Competing Views of the Money Supply Process: Theory and Evidence

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I Introduction.

Within orthodox monetary macroeconomics the determination of the money supply is widely regarded as unproblematic. Recently, Post Keynesian economists have sought to re-open this issue, arguing for a re-focusing of attention away from the money multiplier toward the role of bank lending in this process. The current paper presents three competing models of the money supply process which illuminate some of the issues in this debate. The first model, labelled the "pure portfolio approach", corresponds to the orthodox description of the money supply process. The second model, labelled "the pure loan demand approach", corresponds to the Post Keynesian "accommodationist" view of endogenous money. The third model, labelled the "mixed portfolio-loan demand approach", corresponds to the Post Keynesian "structuralist" view of endogenous money (see Pollin, 1991a).

This third model is very much in the spirit of the earlier "New View" developed by Gurley and Shaw (1960), and Tobin (1969) in the 1960's. However, the model explicitly focuses on the money supply implications of the banking system's response to expansionary shifts of loan demand. The earlier New View theorists emphasized asset substitutabilities, and focused on changes in asset prices. This was consistent with their interest in the monetary transmission mechanism, but they took the money supply to be exogenous. Post Keynesians focus on the implications of asset substitutabilities for the money supply, and the capacity of the banking system to underwrite economic activity.

The critical difference between the "pure loan demand" and "mixed portfolio-loan demand" models concerns the significance ascribed to the private initiatives of banks in accomodating increases in loan demand. In the pure loan demand model, accomodation depends exclusively on the stance of the monetary authority, and its willingness to meet the reserve pressures generated by increased bank lending. However, in the mixed model accomodation depends on both the stance of the monetary authority, and the private initiatives of banks. These initiatives are independent of the monetary authority, and are therefore suggestive of the structurally endogenous nature of "finance capital".

II Three competing models of the money supply.

A. The portfolio choice money multiplier model.

We begin with the orthodox money multiplier model given by

$$(1)\quad Hs = NBR + \max[\,0\,,\ BR(i - id)\,] \qquad (+)$$

$$(2)\quad Dd = D(i, y) \qquad (-\ +)$$

$$(3)\quad Cd = C(i, y) \qquad (+\ +)$$

$$(4)\quad Td = T(i, y)$$

$$(5)\quad Rd = k1Dd + k2Td$$

$$(6)\quad Ed = E(i, id) \qquad (-\ +)$$

(7) Hd = Rd + Cd + Ed

(8) Hs = Hd

(9) M = Cd + Dd

where Hs = supply of base
NBR = non-borrowed reserves
BR = borrowed reserves
id = discount rate
Dd = demand for checkable (demand) deposits
Cd = demand for currency
Td = demand for time deposits/bank cerificates of deposit
Rd = required reserves
Ed = demand for excess reserves
Hd = demand for base
i = nominal interest rate
y = nominal income
k1 = required reserve ratio for demand deposits
k2 = required reserve ratio for time deposits
M = M1 money supply

Signs above functional arguments represent signs of partial derivatives. Equation (1) describes the base supply function, which consists of non-borrowed and borrowed reserves. The level of discount window borrowing is a positive function of the gap between market interest rates and the discount rate. Equations (2) and (3) describe the demands for checkable (demand) deposits and currency, which are both negative functions of the interest rate, and positive functions of income. Equation (4) describes the demand for time deposits, which is a positive function of the interest rate because time deposits are interest bearing bank liabilities. Equation (5) is the demand for required reserves, while equation (6) is the demand for excess reserves. This latter demand is a negative function of the interest rate because this represents the opportunity cost to banks of holding funds: it is a positive function of the discount rate since this represents the cost of substitute emergency funds. Equation (7) defines the total demand for reserves, and it is assumed that this demand is a negative function of the market interest rate. Equation (8) is the base market clearing condition, while equation (9) is the definition of the money supply.

The determination of equilibrium is illustrated in figure I. If there are no borrowed reserves, the supply of base schedule is vertical: if borrowed reserves are positive, it is kinked at the discount rate. Equilibrium in the federal funds market is determined by the intersection of the base demand and supply schedules. Since the demand for base derives from the demand for checkable deposits, equilibrium in the market for base determines the level of demand deposits.

Equilibrium is achieved through interest rate adjustment, which serves to reconcile direct (currency) and indirect (derived) demands for base with the supply of base. This adjustment rests on the standard liquidity preference mechanism: if the interest rate were greater than i*, the non-bank public would be unwilling to hold D* of demand deposits and would seek to purchase bonds, which would drive up bond prices and reduce interest rates until the interest rate had fallen to i*. This description of adjustment means that the interest rate is identified with the bond rate.

