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THE KEYNESIAN-MONETARIST DEBATE: AN ANALYSIS AND SYNTHESIS

A DISSERTATION

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THE KEYNESIAN-MONETARIST DEBATE:

AN ANALYSIS AND SYNTHESIS

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INTRODUCTION

Until recently, the Keynesian-Monetarist debate has been conducted mostly through empirical analysis. Even a cursory look at the literature reveals the relatively large amount of empirical work and the small amount of theoretical work which has bearing on the debate. Tables I and II list the major propositions advanced by Keynesians and Monetarists. In assessing these propositions one must take care to note that neither every Keynesian nor every Monetarist would embrace each proposition, and some might add to the list. However, the propositions accurately convey the flavor of the debate as it has proceeded thus far with Keynesians, Monetarists, and agnostics presenting data which either supports or refutes one position or the other. Since good empirical results can support numerous diverging theories, a solely empirical analysis of Keynesian and Monetarist economics is inconclusive without a concurrent theoretical analysis.

Until Milton Friedman's articles, in the Journal of Political Economy (1970b, 1971), there was no systematic comparison of Keynesian and Monetarist theory comparable to the comparisons of Keynesian and Classical theory. However, in those articles Friedman outlines the Monetarist theory implicit in his empirical work on money, as well as his conception of Keynesian and Classical theory. He then compares the three. Friedman's specifications of Keynesian and Monetarist

economics have been rejected by both Keynesians and Monetarists. In commenting on Friedman's theory, James Tobin (1972b, pp. 852-853) states, "He undoubtedly hoped that use of a common theoretical apparatus would reduce the controversy about the roles of monetary and fiscal policies to an econometric debate about empirical matters.... I wish that these articles brought us closer to this goal, but I am afraid they have not." Karl Brunner and A. H. Meltzer (1972b, p. 838) state that "Neither of Friedman's two recent statements of monetary theory, (1970, 1971) seems to us an adequate underpining for monetary theory or a particularly useful basis for empirical work." They continue and say, "We regard Friedman's discussion as either misleading or a complete reversal of his often stated position." Friedman's model and the resulting polemics in the September/October 1972 issue of the Journal of Political Economy illustrate that Keynesians and Monetarists cannot even agree on what it is they disagree about.

The function of the following analysis is to examine the Monetarist and Keynesian theoretical models with respect to the following questions: what is Keynesian macroeconomics; what is Monetarist macroeconomics; and can Monetarist and Keynesian macroeconomics, after being analyzed, be synthesized, combined into a single, unified paradigm. It should be emphasized that any list of Keynesian and Monetarist propositions necessarily includes both policy and theoretical positions, but this analysis is concerned only with the specifications of Keynesian and Monetarist theoretical models. As will be demonstrated, there exists no lack of diversity among Keynesian theoretical models nor among Monetarist theoretical models. In fact, there is no single

macroeconomic model which can be called either the Keynesian model or the Monetarist model.

One method of comparing economic models is to formulate them as special cases of a general model. This is by no means the only alternative, as reference to the excellent comparison of the Quantity theory and different Keynesian theories by both Tobin (1961) and Fand (1969) shows. However, a general model is developed in hopes that a common framework will, to paraphrase Tobin (1972b, pp. 852, 853), facilitate communication and help reduce the controversy concerning the crucial theoretical differences between Monetarists and Keynesians.

Friedman's use of IS-LM to express the theory behind his empirical work raises the possibility of using the IS-LM system to compare and analyze the Keynesian and Monetarist positions. The use of IS-LM would be desirable since it is perhaps the most widely understood macroeconomic framework. However, it is unacceptable for several reasons. The IS-LM model is specified as a two asset model; therefore, the attainment of equilibrium is the result of the interrelation of three markets--two asset markets and the commodity market--which determine two prices--the interest rate and the price of output. However, there is disagreement over whether the assets are money and bonds, or money and a bonds-capital aggregate in which bonds and capital are perfect substitutes. (This argument is discussed in detail in the chapter examining the IS-LM model.) In either case, not all two asset Keynesian models can be forced into the IS-LM structure. For example, the Radcliffe model is a two asset model in which capital is one asset and money and bonds form the other asset. The assumption that money

and bonds are perfect substitutes leaves IS-LM with only one aggregate asset (money-bond or money-bond-capital) while a correct representation of the Radcliffe model requires two aggregate assets. An additional disadvantage of IS-LM is that no three asset model can be expressed in a two asset framework. The effect of a three asset specification is that equilibrium is the result of the interrelation of four markets, rather than three, which determines three prices, rather than two as IS-LM proposes.

The general model developed below is of a closed economy composed of four markets: the money market, the bond market, the capital market, and the output market. The assets are considered gross substitutes and so the four markets interact to determine the interest rate, the return on capital, the price of capital relative to the price of output, the price of output, the level of wealth, and employment. This model is not general in the sense that every characteristic of each model to be examined within it is initially a part of the general model. To the contrary, only the framework is general. Particular models are presented as special cases of the framework by altering the asset substitutability assumptions and the transmission mechanisms which allow interaction among the four markets. Extrinsic characteristics of a particular model are added only when that model is discussed.[1]

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[1]It should be emphasized that the general model is presented only as a framework into which other models can be placed as special cases. It is not presented as an alternative model.

After examination of Keynesian and Monetarist income determination models, their respective theories of inflation are briefly discussed, as is the role of the budget constraint in their models. Finally, a new model is developed by combining many of the important theoretical characteristics of each school into one theoretical model. It is hoped that the synthesized model will be acceptable to Keynesians and Monetarists alike and will help establish the relative effectiveness of monetary and fiscal policy.

Table I

Keynesian Propositions

1. Changes in the money supply which do not change wealth affect aggregate demand by changing the interest rate in the opposite direction. (Samuelson 1967a, 1967b, Smith 1969, Dernburg and McDougall 1972)

2. The existence of a liquidity trap may prevent monetary policy from having any affect on aggregate demand. (Dernburg and McDougall 1972, Ackley 1969, Texts[2])

3. Inelastic marginal efficiency of investment schedule may prevent the effective use of monetary policy. (Dernburg and McDougall 1972, Ackley 1969, Texts)

4. In terms of Hick's IS-LM analysis, the slopes of the IS and LM curves determine the effectiveness of monetary policy. (Tobin 1972, Dernburg and McDougall 1972)

5. Changes in the supply of money may have direct effects on output if the change in the money supply is also a change in wealth. (Samuelson 1967a, Leijonhufvud 1967)

6. The private economy tends to be subject to fluctuations due, for instance, to changing entrepreneurial expectations or changes in thriftiness. (Samuelson 1967b, Klein 1973, Leijonhufvud 1967)

7. Monetary and fiscal policy may be used to stabilize the economy, but money has an important influence only when it is created to finance government expenditures. (Samuelson 1967b)

8. Fiscal policy is more effective than monetary policy and operates with a shorter lag. (Ando-Modigliani 1967, Deprano and Mayer 1965, Gramlich 1971)

9. The quantity of money can effect the terms on which the community will hold capital, but it is not the only asset supply that can do so. (Tobin 1961) There is no apparent reason why money is more or less important than any other financial asset. (Smith 1969)

10. Liquid assets issued by nonbank intermediaries may be good substitutes for money. This reduces the demand for money. (Gurley and Shaw 1956) This implies that the money supply relevant for monetary theory and policy should, perhaps, include some of these assets. (Fand 1969)

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[2]"Texts" refers to the textbook tradition of which Dernburg and McDougall and Ackley are examples.

Table I (continued)

11. Monetary policy affects mainly interest rates on financial assets and so the burden of monetary policy falls on a relatively small sector of the economy. (Meisel 1967).

12. Rising prices are a real phenomenon to be examined in the real sector. (Heitman and Robinson 1969, Johnson 1963)

13. There are no automatic forces operating to guarantee equilibrium at full employment. (Leijonhufvud 1967, Tobin 1972b)

14. The rate of inflation is inversely related to the level of unemployment. Therefore, the unemployment rate can be reduced by incurring the appropriate rate of inflation. (Lipsey 1960)

Table II

Monetarist Propositions

1. Changes in the money supply affect nominal income in the short run by affecting output but in the long run prices are affected with little influence on output. (Friedman 1970a)

2. Changes in the money supply affect interest rates in one direction initially but in the opposite direction later. (Friedman 1970a, Fand 1970)

3. Monetary policy works through wealth effects and by changing relative prices for a wide range of assets. (Friedman 1972, Fand 1970)

4. The slopes of the IS-LM curves do not determine the effectivenss of monetary policy. (Friedman 1972, Brunner and Meltzer 1972b, 1972c)

5. Liquidity traps are not a likely possibility. (Brunner and Meltzer 1968, 1972a)

6. Inelastic marginal efficiency of investment curve does not preclude effective monetary policy. (Brunner and Meltzer 1972a)

7. The private economy is inherently stable and past government policies are largely responsible for destabilizing the economy. (Brunner and Meltzer 1972a)

8. Since it is the major cause of destabilization, government policy should not be used for short run stabilization. (Brunner and Meltzer 1972a) The money supply should be increased at a constant rate. (Friedman 1969)

9. Fiscal policy is of limited effect on either output or inflation because the multiplier is positive for only a few quarters due to the "crowding out" effect. (Anderson 1973, Friedman 1972)

10. Monetary policy is more effective than fiscal policy and operates with a shorter lag. (Anderson and Jordan 1968)

11. Government expenditures increase aggregate demand permanently only if they are continually financed by creating money.

