1
Introduction

> I have found out what economics is; it is the science of confusing stocks with flows.
>
> A verbal statement by Michal Kalecki, *circa* 1936, as cited by Joan Robinson, in 'Shedding darkness', *Cambridge Journal of Economics*, 6(3), September 1982, 295–6.

1.1 Two paradigms

During the 60-odd years since the death of Keynes there have existed two, fundamentally different, paradigms for macroeconomic research, each with its own fundamentally different interpretation of Keynes's work.[1] On the one hand there is the mainstream, or neo-classical, paradigm, which is based on the premise that economic activity is exclusively motivated by the aspirations of individual agents. At its heart this paradigm requires a neo-classical production function, which postulates that output is the result of combining labour with capital in such a way that, provided all markets clear, there will be no involuntary unemployment while the national income is distributed optimally and automatically between wages and profits. If markets do not clear because wages or prices are 'sticky', the same structure will generate determinate, if sub-optimal, disequilibrium outcomes and, for many economists, it is the possibility of such stickiness that defines Keynesian economics. The key assumption that individual welfare maximization is the universal mainspring is not consistent with the view that firms have an independent existence with distinct motivations, because optimum prices, output and employment are all decided for them by the location of aggregate demand and supply

[1] For a masterly survey of the entire field see Lance Taylor (2004b).

schedules. And as production is instantaneous, while supply is brought into equivalence with demand through the market-clearing process, there is no systemic need and therefore no essential place for loans, credit money or banks. The concept of 'money' is indispensable, yet money is an asset to which there is not, in general, a counterpart liability and which often has no accounting relationship to other variables. Mainstream macroeconomic theory is a deductive system which needs no recourse to facts (though it may be 'calibrated' with numbers) and lends itself to analytic solutions.

The alternative paradigm, which has come to be called 'post-Keynesian' or 'structuralist', derives originally from those economists who were more or less closely associated personally with Keynes such as Joan Robinson, Richard Kahn, Nicholas Kaldor, and James Meade, as well as Michal Kalecki who derived most of his ideas independantly. So, far from being a deductive system, the post-Keynesian vision is underpinned by 'stylised facts' recognizing the manifest existence of institutions, together with regularities and magnitudes in the economic data which can be checked out empirically. Central to this system of ideas is that, in a modern industrial economy, firms have a separate existence with a distinct set of objectives, for example, to make enough profits to pay for growth-maximizing investment. Rejecting as chimerical the concept of the neo-classical production function, post-Keynesians hold that, in an uncertain world, firms, operating under conditions of imperfect competition and increasing returns, must decide how much to produce and how many workers to employ, what prices to charge, how much to invest, and how to obtain finance and how many workers to employ. It will be the pricing decision which, in general, determines the distribution of the national income between wages and profits. And as production and investment take time while expectations are in general falsified, there is a systemic need for loans from outside the production sector which generate acceptable credit money endogenously – in other words (in accordance with common observation) there must exist a banking sector. According to post-Keynesian ideas, there is no natural tendency for economies to generate full employment, and for this and other reasons growth and stability require the active participation of governments in the form of fiscal, monetary and incomes policy. And it will probably be impossible to derive analytic solutions which describe how economies as a whole evolve, particularly as institutions and behavioural patterns change drastically through historic time.

Luigi Pasinetti (2005) laments the fact that post-Keynesians have progressively failed to establish 'a permanent winning paradigm'. And indeed, while pockets of stubborn resistance remain, the post-Keynesian tradition has now been virtually written out of the literature; it has lost out to the mainstream in terms of how the subject is taught, what the 'top' learned journals will accept, where research money is allocated, how appointments are made and how empirical models are built. Pasinetti attributes this collapse

in large part to the personal characters of the formidable economists who directly succeeded Keynes, maintaining (correctly in our opinion), that they did not admit outsiders to their circle or sponsor their work. But Pasinetti also points to 'a lack of theoretical cohesion in the various pieces which emerged from the Keynesian School', which 'paid scant attention to the fundamentals on which an alternative, but coherent, paradigm could be built'. He suggests that 'a satisfactory blueprint that could house, beneath one single roof, the development of the existing ideas along the Keynesian lines ... is still lacking' ... and that there is a need for 'an account of what happens – as Keynes put it – in a "monetary production economy", which is more complex than a pure exchange stationary economy, because it is intrinsically dynamic, continually affected by history subject to changes both in scale and structure'. This is an admission that post-Keynesian economics up to the present time simply does not cover the ground.

Geoffrey Harcourt (2001: 277) in similar vein observes that post-Keynesians have been following the Marshallian/Keynesian method which 'consists at looking at parts of the economy in sequence, holding constant or abstracting from what is going on, or at least the *effects* of what is going on elsewhere, for the moment', in the hope that it would be possible eventually 'to bring all our results together to give a full, overall picture'. Harcourt thinks that 'this may be one of the reasons why ultimately both Marshall and Joan Robinson thought that they had failed – not from realizing that by following the procedure they were attempting the impossible, but because the *procedure* itself was at fault'. While neo-classical economists have general equilibrium theory and computable general equilibrium models that helped capture the overall implications of their vision and the interdependence between markets and sectors, post-Keynesian economics could only offer the Sraffian model as a formal tool to tackle production interdependencies and relative prices, but which, ironically, did not and could not deal with the crucial Keynesian issues of output, unemployment, inflation, financial flows and debts. Post-Keynesian models that dealt with these topics lay in spreadout pieces, with no account of how the system as a whole worked. There is no statement which characterizes how post-Keynesian theory can underlie the way in which an industrial capitalist economy works *as an organic whole*. Despite valiant efforts, such as the book by Eichner (1987), there is no post-Keynesian textbook which covers all of the monetary macro ground as a coherent whole.[2]

[2] This was already pointed out in Godley (1993: 63), where the author deplored the absence of a Kaldorian textbook, stating that 'Kaldorian ideas in their positive mode have not been put together in a way which covers the syllabus'. In a footnote to this, the author added that an exception to this generalization was the 1987 (unfortunately unfinished) Eichner book (Godley 1993: 80).

