2
Balance Sheets, Transaction Matrices and the Monetary Circuit

2.1 Coherent stock-flow accounting

Contemporary mainstream macroeconomics, as it can be found in intermediate textbooks, is essentially based on the system of national accounts that was put in place by the United Nations in 1953 – the so-called Stone accounts. At that time, some macroeconomists were already searching for some alternative accounting foundations for macroeconomics. In the United States, Morris A. Copeland (1949), an institutionalist in the quantitative Mitchell tradition of the NBER, designed the first version of what became the flow-of-funds accounts now provided by the Federal Reserve since 1952 – the Z.1 accounts. Copeland wanted to have a framework that would allow him to answer simple but important questions such as: 'When total purchases of our national product increase, where does the money come from to finance them? When purchases of our national product decline, what becomes of the money that is not spent?' (Copeland 1949 (1996: 7)).

In a macroeconomic textbook that was well-known in France, Jean Denizet (1969) also complained about the fact that standard macroeconomic accounting, designed upon Richard Stone's social accounting, as eventually laid out in the 1953 United Nations System of National Accounts, left monetary and financial phenomena in the dark, in contrast to the approach that was advocated from the very beginning by some accountants (among which Denizet) in the Netherlands and in France. In the initial standard national accounting – as was shown in its most elementary form with the help of Table 1.1 – little room was left for banks and financial intermediaries and the accounts were closed on the basis of the famous Keynesian equality, that saving must equal investment. This initial system of accounts is a system that presents 'the sector surpluses that ultimately finance real investment', but it does not present 'any information about the flows in financial assets and liabilities by which the saving moves through the financial system into investment. These flows in effect have been consolidated out' (Dawson 1991 (1996: 315)). In standard national accounting, as represented

by the National Income and Product Accounts (NIPA), there is no room to discuss the questions that Copeland was keen to tackle, such as the changes in financial stocks of assets and of debts, and their relation with the transactions occurring in the current or the capital accounts of the various agents of the economy. In addition, in the standard macroeconomics textbook, households and firms are often amalgamated within a single private sector, and hence, since financial assets or debts are netted out, it is rather difficult to introduce discussions about such financial issues, except for public debt.

The lack of integration between the flows of the real economy and its financial side greatly annoyed a few economists, such as Denizet and Copeland. For Denizet, J.M. Keynes's major contribution was his questioning of the classical dichotomy between the real and the monetary sides of the economy. The post-Keynesian approach, which prolongs Keynes's contribution on this, underlines the need for integration between financial and income accounting, and thus constitutes a radical departure from the mainstream. [1] Denizet found paradoxical that standard national accounting, as was initially developed by Richard Stone, reproduced the very dichotomy that Keynes had himself attempted to destroy. This was surprising because Stone was a good friend of Keynes, having provided him with the national accounts data that Keynes needed to make his forecasts and recommendations to the British Treasury during the Second World War, but of course it reflected the initial difficulties in gathering enough good financial data, as Stone himself later got involved in setting up a proper framework for financial flows and balance sheet data (Stone 1966).[2]

By 1968 a new *System of National Accounts* (SNA) was published by the national accountants of the UN. This new system provided a theoretical scheme that stressed the integration of the national income accounts with financial transactions, capital stocks and balance sheet (as well as input-output accounts), and hence answered the concerns of economists such as Copeland and Denizet. The new accounting system was cast in the form of a matrix, which started with opening assets, adding or subtracting production, consumption, accumulation and taking into account reevaluations, to obtain, at the bottom of the matrix, closing assets. This new integrated accounting system has been confirmed with the revised 1993 SNA.

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[1] Such an integration of financial transactions with real transactions, within an appropriate set of sectors, was also advocated by Gurley and Shaw (1960: ch. 2) in their well-known book, as it was by a number of other authors, inspired by the work of Copeland, Alan Roe (1973) for instance, whose article was appropriately titled 'the case for flow of funds and national balance sheet accounts'.

[2] Various important surveys of flow-of-funds analysis and a stock-flow-consistent approach to macroeconomics can be found, among others in Bain (1973), Davis (1987), Patterson and Stephenson (1988), Dawson (1996).

Several countries now have complete flow-of-funds accounts or financial flows accounts, as well as national balance sheet accounts, so that by combining the flow-of-funds account and the national income and product account, and making a few adjustments, linked in particular to consumer durable good, it is possible to devise a matrix that accomplishes such an integration, as has been demonstrated by Backus *et al.* (1980: 270–1). The problem now is not so much the lack of appropriate data, as shown by Ruggles (1987), but rather the unwillingness of most mainstream macroeconomists to incorporate these financial flows and capital stocks into their models, obsessed as they are with the representative optimizing microeconomic agent. The construction of this integrated matrix, which we shall call the *transactions flow matrix*, will be explained in a later section. But before we do so, let us examine a simpler financial matrix, one that is better known, the *balance sheet matrix* or the *stock matrix*.

2.2 Balance sheets or stock matrices

2.2.1 The balance sheet of households

Constructing the balance sheet matrix, which deals with asset and liability stocks, will help us understand the typical financial structure of a modern economy. It will also give clues as to the elements that ought to be found in the transaction flow matrix.

Let us consider a simple closed economy. Open economies will not be examined at this stage because, for the model to be fully coherent, one would need to consider the whole world, that is, in the simplest open-economy model, one would need to consider at least two countries.

Our simple closed economy contains the following four sectors: the household sector, the production sector (made up of firms), the financial sector (essentially banks) and the government sector. The government sector can itself be split into two subsectors: the pure government sector and the central bank. The central bank is a small portion of the government sector, but because it plays such a decisive role with respect to monetary policy, and because its impact on monetary aggregates is usually identified on its own, it may be preferable to identify it separately.

Before we describe the balance sheet matrix of all these sectors, that is, the *sectoral* balance sheet matrix, it may be enlightening, in the first stage, to look at the balance sheet of individual sectors. Let us deal for instance with the balance sheet of households and that of production firms. First it should be mentioned that this is an essential distinction. In many accounts of macroeconomics, households and firms are amalgamated into a single sector, that is, the private sector. But doing so, would lead to a loss in comprehending the functioning of the economy, for households and production firms take entirely different decisions. In addition, their balance sheets show substantial

differences of structure, which reflect the different roles that each sector plays. For the same reasons, it will be important to make a distinction between production firms (non-financial businesses) and financial firms (banks and the so-called non-banking financial intermediaries).

We start with the balance sheet of households, since it is the most intuitive as shown in Table 2.1. Households hold tangible assets (their tangible capital K_h). This tangible capital mainly consists of the dwellings that households own – real estate – but it also includes consumer durable goods, such as cars, dishwashing machines or ovens. An individual may also consider that the jewellery (gold, diamonds) being kept at home or in a safe is part of tangible assets. But in financial flow accounts, jewellery is not included among the tangible assets. Households also hold several kinds of financial assets, for instance bills B_h, money deposits M_h, cash H_h and a number e of equities, the market price of which is p_e. Households also hold liabilities: they take loans L_h to finance some of their purchases. For instance households would take mortgages to purchase their house, and hence the remaining balance of the mortgage would appear as a liability.

The difference between the assets and the liabilities of households constitutes their *net worth*, that is, their *net wealth* NW_h. The net worth of households is a residual, which is usually positive and relatively substantial. This is because households usually spend much less than they receive as income, and as a result they accumulate net financial assets and tangible (or real) assets. Note, however, that if equity prices (or housing prices) were to fall below the value at which they were purchased with the help of loans taken for pure speculative purposes – as would happen during a stock market crash that would have followed a stock market boom – the net worth of households taken overall could become negative. This is because household

Table 2.1   Household balance sheet

Assets	64,000	Liabilities	64,400
Tangible capital K_h	25,500	Loans L_h	11,900
Equities $e \cdot p_e$		Net Worth NW_h	52,100
Bills B_h			
Money deposits M_h	5,900		
Cash H_h			

Source: Z.1 statistics of the Federal Reserve, www.federalreserve.gov/ releases/z1, Table B.100, 'Balance sheet of households and nonprofit organizations', March 2006 release; units are billions of dollars.

assets, in particular real estate and shares on the stock market, are valued at their market value in the balance sheet accounts.[3]

In the case of American households, this is not likely to happen, based on the figures presented in Table 2.1, which arise from the balance sheet of households and nonprofit organizations, as assessed by the Z.1 statistics of the Federal Reserve for the last quarter of 2005. Loans represent less than 20% of net worth. Tangible assets – real estate and consumer durable goods – plus deposits account for nearly 50% of total assets. The other financial assets are not so easy to assign, since a substantial portion of these other assets, including equities and securities, are held indirectly, by pension funds, trust funds and mutual funds.

In general net worth turns out to be positive. A general accounting principle is that balance sheets ought to *balance*, that is, the sums of all the items on each side of the balance sheet ought to equal each other. It is obvious that for the balance sheet of households to balance, the item *net worth* must be *added* to the *liability side* of the household balance sheet, since net worth is positive and the asset value of households is larger than their liability value.

