Chapter 8

Weaving Cloth from Graziani's Thread. Endogenous Money in a Simple (but Complete) Keynesian Model*

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8.1 Graziani's Thread

One of Graziani's main themes runs as follows. In order to finance production, the entrepreneur must obtain the funds necessary to pay his workforce in advance of sales taking place. Starting from scratch, he must borrow from banks, at the beginning of each production cycle, the sum which is needed in order to pay wages, creating a debt for the entrepreneur and, thereby, an equivalent amount of credit money, which sits initially in the hands of the labour force. Production now takes place and the produced good is sold at a price which enables the debt to be repaid inclusive of interest, while hopefully generating a surplus – that is, a profit – for the entrepreneur. When the debt is repaid, the money originally created is extinguished. An entire monetary circuit is now complete.

This account of the monetary circuit has a number of extremely important and distinctive features. It emphasises, in particular, that a) there is a gap in (historical) time between production and sales which generates a systemic need for finance; b) bank money is endogenously determined by the flow of credit and c) total real income must be considered to be divided into three parts – that received by entrepreneurs, that received by labour and that received by banks. We have already travelled an infinite distance from the (yes, silly) neo-classical world where production is (must be) instantaneous, where money must be exogenous and fixed and has no counterpart liability, and where the distribution of income is determined by the marginal products of labour and capital – a construction which depends entirely on the assumption that all firms sit perennially on a single aggregate neo-classical production function frontier.

8.2 Weaving Cloth from this Thread

In what follows there is not one breath of criticism of the Graziani construct, which is at once simple, elegant and fruitful. What I propose to do here is adapt the model so that the main insights (as I understand them) are carried across into a world where aggregate production is a continuous set of overlapping individual processes and in which the production period can vary. I shall fill out a whole macroeconomic framework where, in a number of sequences, various stock variables (money, debt and inventories) generate and are generated by flows (incomes and expenditures). All of Graziani's insights are retained.

Table 8.1 Model transaction matrix and glossary

	Households	Firms		Banks		$\sum$
		Current	Capital	Current	Capital	
Consumption (=Sales)	$-C$	$+S$				0
Inventory investment		$+\Delta I$	$-\Delta I$			0
Wages	$+W_B$	$-W_B$				0
Firms' interest payments		$-rL_{-1}$		$+rL_{-1}$		0
Firms' profits	$+F$	$-F$				0
Bank profits	$+F_b$			$-F_b$		0
Change in stocks of:						
Money	$-\Delta M$				$+\Delta M$	0
Loans			$+\Delta L$		$-\Delta L$	0
Σ	0	0	0	0	0	

C, c	=	consumption	M, m	=	credit money	S, s	=	sales
F	=	firms' profits	n	=	employment	U	=	unit wage cost
F_b	=	banks'profits	p	=	price of goods	W	=	wage rate
I, i	=	inventories	p_r	=	productivity	W_B	=	wage bill
k	=	opening volume of inventories as proportion of sales volume	r	=	nominal rate of interest	Y_D, y_d	=	personal income
L	=	bank loans	r_r	=	real rate of interest	y	=	output

Upper case denotes values, lower case volumes. The star (*) denotes a desired quantity. Subscripts *s* and *d* denote supply and demand; *h* means (money) 'held'.

I start with a transactions matrix which defines all the current price flows (occurring in some given period of time) to be used in the model and which describes the accounting relationships between them. I must make it clear that this model is far too simple to be realistic. There is, for instance, no international trade, no government, no financial asset other than credit money and no fixed investment. I am making the smallest possible model capable of embodying the key features I wish to illustrate. It is always possible to add more and more realistic features, but at the cost of dramatically increasing variables and equations; but this would not advance my present purpose.

