometric work that began to be carried out in the late 1930's on the consumption, investment, and liquidity-preference functions individually and, even more notably, on econometric models of the Keynesian system as a whole. (Patinkin, 1976, p. 1092.)

Indeed, we have already asserted that, for many years, macroeconomic models have been constructed as essentially empirical counterparts to the

* (University of Ottawa), ** (University of Pennsylvania), *** (Carleton University).

Keynesian system; only in recent years have econometric models based on alternative paradigms (monetarist, radical, or Post Keynesian) appeared.³

Keynes' **General Theory** itself is worth a cursory review in this context. After six chapters of introductory material, there follow three chapters (grouped together in a section called Book III, "The Propensity to Consume"), which treat the consumption function and an associated concept, the multiplier. The notion of consumption as a relatively stable function of a few explanatory variables, including community income, appears to cry for empirical verification and Keynes himself made some preliminary attempts, using early national income data for the United Kingdom developed by Colin Clark and for the U.S.A. developed by Simon Kuznets, to verify his hypotheses.⁴ However, it must be admitted that the bulk of the work of the empirical testing of the Keynesian system was left for others, particularly after Keynes' severe heart attack in 1937.

Other parts of **The General Theory** contain concepts that are easily put into theoretical formulation susceptible to econometric testing and estimation without much difficulty. Thus, Book IV, entitled "The Inducement to Invest", contains an extended discussion (in Chapters 11 and 12) of a concept called "the marginal efficiency of capital". Without too much manipulation, this discussion can be recast in the form of an investment demand function and so be confronted with statistics on business fixed investment and some of its hypothetical determinants. Book IV also contains an extended discussion of what Keynes called "liquidity-preference" generally, scattered through five chapters (Chapters 13 through 17 of the work); again, one could attempt to render the liquidity-preference function operational and then to estimate its parameters, which indeed was done in 1939 by A.J. Brown and in the immediate postwar period. Finally, Book V, "Money-Wages and Prices", contains three chapters (Chapters 19 through 21) and concludes the central theoretical corpus of the work. Depending upon one's preferences, this portion of **The General Theory** could be formulated as an aggregate supply function relating real national product to the price level or its rate of change; alternatively (and corresponding to the breakdown of Book V into three separate chapters), this portion could be represented as an employment function (an inverted short-period production function), an equation for the determination of the money wage rate, and an equation for the determination of the aggregative price level.⁵ It should be noted that Keynes attempted empirical verification of none of these other relationships, although his theoretical discussion and his example with regard to the consumption function would appear to have pointed the way.

But would Keynes himself have approved of this use of his theoretical apparatus? The apparent answer would appear to be "no", on the basis of two important pieces of evidence: the strictures in **The General Theory** against the representation of his macroeconomic theory as a set of mathematical relationships ("mathematical economics", as he called it) and his September 1939 review of Tinbergen's study for the League of Nations.

About Keynes' attitude towards mathematically formulated economic theory (which is so essential for econometric modelling of any type, not just macro-econometric models), little need be said.⁶ However, his review

of Tinbergen warrants some comment. Keynes was quite critical of his approach to macroeconomic research,⁷ and the tone of his comments suggested that Tinbergen was largely wasting his and the profession's time, if not practising alchemy. The specific criticisms are, in general, reasonably taken, although Keynes' enthusiasts have to be embarrassed by the suggestion that linear difference equations may be incapable of generating cyclical fluctuations in themselves, so that (according to Keynes) Tinbergen may be engaged in the task of explaining cycles (in the endogenous variables) by cycles (in the exogenous variables). The other criticisms seem quite reasonable in themselves and appear to have stood the test of time; thus Keynes' various remarks could be interpreted as pointing to single equation bias, the bias of omitted variables, measurement errors in the explanatory variables,⁸ the possible misspecification entailed in assuming linearity throughout the full range (and beyond) of the dependent variable, and (especially) problems of structural change (i.e., the possibility that all the past data utilized for parameter estimation may not be homogeneous or may emanate from different universes). Keynes' remarks may also be taken to be a criticism of crude empiricism that may be entailed in the determination of time lags without a suitable theoretical foundation or in the introduction of time trend variables to capture ill-defined secular forces. Keynes also points to the difficulties of an econometric estimation of the effects of an explanatory variable, in the case in which this particular variable has very little movement during a particular historical episode (the influence of the rate of interest on investment expenditures during the nineteen-thirties comes to mind as an example). While nearly all of these points are reasonable in themselves⁹ and most would be incorporated into econometrics textbooks today, Keynes seems to have had relatively little appreciation of the difficult nature of the problems that Tinbergen was attacking and of the generally unsatisfactory nature of non-econometric solutions to this class of problems. Indeed, it can be asserted without too much fear of controversy today that intuitive estimates of concepts such as the multiplier or the effect of a certain fiscal policy on the economy are even more likely to be misleading than the econometric estimates, despite the limitations of the latter.¹⁰