This orthodox model is illuminating both for what it includes and what it omits. First, the model emphasizes the supply of base as a constraint on the money supply. Fractional reserve banking

means that base is needed to support deposits, so that the supply of base restricts the quantity of deposits that can be created. Second, bank lending creates inside balances, and in equilibrium these balances must be willingly held, or else agents will seek to spend them causing interest rate, output, or price level adjustments. Thus, equilibrium outcomes must lie on the money demand schedule. Third, the money supply depends on the portfolio choices of agents through the demands for currency, time deposits, and excess reserves. Shifts in any of these asset demands will change the money supply: thus, even the orthodox model exhibits some money supply endogeneity.

The principal limitations of the orthodox model are its suppression of (i) the market for bank loans, and (ii) bank asset and liability management. The suppression of the loan market means that there is no requirement that the market for bank loans to clear: it also means that there is no channel through which loan demand can influence the issue of liabilities by banks. The suppression of bank asset and liability management decisions means that these are irrelevant for the money supply.

Another weakness is confusion over the nature of the interest rate. The appropriate interest rate for choice of borrowed and excess reserves is the federal funds rate. Contrastingly, the appropriate interest rate for the non-bank public's demand for currency and demand deposits is the bond rate. Yet, in the model there is only one interest rate, so that it is implicitly assumed that there is a fixed relation between the federal funds rate and the bond rate. It transpires that such a relationship can be econonomically justified by introducing bank portfolio behavior (as is done in model C), but this increases the significance of banks.

Finally, the model is revealing of the conceptual difficulties of even talking about a money supply function. This is because the money supply is an aggregate of different financial liabilities, the respective quantities of which are determined by the choices of agents. In a fractional reserve banking system, the supply of base sets an upper bound the M1 money supply given by M+ = Hs/k1. Actual M1 is then determined within this bound by portfolio preferences embodied in the demands for C, T, D, and E.

B. A pure loan demand model

The second model is Post Keynesian, and the money supply is endogenously determined by the level of bank lending. The model derives from Rousseas (1985) and Moore (1988, 1989). It contrasts with model A in its inclusion of the demand for bank loans and the banking sector balance sheet constraint. The equations of the model are

(10) $Ld = L(iL, ...)$
(11) $iL = (1 + m)iF$
(12) $Ls + Rd + Ed = D + Td$
(13) $Td = tD$
(14) $Rd = k1D + k2Td$
(15) $Ed = eD$
(16) $Cd = cD$
(17) $Hd = Cd + Rd + Ed$
(18) $Ls = Ld$
(19) $M = Cd + D$

where Ld = bank loan demand
iL = bank loan interest rate
m = bank mark-up
Ls = bank loan supply

iF = federal funds rate

Equation (10) is the loan demand schedule. Equation (11) is the loan pricing equation, according to which the loan rate is a fixed mark-up over the federal funds rate. The federal funds rate is exogenously set by the monetary authority. Equations (13), (15), and (16) describe the demands for currency, time deposits, and excess reserves as fixed proportions of the demand for checkable deposits: this is a simplifying assumption that facilitates the graphical exposition, and one that can be relaxed without changing any conclusions.

Using (10) - (15) and (18) yields

(20) $D = L((1+m)iF ,...) / (1+t-k1-k2t-e)$

Substituting (16) and (20) into (17) yields

(21) $Hd = (c+k1+tk2+e)L((1+m)iF,...)/(1+t-k1-k2t-e)$

while substituting (16) and (20) into (19) yields

(22) $M = (1+c) L((1+m)iF,...)/(1+t-k1-k2t-e)$

The equilibrium of the model is shown in figure (II). The upper left panel describes the federal funds market in which the supply of reserves is perfectly elastic at the exogenously set federal funds rate. The upper right panel shows the market for bank loans in which the loan supply schedule is perfectly elastic at a rate determined by the mark-up over the federal funds rate. The lower right panel imposes the banking sector balance sheet constraint, from which is derived the level of demand deposits associated with any given level of bank lending. The lower left panel then determines the demand for reserves associated with the level of demand deposits, and this links to the upper left panel to determine the actual supply of reserves.

Changes in the federal funds rate cause changes in the level of bank lending and the money supply, with the supply of reserves automatically adjusting to fully accommodate the expansion in deposits. Expansionary shifts of loan demand increase the level of bank lending, and thereby increase the level of demand deposits ("loans create deposits") and the narrow money supply: "broad money", defined as time plus demand deposits, also expands. The reverse holds for contractionary shifts of loan demand.