12. Inflation is always a monetary phenomenon in the sense it can be produced only by a more rapid increase in the quantity of money than in output. (Friedman 1970a)

13. There is a natural rate of unemployment which will eventually evolve at any constant rate of inflation. (Anderson 1973, Friedman 1969)

CHAPTER I

THE GENERAL MODEL

The economy described by the general model is composed of the government sector and the private sector consisting of households, firms, and banks. Firms produce consumer and capital goods by hiring the factors of production owned by households. Households can use their incomes to purchase commodities, bonds, and capital; to hold cash; or to pay taxes. Banks create demand deposits by making loans; however, the supply of "inside money" is assumed to be constant. The government issues demand debt, which serves either as means of payment or as reserves for the banking system, and interest bearing government bonds, which serve as perfect substitutes for private bonds. The collection of taxes and the issuance of demand debt and bonds provide proceeds with which the government purchases goods from firms. The level of government expenditures and the methods of financing government expenditures are assumed exogenous to the model.[1] Therefore, the general model consists of four markets--the money market, the bond market, the capital market, and the output market (which includes the

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[1]Although the supply of demand debt (or outside money) and the supply of bonds are exogenously determined, the net change in the supply of money and bonds must equal the government deficit, which is the difference between nominal government expenditures and revenue raised through taxation.

labor market) in which money, bonds, capital, and output holdings are adjusted to desired levels. The term money market refers to the supply and demand for currency and demand deposits; the term bond market refers to the supply and demand for bonds, and the term capital market refers to the supply and demand for physical capital.[2]

The Money Market

Money is defined as currency plus demand deposits. The demand for money is a demand to hold a stock; the supply of money is a stock determined by past government decisions with respect to deficit financing and past activities of the banking system. Therefore, equilibrium in the money market is a stock equilibrium in which the aggregate amount of real balances the public desires to hold equals the amount supplied by the monetary authorities. The exogenous supply of money (M) is represented by $M_o^o + M_o^I$ where M_o^o is outside money issued by the government and M_o^I is inside money issued by the banking system. The demand for real balances is given by

$$(\frac{M}{p})_d = m(\overset{-}{i}, \overset{-}{i_K}, \overset{+}{Y}, \overset{+}{\frac{W}{p}})$$

and the demand for nominal balances by

$$M_d = m(\overset{-}{i}, \overset{-}{i_K}, \overset{+}{Y}, \overset{+}{\frac{W}{p}})p.$$

The signs above the arguments in each function are the signs of

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[2]This use of the terms money market, bond market, and capital market is consistent with most economic scribings. (For examples see Patinkin 1965, Brunner and Meltzer 1972c)

the partial derivatives. The demand for real balances depends on the interest rate (i); the return on capital (i_K), real income (Y), and real wealth ($\frac{W}{p}$); the demand for nominal balances depends additionally on the absolute level of prices. This specification results from the assumption that there exists no money illusion. If i, i_K, Y, and $\frac{W}{p}$ -- the real variables in the system--remain constant, the demand for real balances remains constant even though nominal wealth (W) and the price level (p) rise. However, since the price level has risen, the demand for nominal balances must rise in order for the demand for real balances to remain constant.

When the interest rate or the return on capital rises, the demand for money falls as alternative assets become relatively more attractive. When real income rises, the demand for money rises in accordance with the normal transactions demand for money. The demand for money varies directly with wealth. As real wealth increases, portfolio holders desire to diversify throughout the entire range of assets at their disposal given constant risk and returns.

The Bond Market

Bonds are assumed to be consols yielding one dollar per period. Therefore, the price of securities equals the reciprocal of the interest rate. Individuals and private businesses hold government bonds and issue private bonds but are assumed to be net creditors.[3] The supply

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[3]Since banks create inside money by making loans via the purchase of bonds, or private IOU's, they have a demand for bonds. The bank demand for bonds depends mostly upon the interest rate and is consolidated into B_d. However, since the supply of inside money is constant, the bank demand for bonds is also assumed constant.

of bonds is the sum of government and private issues which are perfect substitutes. The quantity of government bonds is exogenously determined (S_o), and so the real supply of bonds is:

$$\frac{B_s}{ip} = \frac{S_o}{ip} + \frac{x(\overset{-}{i}, \overset{+}{i_K}, \overset{+}{Y}, \overset{-}{\frac{W}{p}})}{ip}.$$

The demand for bonds reflects the absence of money illusion like the demand for money.

$$\frac{B_d}{ip} = q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{\frac{W}{p}})$$

$$B_d = q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{\frac{W}{p}})ip$$

The equilibrium condition in the bond market is that the demand and supply of bonds are equal.

$$S_o + x(\overset{-}{i}, \overset{+}{i_K}, \overset{+}{Y}, \overset{-}{\frac{W}{p}}) = q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{\frac{W}{p}})ip$$

$$S_o = q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{\frac{W}{p}})ip - x(\overset{-}{i}, \overset{+}{i_K}, \overset{+}{Y}, \overset{-}{\frac{W}{p}})$$

The private demand for bonds falls and the private supply of bonds rises as the return on capital rises, thus decreasing the net demand for bonds. However, when the rate of return on bonds rises, the demand rises and the private supply falls causing a net increase in the demand for bonds. As income increases, the demand for money increases. This causes the public to sell bonds in order to increase their money holdings and so reduce their demand for bonds and increase their supply. Thereby, the desired net creditor position of the public is reduced.

A rise in wealth reduces the supply and increases the demand for bonds. The net private demand for bonds can be rewritten as follows:

$$b(i, i_K, Y, \frac{W}{p})ip \overset{-}{-} q(i, i_K, Y, \frac{W}{p})ip - x(i, i_K, Y, \frac{W}{p}).$$

Therefore, the equilibrium condition for the bond market can be written as

$$S_o = b(i, i_K, Y, \frac{W}{p})ip.$$

The Capital Market

The real supply of capital is

$$K_s = \frac{PK_o}{p}.$$

The demand for capital is

$$\frac{PK_d}{p} = k(i, i_K, Y, \frac{W}{p})$$

$$K_d = \frac{k(i, i_K, Y, \frac{W}{p})p}{p}.$$

The stock of capital (K_o) is assumed fixed although the real value of capital varies directly with the price of capital (P) and inversely with the price of commodities (p). The price of capital depends upon the expected income stream resulting from its purchase (pR) and the rate of discount applied to that stream (i_K).

$$P = \frac{pR_1}{(1 + i_K)} + \frac{pR_2}{(1 + i_K)^2} + \ldots + \frac{pR_n}{(1 + i_K)^n}$$

$$U = \frac{P}{p} = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

R is the expected real income stream which is assumed to be exogenously determined. Therefore, U is an inverse function of the rate of discount applied.[4] For equilibrium to prevail in the capital market, the public must be willing to hold the existing capital stock, and i_K is the return which will make them willing to do so. The demand for capital is downward sloping since for a given stock of money and bonds, portfolio holders would desire to hold additional capital only if they could obtain a higher rate of return on capital. That is, the rate of discount applied to future income streams would rise causing the price of capital to fall.[5]

Figure I shows the demand and supply of real capital given the supply of money and bonds. The supply of capital rises as $\frac{P}{p}$ or

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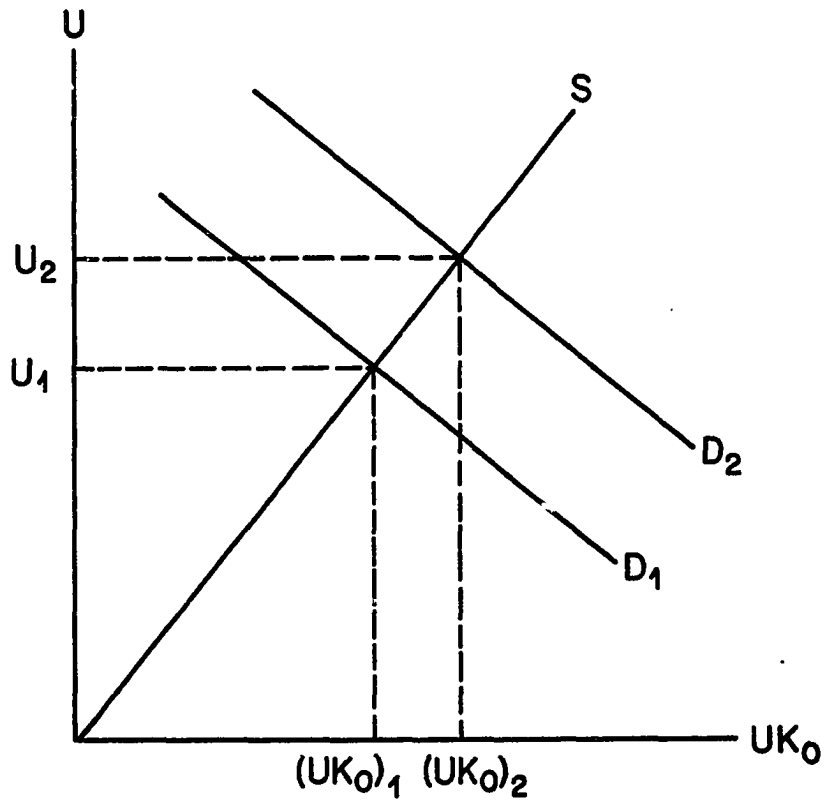
[4]It is not proposed that future prices are forever equal to current prices as one might think from looking at the definition of P. Instead, as a good simple approximation, it is assumed that future prices are proportional to current prices, and this anticipation is incorporated into R.

[5]Changing expectations of the income from capital as the quantity of capital increases can also cause the demand for capital to be downward sloping. Witte (1963) states that as the quantity of the capital good increases, the expected incremental income per unit of capital, and therefore the price of capital, should decline for three reasons. First, as the scale of the enterprise increases, difficulties of control and communication may produce rising cost. Second, as the scale of the firm and its competitors increase, product selling prices may be expected to fall. Third, as the capacity of the enterprise and its competitors increase, the prices of certain resources not in perfectly elastic supply may be expected to rise.

(Figure I)



U rises. Any shift in the demand for capital results in a change in equilibrium U and, thereby, the rate of return on capital. If D_1 moves to D_2, U rises to U_2 and the return on capital falls to eliminate the excess demand at U_1.

When the return on alternative assets rise, the demand for capital falls in keeping with the theory of portfolio choice. The derivative of k with respect to i is, therefore, negative. The derivative of k with respect to Y is also negative, since more income gives rise to a movement from both bonds and capital into transactions balances. When real wealth rises, the demand for real capital rises.

The Output Market

Equilibrium in the output market is a flow equilibrium determined by equating aggregate demand and aggregate supply. The aggregate supply curve is determined by a production function and an assumption of rigid nominal wages (w_o).[6]

$$Y = Y(N, K_o)^{+}$$

$$\frac{w_o}{p} = Y_N$$

With the capital stock fixed, an increase in output can be accomplished

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[6]It is not proposed that wages are actually constant, nor is it necessary to do so in order to get an upward sloping aggregate supply curve. It is only necessary to assume that wages are not completely flexible. As Leijonhufvud (1969) points out, one can assume less than perfectly flexible wages by recognizing that the generation of information needed to coordinate economic activity in a large system will take time and involve economic cost. The assumption of rigid wages is a simple means of introducing this characteristic into the general model. Alternatively one might simply postulate the direct relationship between output and prices as Brunner and Meltzer do. (1972a, 1972b, 1973)

in the short run only by increasing labor (N). The increase in labor relative to capital lowers the marginal product of labor and thereby increases marginal cost. Producers will be willing to hire the additional workers only if they can raise prices to offset the rising cost, that is, prices must rise enough to equate the value of the marginal product with the nominal wage.

