Macroeconomics, Endogenous Money and the Contemporary Financial Crisis: A Teaching Model

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1. Introduction

Macroeconomics has a long history of revolutions and counter-revolutions, and since the symposium devoted to the teaching of macroeconomics that appeared in the *Journal of Economic Education* in 1996 (volume 27, issue 2), the field has undergone another revolution of sorts. This is associated with the 'New Neoclassical Synthesis' or 'New Consensus' in macroeconomics, benchmark statements of which can be found in Clarida *et al* (1999) and Woodford (2003). In its simplest form, the New Consensus is a three-equation model consisting of an *IS* curve, an accelerationist Phillips curve, and a Taylor rule. It is this last feature that points to the key innovation of the New Consensus, namely, the fact that it practices 'macroeconomics without the *LM* curve' (Romer, 2000). Hence in *IS–LM* analysis, which has been the workhorse teaching model in undergraduate textbooks for decades, one of the foundations of the *LM* curve is an exogenous money supply, determined by the central bank. In the New Consensus, however, the interest rate is understood to be the instrument of monetary policy, and as the central bank manipulates the interest rate, the quantity of money in circulation is determined as an endogenous residual. In light of all this, a debate has emerged regarding the extent to which current undergraduate macroeconomics teaching models are well

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grounded in and adequately reflect the latest developments in the field. Several well known and widely cited papers – including those by Allsopp and Vines (2000), Romer (2000), Taylor (2000), Carlin and Soskice (2005), Bofinger, Mayer and Wollmerhäuser (2006), and Turner (2006) – have attempted to 'translate' the New Consensus into forms suitable for presentation to undergraduates at either the introductory or intermediate levels. Indeed, the New Consensus has already begun to influence the content of macroeconomics textbooks, as evidenced by Sørensen and Whitta-Jacobsen (2005), Carlin and Soskice (2006), and Jones (2008).

Building on the work of Fontana (2006; 2009, Chapters 7-8), the ambition of this paper is to present a simple and teachable macroeconomic model that transcends *both* the *IS–LM and* New Consensus frameworks. A simple appeal to realism reveals obvious flaws with the *IS–LM* framework, which call for urgent reform of the teaching of undergraduate macroeconomics. Everyday experience teaches students that the central bank sets the price, rather than the quantity, of liquidity in the economy. The Fed in the US, the ECB in Europe, and the Bank of England in the UK, to mention just some of the world's major central banks, meet monthly in order to set the short-run interest rate used by commercial banks and other financial institutions for determining all other interest rates in the economy. Without doubt, the learning process of students can be enhanced by references to this real-world experience – and this is what the New Consensus has sought to do.

However, there is a crude empiricist bent to the New Consensus, according to which central banks manipulate interest rates (rather than monetary aggregates) because 'that's what central banks do'. Meanwhile, the quantity of money in circulation (if it is

mentioned at all) is treated as a residual by-product of central bank behaviour. This paper seeks to replace this crude empiricism with a sounder analysis of the money supply process that leads students towards an appreciation of the role of commercial banks, firms and consumers – as well as the central bank – in an endogenous money system. An important pedagogical advantage of this approach is that it enhances students' appreciation of how economists base their arguments and policy conclusions on sound economic models, rather than casual observation.

The remainder of the paper is organized as follows. Section 2 describes the workings of the monetary sector, including the conduct of monetary policy by the central bank, in accordance with endogenous money theory (Moore, 1988). Section 3 demonstrates the derivation of a conventional aggregate demand curve (in price – output space), and Section 4 completes the model by describing pricing decisions, the production process, and the workings of the labour market. In section 5, the complete model is used to explain the current financial crisis and the response by policy makers. Finally, section 6 concludes, contrasting the model developed in this paper with both the *IS–LM* and New Consensus frameworks, and drawing particular attention to some of the most pedagogically appealing features of the model.

2. Endogenous Money and the Conduct of Macroeconomic Policy

A controversial feature of the *IS–LM* framework is the assumption that the quantity of money in circulation is exogenously manipulated by the central bank through open market operations. Kaldor (1970), Moore (1988), Goodhart (1989), and more recently Romer (2000) have argued that this assumption is patently unrealistic, failing to describe

central bank behaviour as we actually observe it. Central banks are unambiguously concerned with the manipulation of interest rates rather than monetary aggregates in the conduct of their monetary policies. In what follows, we explain this behaviour by developing a simple model of endogenous money. In this model, creditworthy demands for loans from the non-bank private sector elicit a supply response from commercial banks that results in endogenous variation in the money supply – a process that is accommodated by the central bank albeit at a price (the overnight interest rate) of its own making.

Firms and consumers (the non-bank private sector) demand bank loans in order to finance the purchase of inputs for the production process or of durable goods, respectively. Commercial banks, meanwhile, are institutions in the business of making loans. Commercial banks, therefore, fully accommodate the demands for loans made by creditworthy borrowers. The interest rate charged on these loans – the bank loans rate, r_L – is set by commercial banks as a mark-up (m) over the real short-run interest rate (i) set by the central bank.[1] Formally:

$$r_L = (1+m)i \qquad\qquad (1)$$

In the bank loans market, commercial banks are therefore price-makers and quantity-takers. Meanwhile, as the loans taken out by households and firms are spent, they accrue as receipts elsewhere in the non-bank private sector. These receipts are, in turn, deposited into accounts at commercial banks. In this way, loans create deposits. Of course, these deposits are liabilities of the commercial banks. The liquidity of deposits

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[1] In reality, both central and commercial banks set *nominal* rather than *real* interest rates in the first instance. But given that in the short run the rate of inflation displays inertia (or stickiness), changes in nominal interest rates will translate into changes in real interest rates. It is therefore assumed, for simplicity, that both central and commercial banks exercise direct control over real interest rates.

they hold is thus a concern for commercial banks. In order to meet any expected demand for cash withdrawals from the non-bank private sector, commercial banks will therefore demand monetary reserves from the central bank in proportion to their deposits. At this point, it is important to note that one of the major functions of the central bank is to safeguard the economic system from financial crises. Thus, as the ultimate supplier of liquidity, the central bank will fully accommodate commercial banks' demands for monetary reserves, albeit at a price of its own making. This price is the real short-run (overnight) interest rate. Note, then, that not only is the quantity of credit endogenously determined by the demand for loans, but so, too, is the quantity of monetary reserves or high powered money endogenously determined, by the derived demand for liquidity of commercial banks. The central bank may be the sole legal issuer of high powered or base money, but it has no effective control over even this narrow component of the total money supply, which is instead endogenously determined by the processes governing the demand for and supply of credit in the private sector.