In the overall balance sheet matrix, all the elements on the asset side will be entered with a plus sign, since they constitute additions to the net worth of the sector. The elements of the liability side will be entered with a negative sign. This implies that net worth will be entered with a negative sign in the balance sheet matrix, since it is to be found in the liability side. These conventions will insure that all the rows and all the columns of the balance sheet matrix sum to zero, thus providing consistency and coherence in our stock accounting.

2.2.2   The balance sheet of production firms

It could be sufficient to deal with the household sector, since the balance sheets of all sectors respond to the same principles. The balance sheet of firms, however, suffers from one additional complication, which is worth looking at. The complication arises from the existence of corporate equities. In some sense, the value of these shares is something which the firm owes to itself, but since the owners consider the value of these shares to be part of their assets, it will have to enter the liability side of some other sector where we have to be fully consistent. Equities pose a problem 'because they are financial assets to whoever holds them, but they are not, legally, liabilities of the issuing corporation' (Ritter 1963 (1996: 123)), in contrast to corporate paper or corporate bonds issued by the firm. This implies that interest payments

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[3] This is how it should be; but some statistical agencies still register real estate or stock market shares at their acquisition value.

are a contractual obligation, whereas the payment of dividends is not – it is at the discretion of the board of directors.

However, in practice, as pointed out by Joan Robinson (1956: 247–8), this distinction becomes fuzzy since directors are reluctant to cut off dividends (because of the negative signal that it sends to the markets) and because creditors often will accept to forego interest payments temporarily to avoid the bankruptcy of their debtor. As a result, as suggested by Ritter (1963 (1996: 123)), 'for most purposes the simplest way to handle this is to assume that corporate stocks and bonds are roughly the same thing, despite their legal differences and treat them both as liabilities of the corporation'.

This is precisely what we shall do. The current stock market value of the stock of equities which have been issued in the past shall be assessed as being part of the liabilities of the firms. By doing so, as will be clear in the next subsection, we make sure that a financial claim is equally valued whether it appears among the assets of the households or whether it appears on the liability side of the balance sheet of firms. This will insure that the row of equities in the overall sectoral balance sheet sums to zero, as all other rows of the matrix. The balance sheet of production firms in our framework, will thus appear as shown in Table 2.2.

It must be noted that all the items on this balance sheet (except inventories) are evaluated *at market prices*. This distinction is important, because the items on balance sheets of firms, or at least some items, are often evaluated *at historical cost*, that is, evaluated at the price of acquisition of the assets and liabilities (the price paid *at the time that the assets and liabilities were purchased*). In the present book, balance sheets at *market prices* will be the rule. This means that every tangible asset is evaluated at its replacement value, that is, the price that it would cost to produce this real asset now; and every financial asset is evaluated at its current value on the financial markets. For instance, a $100 bond issued by a corporation or a government may see its price rise temporarily to $120. With balance sheets evaluated at market prices, the bond will be entered as a $120 claim in the balance sheets of both the holder

Table 2.2   Balance sheet of production firms at market prices, *with* equities as a liability

Assets	2001	2005	Liabilities	2001	2005
Total	17,500	22,725	Total	17,500	22,725
Tangible capital K_f	9,200	11,750	Loans L_f	9,100	10,125
Financial assets M_f	8,300	11,975	Equities issued $e_f \cdot p_{ef}$	10,900	10,925
			Net Worth NW_f	−2,500	+1675

Source: Z.1 statistics of the Federal Reserve, www.federalreserve.gov/releases/z1, Table B.102, 'Balance sheet of nonfarm nonfinancial corporate business', March 2002 and 2006 releases, last quarter data; units are billions of dollars.

and the issuer of the bond, although the corporation or the government still look upon the bond as a $100 liability.

However, in the case of firms, the combination of equities treated as a debt of firms with market-price balance sheets yields counter-intuitive results. This is why it becomes important to study in detail the balance sheets of firms. Balance sheets computed at market prices and treating equities issued by firms as a liability of the firm are the only ones that will be utilized in the book because they are the only balance sheets which can be made coherent within the matrix approach which is advocated here.

In the example given by Table 2.2, firms have an array of tangible capital – fixed capital, real estate, equipment and software, and inventories, which, evaluated at *production prices* or *current replacement cost*, that is, at the price that it would cost to have them replaced at current prices, are worth K_f.[4] The numbers being provided are in billions of dollars and are those of the United States economy at the end of the fourth quarters of 2001 and 2005, as they can be found in the flow-of-funds Z.1 statistics of the Federal Reserve. In 2005, tangible assets thus held by nonfinancial corporate business amounted to $11,755 billions. Financial assets of various sorts amounted to $11,975 billions, and hence total assets were worth $22,725 billions.

On the liability side, liabilities are split into two kinds of liabilities. First there are liabilities to 'third parties', which we have summarized under the generic term loans L_f, but which, beyond bank loans, comprises notably corporate paper, corporate bonds and all other credit market instruments. Second, there are liabilities to 'second parties', that is, the owners of the equity of firms. In our table, all these liabilities are valued at market prices. In the case of equities, an amount of e_f shares have been issued over the years, and the current price of each share on the stock market is p_{ef}. The market value of shares is thus $E_f = e_f \cdot p_{ef}$. In 2005, 'loans' L_f amounted to $10,125 billions, while equities E_f were worth $10,925 billions, for an apparent total liability amount of $21,050 billions. Compare this to the total asset amount of $22,725 billions. This implies, to insure that the value of total liabilities is indeed equal to the value of total assets, that in 2005 the net worth of the firm, NW_f as shown in Table 2.2, is positive and equal to +$1700 billions.

But the situation could be quite different and net worth as measured here could be negative, as we can observe from the 2001 data, where we see that net worth then was negative and equal to $2500. Such a negative net worth

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[4] Real estate, as in the case of residential dwelling, evaluated at market prices, but it will enter none of our models. Capital goods are valued at their replacement price. *Inventories* are valued at their *current cost of production*. All these assets are valued neither at their historical cost of acquisition, nor at the price which firms expect to fetch when these goods will be sold. This will be explained in greater detail in Chapter 8.

value will arise whenever the net financial value of the firm is larger than the replacement value of its tangible capital. The ratio of these two expressions is the so-called q-ratio, as defined by Tobin (1969). Thus whenever the q-ratio is larger than unity, the net worth is negative.[5] A similar kind of macroeconomic negative net worth could plague the financial firms, the banks, if banks issue shares as they are assumed to do in the stock matrix below. This will happen when the agents operating on the stock market are fairly optimistic and the shares of the firm carry a high price on the stock market. The negative net worth of the firm is a rather counter-intuitive result, because one would expect that the firm does well when it is being praised by the stock market.

This counter-intuitive phenomenon could be avoided either if accounting at historical cost was being used or if equities were not considered to be part of the liabilities for which firms are responsible. Obviously, accounting at historical cost in the case of the producing firms would make the whole macroeconomic accounting exercise incoherent. In particular the macroeconomic balance sheet matrix, to be developed below, would not balance out. Also, such accounting at cost would omit price appreciation in assets and products.[6] Another way out, which national accountants seem to support, is to exclude the market value of issued shares from the liabilities of the firms. This is the approach taken by the statisticians at the Federal Reserve. As Ruggles (1987: 43) points out, this implies that 'the main break, on the liability side, is no longer between liabilities and net worth, but rather between liabilities to "third parties", on the one hand, and the sum of liabilities to "second parties", that is, owners of the enterprise's equity and net worth, on the other'. This kind of accounting, which can be found in the works of economists of all allegiances (Malinvaud 1982; Dalziel 2001), is illustrated with Table 2.3. Under this definition, the net worth, or stockholders'equity, of American nonfinancial businesses is positive and quite large ($8400 billions in 2001), as one would intuitively expect. But again, such accounting would not be fully coherent from a macroeconomic standpoint, as is readily conceded by an uneasy Malinvaud (1982: 20), unless the q-ratio were equal to unity at all times. As a result, we shall stick to balance sheets inspired by Table 2.2, which include equities as part of the liabilities of firms, keeping in mind that the measured net worth of firms is of no practical significance. Indeed, in the book, no behavioural relationship draws on its definition.

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[5] This q-ratio will also be discussed in Chapter 11.

[6] At the microeconomic level, such a situation gives rise to the appearance of a 'goodwill' asset, which takes into account the fact that some tangible asset may have been bought at a price apparently exceeding its value, because it is expected to yield superior profits in the future.

Table 2.3 Balance sheet of production firms at market prices, *without* equities as a liability

Assets	2001	2005	Liabilities	2001	2005
Total	17,500	22,725	Total	17,500	22,725
Tangible capital K_f	9,200	11,750	Loans L_f	9,100	10,125
Financial assets M_f	8,300	11,975	Net Worth NW_f	8,400	12,600

Source: Z.1 statistics of the Federal Reserve, www.federalreserve.gov/releases/z1, Table B.102, 'Balance sheet of nonfarm nonfinancial corporate business', March 2002 and 2006 releases, last quarter data; units are billions of dollars.