The demand for output is divided into three aggregate components--consumption, investment, and government spending.

$$C = c(\overset{-}{i},\ \overset{+}{U},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})$$

$$I = I(\overset{+}{U})$$

$$C + I \overset{-}{=} d(\overset{-}{i},\ \overset{+}{U},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})$$

Consumption is assumed to be a function of real output or income (Y), real wealth, and asset price.[7] When income changes, consumption changes directly but by less than the change in income, (i.e., the marginal propensity to consume out of income is positive but less than one). Real wealth enters the demand for consumption goods by increasing or decreasing the marginal propensity to consume. If the real value of the wealth rises (i.e., if W rises or p falls), consumption increases. If

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[7]The demand for output is also assumed to depend upon the tax rate. However, since the tax rate is exogenously determined and assumed constant throughout the analysis, it is not explicitly introduced as an argument in the demand function.

real wealth falls (i.e., if W falls or p rises), demand for consumables also falls. As i increases or U falls, individuals view the purchase of consumer goods less favorably than before the bonds and capital became more profitable. This is true since a fall in the price of bonds or capital lowers the cost of providing future income which has command over future commodities. Future commodities are becoming less expensive relative to present commodities, and this lowers the demand for present consumption. Therefore, it is assumed that the derivative of the demand for consumer goods with respect to i is negative and with respect to U is positive.

Investment, like consumption, is a flow variable. An approach similar to James G. Witte's analysis that the demand for investment is determined by the supply and demand for the existing capital stock is illustrated in Figure II.[8] The capital stock is assumed constant at K_o and so the supply curve of real capital slopes upward. This assumption of a constant stock of capital is not completely accurate; the actual capital stock will change with the rate of net investment. However, since the flow of new capital is small relative to the existing stock, the stock of capital is assumed constant. Therefore, the supply curve combines with the demand curve in IIa to determine the price of capital. Figure IIb shows a flow supply schedule which relates the rate of output of capital goods (investment) to the market price. There are two conditions for equilibrium. First,

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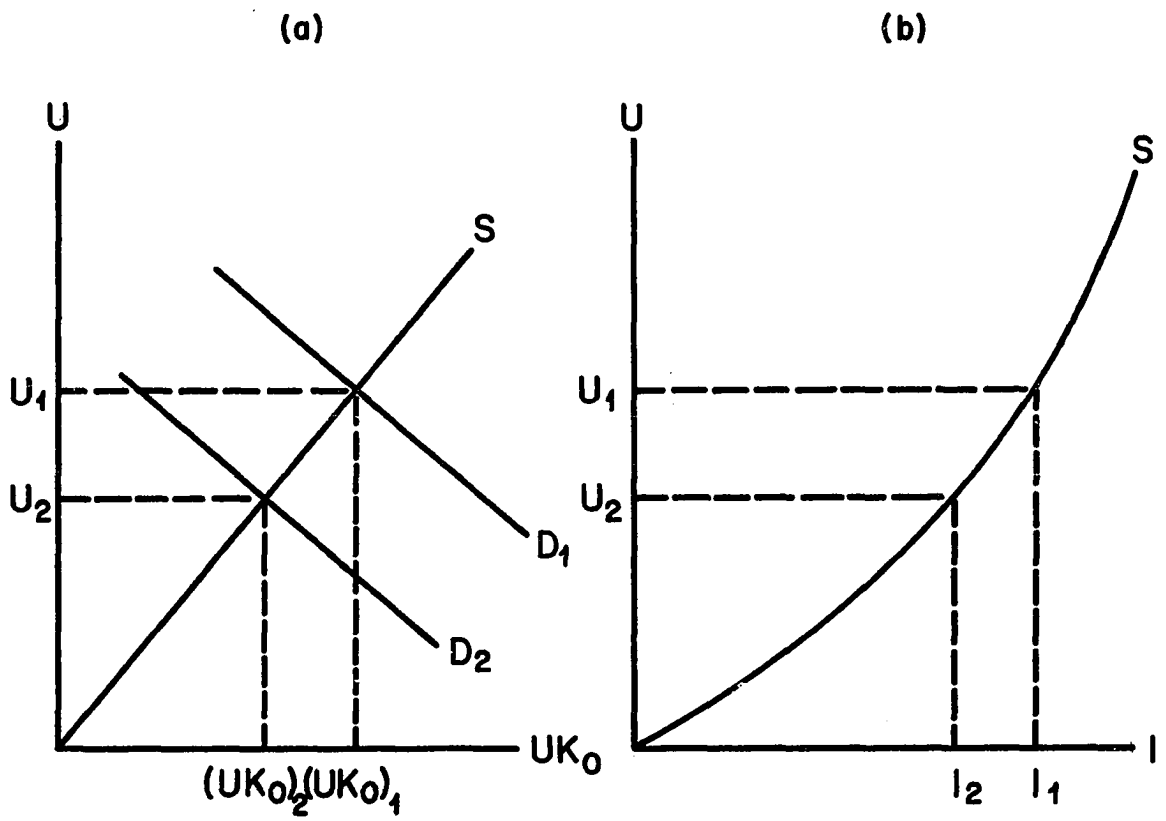
[8]Witte's analysis is used by numerous authors including Foley and Sidrauski (1972), Baird (1973), and Woglom (1974).

(Figure II)



the market price must induce the holding of the existing capital stock (i.e., supply and demand must be equal in IIa). Second, the rate of output of capital goods must equate the marginal supply price with the market price.

In Figure II, price is U_1 and output I_1 when the demand for capital is D_1. As U changes due to a shift in the demand for capital, investment changes since the lower price of capital relative to the price of commodities induces producers to decrease output. Therefore, investment is a positive function of U. But as Witte emphasizes, the rate of investment is determined by the capital producers via the positon of their supply curve. The effects of i and $-\frac{W}{P}-$ on investment can be seen by examining their effect on the demand for the capital stock and, through U, their effect on investment. An increase in i makes bonds more attractive than capital and so shifts the demand curve from D_1 to D_2--holders of capital increase the return required to hold any given stock of capital. Equilibrium is established at a lower U and, therefore, a lower rate of investment. When real wealth falls, the demand for real capital falls. D_1shifts to D_2 since holders of capital desire less capital at every rate of return. U falls and, therefore, investment falls.

An alternative formulation is the marginal efficiency of capital or marginal efficiency of investment approach. Either a fall in the rate of return required to hold capital or a rise in the expected income from holding capital will lead to an increase in investment. If the return required to hold capital falls and thus U rises, then more new capital will be purchased until the expected return on new capital falls and is equated to the required rate of return. If the expected

income from holding capital rises so that U rises, the expected return on new capital rises. Since the required return has not changed, new capital is purchased until the expected return on new capital is equated to the required return. Therefore, the rate of investment can be positively related to the price of capital. Witte (1963) criticizes this approach on the grounds that all the investment opportunities might be used up in the period of analysis and thus no investment would occur in future periods.[9] There are several reasons to believe that this would not occur. First, there are lags between the time the decision to invest is made and the time the optimum capital stock is realized. Second, there may be a cost in terms of control and communications as capital is absorbed too fast. For example, managers might be required to spend all their time incorporating the new capital into the enterprise. This phenomenon might be called diseconomies of speed. Third, if a large amount of investment takes place quickly, the price of new capital may be driven up. Rising costs reduce the return on investment and lower the marginal efficiency of capital schedule. The new schedule is often called the marginal efficiency of investment curve. The rise in the price of new capital is separate from an increase in the price of commodities along the aggregate supply curve. The aggregate supply curve assumes a stable structure of aggregate demand. The price of new capital rises as a result of heavy investment demand and thus unbalanced aggregate demand. Finally, in a growing

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[9]Witte proposes that the rate-of-investment decision is the rate of output decision of supplying enterprises and not the rate of input decision of capital using firms.

economy, new investment opportunities appear in each period. Therefore, even if all current opportunities were exhausted, new opportunities should exist in the future.

The demand for total output can now be determined by combining the effects of the demand function arguments on consumption and investment and adding government spending. When i decreases or $\frac{W}{p}$ and Y increase, only the demand for consumer goods is affected. Therefore, the demand for output rises. When U rises, the demand for investment and consumption increases; therefore, the demand for output increases.

Careful examination of the output market reveals that it includes the labor market via the aggregate supply curve. Everywhere along the aggregate supply curve producers are on their demand for labor curve. This means that at only one output market equilibrium is there full employment. Therefore, it appears that the output and asset markets could be in equilibrium while the labor market is in disequilibrium. Recalling Walras' Law, one would not expect the situation to occur, and indeed, it does not. An excess supply of labor must be accompanied by excess demand in another market. However, excess demand accompanying excess supply in the labor market is different than, for example, an excess demand for commodities due to an excess supply of money. An unemployed laborer may have an excess demand for commodities or assets; however, his excess demand is ineffective. Excess labor cannot be transferred for commodities or assets; excess money balances (or excess assets) can. Therefore, excess supply in the labor market does not disturb equilibrium in the other markets. Perhaps a better description of this situation

is equilibrium in the output and asset markets and quasi-equilibrium in the labor market.

Wealth

$$\frac{W}{p} = \frac{M^O}{p} + \frac{M^I}{p} + \frac{S_o}{ip} + UK_o$$

Real wealth is defined as the nominal value of wealth deflated by the price of commodities. Nominal wealth is the price of each asset times its stock where the price of money is one and government securities are not discounted as future tax liabilities. Both inside and outside money are considered wealth. Several authors argue that inside money should be considered wealth (Pesek and Saving, 1967; Johnson, 1969; Laidler, 1971). B. P. Pesek and T. R. Saving argue that inside money is wealth because its introduction into an economy enables its members to reach a higher level of utility than they could otherwise. They argue that demand deposits are held for the flow of amenities they yield. This argument is analogous to the one which states that opening a closed economy to trade enables a higher level of welfare to be achieved with no expansion in the available supplies of productive resources (Laidler, p. 186). Since banks pay no interest on demand deposits, the amenity flow from demand deposits is not provided at the expense of banks. Therefore, demand deposits represent net wealth to the community since the public's gain from holding demand deposits is not offset by losses of the banking system.