Having thus accommodated the liquidity needs of commercial banks, the behaviour of the central bank completes our description of the endogenous money supply process. The four-panel diagram in Figure 1 illustrates the sequence of events that characterizes this process. The diagram should be read clockwise starting from the upper right panel.

[FIGURE 1 GOES HERE]

The upper right panel shows the credit market, where firms and consumers on one hand, and commercial banks on the other, express the demand for and supply of bank loans, respectively. The supply curve of bank loans is represented by a perfectly elastic

schedule at a bank loans rate (r_{L_1}). This is determined as a fixed mark-up (m) over the specific short-term real interest rate (i_1) that has been set by the central bank. The demand for bank credit (i.e., loans), C^D, is a decreasing function of the bank loans rate and, together with the supply of bank credit (C^S), determines (at equilibrium point A) the total volume of credit created (C_1).

The two lower panels of Figure 1 describe two of the main insights of endogenous money theory, namely, that: (a) bank loans create bank deposits (as captured by the Loans–Deposits or LD schedule); and (b) bank deposits give rise to the demand for monetary reserves (as captured by the Deposits–Reserves or DR schedule). The credit market equilibrium at point A thus determines, via the LD schedule, the supply of new bank deposits (BD_1) in the lower right panel and hence (via the DR schedule in the lower left panel) commercial banks' demand for reserves (R_1). Note that the LD schedule represents the balance sheet constraint of commercial banks and, for the sake of making the graphical exposition feasible, it is drawn on the assumption that banks hold their liabilities (such as time or demand deposits) in fixed proportions.

Finally, the upper left panel of Figure 1 describes the workings of the market for monetary reserves. The supply of reserves is represented by the horizontal line R^S. This shows how the central bank accommodates the demand for monetary reserves by commercial banks at its quoted short-term real interest rate, i_1. Ultimately, the market for monetary reserves clears when the supply of monetary reserves adjusts to equate the demand for reserves (R_1) that was generated by the new supply of bank deposits (D_1) in the lower left panel of Figure 1. Monetary reserve market clearing is illustrated at equilibrium point B in the upper left panel of Figure 1.

3. Deriving the Aggregate Demand Curve

One of the most attractive features of the *IS-LM* framework is that it can be used to derive an aggregate demand (*AD*) curve which, together with a short-run Keynesian (horizontal) aggregate supply curve (AS_{SR}) or a long-run Classical (vertical) aggregate supply curve (AS_{LR}), is one of the building blocks of the *AD-AS* model. Whatever its limitations and weaknesses, the *AD-AS* model is a favourite with students and teachers alike, because it illustrates the effects of many different policy experiments in a straightforward and intuitive manner. In what follows, then, we retain this pedagogical device, but with one major amendment: the *LM* curve and related analysis of the money market is replaced by the endogenous money theory described in the previous section. The resulting endogenous-money-driven *AD-AS* model is then used to explain the current financial crisis and assess the response of policy makers.

The endogenous money supply process described earlier can be used to derive a conventional aggregate demand (*AD*) curve in price (*P*) – output (*Y*) space. In order to accomplish this, the *AD* equation is first written as:

$$AD = ND + cD$$

with:

$$D = f(r_L) \quad , \quad f' < 0$$

where *ND* denotes components of aggregate demand that are not debt-financed by loans from commercial banks (such as consumption expenditures funded from current income, or government spending), *D* denotes planned or desired debt-financed spending by households and firms, and *c* is the proportion of households and business loan

applications that are deemed creditworthy by banks. Note, then, that cD captures the *actual* (rather than planned or desired) debt-financed spending by the non-bank private sector, and also that:

$$C^D \equiv cD$$

In other words, the demand for bank loans schedule in the upper right panel of Figure 1 is identical to the actual debt-financed spending by households and firms. This, of course, makes sense since, as was assumed earlier, households and firms are motivated to borrow from banks by their desire to spend on goods and services. Finally, note that it follows from the equations for *AD* and *D* above that:

$$AD = ND + cf(r_L) \tag{2}$$

Equation (2) is consistent with the notion that an increase in the bank loans rate, by raising the cost of borrowing for households and firms and thus reducing their willingness and/or ability to borrow, will *ceteris paribus* reduce the total expenditures that households and firms undertake, and thus reduce the aggregate demand for goods and services.

The analysis also requires one further equation, linking the value of the short-run interest rate to conditions in the goods market. Hence we write:

$$i = g(P) \quad , \quad g' > 0 \tag{3}$$

Equation (3) is a monetary policy rule describing the operation of the central bank's monetary policy (which, in keeping with the theory of endogenous money developed in the previous section, involves manipulation of the short-run interest rate). In general, monetary policy rules describe the response of real short-run interest rates to changes in

the state of the economy.[2] This means that, in principle, there are many different types of monetary policy rules. The central bank could target a single economic variable (such as inflation), or a combination of variables (such as output, employment and inflation). In many contemporary industrialized economies, central banks have been assigned the specific task of meeting an inflation objective, and doing so through changes in the real short-run interest rate. In view of this, equation (3) has been formulated to represent the simplest type of monetary policy rule consistent with the practice of 'inflation targeting' described above, in which the real short-run interest rate changes in response to variations in the price level.[3]

In the *IS–LM* model, an increase in the general price level, *P*, will automatically reduce the aggregate quantity demanded via the real balance or Pigou effect: given an exogenously determined stock of money *M*, an increase in *P* will reduce the real purchasing power of *M* (the value of 'real balances', *M/P*), and hence the aggregate quantity demanded. But in the endogenous money environment discussed in the previous section, the Pigou effect is weakened and may disappear altogether. Hence, if an increase in *P* results in an equal proportional increase in the demand for loans by households and firms, and if this is accommodated by an equivalent increase in the supply of loans by

[2] Strictly speaking, what it is described here are 'activist' monetary policy rules. It is also possible to identify 'benchmark' monetary policy rules, in which the short-run interest rate is set in such way that it is either invariant to, or else responds only infrequently to, changes in the state of the economy. See, for example, Rochon and Setterfield (2007).