2.2.3   The overall balance sheet matrix

We are now ready to consider the composition of the overall balance sheet matrix, to be found in Table 2.4. We could assume the existence of an almost infinite amount of different assets; we could also assume that all sectors own a share of all assets, as is true to some extent, but we shall start by assuming a most simple outfit. The assets and liabilities of households and production firms have already been described, and we shall further simplify them by assuming away the financial assets of firms. Government issues short-term securities B (Treasury bills). These securities are purchased by the central bank, the banks, and households. Production firms and financial firms (banks) issue equities (shares), and these are assumed to be purchased by households only. We suppose that production firms (and households, as already pointed out) need loans, and that these are being provided by the banks. The major counterpart to these loans are the money deposits held by households, who also hold cash banknotes H, which are provided by the central bank. This special kind of money issued by the central bank is often called *high-powered money*, hence the H notation being used. This high-powered money is also usually being held by banks as reserves, either in the form of vault cash or as deposits at the central bank.

In models that will be developed in the later chapters, it will generally be assumed that households take no loans and the value of their dwellings will not be taken into consideration, but here we shall do otherwise for expository purposes. Finally, it will be assumed that the real capital accumulated by financial firms or by government is too small to be worth mentioning.

As already mentioned, all assets appear with a plus sign in the balance sheet matrix while liabilities, including net worth, are assigned a negative sign. The matrix of our balance sheet must follow essentially one single rule: all the columns and all the rows that deal with financial assets or liabilities must sum to zero. The only row that may not sum to zero is the row dealing with

Table 2.4   A simplified sectoral balance sheet matrix

	Households	Production firms	Banks	Government	Central bank	Σ
Tangible capital	$+K_h$	$+K_f$				$+K$
Bills	$+B_h$		$+B_b$	$-B$	$+B_{cb}$	0
Cash	$+H_h$		$+H_b$		$-H$	0
Deposits	$+M_h$		$-M$			0
Loans	$-L_h$	$-L_f$	$+L$			0
Equities	$+E_f$	$-E_f$				0
Equities	$+E_b$		$-E_b$			0
Net worth	$-NW_h$	$-NW_f$	$-NW_b$	$-NW_g$	0	$-K$
Σ	0	0	0	0	0	0

tangible capital – the actual stock of machines and inventories accumulated by the firms in the production sector and the dwellings of households. A tangible asset – a real asset – only appears in a single entry of the sectoral balance sheet, that of its owner. This is in contrast to financial assets and all liabilities, which are a claim of someone against someone else.

Reading now the column of each sector, the sum of all the components of a column represents the net worth of that sector. Thus adding the net worth, with a negative sign, to all the other elements of the column must by necessity yield a zero result. This guarantees the coherence of the balance sheet matrix. It should be noted that the net worth of the economy, as shown in the last entry of the penultimate row, is equal to the value of tangible capital assets K (Patterson and Stephenson 1988: 792). If there were only financial assets in an economy, the macroeconomic net worth would be nil.

A few additional remarks may be in order. As already mentioned, financial firms, that is, the banks, will also experience some net worth, NW_b, unless we assume by construction that they issue no shares and make no profits, as we shall sometimes do to simplify our earlier models. On the other hand, the government sector usually runs a large negative net worth (therefore, in Table 2.4, $-NW_g$ is a positive entry). This negative net worth NW_g is better known as the *public debt*, which arises as a result of past deficits. It may be noticed that the government public debt is the same whether or not we include the central bank in the government sector. This is because the profits of the central bank are always returned to the general revenues of government, so that the net worth of the central bank is zero (provided the central bank does not hold long-term bonds, the value of which can change through time, as we shall see later, and provided the central bank started to be run with no capital of its own).

2.3 The conventional income and expenditure matrix

2.3.1 The NIPA matrix

While the balance sheet matrix has its importance, the really interesting construct is the transactions flow matrix. This matrix records all the monetary transactions that are occurring in an economy. The matrix provides an accounting framework that will be highly useful when defining behavioural equations and setting up formal models of the economy. The transactions matrix is the major step in fully integrating income accounting and financial accounting. This full integration will become possible only when capital gains are added to the transactions matrix. When this is done, it will be possible to move from the opening stocks of assets, those being held at the beginning of the production period, to the closing stocks of assets, those being held at the end of the production period.

But before we do so, let us consider the conventional income and expenditure matrix, that is, the matrix that does not incorporate financial assets. This matrix arises from the consideration of the standard National Income and Product Accounts, the NIPA. We have already observed a very similar matrix, when we examined the national accounts seen from the perspective of the standard mainstream macroeconomics textbook. Consider Table 2.5. Compared with the previous balance sheet matrix, the financial sector has been scotched, amalgamated to the business sector, while the central bank has been reunited with the government sector. We still have the double entry constraint that the sum of the entries in each row ought to equal zero. This is a characteristic of all social accounting matrices.

It should be pointed out that all the complications that arise as a result of price inflation, for instance the fact that the value of inventories must be adjusted to take into account changes in the price level of these inventories, have been assumed away. In other words, product prices are deemed

Table 2.5 Conventional Income and expenditure matrix

	Households	Business		Government	Σ
		Current	Capital		
Consumption	$-C$	$+C$			0
Govt expenditure		$+G$		$-G$	0
Investment		$+I$	$-I_f$		0
[GDP (memo)]		$[Y]$			
Wages	$+WB$	$-WB$			0
Net Profits	$+FD$	$-F$	$+FU$		0
Tax net of transfers	$-T_h$	$-T_f$		$+T$	0
Interest payments	$+INT_h$	$-INT_f$		$-INT_g$	0
Σ	SAV_h	0	$FU - I_f$	$-DEF$	0

to remain constant. Unless we make this assumption we shall have to face up, at far too early a stage, to various questions concerning the valuation of capital, both fixed and working, as well as price index problems. These complications will be dealt with starting with Chapter 8.

Before we start discussing the definition of gross domestic product, the perceptive reader may have noted that capital accumulation by households seems to have entirely disappeared from Table 2.5. It was already the case in Table 1.1, but then such an omission was tied to the highly simplified nature of the standard mainstream model, where only investment by firms was considered. Why would investment in residential housing be omitted from a more complete NIPA? What happens is that, in the standard NIPA, automobiles or household appliances purchased by individuals are not part of gross capital formation; rather they are considered as part of current expenditures. In addition, to put home-owners and home-renters on an identical footing, 'home ownership is treated as a fictional enterprise providing housing services to consumer-occupants' (Ruggles and Ruggles 1992 (1996: 284)). As a result, purchases of new houses or apartments by individuals are assigned to fixed capital investment by the real estate industry; and expenditures associated with home ownership, such as maintenance costs, imputed depreciation, property taxes and mortgage interest, 'are considered to be expenses of the fictional enterprise', and 'are excluded from the personal outlays of households'. In their place, there is an imputed expenditure to the fictional real estate enterprise. This is why there is no I_h entry in Table 2.5 that would represent investment into housing.

2.3.2   GDP

In this matrix, the expenditure and income components of gross domestic product (GDP), appear in the second column. The positive and negative signs have a clear meaning. The positive items are receipts by businesses as a result of the sales they make – they are the value of production – , while the negative items describe where these receipts 'went to': they are the product of the economy. It has been assumed that every expenditure in the definition of GDP (consumption C, investment I, and government expenditures on goods and services G) is a sale by businesses, although in reality this is not quite true, government employment – which is a form of expenditure which is not a receipt by firms – being the major exception. And as a counterpart, every payment of factor income included in the income definition of GDP is a disbursement by businesses in the form of wages WB, distributed profits FD and undistributed profits FU, interest payments INT_f , and indirect taxes T_f. From the second column, we thus recover the two standard definitions of income:

$$Y = C + I + G = WB + F + INT_f + T_f \tag{2.1}$$

We must now confront the fact that firms' receipts from sales of investment goods, which from the sellers' point of view are no different from any other kind of sales, do not arise from outside the business sector itself.[7] So the double entry principle that regulates the use of accounting matrices requires us to postulate a new sector – the capital account of businesses – which makes these purchases. As we work down the capital account column, we shall eventually discover where all the funds needed for investment expenditure come from.