1.2 Aspiration

In writing this book it has been our aspiration to lay the foundations for a methodology which will make it possible to start exploring rigorously how real economic systems, replete with realistic institutions, function as a whole. Our starting point, though a little intricate for an introduction, is yet so simple that we propose to plunge straightaway *in medias res*.[3]

The standard textbook introduces macroeconomic concepts via the national income identity. Thus total production, or gross domestic product (GDP), is defined as the sum of all expenditures on goods and services or, alternatively, as the sum of all incomes paid for production of goods and services. More precisely, the GDP (assuming the economy to be closed) is made up of personal consumption, investment and government expenditure on goods and services; looked at from the income side, it is made up of income from employment and profits. All these concepts are introduced as 'real' variables, the GDP being an economy's total volume of production. Writing these identities formally we have:

$$C + I + G = Y = WB + F \tag{1.1}$$

where C is consumption, I is investment, G is government expenditure, Y is GDP, WB is the wage bill and F is profits.

And that is about it, so far as accounting goes, though when it comes to studying the consumption function the student will quickly have to learn that personal disposable income is given by:

$$YD = Y - T \tag{1.2}$$

where YD is personal disposable income and T describes all taxes and transfers received or paid by the government. Equation (1.2) builds in the implicit (but counterfactual) assumption that all profits are instantaneously distributed to households.

Decomposing the wage bill into a quantity of employment times a wage rate and postulating the existence of a rate of interest, a stock of money, a price of real product and a stock of fixed capital equipment, we have enough concepts to erect the 'core' model of the so-called neo-classical synthesis, which constituted mainstream macroeconomics at least until the 1980s and from which more recent schools of thought (e.g. Rational Expectations, Real Business Cycles, New Keynesian) are directly descended. By this model, in its most basic manifestation, the demand for output is determined by consumption and investment functions, the profit-maximizing

[3] Latin for 'into the middle of things'.

Table 1.1 Standard textbook simplified national income matrix

		Business			
	Households	**Current**	**Capital**	**Government**	**Σ**
Consumption	$-C$	$+C$			0
Govt. expenditure		$+G$		$-G$	0
Investment		$+I$	$-I$		0
[GDP (memo)]		$[Y]$			
Wages	$+WB$	$-WB$			0
Profits	$+F$	$-F$			0
Tax net of transfers	$-T$			$+T$	0
Σ	*SAVING*	0	*INVESTMENT* (−)	*GOVT SURPLUS*	0

supply of output is determined by the marginal product of labour and the real wage. The demand and supply for labour are both determined by the real wage. The demand for real money balances is determined by income and the rate of interest, while the supply of money is exogenous and given. The entire system is in market-clearing equilibrium when all three demands are in equivalence with all three supplies, yielding determinate values for all the components of the national income as well as for employment and for each 'price'.

Although every author will have his or her own gloss on how exactly this model works, and what happens if in various ways it doesn't work, we have no doubt whatever that this account does fairly summarize the core model which dominated the scene for so long.[4] The purpose of reproducing it here is not to criticize it, but rather to set up a clear reference point in terms of which we can clearly deploy a radically different way of viewing the world and setting up a research agenda to explore it.

The difference between the world to be deployed in the following chapters and that introduced in most textbooks is well introduced by first fitting the variables described in equation (1.1) into a matrix such as that shown in Table 1.1, which brings out the fact that each variable is a transaction between two sectors which takes place in some given period of time.

[4] The classic expositions are to be found in Patinkin (1965) and Modigliani (1944, 1963). The basic model is not changed when markets fail to clear. It is, for instance, commonly argued that 'Keynesian economics' – using this model – is encapsulated by assuming that the nominal wage is exogenously determined, in which case the supply of labour can exceed the demand, causing, and suggesting a cure for, unemployment – in advance of any empirical investigation whatever.

The second column of Table 1.1 does nothing more than reproduce equation (1.1) in a vertical arrangement. The other columns show the transactions implied by the component parts of equations (1.1) and (1.2). Thus, for instance, consumption is a receipt by the business sector and a payment by the household sector. The only thing which might be unfamiliar to a student is the third column, which describes the capital account of the business sector. But there should be no difficulty about the meaning and significance of this; sales of investment goods give rise to receipts by the business sector like any other sales. But these receipts will all have to come (at this level of abstraction) from payments by the business sector itself, which is assumed to do all the investing.

But now it is easy to see that this system of concepts is seriously incomplete. Consideration of the matrix immediately poses the following questions. What form does personal saving take? Where does any excess of sectoral income over expenditure actually go to – for it must all go somewhere? Which sector provides the counterparty to every transaction in assets? Where does the finance for investment come from? And how are budget deficits financed?

There is an obvious answer to these questions, which follows from an elementary knowledge of the way the real world works and which can be quickly verified by inspecting the Flow-of-Funds tables published by the Federal Reserve in the United States, which provide data relating to every quarter since 1952.

Table 1.2 completes and rectifies the story adumbrated in Table 1.1, showing a relatively simple comprehensive system of accounts which describes all the intersectoral transactions implied by the Table 1.1 concepts but not shown there.

The upper, national income, part of the table reproduces Table 1.1, with the important difference that the usual assumption that all profits are distributed has been dropped. Instead some proportion of profits is transferred to firms' capital account, where it may be used to finance investment.[5] The lower, flow of funds, part of the table could have been completed in various different ways depending on the degree of detail and the simplifications deemed appropriate. However, it will be a cardinal principle applying here and to every array of concepts we shall deploy in the future that all rows and all columns sum to zero,[6] thus ensuring, in the catch-phrase, that 'everything comes from somewhere and everything goes somewhere'.