Equations 1 - 8 form the algebraic model of the equilibrium conditions for each market. There are eight equations and seven variables to be determined--i, i_K, U, Y, p, W, N. Since according to Walras' Law one of the markets is dependent, the system is determinant.

$$C = c(\overset{-}{i},\ \overset{+}{U},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})$$

$$I = I(\overset{+}{U})$$

$$C + I = d(\overset{-}{i},\ \overset{+}{U},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})$$

$$(1)\quad Y = d(\overset{-}{i},\ \overset{+}{U},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}}) + g_o$$

$$(2)\quad Y = Y(\overset{+}{N},\ K_o)$$

$$(3)\quad w_o = Y_N p$$

$$(4)\quad M_o^o + M_o^I = m(\overset{-}{i},\ \overset{-}{i_K},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})p$$

$$(5)\quad S_o = b(\overset{+}{i},\ \overset{-}{i_K},\ \overset{-}{Y},\ \overset{+}{\frac{W}{p}})ip$$

$$(6)\quad K_o = \frac{k(\overset{-}{i},\ \overset{+}{i_K},\ \overset{-}{Y},\ \overset{+}{\frac{W}{p}})p}{p}$$

$$(7)\quad \frac{W}{p} = \frac{M_o^o}{p} + \frac{M_o^I}{p} + \frac{S_o}{ip} + UK_o$$

$$(8)\quad U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

Endogenous Variables	Exogenous Variables
i	M^o_o
i_K	M^I_o
U	S_o
Y	K_o
p	g_o
W	w_o
N	

Summary

Markets	Effects: Wealth	Effects: Substitution
Output	via $\frac{M^o_o}{p} + \frac{M^I_o}{p} + \frac{S_o}{ip} + UK_o$	Directly with money, bonds, and capital
Money	via $\frac{M^o_o}{p} + \frac{M^I_o}{p} + \frac{S_o}{ip} + UK_o$	Directly with bonds, capital, and output
Bond	via $\frac{M^o_o}{p} + \frac{M^I_o}{p} + \frac{S_o}{ip} + UK_o$	Directly with money, capital, and output
Capital	via $\frac{M^o_o}{p} + \frac{M^I_o}{p} + \frac{S_o}{ip} + UK_o$	Directly with money, bonds, and output

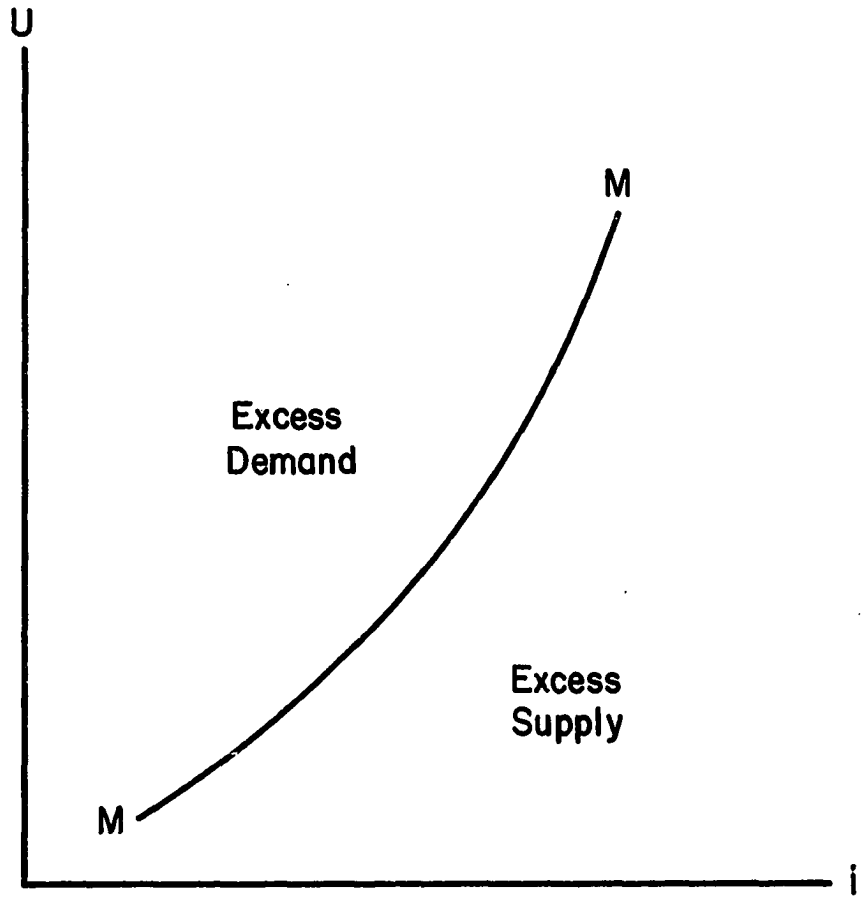
The model can be presented graphically by solving the asset markets in items i and U while the output market can be solved in terms of Y and p. From equation 8, when R is exogenously determined, the

return on capital is inversely related to the price of capital relative to the price of commodities. When i_K falls (rises), U rises (falls). Therefore, combinations of i and U can be derived which create equilibrium in each of the asset markets.

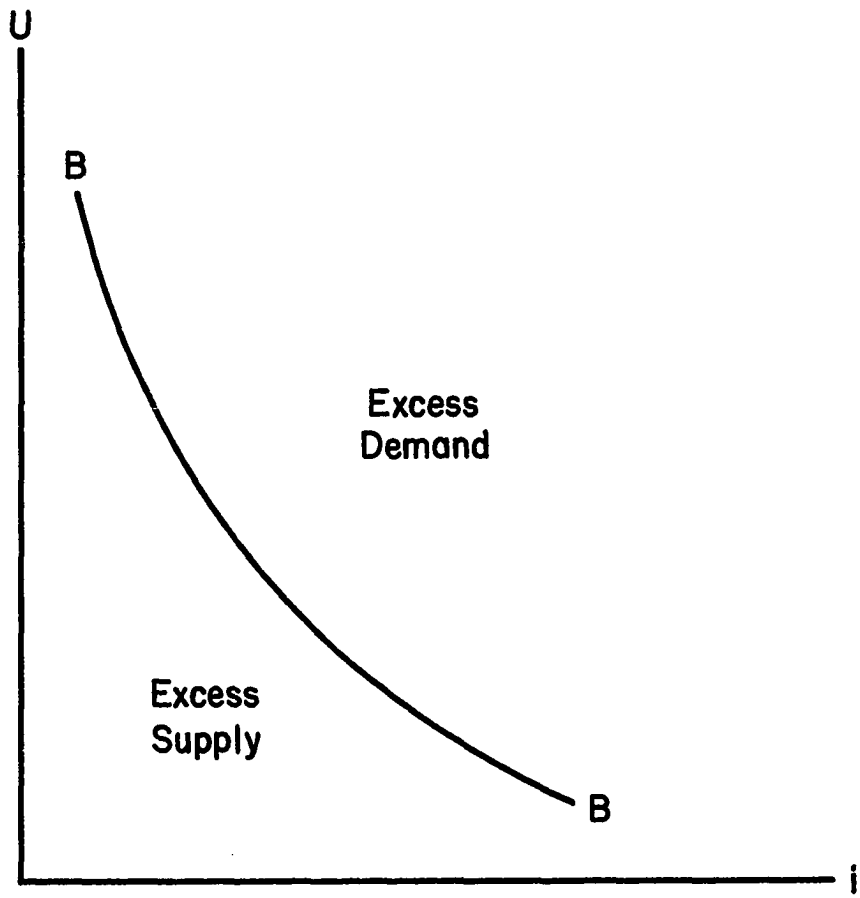
Figure III shows equilibrium in the money market at various combinations of i and U given Y and $\frac{W}{p}$. Anywhere along MM, the money market is in equilibrium. A movement up the line means U rises and i rises. The rising U (falling i_K) increases the demand for money, and so i must rise to recreate equilibrium. Above MM excess demand for money exists and below MM excess supply exists. Increases in Y or $\frac{W}{p}$ shift MM to the southeast while decreases shift MM to the northwest. Figure IV shows all U and i combinations creating equilibrium in the bond market. However, its slope is negative since a rise in U creating excess demand for bonds must be offset by a fall in i. Above the BB line, excess demand prevails. Below the BB line, excess supply exists. A rise in income or fall in wealth creates excess supply and so moves the BB line northwest. Figure V shows the combinations of U and i giving capital market equilibrium. An increase in real wealth or a decrease in income shifts KK northeast. Figure VI shows aggregate supply (AS) and aggregate demand (AD) in terms of Y and p holding i, U, and W constant. By putting MM, BB, and KK into one graph, Figure VII is obtained as a graphic solution for the model where all markets are in equilibrium. The KK and BB lines must be negatively sloped; however, their relative slope is indeterminant.

Duncan K. Foley (1974) argues that there are two different possible specifications of asset market equilibrium in macroeconomic

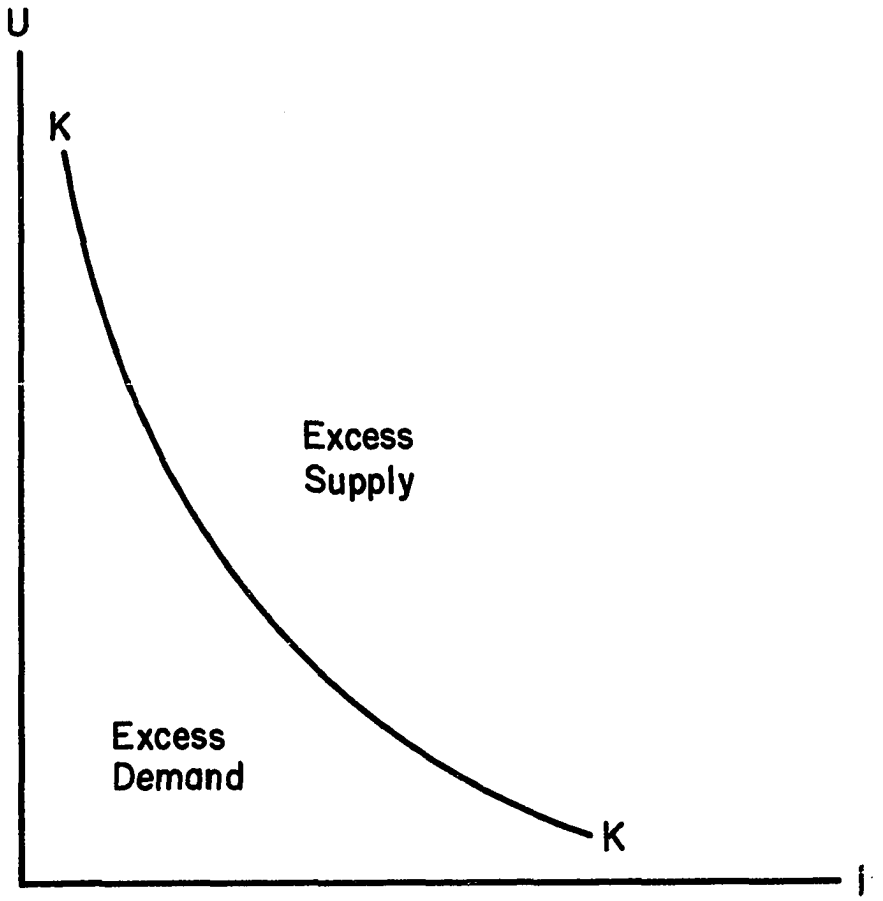
(Figure III)