There is no need to assume that all profits are distributed to households as is *invariably* assumed, without question, in mainstream macroeconomics. In the transactions matrix shown above, part of the net profits earned by business are distributed to households (*FD*) while the rest is undistributed (*FU*) and (considered to be) paid into their capital accounts to be used as a source of funds – as it happens, the principal source of funds – for investment. Figure 2.1 shows that in the United States total internal funds of non-financial businesses exceeds their gross investment expenditures in nearly every year
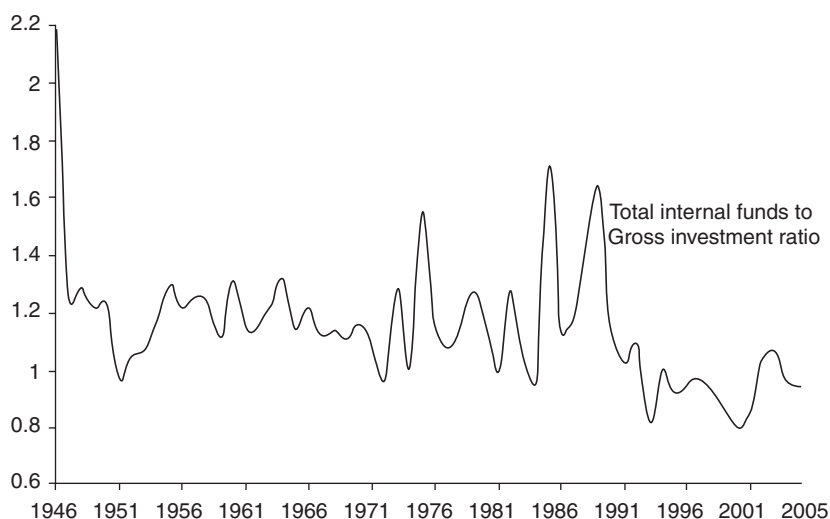

Figure 2.1 Total internal funds (including IVA) to gross investment ratio, USA, 1946–2005.

Source: Z.1 statistics of the Federal Reserve, www.federalreserve.gov/releases/z1, table F102, Non-farm non-financial corporate business. The curve plots the ratio of lines 9 and 10.

[7] As pointed out above, households' investment in housing is imputed to the real estate industry.

since 1946. In fact, it would seem that in many instances retained earnings are even used to finance the acquisition of financial assets.

To complete the picture, we include transfer payments between the various sectors. These are divided into two categories, payments of interest (*INT* with a lower case suffix to denote the sector in question) that are made on assets and liabilities which were outstanding at the beginning of the period and therefore largely predetermined by past history; and other 'unilateral' transfers (*T*), of which the most important are government receipts in the form of taxes and government outlays in the form of pensions and other transfers like social insurance and unemployment benefits.

All this allows us to compute the disposable income of households – personal disposable income – which is of course different from GDP. It can be read off the first column. Wages, distributed dividends, interest payments (from both the business and the government sector, minus interest paid on personal loans), minus income taxes, constitute this disposable income *YD*.[8]

$$YD = WB + FD + INT_h - T_h \qquad (2.2)$$

2.3.3   The saving = investment identity

Matrix 2.5 has now become a neat record of all the income, expenditure and transfer payments which make up the national income accounts, showing how the sectoral accounts are intertwined. The first column shows all current receipts and payments by the household sector, including purchases of durable goods, hence the balance at the bottom is equal to household saving (SAV_h) as defined in NIPA. The second column shows current receipts and payments by firms which defines business profits as the excess of receipts from sales over outlays. The third column shows firms' investment and the undistributed profits (*FU*) which are available to finance it, the balance at the bottom showing the firms' residual financing requirement – what they must find over and above what they have generated internally. The entries in the fourth column give all the outlays and receipts of the general government, and the balance between these gives the government's budget surplus or deficit. The fact that every row until the bottom row, which describes financial balances, sums to zero guarantees that the balances' row sums to zero as well. It is this last row which has attracted the undivided attention of national accountants and of Keynesian economists. This last line says that:

$$SAV_h + (FU - I_f) - DEF = 0 \qquad (2.3)$$

Considering that the retained earnings of firms constitute the savings of the firm's sector, we can write $FU = SAV_f$; similarly, the surplus of the government

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[8] Note that interest payments from government are not included in GDP.

sector is equivalent to its saving, so that $SAV_\mathrm{g} = -DEF$. From these new definitions, and from the definition implicit to the investment row, we can rewrite equation (2.3) in its more familiar form:

$$I = SAV_\mathrm{h} + SAV_\mathrm{f} + SAV_\mathrm{g} = SAV \qquad (2.4)$$

Equation (2.4) is nothing else than the famous Keynesian equality between investment and saving. This is the closest that most mainstream accounts of macroeconomics will get from financial issues.[9] What happens to these savings, how they arise, what is their composition, how they link up the surplus sectors to the deficit sectors, is usually not discussed nor modelled. In Matrix 2.5, until the final row, the nature of the transactions is pretty clear: households buy goods and firms sell them, etc.[10] However, the transfer of funds 'below the (bold) line' requires a whole new set of concepts, which are not part of the conventional income and expenditures national accounts. The answers to the questions that were put to the reader in section 1.2 of the previous section are to be found quite straight forwardly, using concepts which are familiar and easy to piece together so long as the double entry principle continues to be observed and so long as we always live up to our motto that everything must go somewhere and come from somewhere. In other words, we need to bring in the transactions flow matrix.

2.4 The transactions flow matrix

2.4.1 Rules governing the transactions flow matrix

We shall require the reintroduction of the financial sector, the banks that had been introduced in the balance sheet matrix but that had been amalgamated

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[9] Note that neo-classical economists don't even get close to this equation, for otherwise, through equation (2.4), they would have been able to rediscover Kalecki's (1971: 82–3) famous equation which says that profits are the sum of capitalist investment, capitalist consumption expenditures and government deficit, minus workers' saving. Rewriting equation (2.3), we obtain:

$$FU = I_\mathrm{f} + DEF - SAV_\mathrm{h}$$

which says that the retained earnings of firms are equal to the investment of firms plus the government deficit minus household saving. Thus, in contrast to neo-liberal thinking, the above equation implies that the larger the government deficit, the larger the retained earnings of firms; also the larger the saving of households, the smaller the retained earnings of firms, provided the left-out terms are kept constant. Of course the given equation also features the well-known relationship between investment and profits, whereby actual investment expenditures determine the realized level of retained earnings.

[10] The nature of these transactions is not, in reality, so simple as this. In many, perhaps most cases, the contract to purchase and sell something is separated from the transfer of money one way and the goods themselves going the other.

to the business sector in the conventional income and expenditure matrix. Similarly, the operations of the central bank will reappear explicitly in the new transactions flow matrix which is the corner stone of our approach. These additions to the conventional income and expenditure matrix will allow us to assess all transactions, be they in goods and services or in the form of financial transactions, with additions to assets or liabilities.

As in the balance sheet matrix, the coherence of the transactions flow matrix is built on the rule that each row and each column must sum to zero. The rule enforcing that all rows must sum to zero is rather straightforward: each row represent the flows of transactions for each asset or for each kind of flow; there is nothing new here. The top part of the matrix, as described in Table 2.6 resembles the income and expenditure matrix, with a few additions and new notations. In particular, the flow of interest payments, which was noted *INT* in Table 2.5, is now explicit. The flow of interest on an asset or a liability now depends on the relevant rate of interest and on the stock of asset at the opening of the production period, that is, the stock accumulated at the end of the previous period, at time $t - 1$. The lagged variable r_m stands for the rate of interest prevailing on money deposits. Similarly r_l and r_b stand for the rates of interest prevailing on loans and Treasury bills.

The bottom part of the matrix is the flow equivalent of the balance sheet matrix. When we describe purchases and sales of assets of which the nominal value never changes, there is no problem of notation. We simply write ΔH or ΔM (for instance) to describe the increase in the stock of cash, or money deposits, between the beginning and end of the period being characterized. When the capital value of the asset can change – that is, when capital gains and losses can occur, as is the case with long-term bonds and equities – we keep the convention that the assets are pieces of paper, say e for equities, which have a price, p_e. The value of the piece of paper is then $e \cdot p_e$ at a point of time, and the value of transactions in equities – new issues or buy-backs – is given by the change in the number of pieces of paper which are issued (or withdrawn) times their price, $\Delta e \cdot p_e$.

The rule enforcing that all columns, each representing a sector, must sum to zero as well is particularly interesting because it has a well-defined economic meaning. The zero-sum rule for each column represents the budget constraint of each sector. The budget constraint for each sector describes how the balance between flows of expenditure, factor income and transfers generate counterpart changes in stocks of assets and liabilities. The accounts of the transactions flow matrix, as shown by Table 2.6, are comprehensive in the sense that everything comes from somewhere and everything goes somewhere. Without this armature, accounting errors may pass unnoticed and unacceptable implications may be ignored. With this framework, 'there are no black holes' (Godley 1996: 7).