The implication that the money supply is endogenous and credit driven does not rest on the assumption of a perfectly elastic reserve supply schedule. If the central bank were unwilling to fully accommodate increases in loan demand, and imposed a feedback rule whereby the federal funds rate rose in response to market pressures, the supply of reserves would be a positive function of the funds rate. In this case the loan supply schedule would also be positively sloped, as shown in figure (3): expansionary shifts of loan demand would be less than fully accommodated, and the expansion of the money supply would be smaller. Thus, there is more to the dispute between "structuralists" and "accommodationists" (see Pollin, 1991b) than just the slope of the loan supply schedule.

The model's strengths are its inclusion of loan demand and the banking sector balance sheet constraint. Together, these features ensure that the market for bank loans clears, and they enable loan demand to affect the money supply. However, having rediscovered the loan market, money demand has been misplaced. In the model there is no requirement that agents willingly hold the deposits created by the banking system: instead it is implicitly assumed that agents are content with whatever deposits are created by the banking system's lending activities. This is a serious ommission, since if agents are unwilling to hold the existing stock of demand deposits, they will take purchase assets or commodities, or repay loans to eliminate excess holdings: this may then affect the final equilibrium.

C. A mixed portfolio-loan demand model.

The third model derives from Palley (1987). It embodies a Post Keynesian "structuralist" view of endogenous money whereby the private initatives of the banking sector matter for the determination of the money supply. The significant "formal" difference from model A is the inclusion of the effects of bank lending on the money supply, while the significant formal differences from model B are the inclusion of demands for bank liabilities, and the modelling of bank choices regarding the composition of bank assets and liabilities. Bank choice of the composition of assets and liabilities represents the core difference between the accommodationist and structuralist approaches. In the former, such choices are irrelevant, and the ability of the banking system to accommodate loan demand depends exclusively on the rate stance of the monetary authority. In the latter, banks actively manage their asset and liability positions, and this introduces another distinctive channel for loan accommodation.

The equations of the model are as follows.

$$\underset{\;\;-\;\;-\;\;-\;\;+}{\text{(23) } Cd = C(iD, iT, iB, Y)}$$

$$\underset{\;\;+\;\;-\;\;-\;\;+}{\text{(24) } Dd = D(iD, iT, iB, Y)}$$

$$\underset{\;\;-\;\;+\;\;-\;\;+}{\text{(25) } Td = T(iD, iT, iB, Y)}$$

$$\text{(26) } Hd = Cd + kDd$$

$$\underset{\;\;+\;\;+\;\;\;\;+}{\text{(27) } Hs = NBR(iF, A1) + BR(iF - id)}$$

$$\text{(28) } Hd = Hs$$

$$\underset{\;\;-\;\;+\;\;+}{\text{(29) } Ld = L(iL, iB, A2)}$$

$$\text{(30) } MRB = iB - p$$

$$\text{(31) } MRL = iL - cL$$

$$\text{(32) } MCF = MRF = iF$$

$$\text{(33) } MCD = (iD + cD)/(1 - k)$$

$$\text{(34) } MCT = iT - cT \qquad cT < cD$$

$$\underset{\;\;+}{\text{(35) } MCBR = id + v(BR)}$$

$$\text{(36) } MRB = MRL = MRF = MCF = MCD = MCT = MCBR$$

(37) $Y = Y(Ld)^{+}$

(38) $Ls + S + kDd = Dd + Td$
(39) $Ls = Ld$

where iD = interest rate on deposits
iT = interest rate on time deposits
iB = interest rate on bonds
A1 = expansionary monetary policy variable
A2 = positive loan shift variable
MRj = marginal revenue on asset j
MCj = marginal cost of liability j
p = liquidity premium on bonds relative to loans
cL = constant marginal cost per dollar loaned of monitoring loans including provision for expected defaults per dollar loaned.
cD = constant marginal cost per dollar deposited of administering deposit accounts.
cT = constant marginal cost per dollar of administering time deposit accounts.
Y = nominal income
S = bank holdings of secondary reserves

Signs above functional arguments represent assumed signs of partial derivatives. Equations (23) - (25) represent the demands for currency, demand deposits, and time deposits. Equation (26) represents the demand for reserves: for simplicity it is assumed that time deposits carry no reserve requirement, and from the standpoint of banks this gives time deposits a comparative advantage over demand deposits.