[3] Equation (3) is consistent with a literal interpretation of the objective of 'price stability', as a result of which the central bank responds (by varying the short-run interest rate) whenever prices change (see, for example, Feldstein, 1997). In reality, most advocates of inflation targeting – including academic economists and central bankers – associate 'price stability' with low (0–3%) rather than zero rates of inflation (see, for example, Mishkin, 2001). The use of equation (3) therefore involves some loss of realism. This is considered as worthwhile because, as will be demonstrated below, it allows us to derive a conventional *AD* schedule in price–output space, rather than the 'dynamic' *AD* schedule (in inflation–output space) associated with New Consensus models (see, for example, Taylor, 2000). This, in turn, facilitates more straightforward comparison and contrast between the results of our model and those of earlier, exogenous money models such as the *IS–LM* framework.

commercial banks, then *M* will increase *pari passu* with *P* leaving real balances unchanged. In this scenario, thanks to the endogeneity of the money supply, there is no Pigou effect, so that an increase in prices leaves the aggregate quantity demanded unchanged.

It may therefore appear that, since there is no real balance or Pigou effect, the *AD* curve is vertical in price–output space. However, this need not be so. Indeed, equations (1)–(3) above have been deliberately contrived to show how a conventional, 'downward sloping' (*AD*) curve can arise in an endogenous money environment.[4] The important thing to remember is that, as derived from equations (1)–(3), the shape of the (*AD*) curve is a *policy construct*, depending critically on the operation of the monetary policy rule described in equation (3). In other words, the *AD* curve describes how the central bank sets, via changes in the short-run interest rate, the level of output for any general price level in the economy.

To begin with, assume that the general price level (*P*) increases. According to the monetary policy rule in equation (3), this will trigger an increase in the short-run interest rate (*i*) set by the central bank. Since commercial banks set the bank loans rate (r_L) as a constant mark-up (*m*) over the short-run interest rate, an increase in *i* will result in an

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[4] It is important to note that in the analysis that follows, the inverse relationship that is derived between the price level and the aggregate quantity demanded is a strictly *partial equilibrium* result. It depends critically on the assumption that other things (specifically, the variable *ND* in equation (2)) remain equal, whereas in fact, they may not. For example, a reduction in prices may be associated with a redistribution of income that depresses consumption expenditures, or with debt-deflation effects that negatively impact both consumption and investment spending. In this case, even if the central bank lowers interest rates and thus stimulates aggregate demand as in the analysis above, the *total* effect of a drop in the price level on the aggregate quantity demanded may be negative rather than positive. In this case, the *AD* schedule will be upward sloping. It is important to bear this in mind when reflecting on the possible responses of wage and price setting behaviour to what are described below as situations of equilibrium in the labour market. See Fontana and Setterfield (forthcoming) for further analysis, and Dutt (2002) on the propensity of undergraduate AD-AS analysis to ignore these issues.

increase in r_L, as in equation (1). This means that the cost of borrowing is now higher for both households and firms in the non-bank private sector – with adverse consequences for aggregate demand. First, borrowing to finance investment is now more expensive so that *ceteris paribus*, for a given expected rate of return, the demand for investment goods will fall. Meanwhile, an increase in the short-run interest rate and hence in the bank loans rate means that it is more expensive for households to borrow money in order to buy durable goods like homes and new cars. This will decrease the willingness and/or ability of households to borrow so that, *ceteris paribus*, consumption expenditures will decline. Since both consumption and investment are components of aggregate demand, the upshot of these developments is that an increase in r_L will reduce the aggregate quantity demanded – as per the inverse relationship between *AD* and r_L in equation (2).

In sum – and thanks to the operation of the monetary policy rule in (3) – an increase in the price level (*P*) gives rise to a reduction in the aggregate quantity demanded (*Y*). The resulting negatively-sloped aggregate demand schedule is illustrated in Figure 2 below, together with the structural relations from which it is derived (equations (1)–(3)). Figure 2 shows how an increase in prices from P_1 to P_2 will raise the short-run interest rate set by the central bank (from i_1 to i_2) and hence the bank loans rate (from r_{L1} to r_{L2}). This will reduce the aggregate quantity demanded from Y_1 to Y_2.

[FIGURE 2 GOES HERE]

4. Completing the Model: Pricing, Production and the Labour Market

So far, the model described above consists of a monetary sector describing an endogenous money supply process, and an aggregate demand curve. In this section, the

model is completed by introducing theories of pricing and production that give rise to an aggregate supply (*AS*) relationship which, in tandem with the aggregate demand relationship in equation (2), completes the description of the goods market. This section also discusses the labour market and the related distinction between the 'Classical hierarchy' and the 'Keynesian hierarchy' of markets.