There is no substitute for careful perusal of the matrix at this stage. It is a representation, not easily come by, of a complete system of macroeconomic

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Table 2.6 Transactions flow matrix

	Households (1)	Production firms Current (2)	Production firms Capital (3)	Banks Current (4)	Banks Capital (5)	Government (6)	Central Bank Current (7)	Central Bank Capital (8)	Σ
Consumption	$-C$	$+C$							0
Investment	$-I_h$	$+I$	$-I_f$						0
Govt. exp.		$+G$				$-G$			0
Wages	$+WB$	$-WB$							0
Profits, firms	$+FD_f$	$-F_f$	$+FU_f$						0
Profits, banks	$+FD_b$			$-F_b$	$+FU_b$				0
Profit, central Bk						$+F_{cb}$	$-F_{cb}$		0
Loan interests	$-r_{l(-1)}\cdot L_{h(-1)}$	$-r_{l(-1)}\cdot L_{f(-1)}$		$+r_{l(-1)}\cdot L_{(-1)}$					0
Deposit interests	$+r_{m(-1)}\cdot M_{h(-1)}$			$-r_{m(-1)}\cdot M_{(-1)}$					0
Bill interests	$+r_{b(-1)}\cdot B_{h(-1)}$			$+r_{b(-1)}\cdot B_{b(-1)}$		$-r_{b(-1)}\cdot B_{(-1)}$	$+r_{b(-1)}\cdot B_{cb(-1)}$		0
Taxes – transfers	$-T_h$	$-T_f$		$-T_b$		$+T$			0
Change in loans	$+\Delta L_h$		$+\Delta L_f$		$-\Delta L$				0
Change in cash	$-\Delta H_h$				$-\Delta H_b$			$+\Delta H$	0
Change, deposits	$-\Delta M_h$				$+\Delta M$				0
Change in bills	$-\Delta B_h$				$-\Delta B_b$	$+\Delta B$		$-\Delta B_{cb}$	0
Change, equities	$-(\Delta e_f\cdot p_{ef}+\Delta e_b\cdot p_{eb})$		$+\Delta e_f\cdot p_{ef}$		$+\Delta e_b\cdot p_{eb}$				0
Σ	0	0	0	0	0	0	0	0	0

transactions. The best way to take it in is by first running down each column to ascertain that it is a comprehensive account of the sources and uses of all flows to and from the sector and then reading across each row to find the counterpart of each transaction by one sector in that of another. Note that all *sources* of funds in a sectoral account take a *plus* sign, while the *uses* of these funds take a *minus* sign. Any transaction involving an incoming flow, the proceeds of a sale or the receipts of some monetary flow, thus takes a positive sign; a transaction involving an outgoing flow must take a negative sign. Uses of funds, outlays, can be either the purchase of consumption goods or the purchase (or acquisition) of a financial asset. The signs attached to the 'flow of funds' entries which appear below the horizontal bold line are strongly counter-intuitive since the *acquisition* of a financial asset that would *add* to the existing stock of asset, say, money, by the household sector, is described with a *negative* sign. But all is made clear so soon as one recalls that this acquisition of money balances constitutes an *outgoing* transaction flow, that is, a *use* of funds.

2.4.2   The elements of the transactions flow matrix

Let us first deal with column 1 of Table 2.6, that of the household sector. That column represents the budget constraint of the households. In contrast to the standard NIPA, investment in housing is taken into account. Households can consume goods ($-C$) or purchase new residential dwellings ($-I_h$), but only as long as they receive various flows of income or provided they take in new loans ($+\Delta L_h$) – consumer loans or home mortgages – or reduce their holdings of assets, for instance by dishoarding money balances ($+\Delta H_h$ or $+\Delta M_h$). At the aggregate scale, at least as a stylized fact, households add to their net wealth, through their saving. The excess of household income over consumption will take the form of real purchases of dwellings (I_h), and the form of financial acquisitions: cash (ΔH_h), bank money (ΔM_h), fixed interest securities (ΔB_h), and equities ($\Delta e \cdot p_e$), less the net acquisition of liabilities, in the form of loans (ΔL_h) from banks. The change in the net financial position of the household sector, which will require counterpart changes in the net financial position of the other sectors, appears in the rows below the bold line. The categories shown are simplified: there are other important ways in which people save – for example, through life insurance, mutual funds and compulsory pension funds; but for the time being these acquisitions will be treated as though they were direct holdings, perhaps subject to advice from a manager.[11]

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[11]   It has been shown by Ruggles and Ruggles (1992 (1996)) that once the fictitious real estate enterprises of NIPA that take care of households new purchases of residential units have been taken out, and once pension fund schemes are considered as saving by firms rather than that of their employees, then the change in the net financial position of the household sector is virtually nil, and even negative on the average in the United States since 1947.

Column 2 is no different from the one discussed in Table 2.5: it shows the receipts and the outlays of production firms on their current account. Column 3 now shows how production firms ultimately end up financing their capital expenditures, fixed capital and inventories. These capital expenditures, at the end of the period, appear to be financed by retained profits, new issues of securities (here assumed to be only equities, but which could be bonds or commercial paper) and bank loans.

Columns 4 and 5 describe a relatively sophisticated banking sector. Once more, the accounts are split into a current and a capital account. The current account describes the flows of revenues and disbursements that the banks get and make. Banks rake in interest payments from their previous stocks of loans and securities, and they must make interest payments to those holding bank deposits. The residual between their receipts and their outlays, net of taxes, is their profit F_b. This profit, as is the case for production firms, is split between distributed dividends and retained earnings. These retained earnings, along with the newly acquired money deposits, are the counterparts of the assets that are being acquired by banks: new granted loans, newly purchased bills, or additional vault cash. Column 5 shows how the balance sheets of banks must always balance in the sense that the change in their assets (loans, securities and vault cash) will always have a counterpart in a change in their liabilities.

Finally, the last columns deal with the government sector and its central bank. The latter is split from the government sector, as it allows for a more realistic picture of the money creation process, although it adds one slight complication. Let us first deal with Column 7, the current account of the central bank. From the balance sheet of Table 2.4, we recall that central banks hold government bills while their typical liabilities are in the form of banknotes, that is, cash, which carries no interest payment. As a result, central banks make a profit, F_{cb}, which, we will assume, is entirely returned to government. This explains the new entry in column 6 of the government sector, $+F_{cb}$, compared with that of Table 2.5. The fact that the central bank returns all of its profits to government implies that the while the government gross interest disbursements on its debt are equal to $r_{b(-1)} \cdot B_{(-1)}$, its net disbursements are only $r_{b(-1)} \cdot [B_{(-1)} - B_{cb(-1)}]$.

Column 6 is the budget constraint of government. It shows that any government expenditure which is not financed by taxes (or the central bank dividend), must be financed by an issue of bills. These newly issued bills are purchased by households, banks and the central bank, directly or indirectly. Column 8 shows the highly publicized accounting requirement that any addition to the bond portfolio of the central bank must be accompanied by an equivalent increase in the amount of high-powered money, $+\Delta H$. This relationship, which is at the heart of the monetarist explanation of inflation – also endorsed by most neo-classical economists – as proposed by authors such as Milton Friedman, has been given considerable attention in the recent past,

since it seems to imply that government deficits are necessarily associated with high-powered money increases, and hence through some money multiplier story, as told in all elementary textbooks, to an excess creation of money. A quite different analysis and interpretation of these accounting requirements will be offered in the next chapters.

2.4.3   Key features of the transactions flow matrix

It is emphasized that so far there has been no characterization of behaviour beyond what is implied by logical constraints (e.g. that every buyer must have a seller) or by the functions that have been allocated to the various sectors (e.g. that firms are responsible for all production, banks for making all loans) or by the conventional structure and significance of asset portfolios (e.g. that money is accepted as a means of payment).

Reconsider now the system as a whole. We open each period with stocks of tangible assets and a tangle of interlocking financial assets and liabilities. The whole configuration of assets and liabilities is the legacy of all transactions in stocks and flows and real asset creation during earlier periods which constitute the link between past, present and future. Opening stocks interact with the transactions which occur within each period so as to generate a new configuration of stocks at the end of each period; these will constitute past history for the succeeding period. At the aggregate level, whatever is produced and not consumed will turn up as an addition to the real capital stock. At the sectoral level, the sum of all receipts less the sum of all outlays must have an exact counterpart in the sum of all transactions (by that sector) in financial assets less financial liabilities.

The only elements missing for a full integration are the capital gains that ought to be added to the increases in assets and liabilities that were assessed from the transactions matrix. Thus what is missing is the *revaluation* account, or what is also known as the *reconciliation* account. When this is done, it becomes possible to move from the opening stocks of assets, those being held at the beginning of the production period, to the closing stocks of assets, those being held at the end of the production period. This will be done in the next section.

The system as a whole is now closed in the sense that every flow and every stock variable is logically integrated into the accounting to such a degree that the value of any one item is implied by the values of all the others taken together; this follows from the fact that every row and every column sums to zero. This last feature will prove very useful when we come to model behaviour; for however large and complex the model, it must always be the case that one equation is redundant in the sense that it is implied by all the other equations taken together.

As pointed out in the first part of this chapter, other authors have previously underlined the importance of the transactions flow matrix. In his book, Jean Denizet (1969: 19) proposed a transactions flow matrix that has *implicitly*

all the features of the matrix that has been presented here. Malinvaud (1982: 21) also presents a nearly similar transactions flow matrix. The article written by Tobin and his collaborators (Backus *et al*. 1980), has a theoretical transaction flow matrix, nearly identical to the one advocated here, with rows and columns summing to zero; they also have presented the empirical version of such a matrix, including capital gains, with actual numbers attached to each cell of our transaction flow matrix, derived from the national income and product accounts and the flow-of-funds accounts, thus demonstrating the practical usefulness of this approach. The transactions flow matrix has been utilized *systematically* and amalgamated to behavioural equations by Godley in his more recent work (1996, 1999a). It was not present in Godley's earlier work (Godley and Cripps 1983).