Equation (27) represents the reserve supply function. The monetary authority increases NBR in response to a higher federal funds rate, while borrowed reserves (which are contingent on the existence of a discount window) depend on the gap between the funds rate and the discount rate. The shift variable A1 captures a one-off expansion in the supply of reserves, while the slope of the NBR function captures the monetary authority's feed-back response to changes in market demands.

Equations (30)-(35) represent the marginal revenues and marginal costs associated with different bank assets and liabilities, while equation (36) is the first order condition for the representative competitive bank. The liquidity premium on bonds relative to loans captures the greater salability of bonds. Marginal transactions costs, including default risk, are assumed to be constant. If the default risk rose with lending, then the aggregate loan supply schedule would be positively sloped for reasons totally unconnected with "structural" endogeneity. Equation (37) determines nominal income, while equation (38) is the banking sector balance sheet identity. The federal funds market is assumed to clear, and therefore drops out of the identity. Lastly, equation (39) is the loan market clearing equation.

The key innovations, compared with model B, are the introduction of bank holdings of secondary reserves, and explicit modelling of banks' decisions regarding asset and liability holdings via equation (36). Holdings of secondary reserves refer to bank holdings of bonds, and the model adopts a buffer stock approach. Thus, secondary reserves buffer variations in loan demand, and demands for checkable and time deposits: if there are unexpected withdrawals of deposits into currency, individual banks sell secondary reserves to fund the outflow: if there is an increase in loan demand, individual banks sell secondary reserves to fund additional lending. The modelling of bank asset and liability choice provides banks with an incentive to seek the cheapest sources of

financing, which affects their response to higher federal funds rates induced by increased bank lending. Such incentives are absent in the accommodationist model.13

By a process of substitution equations (23) - (39) can be reduced to a two equation system given by

- + - + + + +

(40) C(iF, A2) + kD(iF, A2) = NBR(iF, A1) + BR(iF - id)

- + - + + + +

(41) L(iF, A2) = (1-k)D(iF, A2) + T(iF, A2) + BR(iF - id) - S

The endogenous variables are iF and S: the exogenous variables are A1, A2, k, and id. The signing of functional arguments assumes that an increase in the shift factor A2 increases loan demand and income (i.e. the direct impact of increased loan demand outweighs any subsequent interest rate crowding out effect). Additionally, the signining of the effect of the federal funds rate on the demand for checkable deposits, assumes that there is a net negative effect as agents switch into time deposits which now have a greater rate advantage.

Totally differentiating equations (40) and (41) enables solution for the comparative statics (see Appendix I) which are

diF/dA1 < 0 diF/dk > 0

diF/dA2 > 0 diF/did > 0

dS/dA1 = ? dS/dk = ?

dS/dA2 = ? dS/did = ?

The signing of iF is familiar: increased demands for reserves induced by expansions of loan demand raise interest rates, while increased supplies of reserves induced by a loosening of monetary policy lowers interest rates. More problematic is the signing of S, banks' holdings of secondary reserves. This is because there are ambiguities arising from offsetting interest and income effects. Thus, an increase in A2 causes an initial tightening of the loan market which induces banks to sell secondary reserves to fund increased loan demand: yet, the subsequent increase in income raises the demand for checkable and time deposits, while the rise in loan rates reduces loan demand, and these induced adjustments may ultimately make for enlarged bank holdings of secondary reserves.14 Monetary policy tightening (increased k and id, and decreased A1) causes an initial liquidity shortage, which may cause secondary reserve sales, but the subsequent income effects reduce loan demand, and may cause a net portfolio shift into secondary reserves.

The above analysis is suggestive of the important buffer stock role played by secondary reserves, which buffer variations in the liquidity position of the banking system. In a sense banks perform their own internal open market operations between their portfolios and those of the non-bank public. Although the total stock of reserves remains unchanged from these transactions, they allow the banking system to fund more loans. Interest rate adjustments also play an important role in accommodation of loan demand. Tighter federal funds market conditions provide individual banks with an incentive to bid up rates on time deposits to attract additional funds. This causes a transformation of demand deposits into time deposits, which frees up reserves.15

Unlike the accommodationist model (model B), the money supply implications are not straightforward, and the money supply does not increase one-for-one with bank lending. For instance, if banks finance loans through sales of secondary reserves and transformations of checkable deposits into time deposits, this actually produces an initial decline in the narrow money supply as the non-bank public surrenders demand deposits. However, once these funds are loaned

out the narrow money supply would tend back to its initial level through the process of "loans creating deposits".