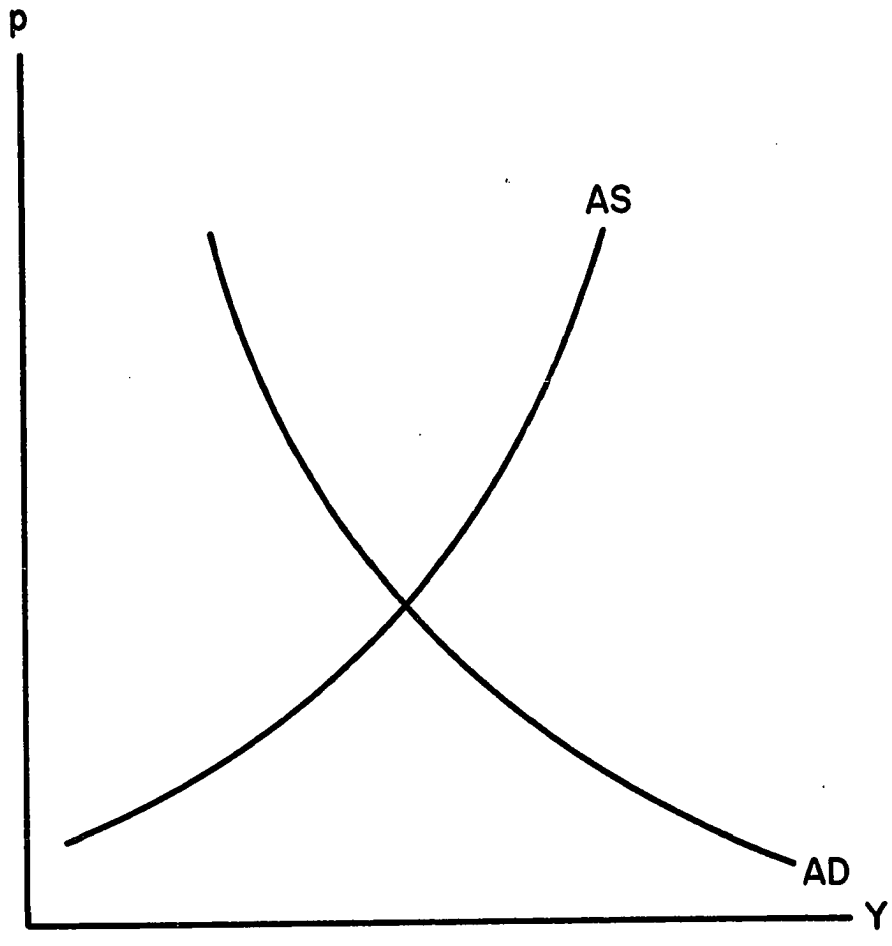
(Figure IV)



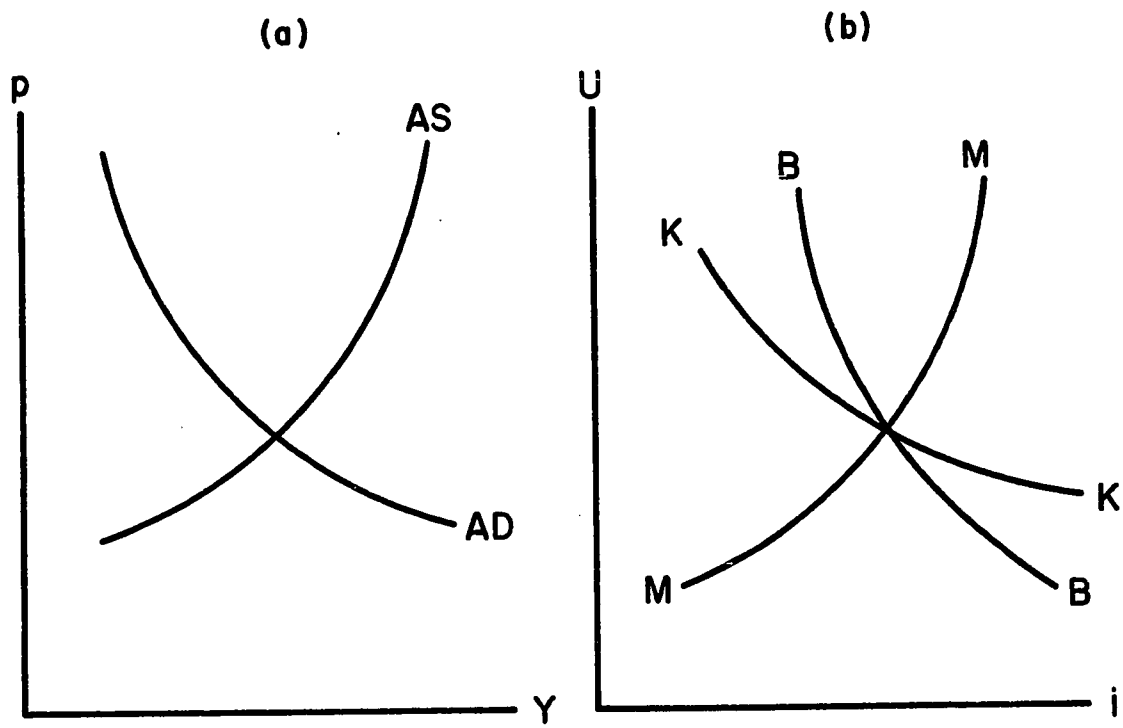
(Figure V)



(Figure VI)



(Figure VII)



models. One specification he calls "beginning of period", and the other he calls "end of period". In beginning of period models, equilibrium is established so that the supply of, and the demand for, stocks of assets are equal at the beginning of the period of analysis. Output, and changes in financial asset supplies, are flows which do not exist at the beginning of the period. Therefore, flow equilibrium equates the supply and demand for flows either during or at the end of the period. Stock equilibrium and flow equilibrium occur at different times and are sharply differentiated. Therefore, an excess supply of a stock must give rise to an excess stock demand. As Foley points out, by Walras' Law one stock, or asset, market can be dropped. Foley (1974) does not indicate that more than one flow market, the consumption market, exists. However, in Foley and Sidrauski (1971) a flow constraint is specified so that any excess supply in one flow market must be offset by an excess demand in other flow markets. Thus, if it is known that all flow markets but one are in equilibrium, all the flow markets are in equilibrium. Therefore, by Walras' Law, any one flow market may be eliminated as well as any one asset market.

In end of the period models, there is no need for flow equilibrium conditions. The flow of output and the flows of financial assets during the period are stocks at the end of the period. In formulating their demand, individuals look ahead in making their plans and try to estimate their desired position at the end of the period. Therefore, equilibrium in end of the period models equates the anticipated stock supply of, and demand for, assets and commodities. Since all markets are like stocks, any one market, including the output market, can be dropped via Walras' Law.

As J. K. Stephens (1975) notes, the static model is a third type of macroeconomic model distinct from beginning or end of the period models. Time is not explicity introduced into the concept of static equilibrium. However, changes in equilibrium positions over time can be analyzed using "comparative statics", although the actual movements through time from one equilibrium position to another is of no concern.

Although time is not explicitly introduced, the establishment of static equilibrium necessarily involves the passage of some time, since the production of new output is a flow which can only occur over time. However, the period of time which elapses in static models is finite and assumed short enough so that flows of assets are too small to significantly change the stock of assets. Any change in asset supply occurs between periods of analysis and manifests itself as simply a larger asset stock in the next period. Since the period of analysis is finite, the flow of output is finite and thus treated as a quasi-stock which is exchangeable for stocks of assets. Equilibria in the output and the asset markets occur simultaneously and represent equilibrium for the period. Therefore, one budget constraint applies to the output and asset markets as in the end of the period model.

The general model expressed in equations 1 - 8 can be interpreted as either a static model or an end of the period model. With a few alterations it may be expressed as a beginning of the period model. Equations 4 - 6 are the asset markets which are markets for stocks. Equations 1 - 3 represent the output market which is the flow market. However, there must be another flow market; otherwise, the

output market would always be in equilibrium. The suppressed market could be either the money or bond market. However, it would be undesirable to specify the suppressed market as either the money or bond market, because then the stock supply of the neglected asset could not be changed. This is true because any change in a stock results from a flow. Thus if the suppressed market were the money market, no change in the supply of bonds could occur. Therefore, the suppressed market is defined as the market for flows of financial assets where the supply of real financial flows $((\dot{M}_s/p) + (\dot{S}_s/ip))$ equals the desired additions to real financial asset holdings $((\dot{M}_d/p) + (\dot{S}_d/ip)) \equiv H_d$. The specification of the demand for financial flows can be obtained from the flow budget constraint.

$$Y - d(\underset{-}{i}, \underset{+}{U}, \underset{+}{Y}, \underset{+}{W/p}) + g_o + (\dot{M}_s/p) + (\dot{S}_s/ip) - H_d \equiv 0$$

Let

$$z(\underset{+}{i}, \underset{-}{U}, \underset{+}{Y}, \underset{-}{W/p}) \equiv Y - d(\underset{-}{i}, \underset{+}{U}, \underset{+}{Y}, \underset{+}{W/p}) + g_o$$

then

$$H_d \equiv z(\underset{+}{i}, \underset{-}{U}, \underset{+}{Y}, \underset{-}{W/p}) + (\dot{M}_s/p) + (\dot{S}_s/ip)$$

and

$$\frac{\partial H_d}{\partial(\dot{M}_s/p)} = 1; \quad \frac{\partial H_d}{\partial(\dot{B}_s/ip)} = 1.$$ [10]

The market for financial flows may be written as follows:

$$(9) \quad (\dot{M}_s/p) + (\dot{S}_s/ip) = z(\underset{+}{i}, \underset{-}{U}, \underset{+}{Y}, \underset{-}{W/p}) + (\dot{M}_s/p) + (\dot{S}_s/ip).$$

---

[10] The reason that the partial derivatives of the demand for output with respect to the supplies of financial flow must equal one is that the supplies of financial flows do not enter the demand for output.

Whatever values of $i, U, Y, \text{ and } \frac{W}{p}$ generate equilibrium in the output market will make $z(i, U, Y, \frac{W}{p}) = 0$ and so generate equilibrium in the bond market as well. A rise in real wealth, income, or the price of capital relative to the price of commodities or a fall in the interest rate, increases the demand for the flow of output and thus must decrease the demand for financial flows. Equations 1 - 3 and 9 form the flow portion of the general model when it is interpreted as a beginning of the period model.

Equilibrium in the flow sector is an interesting and odd equilibrium. The supply and demand for output are equal. However, consistent with Foley and Sidrauski's beginning of period model, individuals are unconcerned with the effects of increased savings on the composition of their portfolios during the period. Individuals may be accumulating the total amount of money and bonds they desire, but not in the proportions they desire. This difference between actual and desired rates of change of financial asset holdings will cause changes in the interest rate and the price of capital relative to the price of output over time, as additions to the asset stocks feed back to change the stock supply of assets at the beginning of the next period. To avoid this specification of flow equilibrium, two flow markets--the money and bond markets--could be introduced rather than one. However, all of the beginning of the period models to be discussed contain only two flow markets with only the output market explicitly specified.