2.5 Full integration of the balance sheet and the transactions flow matrices

We are now in a position to integrate fully the transactions flow matrix to the balance sheet. Table 2.7 illustrates this integration (Stone 1986: 16). As before, we consider five sectors: households, production firms, banks, government, and the central bank. The first row represents the initial net worth of each sector, as they appear in the penultimate row of Table 2.6. We assume again that the net worth of the central bank is equal to nil, as a result of the hypothesis that any profit of the central bank is returned to government. We shall also see that a central bank zero net worth requires that the central bank holds no bonds, only bills, the price of which does not change. We may also note, as was mentioned earlier, that the aggregate net worth of the economy, its macroeconomic net worth, is equal to the value of tangible capital, *K*. Finally, it should be pointed out once more that the net worth of any sector, *at the end of the previous period*, is considered to be the same thing as the net worth of that sector *at the beginning of the current period*, and in what follows we shall make use of the (−1) time subscript whenever beginning-of-period wealth is referred to.

The *change* in the net worth of any sector is made up of two components, as is clearly indicated in the first column of Table 2.7: the change in net assets arising from transactions, and the change arising from revaluations, that is, changes in the prices of assets or liabilities. These two components of change, added to the net worth of the previous period, yield the new net worth of each sector. This new net worth – the net worth at the end of the current period – appears in the last row of Table 2.7.

The first component of the change in net worth arises from the transactions flow matrix. The first five rows of these changes are the exact equivalent of the last five rows (the last row of zeros having been set aside) of the transactions flow matrix 2.6. They reflect the financial transactions that occurred during

Table 2.7 Full-integration matrix

	Households (1)	Production firms (2)	Banks (3)	Government (4)	Central bank (5)	Σ
Net worth, end of previous period	NW_{h-1}	NW_{f-1}	NW_{b-1}	NW_{g-1}	0	K_{-1}
Change in net assets arising from transactions						
Change in loans	$-\Delta L_h$	$-\Delta L_f$	$+\Delta L$			0
Change in cash	$+\Delta H_h$		$+\Delta H_b$		$-\Delta H$	0
Change in deposits	$+\Delta M_h$		$-\Delta M$			0
Change in bills	$+\Delta B_h$		$+\Delta B_h$	$-\Delta B$	$+\Delta B_{cb}$	0
Change in equities	$+\Delta e_f \cdot p_{ef} + \Delta e_b \cdot p_{eb}$	$-\Delta e_f \cdot p_{ef}$	$-\Delta e_b \cdot p_{eb}$			0
Change in tangible capital	$+\Delta k_h \cdot pk$	$+\Delta k_f \cdot pk$				$+\Delta k \cdot pk$
Change in net assets arising from revaluations						
Capital gains in equities	$+\Delta p_{ef} \cdot e_{f-1} + \Delta p_{eb} \cdot e_{b-1}$	$-\Delta p_{ef} \cdot e_{f-1}$	$-\Delta p_{eb} \cdot e_{b-1}$			0
Capital gains in tangible capital	$+\Delta pk \cdot k_{h-1}$	$+\Delta pk \cdot k_{f-1}$				$\Delta pk \cdot (k_{h-1} + k_{f-1})$
Net worth, end of period	NW_h	NW_f	NW_b	NW_g	0	K

the period. The only difference between these five rows as they appear in Table 2.7 compared to those of Table 2.6 is their sign. All minus signs in Table 2.6 are replaced by a plus sign in Table 2.7, and vice versa. In the transactions flow matrix of Table 2.6, the acquisition of a financial asset, say cash money ΔH_h by households, is part of the *use* of funds, and hence carries a minus sign. However, in Table 2.7, the acquisition of this cash money adds something to household wealth, and hence it must carry a plus sign, in order to add it to the net worth of the previous period. Similarly, when households or firms take loans, these new loans provide additions to their *sources* of funds, and hence carry a plus sign in the transactions flow matrix of Table 2.6. By contrast, in the integration matrix of Table 2.7, loans taken by households or firms, all other things equal, reduce the net worth of these sectors, and hence must carry a minus sign.

The last element of the first block of six rows arising from the transactions flow matrix, as shown in Table 2.7, is the row called 'change in tangible capital'. The counterpart of this row can be found in the 'investment' row of Table 2.6. Households, for instance, can augment their net wealth by acquiring financial or tangible capital. In their case, tangible capital is essentially made up of residential dwellings (since, in contrast to financial flows accountants, we do not consider purchases of durable goods as capital accumulation). This was classified as investment in the transactions flow matrix, and called I_h, whereas in the full-integration matrix, it is called $\Delta k_h \cdot pk$, where pk is the price of tangible capital, while Δk_h is the flow of new residential capital being added to the existing stock, in real terms. In other words, Δk_h is the number of new residential units which have been purchased by households. It follows that we have the equivalence, $I_h = \Delta k_h \cdot pk$. Similarly, for firms, their investment in tangible capital (essentially machines, plants, and additions to inventories) was called I_f in the transactions matrix of Table 2.6. *Setting aside changes in inventories,*[12] the value of new investment in tangible capital is now called $\Delta k_f \cdot pk$ in Table 2.7, so that we have the other equivalence, $I_f = \Delta k_f \cdot pk$. Note that for simplification, we have assumed that the price of residential tangible capital and the price of production capital is the same and moves in tandem.

The second major component of the change in net worth arises from capital gains. For exposition purposes, we assume that only two elements of wealth can have changing prices, and hence could give rise to capital gains or capital losses. We assume that the prices of equities can change, those issued by production firms and those issued by banks; and we also assume that the

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[12] This is an important restriction, because, as already pointed out, inventories are valued at current replacement *cost*, while fixed capital is valued at current replacement *price*, and hence they cannot carry the same price variable. See Chapter 11 for an in-depth study of this issue, which is briefly dealt with in section 2.6.2.

price of tangible capital, relative to consumer prices, can change. We assume away changes in the price of securities. The implicit assumption here is that all securities are made up of bills – short-term securities that mature within the period length considered here. In the case of bonds – long-term securities the prices of which change from period to period, before they mature and come up for redemption – capital gains or losses would have to be taken into account. Capital gains on bonds will be explicitly taken into consideration in Chapter 5.

The study of capital gains underlines an important principle: any change in the value of an asset may be made up of two components: a component associated with a transaction, for instance when new equities are issued and bought up for instance, thus involving additional units of the asset in question; and a component associated with a change in the price of the asset, when for instance, existing (and newly issued) equities carry a higher price. In the case of equities issued by production firms, as shown in Table 2.7, the change in the value of equities arising from transactions is $\Delta e_{\mathrm{f}} \cdot p_{\mathrm{ef}}$ while the change in the value of equities arising from capital gains is $\Delta p_{\mathrm{ef}} \cdot e_{\mathrm{f}-1}$. In Chapter 5, we shall provide a precise proof of this result in discrete time (with time subscripts, as done here). In the meantime, it is sufficient to remember first-year university calculus, deal with continuous time, and recall that, given two functions, u and v, the derivative of the product of these functions is such that $\mathrm{d}(u \cdot v) = \mathrm{d}u \cdot v + u \cdot \mathrm{d}v$. In the present case, with e and pe acting as the two functions u and v, we have:

$$\mathrm{d}(e \cdot p_{\mathrm{e}}) = \mathrm{d}e \cdot p_{\mathrm{e}} + e \cdot \mathrm{d}(p_{\mathrm{e}}) \tag{2.5}$$

The first term represents the change arising from transactions, while the second term represents capital gains due to the change in prices. The same rules apply to the changes in the value of tangible capital, where a real term component and a price component can be identified.

Thus, adding the capital gains component so defined and the transactions component to the net worth of the previous period, we obtain the net worth at the end of the current period, as shown in the last row of Table 2.7. The integration of the flow of funds financial transactions and the sector balance sheets with the national income accounts is thus complete. It should be pointed out however that it is no easy matter to produce an empirical version of Tables 2.6 or 2.7. While the flow of funds published by the Federal Reserve in the United States, or by other statistical agencies in other countries, contain a vast amount of information about transactions in financial assets, the sectoral classification and to some extent the concepts employed in NIPA are sufficiently different to make any simple junction of the two data sets. Although the $Z.1$ accounts themselves provide some reconciliation (in tables F.100 and higher), relatively large discrepancies remain.

2.6 Applications of the transactions flow matrix: the monetary circuit

2.6.1 The quadruple-entry principle and production with private money

It has already been claimed that the transactions flow matrix serves an important purpose in guaranteeing the coherence of the accounting when macroeconomic models are built. But the transactions flow matrix can also be shown to serve a further purpose. The transactions flow matrix can really help us to understand how production is being financed at the initial finance state, that is at the beginning of the production period, before households have decided on what they will do with their newly acquired income or their newly acquired savings. The transactions flow matrix sets the monetary circuit – about which so much has been said by French and Italian post-Keynesian school, the so-called circuitistes – within a comprehensive accounting framework, which will help to justify the story told and the claims made by these post-Keynesians (Graziani 1990). In other words, the transactions flow matrix, which ties together real decisions and monetary and financial consequences, is the backbone of the monetary production economy that Keynes and his followers, the post-Keynesians, wish to describe and to model. To get a feel for how the system works we may follow through a few transactions as though they were sequences. We will examine two of these transactions. First, we shall look at how the production of firms is being financed; then we shall see how government expenditures enter the economy.