4.1 Pricing, production and aggregate supply

The description of pricing in the goods market mirrors the pricing behaviour of commercial banks. Specifically, it is assumed that firms set prices (*P*) as a fixed mark-up (*n*) over the average cost of labour, *Wa*, where the nominal wage (*W*) is taken as given (fixed, once negotiated, for the length of the employment contract), and $a = N/Y$ denotes the labour/output ratio, i.e. the labour required to produce one unit of output. The pricing behaviour of firms can therefore be written as:

$$P = (1+n)Wa \qquad\qquad (4)$$

We treat *a*, together with the corresponding capital/output ratio, $v = K/Y$, as fixed in the short run. This means that, given the current state of technology, it takes a specific amount of labour combined with a specific amount of capital to produce any given level of output. The resulting fixed coefficient production function is depicted in Figure 3 below, which illustrates both the quantity of capital (K_0) and level of employment (N_0) necessary to produce an arbitrarily chosen level of output (Y_0). Note that Figure 3 also illustrates the level of output that can be produced (Y_L) if the entire labour force, *L*, is employed (together with the quantity of capital, K_L, necessary to facilitate this level of

production).[5] This draws attention to an important supply constraint on the level of output, since Y_L denotes the *maximum* level of output that the economy can produce. Obviously, the actual level of output, Y, cannot exceed this maximum value.

[FIGURE 3 GOES HERE]

The description of pricing and production above gives rise to the aggregate supply (*AS*) schedule depicted in Figure 4. This schedule is horizontal, capturing the substance of equation (4), which suggests that firms are price makers and quantity takers. They are willing to accommodate any demand for their output at price level P_0, which is associated with the prevailing nominal wage W_0.[6] The schedule ends at (Y_L) since, as demonstrated above, this is the maximum level of output that can be produced regardless of the price level.

[FIGURE 4 GOES HERE]

It is now a simple matter to combine the aggregate supply schedule in Figure 4 with the aggregate demand schedule in Figure 2 to illustrate goods market equilibrium. This is depicted in Figure 5, where we assume that the nominal wage takes the value W_1, and hence the price level is P_1. Figure 5 also illustrates the equilibrium level of output, Y_1.

[FIGURE 5 GOES HERE]

4.2 The labour market

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[5] Readers should note that $K_L < \bar{K}$ in Figure 3, where $\bar{K}$ denotes the total available capital stock. In other words, we assume that the level of economic activity – as measured by Y and N – is never constrained by a shortage of capital.

[6] Readers should recall that both *a* and *n* are fixed.

Labour market outcomes are conventionally derived from the interaction of labour demand and labour supply schedules. But in the model developed above, two important labour market outcomes have already been determined.

First, given the exogenously determined value of the nominal wage (W_1) and the associated price level (P_1) (see Figure 5), it follows that the value of the real wage (w) is determined as $w_1 = W_1/P_1$. Indeed, it follows from equation (4) that, *regardless* of the value of W and P, the value of the real wage is always given by:

$$w = \frac{W}{P} = \frac{1}{(1+n)a}$$

This means that the pricing decisions of firms (specifically, the value of the mark-up, n) and features of the production process (the labour/output ratio, a) are the ultimate determinants of the real wage: once workers sign their labour contracts, their real wage (given the value of a) is determined by the value of n set by firms.

Second, the equilibrium level of employment follows from the interaction of the equilibrium level of output Y_1 determined in Figure 5, and the production function depicted in Figure 3. This is illustrated in Figure 6, which shows how the equilibrium level of output, Y_1, implies both a capital requirement (K_1) and a labour requirement (N_1) in the production function. The latter is the equilibrium level of employment.

[FIGURE 6 GOES HERE]

The results thus far suggest that the monetary sector impinges upon the aggregate demand curve, and hence the determination of equilibrium output (Y_1) in the goods market, which in turn determines the equilibrium level of employment (N_1) in the labour market. In our model, then, the Classical hierarchy of the New Consensus view (according to which labour market outcomes determine goods market outcomes, and

14

monetary factors are of secondary (i.e., temporary) importance) is replaced by a Keynesian hierarchy, where monetary factors have an intrinsic influence on goods market outcomes which, in turn, determine labour market outcomes.

[FIGURE 7 GOES HERE]

The consequences for the labour market of this Keynesian hierarchy are illustrated in Figure 7, which shows a vertical labour supply schedule (S_N), corresponding to the labour supply function:

$$S_N = L \tag{5}$$

where S_N denotes the supply of labour. According to equation (5), the supply of labour is based on the active labour force at any point in time and is invariant with respect to the value of the real wage (w). This labour supply function provides a good first approximation of real-world labour supply functions, which are known to be highly inelastic with respect to the real wage.[7] Figure 7 also depicts the equilibrium real wage ($w = 1/(1+n)a$) and level of employment (N_1) derived earlier. Finally, it shows that the difference between L and N_1 gives rise to an equilibrium level of unemployment $U_1 = L - N_1$.

As is clear from Figure 7, the quantity of labour supplied at the real wage w, namely L, exceeds the quantity of labour demanded by firms (N_1). In other words, there are too many workers chasing too few jobs. But the roots of this unemployment lie in the goods market, since it is the equilibrium level of output (Y_1) that determines the equilibrium level of employment (N_1) and hence the equilibrium level of unemployment (U_1). This means that U_1, rather than being the outcome of the *individual choices* of

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[7] See, for example, Blundell and McCurdy (1999).

workers in the labour market, is the result of a *macroeconomic constraint* on the behaviour of workers emanating from the behaviour of the central bank, commercial banks, households and firms on the demand side of the goods market, and the pricing decisions of firms on the supply side.

5. The Financial Crisis of 2007-2009 and Policy Makers' Responses

The model constructed in the preceding sections can now be used to illustrate the financial crisis of 2007-09, the subsequent recession, and the difficult task faced by central banks and policy makers more generally in avoiding a global depression. The financial crisis of 2007-2009 has developed in two stages, first as a credit crunch in the late summer of 2007, and then, more significantly, as a full asset price crisis in the late summer of 2008. For the purpose of analysis in this section, these two stages of the financial crisis are treated as a single event, since this suffices to illustrate their adverse consequences for the economy.