Beyond the specific issues of econometric technique, there is a more general position regarding methodological approach, as Klant (1985), Lawson (1985), and Pesaran and Smith (1985) have pointed out. One can argue that, due to instability of structures in the social universe, no econometric test is possible; the best that econometricians can do is to **measure** or estimate, as (in this view) testing is a technical impossibility. Klant, Lawson, and Pesaran and Smith argue (with differing degrees of emphasis) that this indeed was Keynes' position, and that this is why Keynes reacted so vehemently against Tinbergen's League of Nations study, which was attempting to test alternative theories of the business cycle. By contrast, it is claimed (by Pesaran and Smith) that Keynes would have been far more sympathetic to Tinbergen's earlier work (1937), which put the emphasis on estimation and on solution of practical policy problems.¹¹ A secondary reason why econometric technique can never test critically a received theory (in this view) is that most (or even all) theories are underidentified or at least ambiguous. Accordingly, for econometric testing, supplementary hypotheses must be provided. But if a theory fails a given econometric test, an ardent proponent of that theory can always claim that the

fault lies in the supplementary hypothesis furnished for testing purposes, rather than in the central core of the theory. This critique resembles the "Post Keynesian" critique of deterministic or econometric models, where it is held that no coherent model, macroeconomic or otherwise, can capture the essential message of Keynes which, in this view, is held to be an emphasis on the important role of uncertainty, the uniqueness of particular historical episodes, and the underdetermination or the indeterminacy of the macroeconomic system, among other points.¹² Nevertheless, it would appear that Klant and Pesaran and Smith (but not Lawson) agree that building forecasting models and econometric research are useful things to do, in the face of serious policy problems. Pesaran and Smith even argue that Keynes would not have been unsympathetic to this approach and that he did something similar in his approach to the practical problems of the day, e.g. in "How to Pay for the War" and "Can Lloyd George Do It?".

This, however, should not be regarded as the end of the matter. Richard Stone (1980) argues that, under the pressure of economic policy-making under wartime conditions, Keynes changed his attitudes toward economic statistics ("political arithmetic") and even towards econometric modelling. Moreover, Keynes was associated with the "Cambridge Research Scheme" of the National Institute of Social and Economic Research during the period just before World War II (1938 and 1939), and much of this research had a strong quantitative and econometric flavour. Stone feels that, in light of the timing of these activities, "the Tinbergen episode seems even more bizarre". Moreover, both Patinkin (1976) and Stone note that, when Alfred Cowles first proposed to Keynes to be President of the Econometric Society, he first protested that "whilst I am interested in econometric work and have done something at it at different times in my life, I have not recently written anything significant or important along these lines, which would make me feel a little bit of an imposter".¹³ Thus, as Patinkin rightly points out, we are entitled to infer that Keynes saw himself as someone who had made important contributions to econometrics at one state of his life; we are also probably entitled to infer that his critical views on econometric modelling had moderated somewhat by that date (1944). This inference is also indirectly corroborated by the fact that Stone reports that Keynes delighted in his personal reunion with Tinbergen right after the end of the Second World War in Europe (in July 1945), speaking enthusiastically not only of Tinbergen's personal qualities but also of his work.¹⁴