The matrix (see Table 8.1), following the methodology advocated by Backus, Brainard, Smith and Tobin (1980), reveals the accounting structure of the model. Its key feature is that all columns and all rows sum to zero thereby enforcing the fundamental principle that all balances between income and expenditure generate equivalent changes in stocks of financial assets and liabilities and, more generally, that 'everything comes from somewhere and everything goes somewhere'. Without a comprehensive accounting framework of this kind, the system properties of macroeconomic models can never be securely tied down. This framework makes it mandatory, for instance, to make it explicit how investment is financed – a key process which is systematically ignored in most conventional macroeconomics. For a more elaborate case where firms undertake fixed investment as well as inventory investment, and this is financed, not just by bank loans but also by undistributed profits and issues of equity, see Godley (1996).

In the following I first give the whole model written out formally and then rapidly run through it (the glossary is in Table 8.1):

$$y = s + \Delta i \tag{8.1}$$

$$s = c \tag{8.2}$$

$$\Delta i = \gamma_1 \left(i^* - i_{-1} \right) \tag{8.3}$$

$$i^* = \gamma s \tag{8.4}$$

$$n = \frac{y}{p_r} \tag{8.5}$$

$$W_B = Wn \tag{8.6}$$

$$U = \frac{W_B}{y} \tag{8.7}$$

$$k = \frac{i_{-1}}{s} \tag{8.8}$$

$$p = (1+\lambda)\left[U(1-k) + k(1+r)U_{-1} \right] \tag{8.9}$$

$$S = sp \tag{8.10}$$

$$F = S - W_B + \Delta I - rI_{-1} \tag{8.11}$$

$$I = iU \tag{8.12}$$

$$L_d = I \tag{8.13}$$

$$L_s = L_d \tag{8.14}$$

$$M_s = L_s \tag{8.15}$$

$$F_b = rL_{-1} \tag{8.16}$$

$$Y_D = F + F_b + W_B \tag{8.17}$$

$$y_d = \frac{Y_D}{p} - \frac{\Delta \text{p}}{\text{p}} m_{-1} \tag{8.18}$$

$$M_h = M_{h-1} + Y_D - C \tag{8.19}$$

$$C = cp \tag{8.20}$$

$$c = a_0 + a_1 y_d + a_2 m_{-1} \tag{8.21}$$

$$m = \frac{M_h}{p} \tag{8.22}$$

$$r = (1 + r_r)\left(\frac{U}{U_{-1}}\right) - 1 \tag{8.23}$$

The production decision, provisionally assuming perfect foresight, is based on sales (entirely taking the form of consumption) plus the change in inventories, (8.1) and (8.2). Inventories are assumed to move towards some desired ratio to sales, (8.3) and (8.4). Employment is determined by output and productivity, (8.5), the wage bill by employment times the wage rate, (8.6), and unit labour costs by the wage bill divided by output, (8.7).

The only tricky bit of the story concerns (8.9), the way in which prices distribute the value of sales proceeds between profits and costs. The process needs a short section to itself, which follows.

Of the physical objects sold this period (*s*), a certain proportion, *k*, were made last period (8.8); the rest were made this period. The objects made, but not sold, last period (*ks*) constitute the stocks with which firms start the period and the unit wage cost of production of these stocks was U_{-1}, while the unit wage cost of objects made this period ($(1 - k)s$) is *U*. It is a fundamental set of assumptions, (8.13)–(8.15), that inventories, since they involve outlays by firms in advance of sales, are always financed by loans which are extinguished when sales are made; also that there is a counterpart to every loan in the form of credit (or bank) money. Firms had loans outstanding at the beginning of the period equal to inventories valued at cost, so they have to pay interest on these loans to the banks. The total historic cost (H_C), including interest, of producing what was sold this period may therefore be written

$$H_C = (1-k)sU + ksU_{-1} + rksU_{-1} \tag{8.24}$$

Firms' profits are equal to the value of what they sell less the historic cost of production