In plain English, a credit crunch is a sudden reduction in the availability of bank loans and/or a sudden increase in the cost of obtaining a loan from commercial banks. In terms of the endogenous money supply process described above, this means that a credit crunch is measured by a reduction in the parameter *c* (see equation (2)) and/or an increase in the mark-up (*m*) and hence, *ceteris paribus*, an increase in the bank loans rate (r_L) (see equation (1)). There are a number of reasons why banks may suddenly make borrowing more difficult or increase the costs of borrowing. One of the factors most frequently

blamed for the credit crunch in 2007-2009 was the collapse of America's (sub-prime) mortgage market.[8]

[INSERT FIGURES 8(a), 8(b), 8(c) NEAR HERE]

The effects of the credit crunch are represented in Figures 8(a), 8(b), 8(c) above. As banks adopt more precautionary lending behaviour, they cut the proportion of household and corporate loan applications that are deemed creditworthy. In terms of equation (2) this means that banks cut the value of the parameter c. The upper right panel of Figure 8(a) shows that the actual demand for loans (C^D) shifts to the left. The new equilibrium point in the credit market is then at point B, and the total volume of credit created is now C_2, which in turn determines (via the LD schedule) the supply of new bank deposits, BD_2 (see the lower right panel of Figure 8(a)). These financial developments negatively affect the actual debt-financed spending by households and firms, namely the cD component of AD in equation (2). In terms of Figure 8(b), this shifts the aggregate demand curve to the left, so that the equilibrium level of output decreases to Y_2. Figure 8(b) also shows that the new lower level of output Y_2 reduces the economy's capital and labour requirements to K_2 and N_2, respectively. The consequences of these changes in the monetary sector and the goods market are shows in Figure 8(c): the equilibrium level of unemployment rises from L-N_1 to L-N_2. In short, as a result of the credit crunch, the economy experiences a

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[8] It could be argued, of course, that this sudden tightening of credit conditions was a disaster waiting to happen, excessive relaxation of these same standards having contributed to the boom in mortgage lending and associated bubble in house prices in the US prior to 2007. This view is compatible with interpretation of the financial crisis of 2007-09 as a "Minsky moment" – i.e., the unwinding of an unsustainable boom fueled by "euphoric" lending practices that was increasingly vulnerable to collapse in the event of disappointing short run results (such as a sudden increase in mortgage defaults in the household sector).

lower level of output and a higher level of unemployment. This is in fact what happened in 2007-09, when most countries experienced slowdowns in economic activity and increases in unemployment.

How should monetary and fiscal authorities react to these events? Figure 8(a) shows the reaction of the monetary authorities and some of its drawbacks. The central bank may try to offset the negative real effects of the credit crunch through a more accommodating monetary policy, i.e., by reducing the short-run interest rate from i_1 to i_2. This means that, *ceteris paribus*, the new bank loans rate is r_{L2}. We will return to the *ceteris paribus* condition shortly, but for the time being let us focus on the outcome of the new, more accommodating monetary policy. The new supply of bank loans is now C^S_2, and equilibrium in the credit market is now at point *F*, where C_2^S and C_2^D intersect. Therefore, as a result of monetary policy, the total volume of credit created is now back to the pre-credit crunch level (C_1), as is the supply of new bank deposits (BD_1). Figure 8(b) shows that the aggregate demand curve (*AD*) shifts to the right, back to its original position. This is caused by the stimulus to debt-financed expenditures *cD* that results from the reduction in the bank loan rate to r_{L2}. As a result, the aggregate equilibrium level of output is again Y_1, with the equilibrium rate of unemployment equal to L-N_1. If the analysis were to stop here, it could be concluded that the central bank has succeeded in offsetting completely the negative effects of the credit crunch. But even as early as the summer of 2008, it was clear that this was not what was happening. How can this apparent failure of a more accommodating monetary policy be explained?

In order to answer this question, it is important to understand that, in the first place, while the central bank can reduce the short-run interest rate from i_1 to i_2, this does not

mean that it will necessarily succeed in reducing the bank loan rate from r_{L1} to r_{L2}. We have said that a credit crunch is a sudden reduction in the availability of bank loans *and/or* a sudden increase in the cost of obtaining a loan from commercial banks. The analysis so far has focused exclusively on the first feature of a credit crunch, *ceteris paribus*. But what happens if we allow for the second feature of a credit crunch, namely, a sudden increase in the cost of obtaining a bank loan? In terms of equation (1), this means that banks raise their mark-up (m) over the short-run interest rate set by the central bank. The upper panels of Figure 8(a) show that, even with the new short-run interest rate i_2, the bank loan rate will remain at r_{L1} if the mark-up rises to $m' > m$. The equilibrium configuration of the credit market remains at point B which, as discussed above, is associated with the low equilibrium level of output Y_2, and correspondingly high equilibrium level of unemployment $L-N_2$. A problem similar to this materialized in the UK in Autumn 2008, when dramatic cuts in the short-run interest rate by the Bank of England failed to immediately stimulate corresponding rate cuts by high street banks (*The Economist*, 2008).

Figure 8(a) also illustrates a further problem for the central bank. The effectiveness of its monetary policy strategy is greatly reduced as the short-run interest rate approaches the zero lower bound (i.e., as i moves closer to zero). Because of the zero lower bound, the more the central bank cuts the short-run interest rate now, the less it can do so in future. This problem is well illustrated in the US, where by December 2008, the Federal reserve had cut its key short-run interest rate (the Federal Funds rate) to a historic low of 0—0.25%.

In short, an accommodative monetary policy may not succeed in offsetting the conditions associated with a credit crunch, especially when, in the face of liquidity shortages in global financial markets, banks raise their mark-up over the short-run interest rate. These problems and their adverse implications for the real economy will only be compounded if, as liquidity preference rises in the non-bank private sector, both the *D* and *ND* components of aggregate demand in equation (2) fall independently of monetary policy and the behaviour of commercial banks.[9]

However, policy makers do have an alternative tool for responding to these circumstances. They can try to affect the components of aggregate demand that are *not* debt-financed by loans from commercial banks, using non-monetary instruments. For instance, the fiscal authorities of a country can increase government spending and/or reduce taxes in order to boost the *ND* component of aggregate demand in equation (2). This is, in fact, what the US Congress did early in 2008 and again in early 2009, when it passed first the Economic Stimulus Act and then the American Recovery and Reinvestment Act. The potentially beneficial effects of these measures are straightforward to analyse using our model. Figure 8(b) shows that a shift leftward of the *AD* curve caused by the credit crunch and its aftermath can be offset by a shift rightward of the same curve due to an increase in the *ND* component of aggregate demand. In this way, the fiscal authorities can bring the economy back to the pre-credit crunch level of output Y_1, and to the equilibrium rate of unemployment L-N_1. The scale of the stimulus necessary to restore the real economy to pre-credit crunch levels of activity is difficult to ascertain in practice – especially once the adverse effects on aggregate demand of