[5] Table 1.2, although an improvement over Table 1.1, still omits several relevant features, such as interest payments, and it assumes that the central bank is amalgamated with the government. A more complete matrix will be introduced in Chapter 2.

[6] For this reason the closed economy described above could not be 'opened' by adding a column describing exports and imports since this will not normally sum to zero. The solution will be to include all trading partners in the matrix, as will be shown

However, no sooner does one contemplate filling in the assets which are acquired by households than a second important inadequacy of Table 1.1 immediately becomes manifest. Households may (for instance) acquire credit money as an asset, but where is the counterpart acquisition of liabilities to be found? And firms may require loans to finance investment in excess of retained profits, but from where are these to come? The answers are obvious as soon as the questions are asked. The matrix cannot be completed unless a whole new sector – a banking sector – is introduced into the elementary system of concepts.

In column 1 the saving of the personal sector is assumed to go entirely into cash, credit money, government securities and newly issued equities. There are no entries in column 2 because profits are defined as the residual between current inflows and outflows. In line 5 profits are in part distributed and in part – in practice by far the greater part – undistributed. In column 3 the funds in excess of retained profits required for investment are assumed to come in part from the issue of equities, with the balance coming from loans. In column 5 the government is assumed to finance any deficit by the issue of securities and cash. Finally in column 4 we have the banks' transactions in assets which comprise the genesis of loans and credit money and which bring these concepts firmly into the most basic accounting structure, and they also say, non-trivially, that any gap between these two supplies must always be matched exactly by net accumulation by banks of cash and government bills – for the balance of banks' transactions in assets must sum to zero if only because every other row and column in the table sums to zero.

All entries in the flow-of-funds sections of Table 1.2 describe changes in stock variables between the beginning and end of the period being described.[7] Thus the evolution of historic time is being introduced into the basic system of concepts. The transactions in asset stocks in Table 1.2 imply the existence of an interlocking system of balance sheets, described in Table 1.3, these balance sheets measure the levels of all stock variables at some given point of time. And it is the configuration of stock variables which is providing the link between each period of time and that which follows it.

The evolution of the entire system may be characterized (at the level of accounting) by saying that at the beginning of each period, the configuration of stock variables (i.e. all physical stocks together with the interlocking system of financial assets and liabilities) is a summary description of (relevant[8]) past

in Chapters 6 and 12, making a larger closed system in which there is no place for a balance of payments column.

[7] The variables are defined in the matrix. The term e in the final line describes the number of equity titles and p_e describes their price.

[8] A more comprehensive definition would comprehend human capital, natural resources and many other items.

Table 1.2 Transactions flow matrix

	Households	Production firms		Banks	Government	Σ
	(1)	Current (2)	Capital (3)	(4)	(5)	
Consumption	$-C$	$+C$				0
Investment		$+I$	$-I$			0
Govt. expenditures		$+G$			$-G$	0
Wages	$+WB$	$-WB$				0
Profits	$+FD_f$	$-F_f$	$+FU_f$			0
Taxes-transfers	$-T$				$+T$	0
Change in loans			$+\Delta L_f$	$-\Delta L$		0
Change in cash	$-\Delta H_h$			$-\Delta H_b$	$-\Delta H$	0
Change, deposits	$-\Delta M$			$+\Delta M$		0
Change in bills	$-\Delta B_h$			$-\Delta B_h$	$+\Delta B$	0
Change in equities	$-\Delta e \cdot p_e$		$+\Delta e \cdot p_e$			0
Σ	0	0	0	0	0	0

Table 1.3 Balance-sheet matrix

	Households	Production firms	Banks	Government	Σ
Loans		$-L$	$+L$		0
Cash	$+H_h$		$+H_b$	$-H$	0
Deposits	$+M$		$-M$		0
Bills	$+B_h$		$+B_b$	$-B$	0
Equities	$+e \cdot p_e$	$-e_f \cdot p_e$	$-e_b \cdot p_e$		0
Tangible capital	$+K_h$	$+K_f$			$+K$
Sum (net worth)	NW_h	NW_f	NW_b	NW_g	K

history. Then the transactions described in Table 1.1 heave the stock variables from their state at the beginning of each period to their state at the end,[9] to which capital gains will have to be added.

For this system of accounting identities to hold, all variables must be measured at current prices, since they describe the sums of money that actually change hands each period – otherwise, unless there is no change in any price,

[9] Capital gains and losses, which are not transactions, will have to be accounted for when we come to examine the relationship between the two matrices.

the columns would not add up to zero.[10] Yet a number of key decisions regarding, in particular, production, consumption, investment and many kinds of government expenditure are taken in terms of real, physical quantities. So we shall at some stage have to describe, at the level of accounting (i.e. before considering behaviour) how prices translate nominal into real variables, thereby determining the distribution of the national income.

1.3 Endeavour

We can now disclose in a nutshell the nature of the task we have set for ourselves. We are going to define a series of evolutionary models, each of which describes an economy moving forward non-ergodically in historic time, as Paul Davidson (1988) would put it. We start with truly primitive models containing a mere handful of equations and end up with relatively elaborate models containing one hundred or more equations. Each model must account for every single one of the variables contained in the relevant transactions and balance sheet matrices. So in sharp contrast with the Marshallian method we shall always be exploring the properties of complete systems, never assuming that we can consider one topic at a time in the hope that the rest of the world stays in place while we do so.

The method will be to write down systems of equations and accounting identities, attribute initial values to all stocks and all flows as well as to behavioural parameters, using stylized facts so well as we can to get appropriate ratios (e.g. for the proportion of the national income taken by government expenditure). We then use numerical simulation to check the accounting and obtain a steady state for the economy in question. Finally we shock the system with a variety of alternative assumptions about exogenous variables and parameters and explore the consequences. It will be our contention that via the experience of simulating increasingly complex models it becomes possible to build up knowledge, or 'informed intuition',[11] as to the way monetary economies must and do function.