$$F = S - H_C$$

which may be written using a mark-up

$$S = (1 + \lambda)H_C \tag{8.25}$$

Then from (8.24), (8.25) and (8.10) we have a key identity which describes how the price implies (or is implied by) the profit mark-up on historic unit costs, i.e. equation (8.9). For the rest, the value of sales, inventories and consumption are given by (8.10), (8.12) and (8.20) while, given the price decision, profits are given by (8.11) – the residual item in column 2 of the transactions matrix. Banks are assumed to charge interest on loans outstanding, (8.16), but not to pay interest on money and this is how banks'profits are generated. Banks'profits, like firms' profits, are all distributed to households and these receipts together with the wage bill make up nominal personal disposable income, (8.17). Real disposable income, as defined in (8.18) above, is always equal to real consumption plus the change in the real stock of money (8.22) – the only form of wealth in this model. To spell this out, note first the identity (8.19) which says that nominal money held at the end of each period is equal to the opening stock of money plus nominal disposable income less nominal consumption.

Next, noting that changes in the nominal stock of money, like changes in the value of any stock variable, can be decomposed into prices and quantities, we can write

$$\Delta M = M - M_{-1} = mp - m_{-1}p_{-1} = \Delta mp + \Delta pm_{-1}$$

Hence , using (8.19) and (8.20), we obtain

$$\Delta m = \frac{Y_D}{p} - \frac{\Delta pm_{-1}}{p} - c$$

The consumption function (8.21) makes consumption depend on real income and the opening stock of money (the only form of wealth in this model) plus an exogenous component. Note that since real income is defined as above the consumption function can be alternatively written as a wealth adjustment function

$$\Delta m = a_2\left(-\frac{a_0}{a_2} + a_3 y_d - m_{-1}\right)$$

where $a_3 = (1 - a_1)/a_2$, implying a long run wealth target (achieved when Δm = 0)

$$m^* = -\frac{a_0}{a_2} + a_3 y_d$$

Finally banks are assumed to adjust nominal loan rates so as to maintain real interest rates at some given level, (8.23).

The model is now complete. Treating as exogenous the variables a_0, r_r, W, p_r, and λ we have an equation in every variable – all stocks and all flows, both real and nominal. The model may be solved (given initial conditions) as a fully interdependent dynamic system evolving in a determinate way though real time. And conditional on any given configuration of exogenous variables it will reach a full steady state when the real wealth target is met ($m = m^*$).

The full steady state for output is given by

$$y^* = \frac{a_0}{1 - a_1 - a_4}$$

where

$$a_4 = \frac{a_0 \gamma}{(1+\lambda)(1+\gamma r_r)} .$$

8.3 Some Major Implications

One conclusion of central importance may be indicated *via* re-perusal of the equations of the formal model, where we have one equation in the money supply generated by loans to firms, (8.15), and another in the money which households find themselves holding, (8.19) – yet there is no equation which brings the two into equivalence with one another. This equivalence is invariably and exactly guaranteed, however, by the system properties of the model taken as a whole. The use of a comprehensive double entry system, and the combination of national income concepts with flow of funds concepts, guarantees that every row and every column sum to zero (see Table 8.1). From this it follows ineluctably that as soon as every variable except one is determined, that last variable must be determined as well. And that is the position we now find ourselves in. Every row and every column is indeed determined in the model as summing to zero *except* row 7, which shows the supply of money and money holdings, each determined by a different process. Yet because all other rows and columns sum to zero, it follows that there is neither need nor place for an equation to make these two numbers equal to one another; the system ensures that this is invariably and exactly true. This conclusion confirms the view reiterated endlessly by (for instance) Kaldor, Wray and Moore.