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[9] Fuller analysis of the implications of these developments in the model developed above is left to the reader. Intuitively, they will involve *AD* shifting to the left of AD_2 in the goods market, as a result of which Y will fall below Y_2 and unemployment will increase beyond $L - N_2$.

heightened liquidity preference in the non-bank private sector begin to compound those directly associated with the credit crunch itself. Whether or not the American Recovery and Reinvestment Act constitutes a sufficiently large stimulus in this respect remains to be seen.

6. Conclusion

This paper has developed a simple, short-run macroeconomic model that transcends shortcomings of both the *IS–LM* and New Consensus frameworks. The model improves on *IS–LM* analysis by incorporating an endogenous rather than exogenous money supply, and by positing that the instrument of monetary policy is the interest rate. At the same time, it improves on the New Consensus framework by providing an explicit model of the endogenous money creation process that draws attention to the roles of commercial banks and the non-bank private sector, as well as the central bank, in the monetary process. Moreover, the Keynesian hierarchy embodied in the model provides an alternative conceptualization of the real economy and, in particular, of real-monetary interactions, when compared with the Classical hierarchy of the New Consensus. Finally, it has been shown that the model can be used to analyse both the consequences of, and the policy responses to, the contemporary financial crisis..

The model presented in this paper complements an important general message that undergraduate teaching seeks to impart to students: that economic discourse is conducted in terms of explicit analytical models of economic processes. The analysis of the money supply process also shows that it is possible to add realism and rigour to the teaching of

undergraduate macro *without* sacrificing the simplicity that is a virtue of both *IS–LM* and

New Consensus teaching models.

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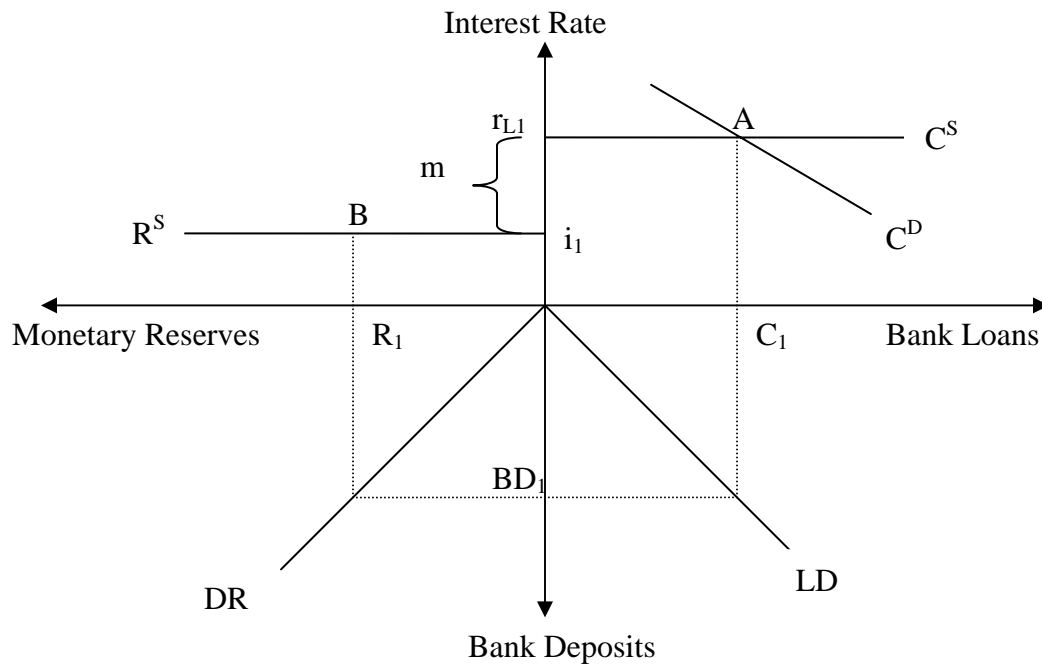
Figure 1: The Endogenous Money Supply Process

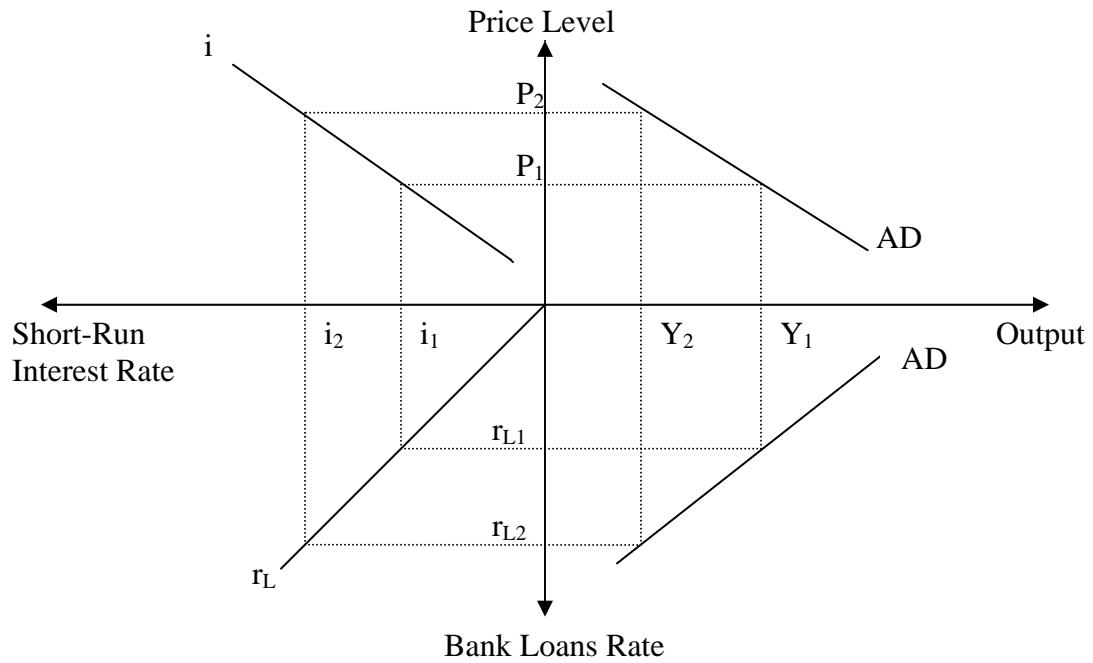
Figure 2: A Conventional (Downward-Sloping) Aggregate Demand Schedule