Ultimately, however, the issue of Keynes' final views on the econometric developments that his macroeconomic theory stimulated is to a very large extent a secondary issue.¹⁵ It now seems clear that **The General Theory** was a tremendous stimulus not only to macroeconomic theory in general, but to macroeconomic model-building in particular. Indeed, as asserted above (and as detailed in our book), for nearly a generation and a half after the publication of **The General Theory**, macroeconomic models constructed in the spirit of Keynesian theory dominated the model-building process; only around the beginning of the 1970s did alternative paradigms of macroeconomic theorizing begin to be incorporated into macroeconomic models. Moreover, Keynes' theorizing completed a small step that Pareto had taken away from Walras' microeconomic analysis, allowing researchers to deal with global concepts and quantities that were much easier to measure

in practice. This in turn permitted a return to the sweeping, aggregative concepts of Francois Quesnay's *tableau économique*,¹⁶ with, however, a much higher degree of precision. In summary, then, this aspect of the "Keynesian Revolution" opened the field to macroeconomic model-building.

Footnotes

1. This paper is drawn from Chapter I, "Antecedents of Macroeconomic Models" of our prospective book, **A History of Macroeconomic Model-Building**. For helpful comments, we should like to thank Eric G. Davis and Thomas K. Rymes.

2. Another fascinating bit of prescience appears to have been displayed by Alfred Marshall in a celebrated article published in 1897 and entitled, "The New Generation of Economists and the Old". Here Marshall asserted that an important task of economists during the twentieth century would be to estimate and to measure, or, in other words, to find empirical counterparts to the theoretical structure that had already been developed by the end of the nineteenth century. (Marshall probably did not anticipate how much theoretical macroeconomics would develop during the twentieth century.)

3. Suggestions for alternative models have come from other sources such as the school of rational expectations (e.g. R.E. Lucas [1976] or Thomas J. Sargent [1976] or the time series, "little theory" approach of Christopher A. Sims (1980).

4. Keynes' methods of attempting to corroborate his theoretical constructs (an informal examination of the data, grouping the years in pairs) seem rather casual, and it is no surprise to learn that Patinkin (1976) was unable to reproduce Keynes' estimate (between 2.5 and 3) for the multiplier for the U.S. economy. (This might conceivably be the case because Patinkin not unreasonably considered only contiguous years, while Keynes may have carried out his estimation over two more widely separated years.) In any case, in that Keynes then inferred a value of the marginal propensity to consume parameter from the estimated multiplier, it seems likely that he carried out the first instance of reduced form estimation, as Patinkin notes.

5. Thus Keynes appears (in Chapter 21) to have interpreted the marginal productivity condition of neo-classical economics (the equality, under pure competition, of the marginal physical product of labour to the ratio of the nominal wage rate to the price of final output) as a relationship for the determination of final goods prices, rather than as a labour demand relationship, at least under conditions of less than full utilization of the labour force.

6. Stone traces Keynes' views on this subject to his own personality conflicts regarding a lack of success as a research mathematician. Patinkin sees these remarks as a ritualistic continuation of Marshall's attitudes, but also feels that Keynes' comparative advantage did not lie in this field. Presumably Keynes made his peace with mathematically oriented econo-

mic theory, as he seems to have acquiesced to Meade's (1936-1937) and Hicks' (1937) representations, in fairly tight mathematical terms, of his basic system.

7. We may note that, in his private correspondence, especially with R.F. Harrod and R.F. Kahn, Keynes showed himself to be even more sceptical than in the published review. See Moggridge (1973), pp. 285-306, for a substantiation of this point.

8. This point brings us back immediately to the rudimentary character of national income data in Great Britain and the United States during the 1930s, and hence this point would appear to have been particularly pertinent at the time of Keynes' review. Whether Keynes contributed to the improvement of this situation or whether, **au contraire**, he hindered some useful developments that were taking place in any case is a point of dispute between Stone (1980) and Patinkin (1976), following some correspondence with Colin Clark.