Since output market equilibrium is determined at the end of the period, the level of income is not determined until the end of the

period. Therefore, income cannot enter beginning of the period demand functions. The demand for stocks of assets must depend on anticipated income. This increases the number of endogenous variables to eight, but there are only seven independent equations. Two possible solutions exist. Anticipated income (Y*) can be assumed equal to current income. Thus, equation 10 can be added.

$$(10) \quad Y^* = Y$$

After substituting equation 10 into equations 1 - 6 and 9, the beginning of the period model is determinant in seven endogenous variables and seven independent equations. Alternatively, the anticipated level of income could be exogenously determined, thus reducing the number of endogenous variables to seven. The former alternative is adopted, and the beginning of the period general model is represented by equations 1 - 10 or, after substitution, equations 1 - 9.

Before ending the discussion of beginning of period models, one comment needs to be made about the stock flow separation. The stock budget constraint and the flow budget constraint make the two sectors independent in the sense that excess supply in one cannot create offsetting excess demand in the other. To do so would violate the budget constraints. However, this does not mean that disequilibrium in one sector, which, for instance, results in a change in the price of capital relative to the price of output, cannot alter equilibrium in the other sector. It may do so, but not by the interaction of excess supply in one sector, excess demand in the other, and the resulting movement to equilibrium as occurs in either end of the period or stock

models. Instead, disequilibrium in the asset market which alters U will create excess supply and an equal excess demand in the flow sector. New equilibrium values will result and both budget constraints will be satisfied.

Equations 1 - 8 or 1 - 9 form the general model. Ideally they would incorporate all the Keynesian and Monetarist models in need of examination. Unfortunately the Monetarist model of Brunner and Meltzer, and the Keynesian model of Foley and Sidrauski, contain intrinsic characteristics which are not part of the general model and whose inclusion in it would preclude its usefulness as a framework common to the majority of the models examined. Therefore, the following analysis cannot be conducted solely in terms of the general model. However, the common framework is still a useful tool, especially since both exceptions bear some resemblance to it. Therefore, in the following analysis two versions of the IS-LM model, the Radcliffe model, Tobin's supply price of capital model, Patinkin's model, Friedman's Monetarist model, and the Quantity theory are examined within the general model. The Brunner-Meltzer model, and the Foley-Sidrauski model are examined separately and compared to the general model.

CHAPTER II

KEYNESIAN TWO ASSET MODELS

IS-LM

The IS-LM model is considered a beginning of the period model by several authors (Foley 1974, Woglom 1974). The IS curve represents combinations of the interest rate and levels of income that generate equilibrium in the output market which is a flow market. The LM curve represents combinations of the interest rate and levels of income that generate equilibrium in the money and bond markets, which are markets for stocks. This apparent separation of stocks and flows appears to be the major reason for considering IS-LM a beginning of the period model. However, as Foley states, the choice between beginning and end of the period models is often suppressed to the level of the "model in the back-of-one's mind" rather than explicitly stated. So it is with the IS-LM system. As a result it is not at all clear that economists have a beginning of period model in mind.

In the IS-LM system, the bond market is the market which is dropped via Walras' Law. If IS-LM were a beginning of the period model, an additional flow market would also be suppressed. In no specification of the IS-LM system is such a market even indirectly mentioned. Instead it appears that output is considered a quasi-stock

and thus not subject to a separate budget constraint.

A point often made in IS-LM models is that the period of analysis is short enough that asset flows are of such small magnitude that they do not significantly affect the stocks of assets. This specification is consistent with the specification of static models. Foley (1974, p. 31) states that the use of beginning of the period analysis strongly suggests a two-sector production model. In Hick's original article, he uses a two-sector production model; however, that specification has long been dropped by economists using IS-LM models. If IS-LM is a beginning of the period model, the demand for money should depend on expected income. However, current income enters the asset demand functions rather than anticipated income.

In the following analysis, IS-LM is considered a static model of the kind previously described where flows are considered quasi-stocks. Therefore, equations 1 - 8 of the general model are used to analyze the IS-LM system.

In comparing Keynesian models by starting with the IS-LM system, the divergent opinions within Keynesian theory become apparent immediately, because economists cannot conclusively decide on the aggregate asset structure of their most popular paradigm. Axel Leijonhufvud (1967) maintains that the model consists of commodities--a single output which serves as either a consumer or capital good--, two assets--money and bonds--, and labor although labor is not explicitly introduced in most IS-LM models. However, Brunner and Meltzer (1972c, 1973) disagree. They maintain that the IS-LM structure does not include capital as a commodity to its exclusion as an

asset in the portfolio of savers. It is an asset which individuals view as a perfect substitute for bonds. Both views are examined below with prices made an endogenous variable via the introduction of aggregate supply and demand.

IS-LM as a Money, Bond, Commodity Model

First, assume that money and bonds are the only assets in the system and that capital is a commodity whose price equals the price of output. Under this assumption, the role of the existing capital stock is no greater than the role of any other durable commodity. There are three markets--money, bond, and commodities. Money and bonds are imperfect substitutes for each other; therefore, their returns depend upon their relative supplies. However, since the own return on money is zero, only the return on bonds need be explained. An increase in the supply of money lowers the interest rate. Since capital is not an asset, the fall in i has no effect on the demand for the the existing capital stock. However, a falling interest rate reduces the cost of borrowing and, therefore, the discount applied to future income streams generated through investment. For a given risk, investment increases until enough projects are undertaken to equate the return on new investment projects to the interest rate. Only two prices, the price of bonds and the price of commodities, need be determined in the system.

Equations 1 - 8 can be altered to represent this model. Equations 6 and 8 and variables U and i_K are dropped, since capital is treated as a commodity. Wealth does not enter the model, so wealth

is dropped as a variable as is equation 7. This leaves equations 1_I - 5_I to represent a money, bond, and commodity model which determines output, employment, prices, and the interest rate.

IS-LM as a Money, Bond-Capital, Commodity Model

Leijonhufvud (1967, p. 401) criticizes the Hicks IS-LM model for misinterpreting Keynes. He charges that its aggregate structure is commodities, bonds, money, and labor services, and that the correct structure is consumer goods, nonmoney assets, money, and labor services. "The prototype of these models dates back to the famous paper by Hicks...This standard model appears to me a singularly inadequate vehicle for the interpretation of Keynes' ideas." However, Leijonhufvud's idea of the aggregate structure of the IS-LM system is not everyone's. Brunner and Meltzer contend that, "Bonds and real capital are assumed to be perfect substitutes." (1973, p. 45) and "Bonds and real capital are treated as a single asset" (1972c, p. 951). Six years prior to Leijonhufvud, Tobin (1961, pp. 30, 31) stated that Keynes "...assumed that capital, bonds, and private debts are perfect substitutes in investors portfolios.... Post Keynesian aggregative theorists, whether disciples or opponents or just neutral fanciers of models, have stuck pretty closely to the Keynesian picture of the capital account." Tobin then gives Patinkin's model as an example. If Tobin, like Leijonhufvud, considers IS-LM a prototype of such Keynesian models, it too must assume capital is an asset, and therefore, a perfect substitute for bonds. A difference of opinion seems to exist, and so this section examines

IS-LM as a model in which bonds and capital are perfect substitutes.

In this interpretation, there are three assets--money, bonds, and capital--rather than two. However, capital and bonds are perfect substitutes and so their rates of return are either equal or vary by a constant differential. Leijonhufvud believes money should be distinguished from bonds-capital by the interest elasticity of present value. That is, all assets which have a low interest elasticity of present value (liquid or short term assets) may be considered money. Assets with a high elasticity of present value (illiquid or long term assets) may be considered bonds-capital. However, most IS-LM models define money as currency plus demand deposits, and sometimes time deposits.

A fall in i relative to the return on capital results in the substitution of capital for bonds until the original difference between their returns is established. As i decreases, future income flows from owning capital are discounted at a lower i. Therefore, driving i down is the same as driving i_K down or, via equation 8, U up, and investment can be related to changes in the bond rate rather than U.[1] As Leijonhufvud (1967, p. 405) says, "In Keynes' short run, a decline in the interest rate" and "a rise in the market price of capital goods, equities, and bonds, are interchangeable descriptions of the same event."

---

[1]This process might seem rather confusing. Recall from equation 8 that when R is exogenously determined, U is inversely related to i_K, so a fall in i_K is an increase in U. Since bonds and capital are perfect substitutes, i and i_K move together; therefore, i and U move together though in opposite directions.

Equations 1 - 8 can be altered to represent this model. The bonds-capital substitutability assumption eliminates the need to explain the relative returns of bonds and capital. The two markets are dependent, so either i, or i_K and U, can be dropped and the bond and capital markets combined to form the bond-capital market. In the IS-LM model, i_K and U (and thus equation 8) are dropped and the new aggregate asset bonds-capital is represented by equation 5_I where $\frac{S_o}{ip}$ is the supply of bonds-capital.[2] This leaves one asset return, the interest rate, and two aggregate asset markets--the money market and the bond-capital market. In addition, equation 7 is dropped since IS-LM assumes no wealth effect.[3] Four variables i, Y, p and N are to be determined by five equations only four of which are independent. Equations 1_I - 5_I represent this model.

Both interpretations, although having different asset structures, have now been reduced to the same five equations determining the same four variables. However, as previously mentioned, there is still one major difference between equations 1_I - 5_I and the normal IS-LM system -- prices are an endogenous variable.

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[2]Leijonhufvud (1967) points out that bond streams and equity streams are lumped together as assets by Keynes through some quite mechanical manipulation of risk and liquidity premia.

[3]It is not proposed that the wealth effect is never discussed in IS-LM models. IS-LM models are often modified to include the wealth effect in the demand for output. See, for example, Dernburg and McDougall's (1972) discussion of the Pigou effect and Bailey's (1962) presentation of what is essentially an IS-LM model with wealth effects and variable prices. However, usually wealth effect in IS-LM models is introduced only secondarily and is considered relatively weak.

In some IS-LM discussions, the price of commodities and wages are considered constant or exogenously determined. Equations 1_I and 2_I form such an IS-LM model in which only i and Y are determined. This practice, although not necessary to the model, sometimes gives the impression that Keynesians, at least in their basic theoretical framework, consider price as constant. However, many versions of the IS-LM model do not take the price level as a parameter. (Heitmen-Robinson 1969, Bailey 1962, McKenna 1958) It seems inconceivable that any modern Keynesian would seriously suggest that prices are constant or justify price determination outside their theoretical model.[4] In fact, when aggregate supply and aggregate demand are introduced, the IS-LM framework with rigid wages is overdetermined without the inclusion of prices as an endogenous variable. (Stephens and Turner 1972) Therefore, prices are made a variable to be determined within the model via the interaction of aggregate supply and demand.