Whether the narrow money supply rises in response to increased lending is (in principle) ambiguous owing to offsetting income and interest rate effects. The induced rise in income increases the demand for checkable deposits, but the subsequent rise in interest rates reduces demand. The same pattern applies to currency demand. Thus the narrow money supply (currency plus checkable deposits) only rises if the income effect dominates.16

Assuming the narrow money supply rises, how is this increase supported? The answer is through increased non-borrowed and borrowed reserves, and possibly reduced currency holdings. These measures both increase the total stock of reserves, as well as making the banking system use this stock more intensively in its production of loans. The traditional money multiplier approach correctly recognizes that these are the only channels for variation in the narrow money supply. However, its deficiency is the failure to recognize the causal link between variations in bank lending and variations in the supply of reserves and the components of the money multiplier.

III Evaluating the competing models: some empirical evidence.

The above models have different implications regarding the causes of change in the money supply, and this section uses a Granger-causality framework to identify their relative consistency with the data.17 By definition the money supply may be expressed as

(42) $M = z.H$

where M = money supply

z = money multiplier

H = supply of base

(i) In the pure portfolio model (model A) the money supply was independent of loan demand. Consequently, bank lending (L) should fail to Granger-cause both z and H. However, from the banking sector balance sheet identity, changes in the money supply, arising from changes in either z or H, do cause changes in bank lending: consequently, both z and H should Granger-cause L.

(ii) In the pure loan demand model (model B) the money supply rose in response to increased bank lending. This was accomplished through a passive increase in H, so that the model is consistent with L Granger-causing H. However, in this model lending is not reserve constrained (Moore, 1985), so that H does not Granger-cause L.

(iii) In the mixed portfolio-loan demand model (model C) there is potential for bivariate causality between both L and z, and L and H. Increased lending causes liability transformations that increase z, and also increase H through increased NBR and BR: changes in asset preferences or changes in the supply of reserves also cause changes in lending, so that z and H can Granger-cause L.

The postulated hypotheses are summarized in table (1). Testing these hypotheses involved standard bivariate Granger-causality regressions between bank lending, the money multiplier, and the supply of base using autoregressions of the form

$$(43)\quad Y_t = a_0 + \sum_{1=1}^{n} a_{1,t-i} Y_{t-i} + \sum_{i=1}^{n} a_{2,t-i} X_{t-i} + e_t$$

If the F-statistic associated with the lagged values of X is statistically significant, then X can be said to Granger-cause Y. Bank lending, the money multiplier, and the supply of base are all non-stationary variables, which gives rise to the problem of spurious regression (Granger and Newbold, 1974). To overcome this, all variables were rendered stationary by differencing, and these series were then used in the regressions.18 The sample period was 1973;01 - 1990;06: data was in

average monthly form, and drawn from the CITIBASE data bank. All estimates were by ordinary least squares. Variable definition was :

z1 = log of M1 money multiplier
z2 = log of M2 money multiplier
LL = log of total loans and leases at commercial banks
LS = log of total loans and securities at commercial banks
LH = log of the monetary base
GX = X - X(-1) X = z1, z2, LL, LS, LH
DX = GX - GX(-1)

Both LS and LL excluded loans to commercial banks in the U.S.. Further details concerning the data are in the appendix II.

Table (2) provides the results of the of Granger causality regressions. These were run using 3, 6, 9, 12, 18, and 24 month lag lengths so as to help assess the robustness of results. The principal findings are that

(i) total loans and leases at commercial banks Granger-cause the M1 money multiplier (line 1),
(ii) total loans and securities at commercial banks Granger-cause the M1 money multiplier (line 3),
(iii) bank loans do not Granger-cause the M2 money multiplier (lines 5 and 7),
(iv) bank loans do not Granger-cause the monetary base (lines 10 and 12),
(v) the monetary base does Granger-cause bank loans (lines 9 and 11).

In terms of the hypotheses in table (1), these results seem most consistent with the mixed portfolio-loan demand model. The fact that bank loans cause the M1 money multiplier is inconsistent with the pure portfolio model. The absence of an effect of bank lending on the monetary base is inconsistent with the pure loan demand model since reserves are supposed to expand to accommodate loans. The presence of an effect of the monetary base on bank lending is also inconsistent with this model, since lending is not supposed to be reserve constrained.19 Finally, the effect of L on z1, and H on L were both consistent with model C.

IV Conclusions

This paper has described three competing approaches to the determination of the money supply. The first approach was labelled the pure portfolio approach, and it was identified with the orthodox money multiplier explanation of the money supply. The second approach was labelled the pure loan demand approach, and it was identified with the Post Keynesian accommodationist approach. The third approach was labelled the mixed portfolio-loan demand approach, and it was identified with the Post Keynesian structuralist approach. The critical theoretical difference between the latter two approaches was identified in terms of the importance of the private initiatives of banks in accommodating expansions of loan demand. Finally, the paper provided some Granger-causality evidence on timing relations predicted by the three approaches, and concluded in favor of the mixed portfolio-loan demand approach.