The use of logically complete accounts (with every row and every column in the transactions matrix summing to zero) has strong implications for the dynamics of the system as a whole. This completeness carries the implication that once $n-1$ equations are satisfied then the nth equation will be found to be satisfied as well and for this reason must always be dropped from the computer model to avoid overdetermination. If the accounting is less than complete in the sense we use, the system dynamics will be

[10] Put another way, conventional real disposable income less real consumption does not equal the change in the real stock of wealth – a major contention in inflation accounting to be discussed in Chapter 9.

[11] An expression of James Tobin to describe the IS/LM model!

subverted – rather as though we were trying to operate a hydraulic machine which had leaky pipes.

Yet what we offer is no more than a beginning. We are not writing as experts with special knowledge concerning, say, the investment or consumption functions. Our accounting will always be solid and comprehensive – and this by itself will carry us a considerable distance, particularly when it comes to characterizing the interactions between the real and financial parts of the more elaborate models. But we leave every functional relationship in a primitive state yelling to be more thoroughly explored. For instance, we make the assumption that some small fixed proportion of investment is financed by the issue of equity in accordance, very broadly, with the facts as revealed in the Flow-of-Funds accounts. But industry finance, as it changes radically in the course of time, is a major subject worth deep and ongoing analysis though always, we argue, in the context of how the system as a whole must be behaving. It is an implication of our method that, by virtue of its comprehensive nature, it will ultimately enforce empirical study of the entire range of macroeconomic relationships, both accounting and functional, all dancing together as one.

Although we shall be writing down postulated 'parameters' for all functional relationships in the service of grinding out numerical simulations, we doubt whether these have, in the real world, anything remotely like the stability we have perforce attributed to them. We take the view, on the contrary, that all behavioural relationships are contingent in the technical sense that they 'may or may not happen'. The elementary models presented in Chapters 3–6 of this book achieve steady states and use stable 'parameters' in order to obtain comprehensible simulation results, but we have not yet had time to explore alternative possibilities thoroughly. Steady states are theoretical constructs which would be achieved '*if all parameters and functions of the model are taken as given*. Since in reality they are not given, the real-world counterpart of such constructs do not imply that the economy is at a position of rest' (Dutt 1997: 450). The steady state is just an analytical device never in practice reached, because parameters and exogenous variables are actually changing all the time. This implies that steady states should be treated as a reference point (Turnovsky 1977: 7). With the simulations advocated here, one ends up knowing something about the initial effects of some change (in the early periods of the dynamic response) as well as the terminal effects (in the steady state). These terminal effects will eventually arise as long as the structure of the model is left unchanged, although we know that this is unlikely. However, the far more complex later models, described, for example, in Chapter 11, do not spontaneously achieve steady states in any useful way, because sensible solutions to them require one to make assumptions about how the government reacts – for instance to an increase in inflation.

The only thing about which we are really certain at this stage is that the various items must always and everywhere add up appropriately. For instance

in those models where households have a choice as to how their wealth is to be allocated, we have followed the procedure suggested by Tobin whereby the proportion of wealth held in any particular form is determined in a regular way by the rate of return on that asset compared with the return on all other assets. However, we do not for a moment suppose that the coefficients determining the relevant proportions are fixed through time and do not, therefore, believe that the theory is confuted because econometricians have so far failed to discover coefficients which are stable. All we can be sure of at this stage is that all (exactly all) wealth must go somewhere and that expected rates of return have something to do with this allocation. We should, however, be able to think coherently about the nature of the difference made to the outcome if the proportions change in various ways. Similarly we are certain that the finance for investment comes in some proportion from undistributed profits, issues of securities and bank loans, and the changing proportions merit empirical study. But for the time being we may, through simulation, develop a sense of the difference which alternative financing methods may make to the solutions obtained. And so on.

Our method guarantees that we will always be learning to live in a logically coherent world. And we are prepared to conjecture that, given that there are limits to the extent to which stock-flow ratios can change, the system dynamics of whole economies will pin down their overall behaviour in a way that can override the findings of econometrics as to the putative behaviour of bits and pieces.

A final *obiter dictum*. We have no compunction whatever about aspiring to describe the behaviour of whole sectors, in defiance of the putative maximization of utility by individual agents.

1.4 Provenance

Over the past few years, centred along the axis of the New School University and the Levy Economics Institute, both located in New York State, there has been a revival of interest in the stock-flow consistent approach to macroeconomic modelling, or what we could call a sectoral monetary stock-flow consistent approach.[12] The purpose of the present book is to feed this revival, in the hope that an accessible introduction to stock-flow consistent

[12] This revival is exemplified by the works of Godley (1996, 1997, 1999a,b) and Godley and Shaikh (2002), but also those of Dos Santos (2002a,b, 2005), Izurieta (2003), Lavoie and Godley (2001–02), Lavoie (2003), Moudud (2007), Taylor (2004a,b), Foley and Taylor (2004), Zezza and Dos Santos (2004), who all explicitly refer to a social accounting matrix (SAM) approach or to stock-flow consistency (SFC). One may also include as part of this revival the works of Willi Semmler, also partly located at the New School, and his associates (Flaschel, Franke and Semmler 1997; Chiarella and Flaschel 2000; Flaschel, Gong and Semmler 2001). In addition one can note

macroeconomic modelling will induce more students and more colleagues to adopt and develop such an approach. Our belief is that, if such an adoption occurs, macroeconomics in general and heterodox economics in particular should become sounder and more transparent.