IS $\quad (1_I) \quad Y = d(\overset{-}{i}, \overset{+}{Y}) + g_o$

LM $\quad (2_I) \quad M_o^o + M_o^I = m(\overset{-}{i}, \overset{+}{Y})p$

$\quad (3_I) \quad Y = Y(\overset{+}{N}, K_o)$

AS $\quad (4_I) \quad w_o = Y_N p$

---

[4]For a discussion of the effects of different assumptions concerning wage and price rigidity in the IS-LM model see Mundell (1965).

$$(5_I)\ S_o = b(i, Y, \frac{M_o^o}{p} + \frac{M_o^I}{p}, \frac{S_o}{ip})ip$$

Due to Walras' Law, one of the three markets can be dropped. The market dropped in normal IS-LM analysis is the bond market, equation 5_I. Since it is dropped, equation 5_I is generally not explicitly specified. Note that the demand for bonds includes the supply of real balances and the supply of real bonds (or bonds-capital) as well as the interest rate and real income. This specification is required by the budget constraint which makes the model internally consistent -- excess supply must be offset by a corresponding excess demand. Since $\frac{M_o^o}{p} + \frac{M_o^I}{p}$ and $\frac{S_o}{ip}$ do not enter the demand for money or output, they must enter the bond equation. Any change in the supply of money or bonds creates an equal excess demand for bonds.

Equations 1_I through 4_I form an IS-LM system with the addition of an aggregate supply curve to make the price level determinant. Equation 1_I is the IS curve where the demand for consumption goods is not a matter of portfolio choice but depends only on current income, while investment depends upon the interest rate. To make these relationships in the output market more explicit, the following equations could be added:

$$C = c(Y)$$

$$I = I(i)$$

where

$$d(i, Y) \equiv C + I$$

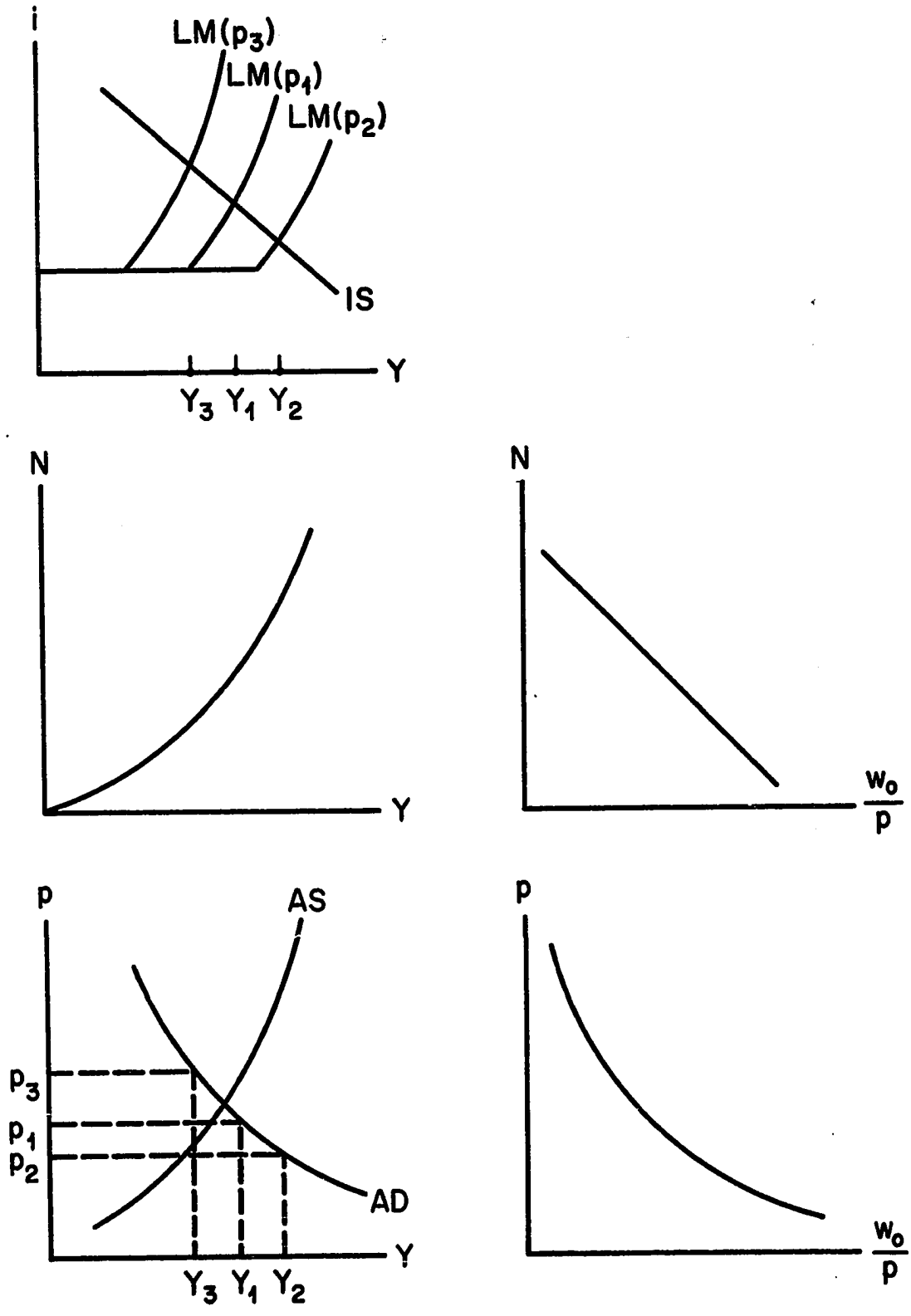
Equation 2_I is the LM curve relating the demand for real balances only to income and the interest rate. Equations 3_I and 4_I determine the aggregate supply curve as before. Aggregate demand is determined by changing the price level and relating the resulting changes in equilibrium income due to shifts in the LM curve to the new price level. This is done graphically in Figure VIII. (See McKenna 1958, Stephens and Pinto 1974)

By comparing equations 1 - 8 with 1_I - 4_I, the differences between the general model and IS-LM can be seen. In the IS-LM system, the asset and output markets interact. However, there is no wealth effect and only one rate of return need be determined--the interest rate. There is no wealth effect, and so the transmission mechanism between the monetary and real sector is only through investment via the interest rate on bonds. The prevalence of the liquidity trap in IS-LM discussions is in large part due to this limited transmission mechanism. The price of output affects aggregate demand by changing the supply of real balances and creating an excess supply or demand for money. There are no wealth effects in the demand functions.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	None	Indirectly via the substitution of money and bonds which changes i and investment
Money	None	Directly with bonds
Bonds	None	Directly with money

(Figure VIII)


i
LM(p3)
LM(p1)
LM(p2)
IS
Y
Y3 Y1 Y2
N
Y
N
Wo/p
p
AS
p3
p1
p2
AD
Y
Y3 Y1 Y2
p
Wo/p

Radcliffe

An alternative to the money-bond structure of the IS-LM system, consistent with the views that nonbank liquid assets are not significantly different from money, is the money-capital model. David Fand (1969) calls this model, which assumes that money and bonds are perfect substitutes, the Radcliffe model. An example of treating money and bonds as perfect substitutes is Tobin's (1955) monetary growth model. The major differences between the Radcliffe model and the money-bond model is the rate of return structure or, equivalently, the price structure to be determined. Since money and bonds are perfect substitutes, the money stock and total liquidity are identical. Therefore, the supplies which determine the rate structure are the supply of liquidity, and the supply of capital. If the total amount of "liquidity" is changed, then the relative supply of liquidity to capital changes and the demand for capital changes. However, a change in the relative supply of money and bonds, without changing liquidity, does not directly affect the demand for capital. According to Fand, a change in the composition of liquidity has its main effects on the flow of funds in credit markets, on intermediation and disintermediation, on the structure of rates, and, at times, even on the level of interest rates. To the extent that the level of interest rates may change, the expected yield on capital might change. However, to be sure monetary policy is effective, the money capital margin and, thereby, the expected yield on capital must be affected.

Tobin (1961) seems to allow no room at all for a change in

the composition of liquidity changing the yield structure and thereby influencing output. By defining perfect substitutes as assets whose yield differential is constant, a change in composition results only in the switching of assets until the original differential is established. When the own return on money is zero, a change in the composition of liquidity cannot lead to a change in relative yields. Only by changing the money capital margin can monetary policy be effective.

Discussions of the Radcliffe hypothesis are generally conducted on an informal basis. It is difficult to determine, therefore, whether its proponents have in mind a static, beginning of the period, or end of the period model. Therefore, the Radcliffe hypothesis is presented below in a static form to make it readily comparable to the IS-LM models.

Due to the "liquidity" concept, equations 4 and 5 can be combined. This reduces the number of equations to seven. Since no variable has been dropped, this leaves the same number of variables as total equations, as opposed to independent equations, and thus makes the system indeterminant. However, since either the fluctuation in the bond rate is inconsequential (the liquidity-capital margin is what is important (Fand)) or the bond rate is tied to the zero own return on money (Tobin), the rate of interest is dropped as an argument in the demand functions and the real supply of bonds is represented by $-\frac{S_o}{I_o P}$. Equation 6 and $-\frac{W}{P}$ are dropped since there is no wealth effect. This makes the system determinant in five independent equations and five variables with the specification of the capital market determined by the budget constraint, as was the bond market in the IS-LM model.

$$C = c(\overset{+}{Y})$$

$$I = I(\overset{+}{U})$$

$$d(\overset{+}{Y}, \overset{+}{U}) \equiv C + I$$

$$(1_R) \quad Y = d(\overset{+}{Y}, \overset{+}{U}) + g_o$$

$$(2_R) \quad Y = Y(\overset{+}{N}, K_o)$$

$$(3_R) \quad w_o = Y_N p$$

$$(4_R) \quad M_o^o + M_o^I + \frac{S_o}{i_o} = m(\overset{-}{i_K}, \overset{+}{Y}, \overset{+}{UK_o})p$$

$$(5_R) \quad K_o = \frac{k(\overset{+}{i_K}, \overset{+}{Y}, \frac{M_o^o}{p} = \frac{\overset{+}{M_o^I}}{p} = \frac{S_o}{i_o p}, \overset{+}{UK_o})}{U}$$

$$(6_R) \quad U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

As can be seen from these equations, only an increase in the supply of liquidity can change the equilibrium price of capital relative to the price of commodities and thereby investment. If only the composition of money and bonds changes, there is no effect on output since equations 4_R and 5_R remain in equilibrium. A rise in the money supply offset by a fall in the value of bonds, results in no excess supply or demand in the system. Only if liquidity

$(M_o^o + M_o^I + \frac{S_o}{i_o})$ changes is excess supply or demand created in equations 4_R and, therefore, i_K, U and investment altered. There are only two prices to be determined -- the price of capital relative to the price of commodities and the price of commodities. The price of commodities affects the asset market only by changing the real supply of liquidity or capital.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	None	Indirectly via the effects of liquidity and capital on U and investment
Liquidity	None	Directly for capital which changes U
Capital	None	Directly for liquidity which changes U

Patinkin

Patinkin's (1965) model consists of the labor, commodity, bond, and money markets which, if wages are held constant, determine four endogenous variables -- income, employment, the price level, and the interest rate. The budget constraint includes the money, bond, and commodity markets. Therefore, it is not a beginning of period model. Consistent with Foley (1974) and May (1970), it is considered an end of period model. The main differences in Patinkin's model and the IS-LM models just examined is Patinkin's inclusion of real wealth as an argument in the demand functions of commodities, bonds, and money; the inclusion of the interest rate in the consumption function; and the inclusion of income in the investment function. These differences are easily seen by examining Patinkin's model in the general framework.