Appendix I

Appendix I presents the comparative statics associated with model C. The total differential of equations (40) and (41), arranged in matrix form, is given by

$$\begin{vmatrix} CiF + kDiF - NBRiF - BRiF & 0 \\ LiF - (1-k)DiF - TiF - BRiF & 1 \end{vmatrix} \begin{vmatrix} diF \\ dS \end{vmatrix} =$$

$$\begin{vmatrix} (-CA2 - kDA2) & -D & NBRA1 & BRid \\ (-LA2 + (1-k)DA2 + TA2) & -D & 0 & BRid \end{vmatrix} \begin{vmatrix} dA2 \\ dk \\ dA1 \\ did \end{vmatrix}$$

The Jacobian is given by

$$|J| = \begin{vmatrix} - & 0 \\ ? & 1 \end{vmatrix} < 0$$

$$diF/dA2 = \begin{vmatrix} - & 0 \\ ? & 1 \end{vmatrix} / |J| > 0 \qquad dS/dA2 = \begin{vmatrix} - & - \\ ? & ? \end{vmatrix} / |J| = ?$$

$$diF/dk = \begin{vmatrix} - & - \\ - & 1 \end{vmatrix} / |J| > 0 \qquad dS/dk = \begin{vmatrix} - & - \\ ? & - \end{vmatrix} / |J| = ?$$

$$diF/dA1 = \begin{vmatrix} + & 0 \\ 0 & 1 \end{vmatrix} / |J| < 0 \qquad dS/dA1 = \begin{vmatrix} - & + \\ ? & 0 \end{vmatrix} / |J| = ?$$

$$diF/did = \begin{vmatrix} - & - \\ - & 1 \end{vmatrix} / |J| > 0 \qquad dS/did = \begin{vmatrix} - & - \\ ? & - \end{vmatrix} / |J| = ?$$

If LiF - (1-k)DiF - TiF - BRiF < 0, which implies that an increase in loan market interest rates loosens the bank credit market, then dS/dA1 < 0.

Appendix II

The CITIBASE codings for data used in the regressions reported in tables (2) - (5) were

FM1 = M1 money supply
FM2 = M2 money supply
FMFBA = monetary base
FMRNBA = non-borrowed reserves
FCLS = total loans and securities of commercial banks
FCLL = total loans and leases of commercial banks
FYFF = federal funds rate

The money multipliers were computed as

M1 multiplier = FM1/FMFBA
M2 multiplier = FM1/FMFBA

Borrowed reserves were computed as

BR = FMFBA - FMRNBA

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Pure portfolio model: z, H -----> L
L --/--> z, H

Pure loan demand model: L -----> H
H --/--> L

Mixed portfolio-loan demand model:
L ------> z, H
z, H ------> L

Table (1): Shows the pattern of Granger-causality relations between L, z, and H implied by the alternative theoretical models.
Key: ------> = does Granger-cause
---/--> = does not Granger-cause

	3 lags	6 lags	9 lags	12 lags	18 lags	24 lags
1. GLL------>Gz1	3.09	2.83	2.16	2.06	1.55	1.33
	(2.81)	(1.16)	(2.61)	(2.17)	(7.85)	(5.27)
2. Gz1------>GLL	2.40	1.27	0.89	1.16	1.20	1.02
	(6.92)	(27.51)	(53.87)	(31.30)	(26.91)	(44.32)
3. DLS------>Gz1	3.54	2.76	1.99	2.13	1.27	1.64
	(1.56)	(1.34)	(4.20)	(1.72)	(21.47)	(28.44)
4. Gz1------>DLS	2.45	1.04	1.34	1.55	1.26	1.16
	(6.42)	(40.12)	(21.68)	(10.93)	(22.29)	(27.79)
5. GLL------>Gz2	1.90	1.44	0.94	0.72	0.88	0.78
	(13.07)	(20.02)	(49.55)	(73.24)	(60.93)	(75.28)
6. Gz2------>GLL	0.73	0.72	0.46	1.73	1.54	1.26
	(53.68)	(63.41)	(90.02)	(6.41)	(8.19)	(20.32)
7. DLS------>Gz2	2.03	1.37	0.91	0.97	0.81	0.83
	(11.07)	(23.03)	(51.53)	(48.13)	(68.10)	(69.03)
8. Gz2------>DLS	1.72	1.37	1.27	1.77	1.42	1.58
	(16.46)	(22.94)	(25.78)	(5.56)	(12.80)	(5.23)
9. DLH------>GLL	2.21	1.26	1.05	1.19	0.78	0.69
	(8.75)	(27.75)	(40.46)	(84.93)	(71.87)	(85.69)
10. GLL------>DLH	0.25	0.30	0.58	0.59	0.81	0.95
	(86.05)	(93.51)	(81.61)	(84.93)	(68.13)	(54.06)
11. DLH------>DLS	2.73	2.24	1.67	1.72	1.00	0.78
	(4.50)	(4.06)	(9.89)	(6.62)	(46.29)	(75.82)
12. DLS------>DLH	0.07	0.59	0.30	0.67	0.46	0.66
	(97.52)	(73.56)	(97.26)	(78.21)	(96.96)	(88.62)