A relatively small group of authors in the past have suggested that such a coherent financial stock-flow accounting framework be part of macroeconomic theory. In broad terms, one can identify two schools of thought which actively developed a series of models based on the stock-flow consistent approach to macroeconomic modelling, one located at Yale University and led by the Nobel Prize winner James Tobin, and the other located at the Department of Applied Economics at Cambridge University and led by one of the present authors (Wynne Godley). To a large extent, both groups worked independently, at least until a conference on Keynes that was organized in Cambridge (UK) in 1983, most of their papers and articles having been written in the 1970s and early 1980s. The Yale group, also known as the 'pitfalls approach' or the New Haven school, focused its attention on portfolio and asset choice; its inspiration was essentially neo-classical and based on a practical variant of general equilibrium theory. The Cambridge UK group, which was known as the Cambridge Economic Policy Group (CEPG) or the New Cambridge school, used the stock-flow consistent framework mainly for forecasting whether an expansion was *sustainable*, as Godley (1999c) still does today, and to discuss the balance of payments problems that were then plaguing the United Kingdom.

Both research groups faded in the middle of the 1980s, as their funding was cut off, and their ideas, whatever their importance or their relevance, were put on the back-burner, and overtaken by research based on the representative agent, as in New Classical and New Keynesian economics.[13] But these new models are devoid of the comprehensive outlook that characterizes the approach advocated by the Yale school and the CEPG, as could be seen from a reading of Tobin (1982a) and Godley and Cripps (1983) respectively, or by the reading of other outstanding individual contributions to the stock-flow consistent approach, such as that of Turnovsky (1977) or Fair (1984).

The more recent work of Godley (1996, 1997, 1999a), which has led to the creation of the present book, owes a substantial debt to Tobin, most particularly the work of Tobin as it appears in Backus, Brainard, Smith and Tobin (1980),

the work of students and colleagues from various countries, such as Lequain (2003), Kim (2006a,b), Mouakil (2005), Le Héron and Mouakil (2005), Tymoigne (2006), Clévenot and Mazier (2005).

[13] It is true that mainstream economists have retained the intertemporal budget constraints of the representative agent, which is a form of stock-flow consistency internal to a single sector, but the stock-flow consistency required throughout the various sectors of the economy has been left in the void.

which presented the most explicit and most empirically-oriented version of the research programme that was being pursued at Yale University on the stock-flow consistent approach to macroeconomic modelling.[14] Indeed, because the paper was empirically oriented, it contains many heterodox features which are not present in the other Tobin papers. The present book, in some directions, goes further than those previously enlightened authors, or so we believe, and it also treks along paths that were not suggested by these precursors – paths that generally have a post-Keynesian flavour.[15]

1.5 Some links with the 'old' Yale school[16]

In his Nobel lecture, Tobin (1982a: 172–3) identified the main features that distinguished his work. Four features stood out, and they certainly apply to the present book.

1. Tracking of stocks and precision regarding time;
2. Several assets and rates of return;
3. Modelling of financial and monetary policy operations;
4. The budget constraint and the adding-up constraint.

We have already extensively discussed feature (1). It is simply the idea that one should adopt a stock-flow coherent approach to modelling. This implies, as was pointed out by Turnovsky (1977: 3), that there are *intrinsic dynamics*, that reflect 'the dynamic behaviour stemming from certain logical relationships which constrain the system; specifically the relationships between stocks and flows', and which cause the modelled system to evolve over time. The short-run determination of macroeconomic variables is one among several steps of a dynamic sequence. These intrinsic dynamics must be distinguished from the *lag dynamics*, which are involved with the passage of time. These lags insure that causes precede effects, so that we keep the time-sequence right and understand the processes at work. Lags, even small ones, are required to avoid telescoping time (Hicks 1965: 66–7), and they will be extensively used in our models – more so than in Tobin's own models. As well, we shall often be appealing to the existence of stock-flow *norms*, both for firms and for households. These norms are well known in the case of governments, where political discussions often centre around sustainable public debt to GDP ratios.

[14] 'The paper could not have been written without Tobin's monumental contribution to the subject' (Godley 1997: 48).

[15] See Chapter 13 for a more detailed assessment of the specific behavioural equations and closures used in our models, compared with those of Tobin.

[16] This section has strongly benefited from the assessment provided by Dos Santos (2002a,b).

Feature (2) says that a comprehensive model should have several assets and several rates of return. Tobin objected to the standard representation of the IS/LM model, which has only one explicit rate of return, the bill rate, and one explicit asset, money. Since financial relations are so important in a modern economy, a sophisticated financial framework must be developed to understand the various interactions between borrowers and lenders, as well as the role of the banking system. In our book, we shall experiment with various numbers of assets, and various kinds of assets. In some models, where we wish to emphasize other blocks of the economy, we shall stick to a single monetary. However, in most chapters, there will be indeed a multiplicity of assets and liabilities, each with their own rate of return. The portfolio choice of households will follow the tracks laid out by Brainard and Tobin (1968) in their famous 'pitfalls' article. This hypothesis has been abandoned by the profession (on the grounds that its econometric performance, due to collinearity problems, was 'a mixed success at best' (Buiter 2003: 7), but, as we have already argued, there is no theoretical reason to assume that Tobin's asset demands are (stable enough to be) amenable to econometric treatment in the first place.

Feature (3), the modelling of financial and monetary policy, will be a key part of our book. How the stocks of the various assets are being supplied, in particular by the monetary authorities and the government, will be described in detail. Whatever financial or monetary rule must be followed will be modelled precisely. Indeed, how the banking and financial systems are precisely being modelled constitutes one of the major differences between the Yale approach on the one hand and the New Cambridge approach which is being advocated here.

Finally, there is feature (4), which says that agents must respect their budget constraint, both in regard to their expectations and when they assess realized results. In the case of expected results, this is sometimes referred to as Walras' Law, as does Tobin in his Nobel lecture, but we would rather refer to a budget constraint or to a system-wide consistency requirement. In a water-tight accounting framework, the transaction flows of the ultimate sector are entirely determined by the transaction flows of the other sectors. Indeed, we shall see that this consistency requirement always implies an additional equality, which must not be included into the model when simulation programs are run. Feature (4) means that there cannot be any *black hole*. In the words of Godley and Cripps (1983: 18), 'the fact that money stocks and flows must satisfy accounting identities in individual budgets and in an economy as a whole provides a fundamental law of macroeconomics analogous to the principle of conservation of energy in physics'. While consistency is required at the accounting level, it is also required at the behavioural level. This consistency requirement is particularly important and useful in the case of portfolio choice with several assets, where any change in the demand for an asset, for a given amount of expected or end-of-period wealth, must be

reflected in an overall change in the value of the remaining assets which is of equal size but opposite sign.