Figure 3: The Aggregate Production Function
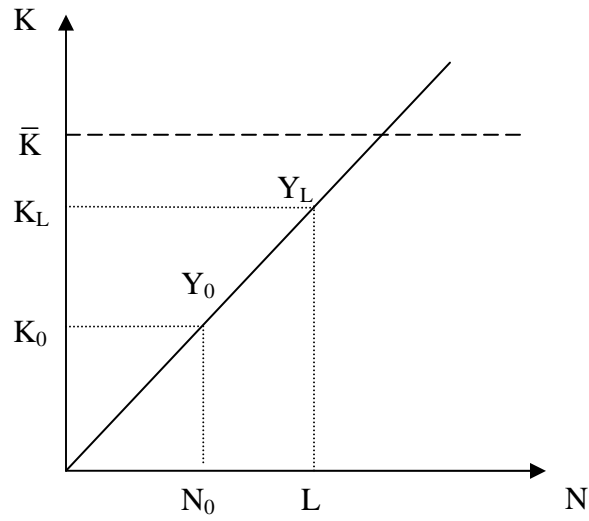
Figure 4: The Aggregate Supply Schedule
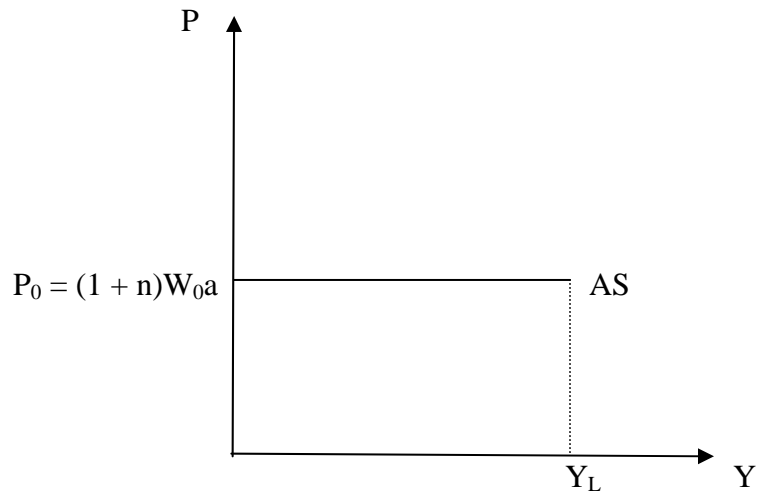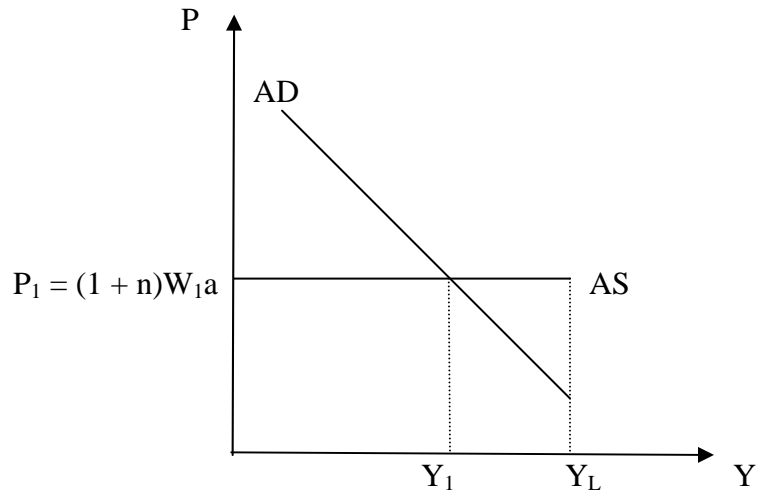
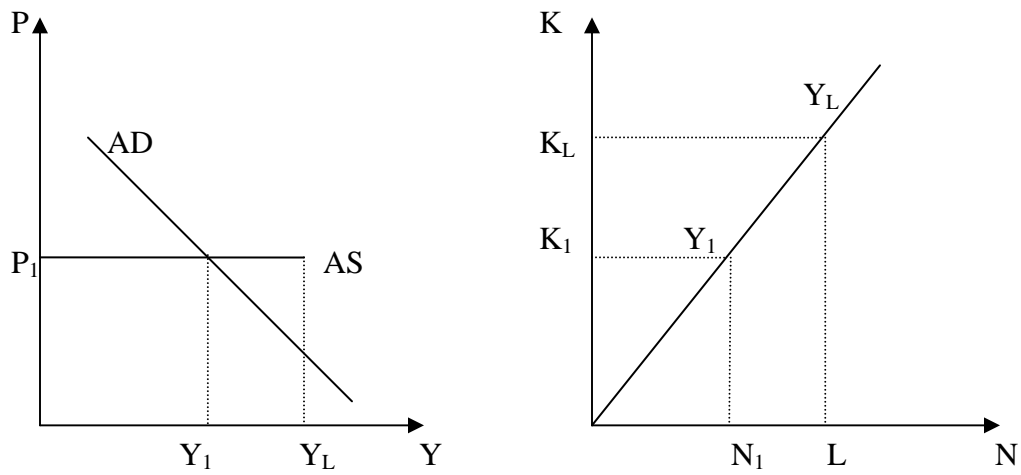**Figure 5: The Goods Market**