The necessary equivalence of money created with money held gains a new dimension, augmenting the theoretical foundations of monetary theory in a very fundamental way, when expectations are introduced into the story. Suppose that (as in reality) firms do not know exactly what their sales are going to be, and that therefore they base their production decision on *expected* sales and *intended* inventory changes. To the extent that sales expectations are not fulfilled, inventories will take the rap – they will differ from their intended values to the extent that realised sales differ from expected sales, and the amount of loan finance will be comparably different as well. Then next period, starting from a position in which inventories are out of kilter, too high or too low, the production decision will be modified to take account of this. The firm will thus be responding to quantity signals when making its key decisions, not price signals. No elaborate theory of expectations is needed to underpin this account, as mistakes are quickly remedied as a result of the palpable fact that inventories have turned out to be excessive or inadequate.

A very similar story may be told about the consumption and the implied intended end-of-period money holdings by households. The consumption decision has to be taken in partial ignorance of what real income is going to be. If income turns out to be different from what was expected, then the accumulation of money (wealth) will be different from what was intended to an equal extent. It is the unexpected accumulation or depletion of the stock of money (perhaps a letter from the bank manager) which gives a quantity signal to the household that it must modify its consumption behaviour.

Note that in each case (that of producers and that of consumers) we have, by introducing the notion of unintended stocks, abolished the need for the equilibrium conditions (or disequilibrium conditions) which are so fundamental to the traditional neo-classical theory. Producers themselves set prices; they do not need to know a hypothetical price which will bring aggregate demand into equivalence with aggregate supply. And households will invariably be found to be holding that amount of money which is created by the need for business finance. As already mentioned, there is neither need nor place for an equilibrium condition which makes the 'demand' for money (whatever that may mean) equal to the supply, and which determines the rate of interest in the process. And while, in this model, expectations take on a centrally important theoretical function, their practical importance is not very great because mistakes are easy to rectify. The destruction of the key equilibrium condition used by neo-classical authors by including inventory investment in the demand/supply equation was emphasised by Hicks (1989).

A second major implication of the equations in this model is that with only a small number of further steps we may derive an expression which precisely describes the distribution of the real national income between the three major sectors.

First define the rate of cost inflation,

$$\pi_w = \frac{U}{U_{-1}} - 1$$

and the real rate of interest defined with respect to cost inflation

$$r_r = \frac{1+r}{1+\pi_w} - 1$$

These two equations may be substituted in the price equation (8.9) to obtain

$$p = (1+\lambda)(1+kr_r)U$$

We may now divide by p and multiply by y, real output, to obtain an expression which precisely decribes the division of real output (or income) between real profits, the real wage bill ($w_b = W_B/p$) and the real income of banks, the creditors of the system – all in one single period of time

$$y = (1+\lambda)(1+kr_r)w_b$$

This equation, although in itself nothing more than an accounting identity, is extremely useful when it comes to analysing the distribution of income, both empirically and theoretically. No one of these shares can change without the sum of the other two changing by an equal amount; and no pair of shares can change without there being a precise implication for the third. If the profit mark-up could be fixed, rather as an indirect tax rate can be fixed, and if banks could adjust the nominal rate of interest on loans so that the real rate (as defined here) remained fixed, it would follow that the nominal wage bargain is completely impotent as a means of changing real wages; the real wage bill would simply be a residual. Alternatively if the profit mark-up had to be adjusted in such a way that prices remain constant, as a result, say, of foreign competition, then we have a way of gauging the effect of nominal wage changes both on real wages and on real profits. This description of income distribution may also be useful for the analysis to which Graziani has given considerable amount of thought (see Graziani, 1985) of the interaction between the aspirations of the three sectors to collar various shares of real income and the way in which inflation resolves conflicts between them.

8.4 Conclusion

In this chapter, starting from the ‘monetary circuit’ theory of how and why credit money is generated, I have taken a single step towards the incorporation of its insights into the simplest imaginable macro-economic model which is yet complete in the important sense that all rows and all columns of the transactions matrix sum to zero. One important conclusion is that it is impossible for the supply of money to differ from the amount of money which people want to hold, or find themselves holding, without either the need or the place for any mechanism to bring this about.

Note

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