The above four features distinguish the work of Tobin and that of the New Haven school, along with the work of individuals such as Turnovsky (1977), compared with that of standard mainstream macroeconomics.[17] The same features apply to the work and the approach being presented in this book. Thus, on the method – consistent accounting, consistent stock-flow analysis and consistent adding-up constraints on behavioural relationships – the New Haven school and the New Cambridge school are in agreement.[18] In addition, as already pointed out, the modelling of portfolio behaviour by households in the present book is essentially being inspired by the method propounded by Brainard and Tobin (1968).

However, agreement on the method does not preclude disagreement on the model. While it is crucial to have coherent accounting and stock-flow consistency, the behaviour of the model and its results depend as well on the *closure* and the *causality* of the model, that is, on the behavioural equations that will be associated with the accounting equations. More precisely, as defined by Lance Taylor (1991: 41): 'Formally, prescribing closure boils down to stating which variables are endogenous or exogenous in an equation system largely based upon macroeconomic accounting identities, and figuring out how they influence one another .... A sense of institutions and history necessarily enters into any serious discussion of macro causality'. It is at this stage of modelling that the work that we pursue can be best distinguished

[17] For instance, in Hicks's (1937) famous IS/LM model of Keynes's *General Theory* (1936), investment is carried on, and saving occurs, while the supply of money is assumed to be exogenous to the model. What happens to wealth or debt at the end of the period is never discussed. Whereas the money stock ought to be an endogenous variable, determined by the system, it is assumed to be exogenous and controlled by the monetary authorities. As pointed out by Tobin (1982a: 187), 'the conventional strategy is to model the determination of asset prices and interest rates as a temporary stock equilibrium independent of flows of new saving'. The stock-flow consistent approach to macroeconomic modelling, advocated here and advocated by Tobin, precisely goes beyond this temporary equilibrium, where time seems to be frozen and the flows of investment and household saving have no impact on fixed capital, debt, wealth, and money stocks. The IS/LM model is only one slice of time (Tobin 1982a: 172), and a bad one at that.

[18] We thus disagree with a statement by Victoria Chick (1992: 81), who said that 'economics is not about the logical consistency of models – mercifully, as very few models are logically consistent and those which are, are sterile'. However we do agree with the rest of her paragraph, when she writes that 'models involve compromise, and the trick [is] to find the right compromise for the problem at hand'. All sorts of simplifications must be introduced, and different simplifications will be needed depending on the problem at hand. However, compromise cannot involve a lack of stock-flow consistency.

from that of the New Haven school. As we shall see our book is essentially post-Keynesian or heterodox, rather than neo-classical Keynesian as is the case of Tobin's work. Still, as was advocated by Thomas Palley (1996: 2), to add some aspects of Yale Keynesianism to heterodox post-Keynesian theory may yield a good mix.

1.6 Links with the post-Keynesian school

In contrast to neo-classical economics, the adjustment processes towards the steady state will be based on simple reaction functions to disequilibria. There will be no need to assume that firms maximize profit or that agents optimize some utility function, nor will there be any need to assume that agents have perfect information or know perfectly how the macroeconomic system behaves. In other words, there is no need nor no room for the rational expectations hypothesis. Still agents in our models are rational: they display a kind of *procedural rationality*, sometimes misleadingly called *weak rationality* or *bounded rationality,* or more appropriately named *reasonable rationality*.[19] They set themselves norms and targets, and act in line with these and the expectations that they may hold about the future. These norms, held by agents, produce a kind of autopilot. Mistakes, or mistaken expectations, bring about piled-up (or depleted) stocks – real inventories, money balances, or wealth – that signal a required change in behaviour. With stock-flow norms, the exact way in which expectations are formed generally is not crucial. In addition, except in the simplest models, agents will be assumed to know only the values taken by the various key variables of the previous period, and not those of the current period. This information about the past will allow them to make predictions about future values, but in a world of uncertainty. The required behavioural assumptions are not very strong. What is needed is an appropriate knowledge of the structure of the economy and the functioning of its main institutions.[20]

[19] Several psychologists now argue that people take their decisions on the basis of satisficing, that is when thresholds have been met as Herbert Simon (1959) would put it, and on the basis of fast and frugal heuristics, and that these heuristics give rise to decisions which are as valid if not better than decisions that would be based on compensatory criteria or linear regressions. See Gigerenzer and Todd (1999).

[20] As shown in Lavoie (2006b), our views on this are very close to those of Duménil and Lévy (1993: ch. 10), who advocate the *principle of adjustment* to observed disequilibria by decentralized agents or institutions, in opposition to the optimization principle used by neo-classical authors , and in opposition to the centralized tâtonnement of the Walrasian commissaire-priseur. As Duménil and Lévy (1995: 372) point out, 'adjustment concerns all behaviour. … It can serve to describe the behaviour of an individual … it applies to an institution, like a firm. We can also apply it to the banking system and the entire system that governs monetary policy.'

This kind of epistemology, that is, this theory of available knowledge, is quite in line with a brand of economics which has become known as post-Keynesian or Post Keynesian economics. Post-Keynesian economics is associated with a fundamentalist reading of John Maynard Keynes's *General Theory* but it is also associated with the work of the Polish economist Michal Kalecki, who is said to have discovered Keynes's principle of effective demand on his own. The other features of Kalecki's models – imperfect competition, imperfect information, markup pricing, fixed technical coefficients, the relevance of income distribution, the role of capacity utilization and corporate retained profits, the importance of lags and time, long-run trends being conceived as 'a slowly changing component of a chain of short period situations' (1971: 165) – are all characteristics that have been taken over by the better-known Cambridge economists, in particular Joan Robinson and Nicholas Kaldor. Most of these features are incorporated into the present book, and they have been discussed at length in the past by both authors (Godley and Cripps 1983; Lavoie 1992).