Suppose, as we assumed in the transactions flow matrix, that firms distribute wages in line with production, that dividends are distributed according to past profits, and that interest payments, as shown here, depends on the past stock of deposits and on a rate of interest administered by the banking system. Suppose further that firms borrow, at the beginning of the production period as the circuitistes would have it, the amount needed to pay the wages of the current period. This is, as the circuitistes say, the first step of the monetary circuit (Lavoie 1992: 153). Thus in the first step of the circuit, both the loans and the deposits newly created by the banking system belong to the production sector. This initial step of the monetary circuit with private money is shown in Table 2.8A, which is a subset of the transactions matrix of Table 2.6.

A clear feature of Table 2.8A. is that it contains four entries. This is an illustration of the famous *quadruple-entry* system of Copeland (1949 (1996: 8)). Copeland pointed out that, 'because moneyflows transactions involve two transactors, the social accounting approach to moneyflows rests not on a double-entry system but on a quadruple-entry system'. Knowing that each of the columns and each of the rows must sum to zero at all times, it follows that any alteration in one cell of the matrix must imply a modification to at least three other cells. The transactions matrix used here provides us with

Table 2.8A   First step of the monetary circuit with private money

	Households	Production firms		Banks	
		Current A.	**Capital A.**	**Capital A.**	**Σ**
Consumption					
Investment					
Wages					
Δ loans			$+ \Delta L_f$	$-\Delta L$	0
Δ deposits			$-\Delta M_f$	$+\Delta M$	0
Σ			0	0	0

an exhibit which allows to report each financial flow both as an inflow to a given sector and as an outflow to the other sector involved in the transaction. In the current instance, the production and the banking sectors are the two parties to the financial transaction, and each sector must have two modified entries, since all columns must balance.

A peculiar feature of the quadruple-entry system is that it corrects a prevalent misconception regarding the creation and the role of money. In the mainstream framework, money is sometimes said to fall from the sky, thrown out of an helicopter, as in the famous parable by Milton Friedman. In that mainstream framework, which is highly popular in mainstream intermediate macroeconomic textbooks, money is a given stock, which seems to appear from nowhere, and which has no counterpart in the rest of the economy. Despite changes in the real economy, and presumably in financial flows, the stock of money is assumed to remain at all time constant. The quadruple-entry system shows that such a conception of money is meaningless.

Coming back to Table 2.8A, a very important point, related to the dangers of confusing semantics, must be made. Recall that a minus sign in the transaction matrix is associated with the use of funds, while a positive sign implies the source of funds. In Table 2.8A, in the column of banks, the addition to money deposits is associated with a plus sign, while the addition to bank loans is associated to a minus sign. From a flow-of-funds standpoint, increased deposits are thus a source of funds while increased loans are a use of funds for the banks. For some, this terminology seems to reinforce the mainstream belief, associated with the loanable funds approach, that banks provide loans only insofar as they have the financial resources to do so; in other words, banks make loans only when they have prior access to deposits. The source of the funds to be lent, in Table 2.8A, is the money deposits, as the minus sign would show.

Needless to say, this loanable funds interpretation is not being defended here. On the contrary, a key feature of the banking system is its ability to

create deposits *ex nihilo*. More precisely, when agents in the economy are willing to increase their liabilities, banks can increase the size of both sides of their balance sheet, by granting loans and simultaneously creating deposits. As neatly summarized by Earley, Parsons and Thomson (1976, 1996: 159), 'to encapsulate, we see fluctuations in borrowing as the primary cause of changes in spending'. It may be that, in flow-of-funds terminology, money deposits is the source of funds allowing the use of bank loans. But the *cause* of this increase in deposits and loans is the willingness to contract an additional liability and the desire of the borrower, here the production firm, to expand its expenditures.

2.6.2 Initial finance versus final finance

This situation as shown in Table 2.8A, however, can only last for a split second. Firms only draw on their lines of credit when they are required to make payments. In the second step of the circuit, the deposits of the firms are transferred by cheques or electronic payment to the workers who provided their labour to the firms. The moment these funds are transferred, they constitute households' income. Before a single unit is spent on consumer goods, the entire amount of the bank deposits constitutes savings by households, and these are equal to the new loans granted to production firms.

This is all shown in Table 2.8B. The matrix requirement that all rows and columns must sum to zero makes clear the exigencies of the second step of this monetary circuit. Because of these zero-sum requirements, the following three equations must hold:

$$I - WB = 0 \tag{2.6}$$
$$I - \Delta L_\text{f} = 0 \tag{2.7}$$
$$\Delta M_\text{h} - \Delta L_\text{f} = 0 \tag{2.8}$$

At that stage of the circuit, output has been produced but not yet sold. The unsold production constitutes an increase in inventories (which will later be

Table 2.8B   The second step of the monetary circuit with private money

| | Households | Production firms | | Banks | |
		Current A.	Capital A.	Capital A.	Σ
Consumption					
Investment		$+I$	$-I$		0
Wages	$+WB$	$-WB$			0
Δ loans			$+\Delta L_\text{f}$	$-\Delta L$	0
Δ deposits	$-\Delta M_\text{h}$			$+\Delta M$	0
Σ	0	0	0	0	0

associated with the symbol *IN*). This increase in inventories is accounted as investment in working capital. Staying faithful to our requirement that all rows and all columns must sum to zero, inventories must necessarily rise by an amount exactly equal to the production costs, the wages paid *WB*, as in equation (2.6).[13] The zero-sum column requirement, as applied to the current account of firms makes it so. This demonstrates a very important point: that inventories of unsold goods should be valued at cost, and not according to the price that the firm believes it can get for its goods in the near future.

On the side of the capital account, it is clear that the value of this investment in inventories must be financed by the new loans initially fetched for, as in equation (2.7). Table 2.8B, contrasted with Table 2.6, helps to understand the distinction between *initial* and *final* finance which has been underlined by the circuitistes (Graziani 1990). Initial finance, or what Davidson (1982: 49) calls *construction finance*, appears in Tables 2.8A: it is the bank loans that firms usually ask to finance the initial stages of production and hence to finance inventories. Final finance, or Davidson's *investment funding*, is to be found in the last rows of Table 2.6. Final finance are the various means by which investment expenditures are being ultimately financed by the end of the production period; the retained earnings of corporations constitute the greatest part of gross investment funding.

The transition from Tables 2.8A and 2.8B, which represent the first and second steps of the monetary circuit, to Table 2.6, which represents the third and last step of the monetary circuit, is accomplished by households getting rid of the money balances acquired through wages, and eventually the additional money balances received on account on their dividend and interest payments. As the households get rid of their money balances, firms gradually recover theirs, allowing them to reimburse the additional loans that had been initially granted to them, at the beginning of the period.

The key factor is that, as households increase their consumption, their money balances fall and so do the outstanding amount of loans owed by the firms. Similarly, as households get rid of their money balances to purchase newly issued equities by firms, the latter are again able to reduce their outstanding loans. In other words, at the start of the circuit, the new loans required by the firms are exactly equal to the new deposits obtained by households. Then, as households decide to get rid of their money balances, the outstanding loans of firms diminish *pari passu*, as long as firms use the proceeds to pay back loans instead of using the proceeds to beef up their money balances or their other liquid financial assets. Although determined by apparently independent mechanisms, the supply of loans to firms and

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[13]   Note that it is assumed as well that the new fixed investment goods have not yet been sold to the corporations which ordered them.

the holdings of deposits by households (and firms) cannot but be equal, as they are at the beginning of the circuit, as in equation (2.8). This mechanism will be observed time and time again in the next chapters, when behavioural relations are examined and formalized.

The primary act is best thought of as a decision to produce something. This induces firms to take up a loan to start up the production process. The build up of initial inventories, when production begins, is the result of such a production decision, made with the agreement of a bank. It is this act which brings a bank loan into existence and simultaneously brings a bank balance of equal size into existence (that of the firm asking for a loan). As soon as households are paid for their services, the money deposits are transferred to the bank accounts of the newly employed labour force.[14] We can already see how it is that the household sector comes to 'lend' its surplus to the production sector, as mainstream economists would say. In the example just given, the mere holding of the money paid out as wages has a loan as its exact counterpart. When the household sector buys something from the production sector, this destroys money and loans by an exactly equal amount. While the loan-granting activity created an efflux of money into the economy, the purchase of goods by households creates a reflux – the destruction of money. Thus, any series of transactions can be conceived as the creation, circulation and destruction of money.