9. Keynes also appears not to have had a full appreciation of the technique of multiple regression as an artificial manner of holding other influences constant, as he asserts in his review that the technique requires the explanatory variables to be "largely independent" statistically. On the other hand, an apologist for Keynes might interpret his remarks as anticipating the problem of (nearly perfect) multi-collinearity.

10. Opinions on Keynes' performance in this episode have certainly varied among commentators, over the years. Thus, thirty-five years ago, one of us (Klein, 1951) characterized Keynes' review of Tinbergen's work as "one of his sorriest professional performances"; even with the passage of time, Klein sees no reason to revise this evaluation. On the other hand, Patinkin summarizes this same review and concludes that Keynes was more right than incorrect, as well as observing that he (Patinkin) finds it depressing to note how many of Keynes' criticisms are still relevant today. Another evaluation is that of Stone, who, while conceding the validity of some individual points, regards Keynes' review as "a model of testiness and perverseness"; in particular, he argues that Keynes failed to realize that the new technique might have been exactly what might be very helpful "to quantify the multiplier [e.g., as in Clark's contemporaneous (1938) article] and other parameters of **The General Theory**". Finally, Johannes J. Klant, who is generally sympathetic to what he regards as Keynes' basic methodological position, concedes, "Keynes displayed much ignorance and misunderstanding of what Tinbergen had done" (Klant, 1985, p. 91).

11. However, Tinbergen in his concluding remarks of **An Econometric Approach to Business Cycle Problems** (1937) clearly mentions testing various received theories as one of the advantages of such an approach. Nor has much changed in this regard. For example, a recent exposition of methodological and philosophical issues in econometric practice (Hendry, 1980) placed great emphasis on econometric techniques as a means of resolving conflicts among rival theories. Hendry, incidentally, reviewed the Keynes-Tinbergen interchanges and expressed great doubt that Keynes could have really meant his apparent position, namely that empirical methods in general and econo-

metric techniques in particular were unsuitable for resolving conflicts among rival economic theories!

12. Taken to its logical extreme, such a philosophical position would appear to imply that no macroeconomic policies (stabilization policies in particular) are possible, because if the structure of the economy is so unstable, one can never be sure of what one is doing. In this regard, the proponents of this point of view would appear to join Robert Lucas (1976) and the rational expectations school, who argue that the parameters of the system are highly unstable, at least with a shift in the policy regime itself, thus rendering both economic policy and macroeconomic estimation extremely difficult, if not impossible.

13. Quoted by Stone (1980), p. 63, and by Patinkin (1976), p. 1092 (all but the final phrase, "which would make me feel a bit of an imposter").

14. Stone (1980) concludes his review of the episode by noting that the renewal of the contact had convinced Keynes that Tinbergen's work should be given "every scope and opportunity", and he (Stone) asserts, "Nothing could show better the difference between Keynes' first impersonal impressions and his considered view based on personal experience" (p. 64). At the same time, we may note that Lawson (1985) has argued that Stone's analysis at most explains the **force** of Keynes' critique of Tinbergen, without "explaining away" his well-founded (according to Lawson) logical objections.

15. If Keynes had lived to the ripe of old age of his parents, it seems likely that his views would have evolved further, under the combined influences of additional evidence and the further thinking of himself and others about these problems. What direction his further thoughts would have taken is, at this point, a matter of pure speculation.

One of our discussants argued that it is not inconceivable that Keynes would have modernized his small models by use of the personal computer and that he could visualize a high-tech "circus" about Keynes, with many current problems of policy being attacked by the intuition of this brilliant individual, aided by current technology. In this view, econometric estimation (but not testing) would have formed part of the picture. As noted in the text, Pesaran and Smith (1985) would appear to agree, noting that Keynes made use of numerically estimated models in his applied works, such as "How to Pay for the War" and "Can Lloyd George Do It?".

16. In this context, it may be recalled that the Physiocrat Francois Quesnay developed in the 1750s an economic construct which he called the **tableau économique** and which some have interpreted as the first macroeconomic model. As the **tableau** is numerical (if not statistical), it is not difficult to see affinities with modern macroeconomic constructs, such as macroeconomic models or input-output tables.