It should be pointed out that Kaleckian markup pricing is a specific variant of the more generic *cost-plus* pricing (Lee 1998; Lavoie 2001a). Cost-plus pricing asserts that prices are determined by unit costs, somehow measured, to which is added a costing margin. For a long time, heterodox Cambridge economists denied that Kaleckian markup pricing had anything to do with full-cost pricing or normal cost pricing as developed by members of the Oxford Economists' Research Group, such as Hall and Hitch (1939), P.W.S. Andrews (1949) and Andrews and Brunner (1975). It is now generally acknowledged that Kaleckian markup pricing and Andrewsian normal cost pricing are based on the same general conceptual cost-plus framework. One of us studied under Andrews and worked under Hall, and has done a substantial amount of empirical work vindicating their theories (Coutts, Godley and Nordhaus 1978), which may help to explain why full-cost pricing or normal pricing is such an integral part of the more realistic models to be deployed in the latter chapters. Because cost-plus pricing ties together labour costs, interest costs and normal profits, it is also crucial in determining income distribution, which is of such importance in heterodox economics.

Our book also has links with post-Keynesian theory because of its emphasis on *monetary* macroeconomics. Post-Keynesians attribute great importance to the fact that Keynes wished to deal with a monetized economy of production, an *entrepreneur* economy in the words of Keynes. This means that production is made possible by bank advances, while firms go into debt before attempting to recover monetary proceeds. This also means that households hold financial assets, as well as real ones, and that this feature has to be taken into consideration when dealing with their behaviour. In particular, it should be clear, as was already pointed out by Davidson (1968a), that although households hold property rights to corporations, in the form of equities which carry a certain rate of return, they do not directly hold the physical

capital goods used in the production process, and hence do not make their portfolio decisions on the basis of the profit rate generated by these capital goods.

This focus on the monetary side of production, debt and portfolio behaviour requires a serious examination of the banking system and of the financial system more generally. Banks and their balance sheets have to be fully integrated to the production process, and interest flows have to be taken into account explicitly. Our accounting framework will allow us to do just that. In addition, this framework will allow us to describe and understand the monetary circuit, that is, the monetary creation, circulation and destruction that accompanies production and wealth creation. The role of government expenditures, and their link with monetary creation and interest rates prevailing on government securities will also be understood through the use of the same rigorous accounting framework. In particular, that the money stock is *endogenous*, as post-Keynesians such as Kaldor (1970, 1982) and Robinson (1956, ch. 23) have long asserted, will be a crucial element of our models.

Another feature of post-Keynesian models, which can be associated with the *principle of effective demand*, is that market clearing through prices does not usually occur except in financial markets. The real markets, those for products and labour, are assumed to be demand-led. Full employment of labour is not assumed, nor is full employment of capacity, although, in the later chapters, where the possibility of inflation is introduced, high levels of employment or capacity will be assumed to generate inflationary pressures. In that sense, one can say that our later models will be demand-led but eventually supply constrained. Post-Keynesians believe that if market forces based on price clearing were to act on the labour market, they would generate instability. As to product markets, when dealing with the simplest models it will be assumed that supply adjusts to demand – the reverse of Say's law – while when dealing with more realistic models there will be another sort of quantity adjustment, a partial one, through inventories. It follows that the models to be described are typically *Keynesian*: product markets clear through quantity adjustments, and the models are *demand-led*. The lack of production capacity, brought about by insufficient past investments will not be discussed here although it may provide a possible explanation of current unemployment.

Our claim is thus that the present modelling approach is an integral part of the post-Keynesian school.[21] Indeed, as emphasized by Dos Santos (2005), there is a long tradition among post-Keynesian authors in attempting to analyse together flows and financial stocks, as can be seen from the works of Davidson (1968a,b), Minsky (1975, 1986) and Eichner (1987), just to mention

[21] See Harcourt (2006) for a recent review of post-Keynesian thought.

a few well-known authors, and more recently from Dalziel (2001).[22] The purpose of our book is to make this concern more explicit.

1.7 A sketch of the book

1.7.1 How the book was written

Our approach is to present a series of models, starting from very simple ones so that the reader can fully comprehend the methodology which is being advocated here, as well as its implications. Gradually, various complications will be added to the basic model, and these complications will make the model richer and more realistic, enabling us to understand more features of the real world surrounding us. Initially, some of the added complications will be removed, leaving room for yet other realistic complications, which will allow us to deal with new facets of reality. To give two instances, price inflation, and its adequate accounting, will not be considered in the initial stages of the book; similarly, open economies will only be considered at first within a highly simplified setting. As a result, we shall present first a series of highly simplified models, the behaviour of which shall be simple enough to be understood intuitively. Only towards the end of the book shall we consider some of these complications all at the same time.

All the descriptions of models in the text were preceded by the construction of a numerical simulation model which the computer solved successfully and displayed. This procedure guaranteed that each model was complete and that the accounting was correct, that is to say that the model endogenized all the relevant variables, that it yielded a stable solution and that the missing equation was satisfied. We found the simulation experiments, some of which will be illustrated later on, to be extremely instructive. It has to be admitted that the text does not always do justice to the insights we obtained.

1.7.2 And how it should be used

As most of our models do not lend themselves to analytic solution, we strongly recommend readers to carry out simulations for themselves (Table 1.4). It will be via the experience of trying out alternative values for exogenous variables and parameters – and, indeed, by changing the models themselves – that major intuitions will be achieved. It will be found that key results will be far less arbitrary (less open to the 'garbage in garbage out' gibe) than one might suppose. The reader will be able quite easily to verify our results and conduct his or her own experiments because our colleague Gennaro Zezza has set up every one of our models (complete with data and solution routine) in a form that can be readily accessed.[23]

[22] See A1.1 for more details on the links with previous post-Keynesian authors.
[23] At www.gennaro.zezza.it/software/models.