Figure 6: Equilibrium Output and Employment

Figure 7: The Labour Market
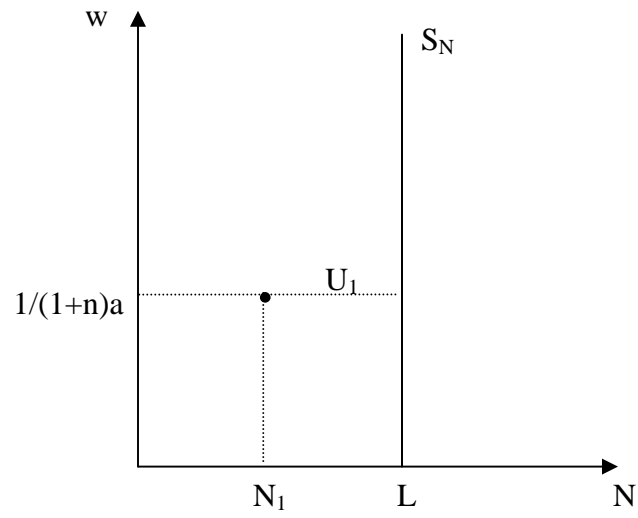
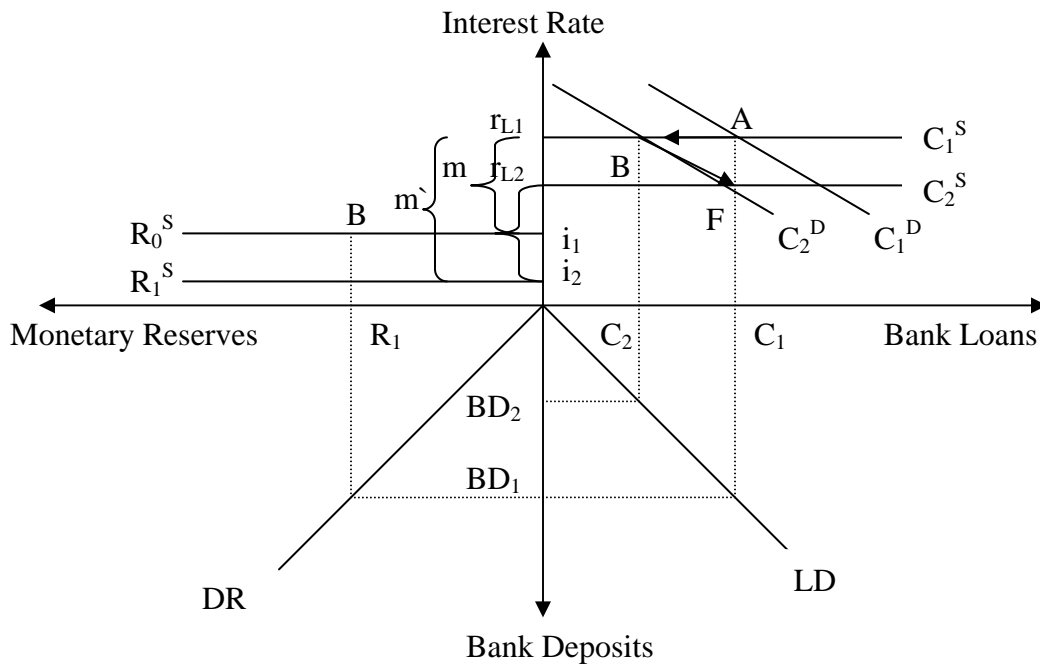**Figure 8(a): The Financial Crisis of 2007-2009 and the Endogenous Money Supply Process**

Interest Rate

R_0^S B   m`   m r_{L1} r_{L2} A C_1^S

B C_2^S

R_1^S i_1 F C_2^D C_1^D

i_2

Monetary Reserves R_1 C_2 C_1 Bank Loans

BD_2

BD_1

DR   LD

Bank Deposits

Figure 8(b): Consequences of, and Policy Responses to, the Financial Crisis of 2007-2009

P   AD$_2$ AD$_1$ AS P_1

Y_2 Y_1 Y_L Y

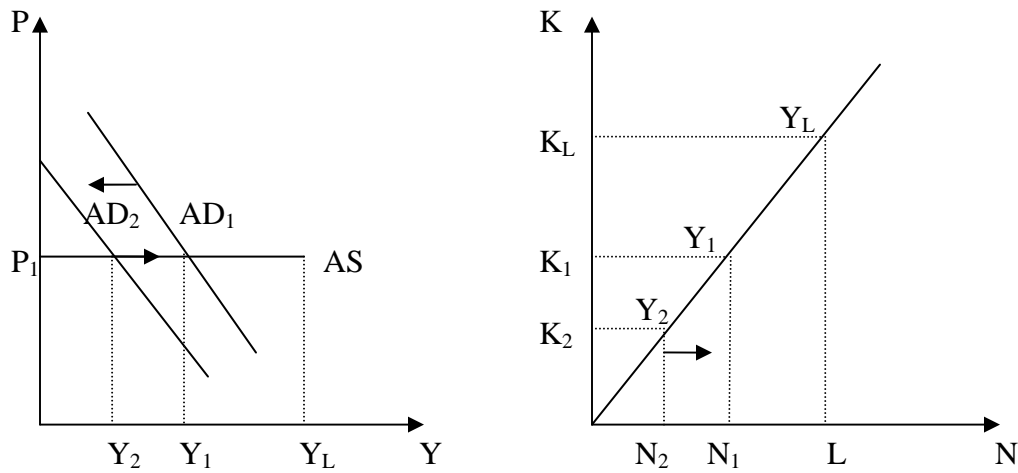K Y_L K_L Y_1 K_1 Y_2 K_2

N_2 N_1 L   N

Figure 8(c): The Effects of the Financial Crisis of 2007-2009 in the Labour Market