Table(2): Shows the F-statistics from the Granger causality regressions between bank lending, the M1 and M2 multipliers, and the monetary base. Figures in parentheses are significance levels (bold face = significant at 10% level).

Abstract

This paper examines three competing approaches to the determination of the money supply. The first approach is labelled the pure portfolio approach, and corresponds to the othodox approach to the money supply. The second approach is labelled the pure loan demand approach, and corresponds to the Post Keynesian accommodationist view of endogenous money. The third approach is labelled the mixed portfolio-loan demand approach, and corresponds to the Post Keynesian structuralist view of endogenous money. The critical theoretical difference between the latter two models is identified in terms of the importance of the private initiatives of banks in accommodating expansions of loan demand. The paper then provides Granger-causality evidence on the three approaches, and concludes in favor of the mixed portfolio-loan demand approach.

Key words: Endogenous money supply, money demand, loan demand, bank lending

JEL ref.: E0, E4, E5

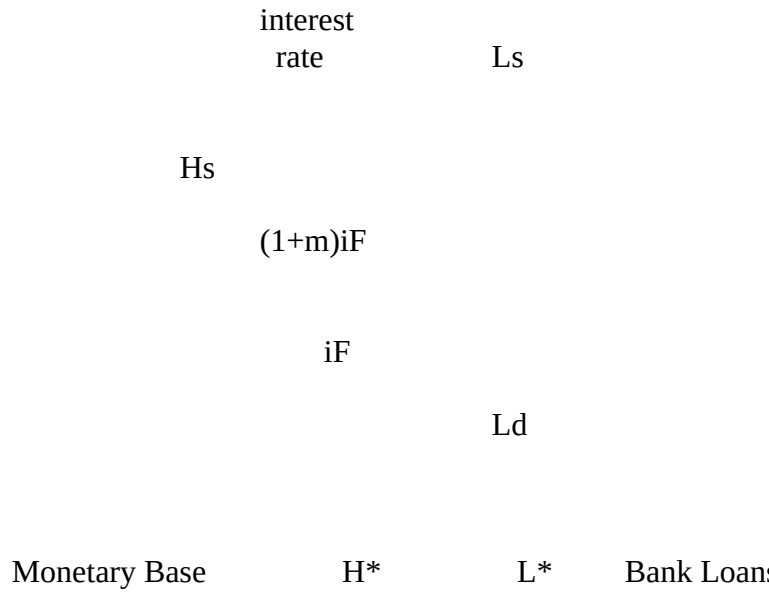

Figure (3):Shows the determination of bank loan rates,bank lending, demand deposits, and the monetary base in the Moore (1989) model with partially accommodative monetary policy.