2.6.3   Production with central bank money

The steps of the monetary circuit can once again be used to help understand how money creation and government deficits are being related to each other. Suppose that, at the beginning of the circuit, the government sector orders the production of some goods to the private production sector. Once these goods have been produced, they must be purchased by government. The simplest solution to do so would be for government to draw on its line of credit at the central bank: the government sector would get high-powered money as the central bank would grant a loan to its government. But such credit facilities are now regarded as inflationary by mainstream economists and politicians, and as a result, these direct credit facilities are forbidden by law. The alternative is for government to issue new bills, which can either be purchased by the central bank or by a private bank. Direct government bond sales to the central bank are also feared by mainstream economists, and as a result, in some countries, they are either forbidden or highly restricted. But let us assume that such a sale occurs anyway. The counterpart of the newly purchased bills, in the books of the central bank, is the amount of high-powered money credited to the government account. This is, once

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[14] There is some resemblance with Moore's (1997: 426) point that 'depositors can only "supply" banks with deposits if they have somehow previously acquired them'.

more the first step of the monetary circuit, and it is shown with the help of Table 2.9A. This money will circulate, first to pay the producing firms. These firms get cheques, drawn on the account of the government sector at the central bank. Once cashed at the private banks, these cheques give rise to bank deposits. This is shown in Table 2.9B. The firms then use these bank deposits to pay their workers and remunerate their owners. Here for simplification, the income so created is to be found on a single row, as Y.[15] The money balances so created will thus wind up in the deposit accounts of households. This is illustrated with the help of Table 2.9C.

Table 2.9A   The first step of government expenditures financed by central bank money

		Production firms		Banks		Central bank	
	Households	Current		Capital	Government	Capital	Σ
Govt. exp.							
Income [GDP]							
Change in cash					$-\Delta H_g$	$+\Delta H$	0
Change in deposits							0
Change in bills					$+\Delta B$	$-\Delta B_{cb}$	0
Σ					0	0	0

Table 2.9B   The second step of government expenditures financed by central bank money

		Production firms		Banks		Central bank	
	Households	Current		Capital	Government	Capital	Σ
Govt. exp.		$+G$			$-G$		0
Income [GDP]							
Change in cash				$-\Delta H_b$		$+\Delta H$	0
Change in deposits		$-\Delta M_f$		$+\Delta M$			0
Change in bills					$+\Delta B$	$-\Delta B_{cb}$	0
Σ		0		0	0	0	0

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[15] Here we have slightly cheated, assuming that all profits are distributed to households.

Table 2.9C The third step of government expenditures financed by central bank money

		Production firms		Banks		Central bank	
	Households	Current		Capital	Government	Capital	Σ
Govt. exp.		$+G$			$-G$		0
Income [GDP]	$+Y$	$-Y$					0
Change in cash				$-\Delta H_b$		$+\Delta H$	0
Change in deposits	$-\Delta M_h$			$+\Delta M$			0
Change in bills					$+\Delta B$	$-\Delta B_{cb}$	0
Σ	0	0		0	0	0	0

Once again, all rows and columns must sum to zero. Before households decide what to do with their newly acquired money balances, spending them on consumption or acquiring interest-earning assets – including government bills –, all accounts must balance. As a consequence, the deficit cannot but be 'monetized' initially, in line with what neo-chartalist post-Keynesians have been recently arguing (Wray 1998: ch. 4–5; Mosler and Forstater 1999). The matrices of Tables 2.9B and 2.9C also show the standard result, so often underlined in mainstream textbooks, that private banks now wind up with additional reserves, the ΔH_b entry in the capital account of banks. These extra reserves do not mean however that a multiple amount of money deposits will be created, as the standard money multiplier has it. If banks do not find any credit-worthy borrower – and the fact that they now have additional reserves implies in no way that additional credit-worthy borrowers will be forthcoming – they always have the choice to purchase government bills.[16] As we shall see more formally in Chapter 4, if the central bank is to keep the interest rate at its target level, the central bank must sell to the banks (and to households) the bills that they lurk for, and by so doing, the central bank will absorb the money balances that neither the banks nor the households wish to hold.

We said before that the government sector, to finance its expenditures, could also have sold its bills to private banks. The transactions matrix that corresponds to such a transaction, with the ensuing deposits ending up in the hands of workers and stockholders is even simpler, as illustrated with the help of Tables 2.10A and 2.10B. Private banks buy the bills and grant a bank deposit to the government, as shown in Table 2.10A. This deposit then moves on to the household sector, after having transited through the

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[16] There is another possibility that will be examined in the next subsection.

Table 2.10A   The first step of government expenditures financed by private money

	Households	Production firms Current	Banks Capital	Government	Central bank Capital	Σ
Govt. exp.						
Income [GDP]						
Change in cash						
Change in deposits			$+\Delta M$	$-\Delta M_g$		0
Change in bills			$-\Delta B_b$	$+\Delta B$		0
Σ			0	0		0

Table 2.10B   The third step of government expenditures financed by private money

	Households	Production firms Current	Banks Capital	Government	Central bank Capital	Σ
Govt. exp.		$+G$		$-G$		0
Income [GDP]	$+Y$	$-Y$				0
Change in cash						
Change in deposits	$-\Delta M_h$		$+\Delta M$			0
Change in bills			$-\Delta B_b$	$+\Delta B$		0
Σ	0	0	0	0	0	0

production sector, when the public goods are paid for. This is shown with the help of Table 2.10B. It would seem this time that there is no inflationary danger, since banks hold no additional high-powered money, in contrast to the case where bills were being purchased directly by the central bank. But this is all an illusion. Whether the bills are initially purchased by banks or by the central bank makes no difference whatsoever. If banks or households are in need of additional cash, as a consequence of the increased activity generated by the public expenditures, the central bank will need to intervene in the second-hand market, purchasing some of the bills initially bought by the private banks, as long as it wishes to maintain its interest rate target. In the end, the only money or high-powered money left in the economy will be held voluntarily, and this amount depends in no way on the exact financial scheme used to finance government expenditures.

2.6.4 The case of the overdraft economy

Up to now, we have assumed that government expenditures were financed either by selling bonds to the private banks, or by selling bonds to the central bank. This corresponds however to a particular institutional set-up, that Hicks (1974: 51) has called the *pure auto-economy*. It turns out however that the pure auto-economy, or what Lavoie (2001b: 216) has called the *asset-based economy*, is only one of the possible institutional set-ups. While the asset-based economies have been described in great detail in mainstream text-books, specially in Anglo-saxon textbooks, the other institutional set-ups have been usually ignored. It turns out, however, that most financial systems in the world are not of the asset-based type, but rather can be described as

Table 2.11A First step of government expenditures in overdraft system

| | | Production firms | | Banks | | Central bank | |
	Households	Current	Capital	Government	Capital	Σ
Govt. exp.						
Income [GDP]						
Change in cash						
Change in deposits			$+\Delta M$	$-\Delta M_g$		0
Change in bank loans			$-\Delta L$	$+\Delta L_g$		0
Change in central bank advances						
Σ			0	0		0

Table 2.11B Second step of government expenditures in overdraft system

| | | Production firms | | Banks | | Central bank | |
	Households	Current	Capital	Government	Capital	Σ
Govt. exp.		$+G$		$-G$		0
Income [GDP]	$+Y$	$-Y$				0
Change in cash	$-\Delta H_h$				$+\Delta H$	0
Change in deposits	$-\Delta M_h$		$+\Delta M$			0
Change in bank loans			$-\Delta L$	$+\Delta L_g$		0
Change in central bank advances			$+\Delta A$		$-\Delta A$	0
Σ	0	0	0	0	0	0

overdraft economies, making use once more of the terminology proposed by Hicks (1974: 53).

In the pure overdraft economy, as defined by Hicks, firms hold no financial assets, and are thus 'wholly dependent, for their liquidity, on the banks'. The notion of a pure overdraft economy can however be extended to the relations between the private banks and the central bank, as is done in Lavoie (2001b). In pure overdraft financial systems, private banks hold little or no government securities. On the contrary, private banks in such overdraft economies are permanently in debt *vis-á-vis* the central bank, having borrowed funds from the central bank to acquire the reserves that they are legally required to hold, and to obtain the central bank banknotes that their customers have been asking for.

The impact of new government expenditures on the transactions flow matrix, or at least a part of it, is shown in Tables 2.11A and 2.11B. As before, we assume new government expenditures of an amount G. This is now financed by a loan from the private banks to the government. This is shown in Table 2.11A, which is very similar to Table 2.8A. These government expenditures generate an income of Y, which we assume as before to be kept initially in the form of money balances by households. A new assumption, compared to Tables 2.9 or 2.10, is that households wish to hold a certain portion of their new money balances in the form of cash money. In the pure overdraft economy, private banks must borrow all cash money from the central bank. Private banks obtain advances A from the central bank, to cover the needs in cash money of the public, as shown in Table 2.11B. Within such a system without government securities, the determination of interest rates is quite straightforward. The central bank simply needs to set the rate of interest on the advances made to private banks. This rate of interest on advances is then the base rate of interest, that sets the standard for all other rates of interest in the financial system. The study of overdraft financial systems thus help to pierce through the veil of the asset-based financial systems, showing with obvious simplicity that central banks do have the ability to set short-term interest rates.