Table 1.4 Suggested reading sequence

Undergraduate students	Graduate students and professors
Chapter 1	Chapter 1
Chapter 3	Chapter 2
Chapter 4	Chapter 4
Chapter 5	Chapter 5
Chapter 6	Chapter 6
Chapter 2	Chapter 7
	Chapter 8
	Chapter 9
	Chapter 10
	Appendices 3.3 and 3.4
	Chapter 11
	Chapter 12
	Chapter 13

The material to be covered in Chapter 2, is undoubtedly difficult for undergraduates. But this material is also of the utmost importance, because it will clearly illustrate why the method and the approach advocated in this book is different from that to be found in standard macroeconomics. There is thus some dilemma here. As a strategic move, undergrads may prefer to skip Chapter 2, and jump right away into Chapter 3, where a very simple model – the simplest we could imagine – illustrates some of the principles which have been evoked in this introductory chapter. After having worked out the models presented in the next three chapters, where these principles appear time and time again, in various simplified economies, usually with several assets, the reader should become drilled enough to understand the material presented in Chapter 2. It would then be quite advisable to track back to that chapter, where the reader will find the answers to some of the queries that could have arisen while dealing with the formal models see (Table 1.4).

A1.1: Stock-flow relations and the post-Keynesians

In her survey of post-Keynesian economics, Chick (1995) considers that stock-flow analysis is among its achievements. Chick refers to the works of Hyman Minsky, who she says was always concerned by the gap between flow analysis and its stock implications. The influence of Minsky can also be felt in Wray (1990: ch. 9), where a balance sheet approach including firms, banks and households is being proposed to explain the appearance of endogenous money. Chick (1995) also refers to the balance-sheet approach of Godley and Cripps (1983), which elsewhere, in Chick (1992: 81), she called 'a very successful integration of stocks and flows'. In an article originally published in 1973, Chick (1992) challenged the separation of IS from LM and said that the IS/LM model only made sense in a stationary equilibrium, arguing that if one could ignore

the impact of investment on output capacity, one could not ignore the immediate financial consequences of investment financing. In this article, Chick also directs the reader towards two articles of Paul Davidson. In the first one, Davidson (1968a) criticizes Kaldor (1966) for omitting money balances in his famous neo-Pasinetti growth model with stock equities, which is at the origin of an important and successful attempt at integrating growth of output flows and portfolio analysis, that of Peter Skott (1989). In his second paper, Davidson (1968b) provides an excellent critique of Tobin's growth model and portfolio analysis. Davidson underlines the fact that that Tobin does not introduce an independent investment function, which is the hallmark of Keynesian analysis, so as to avoid Say's law, thus assuming that households choose between money balances and real capital, whereas their choice ought to be between money balances and placements, that is, securities or equities. While putting forward his own q-theory of investment, before Tobin, while not attaching much faith in it, Davidson points out that more household saving would lead to higher valuation ratios, and hence, lower long-term yields or dividend yields, but that this will not in general lead to faster investment. Both of these Davidson papers show a substantial concern for stock-flow consistency.

Another post-Keynesian author who is clearly concerned with stock-flow consistency is Alfred Eichner (1987), in his synthesis of post-Keynesian economics. Eichner (1987: ch. 12) also presents the endogeneity of money, the creation of loans, as well as clearinghouse and central bank operations through a balance-sheet approach, where he makes a distinction between the financial sector and two non-financial sectors. Eichner explicitly ties this approach to the flow-of-funds approach of Jacob Cohen (1986) and to the work of Godley and Cripps (1983). The post-Keynesian theory and the flow-of-funds approach also intersect in a paper by Alan Roe (1973), who also worked with Richard Stone in the early 1970s to establish flow-of-funds measures of financial interdependence, in a way which closely resembles the coefficients of Leontief's input-output analysis, as recently advocated by Lawrence Klein (2003). Roe (1973) believes that individuals and institutions generally follow stock-flow norms related to their assets, liabilities, income or sales, but that during expansion, because of improved expectations, they may agree to let standards deteriorate. Roe is particularly concerned with brisk attempts at changing the composition of portfolios, when cash flows or expectations return to normal values. This sounds very much like Minskyan economics, and indeed it is, as Roe explicitly refers to the work of Minsky on financial fragility, showing that a stock-flow consistent framework is certainly an ideal method to analyse the merits and the possible consequences of Minsky's financial fragility hypothesis.[24]

The ties between flow-of-funds analysis and post-Keynesian economics are reinforced by the fact that most proponents of financial flows analysis were heterodox economists, associated more or less closely with (old) Institutionalism. For instance, in the preface to his handbook on flow-of-funds analysis, Dawson (1996: xx) says that 'the book will reveal me as an institutionalist, practical in orientation, and skeptical of economic doctrine'. Dawson (1996: 5) points out that 'the acceptance of … flow-of-funds accounting by academic economists has been an uphill battle because its implications run counter to a number of doctrines deeply embedded in the minds of economists', and he adds that Morris A. Copeland, who is considered to

[24] On this specific issue, see the recent efforts of Dos Santos (2005) and Tymoigne (2006).

be the inventor of flow-of-funds accounts, 'himself was at pains to show the incompatibility of the quantity theory of money with flow-of-funds accounting'. Indeed, James Millar (1996: 85) claims that 'Copeland always proudly proclaimed his commitment to institutionalism' even though he is not 'fully recognized today as an institutionalist'. He can surely be recognized as some early radical post-Keynesian author, since Copeland argued that 'the changes Keynes introduced represented modifications of neoclassicism, not its rejection', adding, as early as the late 1950s that 'Keynes was being brought back into the neoclassical church' – an assessment which looks quite similar to those that Cambridge Keynesians such as Robinson and Kaldor were also making at that time.