│.Though differing in specifics, both the accomodationist and structuralist formulations, ultimately derive from Kaldor's (1970, 1982) seminal identification of the endogenous character of the money supply.
│.Pollin (1991b) suggests that the New View represents a "path not taken" by mainstream macroeconomics, and one that is in principle consistent with Post Keynesian "structural endogeneity".
│.There is some ambiguity because a decline in interest rates increases currency holdings, required reserve holdings on demand deposits, and excess reserve holdings, but decreases required reserve holdings on time deposits. If this latter effect dominates, the demand for reserves would be a positive function of the interest rate.
│.Discount window borrowing is a feature of the U.S. banking system. Its presence or absence in no way alters the substantive conclusions of any of the three models examined. It should also be noted that the reserve supply schedule can be positively sloped throughout if the monetary authority follows a policy of "leaning against the wind". In this case the reserve supply schedule represents a reduced form of the monetary authorities reaction function: the greater the slope, the less accomodative is the monetary authority.
│.Interest rate adjustment is one way of ensuring that the non-bank public is willing to hold the demand deposits created by the banking sector. Other possible adjustments that also ensure this are adjustments in real income or the price level.
│.This expression is a more sophisticated statement of the loan multiplier derived in Coghlan (1978).
│. Both Structuralists and Accommodationists believe that the money supply is endogenously affected by bank lending. Palley(1991) claims that their differences concern the slope of the aggregate banking industry loan supply schedule. Instead, the differences really center on the manner in which the banking sector accommodates changes in loan demand. Accommodationist models make a simple appeal to accommodation by the Fed, whereas Structuralist models also include adjustments in the composition of bank funding obtained from the non-bank public.
│. This is tantamount to assuming that the demand for deposits is infinitely elastic at the going level of interest rates.
│. In the current model banks are assumed to have constant marginal costs of monitoring borrowers and administering deposits. This implies that the wedge between deposit rates and loan rates is constant. If marginal costs of monitoring and administering rose with the level of loans and deposits, the wedge would increase with the volume of intermediation. This would cause the loan supply schedule to be positively sloped for reasons completely independent of households portfolio preferences, and the need to pay households more to induce them to hold more bank liabilities.
│.Time deposits should be viewed as proxying for the array of liabilities banks have introduced to circumvent reserve requirements and other regulations. Zero reserve requirements on time deposits is a simplifying assumption. All that is required is that the requirement be less than that on demand deposits.
│.It would also be positively sloped in the pure loan demand model since the mark-up would rise with lending. Since we wish to focus on the intrinsic differences between the models, we adopt the simplifying assumption of constant default risk.
│.There are a two of justifications for this specification of nominal income determination. First, loans finance expenditures, so that increases in lending imply higher consumption and investmemt

spending: this is a Keynesian rationalization. Second, loans create deposits, and these deposits are then spent: this is a monetarist rationalization, without the assumption of exogenous money.

13.The accommodationist model can be nested within the structuralist model by having the monetary authority peg the federal funds rate: HS then becomes endogenous, and iF is exogenous. The model is therefore capable of incorporating different policy regimes. Interest pegging changes the response to loan demand shocks, since from equation (36), all additional reserves necessitated by an expansion of bank lending are supplied by the monetary authority at a constant price. However, the structuralist perspective still applies regarding changes in the peg, since such changes will set up incentives for banks to reconfigure their balance sheets.

14. If bank lending has no effects on income, the model is particularly simple. In this case variations in loan demand are simply accomodated through variations in the level of secondary reserves. In terms of the model it means that A2 has no effect on the demands for currency, demand deposits, and time deposits. From equation (41), this means that banks just buffer the change in loan demand through sales of secondary reserves. The economic logic is that if lending has no effect on income, it leaves the demand for reserves and interest rates unchanged: with rates unchanged, there is then no incentive to liability management. It also means that the money supply is unaffected by lending.

15. Though an individual bank gains reserves equal to the time deposits it attracts from outside its' customer base, the banking system as a whole only gains reserves equal to the difference in reserve requirements on time and demand deposits.

16.In principle there are similar ambiguities with the broad money supply (M1 plus time deposits). To the extent that banks reduce secondary reserve holdings to finance lending, there is less need to issue additional liabilities. Also, time deposits could increase while M1 falls, so that the movement in M2 would be ambiguous.

17.Moore (1988) produces two forms of evidence on endogeneity: first, a structural regression of the monetary base: second, causality evidence on the relation between M1 and lending. Both forms are consistent with the theory of endogenous money, but they do not allow one to discriminate between the "accommodationist" and "structuralist" positions. By decomposing the money supply into the mulitplier and the base, the current tests enable such discrimination because the theories have different implications regarding the relation of lending to these components.

18.For purposes of establishing the stationarity properties of the series used, augmented Dickey-Fuller tests were conducted on the various time series. This involved running the regression

$$dXt = a0Xt + \sum_{i=1}^{i=4} a1,t\text{-}i\ dXt\text{-}i + et$$

If the coefficient a0 was negative and statistically significant according to the Dickey-Fuller test statistic, the series was stationary. All the variables were non-stationary when expressed as log levels. All except LS and LH were stationary when expressed as first differences of log levels, and LS and LH were stationary when expressed as second differences of log levels. Only the regressions with stationary series are reported. However, the results using log levels (non-stationary) were almost identical.

19.When read in conjunction with Pollin's (1991a) results on interest rate causation, these "quantities" based results seem to reject the "accommodationist" view of endogenous money.