References

1. Brown, A.J., "Interest, Prices and the Demand Schedule for Idle Money," **Oxford Economic Papers**, No. 2 (May 1939), pp. 46-69.
2. Clark, Colin, "Determination of the Multiplier from National Income Statistics," **Economic Journal**, Vol. XLVIII, No. 191 (September 1938), pp. 435-448.
3. Hendry, David F., "Econometrics—Alchemy or Science," **Economica**, Vol. 47, No. 4 (November 1980), pp. 387-406.
4. Hicks, John R., "Mr. Keynes and the 'Classics': A Suggested Interpretation," **Econometrica**, Vol. V, No. 2 (April 1937), pp. 147-159.
5. Keynes, John Maynard, **The General Theory of Employment, Interest and Money** (New York: Harcourt, Brace & Company, 1936).
6. _____, "Professor Tinbergen's Method," **Economic Journal**, Vol. XLIX, No. 195 (September 1939), pp. 558-568.
7. Klant, Johannes J., "The Slipper Transition," pp. 80-98 of Tony Lawson and Hashem Pesaran (eds.), **Keynes' Economics: Methodological Issues** (London and Sydney: Croom Helm, 1985).
8. Klein, Lawrence R., "The Life of John Maynard Keynes," **Journal of Political Economy**, Vol. LIX, No. 5 (October 1951), pp. 443-451.
9. Lawson, Tony, "Keynes, Prediction, and Econometrics," pp. 116-133 of T. Lawson and H. Pesaran (eds.), **Keynes Economics: Methodological Issues**.
10. Lucas, Robert E., Jr., "Econometric Policy Evaluation: A Critique," pp. 19-46 of Karl Brunner and Allan H. Meltzer (eds.), **The Phillips Curve and Labor Markets** (Amsterdam: North-Holland Publishing Company, 1976), Carnegie-Rochester Conference Series on Public Policy, Vol. 1, **Supplement to the Journal of Monetary Economics**.
11. Marshall, Alfred, "The Old Generation of Economists and the New," **Quarterly Journal of Economics**, Vol. 11 (January 1897), pp. 115-135.
12. Meade, J.E., "A Simplified Model of Mr. Keynes' System," **Review of Economic Studies**, Vol. IV (1936-1937), pp. 98-107.
13. Moggridge, Donald (ed.), **The Collected Writings of John Maynard Keynes**, Volume XIV, **The General Theory and After, Part II, Defence and Development** (London: The Macmillan Press Ltd., 1973).
14. Patinkin, Don, "Keynes and Econometrics: On the Interaction between the Macroeconomic Revolutions of the Interwar Period," **Econometrica**, Vol. 44, No. 6 (November 1976), pp. 1091-1123.
15. Pesaran, Hashem, and Ron Smith, "Keynes on Econometrics," pp. 134-150

of T. Lawson and H. Pesaran (eds.), **Keynes' Economics: Methodological Issues**.

16. Sargent, Thomas J., "A Classical Macroeconomic Model for the United States", **Journal of Political Economy**, Vol. 84, No. 2 (April 1976), pp. 207-237.
17. Sims, Christopher A., "Macroeconomic and Reality," **Econometrica**, Vol. 48, No. 1 (January 1980), pp. 1-48.
18. Stone, Richard, "Keynes, Political Arithmetic and Econometrics," Keynes Lecture in Economics 1978, pp. 55-92 of the **Proceedings of the British Academy**, London, Volume LXIV, 1978 (Oxford: Oxford University Press, 1980).
19. Tinbergen, Jan, **Business Cycles in the United States of America, 1919-1932**, Part II of **Statistical Testing of Business Cycle Theories** (New York: Agathon Press, Inc., 1968). [This work was originally published in Geneva by the Economic Intelligence Service of the League of Nations, in 1939.]
20. _____, **An Econometric Approach to Business Cycle Problems** Paris: Herman et Compagnie, 1937).