The capital market is as difficult to analyze in Patinkin's model as in IS-LM, and for the same reasons. Either capital is an asset to be treated as a perfect substitute for bonds, or it is a commodity whose price equals the price of commodities. Tobin (1961, pp. 30, 31) believes the former. He states that Keynes assumed that capital, bonds, and private debts are perfect substitutes and Tobin states of Patinkin that "His difference from Keynes is his real balance effect." Patinkin (1965, p. 199) states that his model"... divides all the goods of the economy into four composite categories: labor services, commodities, bonds, and money." Patinkin (1965, p. 208) further states when analyzing the effect of the interest rate on investment, "Let us adopt the usual assumption of a declining

marginal efficiency of capital. Then, the higher the rate of interest, the fewer the investment projects the firm can undertake which yield (after taking into account risk factors) a rate of return greater than or equal to the rate it could earn in interest-savings by simply repurchasing its bonds." Patinkin neither refers to the public's desire to hold capital as an asset nor speaks of the price of capital. It seems that the correct interpretation is capital as a commodity. However, regardless of which view is adopted, there are only two aggregate assets as was demonstrated in the discussion of IS-LM. Therefore, the capital market can be either dropped or combined with the bond market, and i_K and U dropped as variables.

Patinkin assumes, like all the models thus far examined, that the demand for output can be divided into the demand for consumer goods and investment goods. Both are functions of income, the interest rate, and real wealth. As in the general model, consumption depends upon the interest rate, since it reflects the cost of bonds necessary to provide purchasing power over a fixed quantity of commodities. Therefore, an increase in the interest rate reflects a cheapening of future commodities with respect to present ones. The interest rate also affects investment since a higher rate reduces the number of investment projects which could be profitably undertaken. Since both consumption and investment depend negatively upon the interest rate, the derivative of output with respect to i is negative. Patinkin introduces real balances as an argument in the demand functions for output, money, and bonds. Wealth is defined as the tangible assets of the household, plus outside money, plus tax dis-

counted government bonds. If it is assumed that the tangible assets of households equal only their claims on the capital stock, and government bonds are not discounted as future tax liabilities, real wealth becomes

$$\frac{W}{p} = K_o + \frac{S_o}{ip} + \frac{M^o}{p}$$

when capital is considered a commodity.[5] The demand for output, money, and bonds increases as the level of wealth increases. According to Patinkin, an individual adjusts these expenditures to maintain a desired relationship between them and his money balances. The demand for output is

$$C = c(\underset{-}{i}, \underset{+}{Y}, \underset{+}{\frac{W}{p}})$$

$$I = I(\underset{-}{i}, \underset{+}{Y}, \underset{+}{\frac{W}{p}})$$

$$C + I \underset{-}{=} d(\underset{-}{i}, \underset{+}{Y}, \underset{+}{\frac{W}{p}}) + g_o.$$

The exogenously determined supply of money consists of outside or fiat money issued by the government, and "inside" money issued by the banking system in exchange for private or government bonds. The demand for money depends on the interest rate since bonds are an alternative to holding money. Consistent with other Keynesian models, when the interest rate rises, the demand for money falls. As income rises, the demand for money rises as more is needed for transactions.

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[5] When capital is treated as a perfect substitute for bonds, wealth equals $\frac{S_o}{ip} + \frac{M^o}{p}$ where S_o is the stock of bonds-money.

$$M_o^o + M_o^I = M(\overset{-}{i}, \overset{+}{Y}, \overset{+}{-\frac{W}{p}-})p$$

In the bond market, bonds are issued by the government and by firms to be held as assets by banks and individuals. As income, inside money, or real wealth increase, the demand for bonds rises. This income effect is the oppostite of the income effect in the general model. As the price of bonds falls, i.e., the interest rate rises, Patinkin assumes that the demand for bonds rises.

$$S_o = b(\overset{+}{i}, \overset{+}{Y}, \overset{+}{-\frac{W}{p}-}, \overset{+_I}{--\frac{M_o}{p}-})ip$$

Equations 2 and 3 of the general model are consistent with Patinkin's involuntary unemployment case caused by rigid wages. Equation 3 can be translated into a demand for labor curve. Therefore, when the whole system is in equilibrium, producers' demand for labor is satisfied; however, for full employment to exist, supply and demand in the labor market must be equal. This occurs only if the supply of labor happens to intersect the demand for labor curve at the existing real wage. There is no automatic mechanism to guarantee this since the rigid nominal wage prevents excess supply in the labor market from lowering the real wage and establishing equilibrium in the labor market at full employment.

Equations 1_p - 6_p are the altered general model which depicts Patinkin's Keynesian model.

$$C = c(\overset{-}{i}, \overset{+}{Y}, \overset{+}{-\frac{W}{p}-})$$

$$I = I(i, Y, \frac{W}{p}) \qquad (-, +, +)$$

$$C + I = d(i, Y, \frac{W}{p}) \qquad (-, +, +)$$

$$(1_P) \quad Y = d(i, Y, \frac{W}{p}) + g_o \qquad (-, +, +)$$

$$(2_P) \quad Y = Y(N, K_o)$$

$$(3_P) \quad w_o = Y_N p$$

$$(4_P) \quad M_o^o + M_o^I = m(i, Y, \frac{W}{p})p \qquad (-, +, +)$$

$$(5_P) \quad S_o = b(i, Y, \frac{W}{p}, \frac{M_o^I}{p})ip \qquad (+, +, +, +)$$

$$(6_P) \quad \frac{W}{p} = K_o + \frac{S_o}{ip} + \frac{M_o^o}{p}$$

There are five variables to be determined -- W, Y, i, p, and N -- by the five independent equations. Of the models in which there are only two aggregate assets, Patinkin's most closely resembles the general model. The main difference is that the capital market is not treated as an independent market. Therefore, i_K and U are dropped. This can be done either because capital goods are treated as commodities or because bonds and capital are perfect substitutes. In either case, the demands for output, money, and bonds

depend only on the level of the interest rate, income, and wealth. Therefore, only one rate of return is to be determined, and the substitution effect between the money and real sectors is limited to the interest rate. However, the financial sector can influence output via real wealth. However, unlike the general model, wealth is at the same time more broadly and more narrowly defined. It is more broadly defined in that it includes all tangible assets held by the public rather than only the capital stock. It is more narrowly defined as including only outside money rather than the total money stock. As in the general model, the price level effects more than the supply of assets since real wealth enters all demand functions.

It is not entirely clear whether Patinkin's model is Monetarist or Keynesian. Although the substitution effect between the money and real sectors is limited to the interest rate, the interest rate affects both consumption and investment. In most Keynesian models the real and monetary sectors are integrated only through investment demand. However, Keynesians may argue that to classify Patinkin as Monetarist on the grounds that the interest rate affects consumption is cavil, because what is important is that the substitution effect of monetary policy is limited to the interest rate. If one accepts Dernburg and McDougall's (1972) contention that Monetarists believe that monetary policy can be effective without changing the interest rate, Patinkin's model is Keynesian.

Monetarists might reject Dernburg and McDougall's contention and argue that since the own return on money is zero, there is only one asset return to be determined -- the interest rate. Therefore,

the interest rate is the only return through which the substitution effect can work. One must look beyond the "strategic variable" to the component of output which is affected.[6] On this basis, Patinkin's model might be classified as Monetarist. However, for present purposes, Patinkin's model is arbitrarily classified as Keynesian, but it is recognized that the classification is open to question.

SUMMARY

Markets	Wealth	Effects: Substitution
Output	via $K_o + \frac{S_o}{ip} + \frac{M^o_o}{p}$	Indirectly via the substitution of money, bonds and capital which changes i and thereby, consumption and investment.
Money	via $K_o + \frac{S_o}{ip} + \frac{M^o_o}{p}$	Directly with bonds
Bond	via $K_o + \frac{S_o}{ip} + \frac{M^o_o}{p}$	Directly with money

[6]The term "strategic variable" refers to the asset price or rate of return which is affected by disequilibrium in the asset market and in turn creates excess demand for output. The strategic variable changes as the asset structure of the particular Keynesian model changes. For example, in IS-LM the strategic variable is the return on bonds. In the Radcliffe model of equations 1_R - 5_R the strategic variable is the price of capital relative to the price of output. However, in both models investment is the only component of aggregate demand affected by changes in the "strategic variable".

CHAPTER III

KEYNESIAN THREE ASSET MODELS

Tobin

John G. Gurley and Edward S. Shaw (1956, 1960) have analyzed the effects of nonbank financial intermediaries on monetary policy. One conclusion is that money is not a unique financial asset but instead is a substitute for other financial assets such as savings and loan shares (Gurley and Shaw 1956, Tobin 1963). Good substitutability between money and other financial assets can reduce the demand for money at any given income and interest rate level. In fact, the same money supply could be consistent with many income and interest rate levels depending upon the size of the non-money financial sector. This makes monetary policy more difficult to implement since money is no longer a unique asset. In fact, if money and other financial assets are perfect substitutes, this view falls into the Radcliffe hypothesis. If money and other financial assets are simply gross substitutes, one can conclude about money that it is not the only asset supply which can effect the terms on which the community will hold capital (Tobin 1961). The real economy can be affected by other assets as well as money. It is this concept that money is neither unique nor a perfect substitute for other financial assets that characterizes Tobin's supply price of capital models.

Tobin's supply price of capital model is presented below as a beginning of the period model. Foley (1974, p. 35) states, "Tobin, for example, invariably and instinctively formulates the determination of asset prices as an equilibrium between stock demands and stock supplies of assets." In discussing the capital market and the separation of macroeconomic models into stock and flow sectors, Tobin (1969, p. 16) states, "The key behavior assumption is that spending decisions and portfolio decisions are independent -- specifically the decisions about the accumulation of wealth are separable from decisions about its allocation." This statement accurately describes the beginning of the period specification in which transactors are assumed to be concerned with the effects of increased savings on the composition of their portfolio during the period. Consistent with this behavioral assumption is a model presented by Brainard and Tobin (1968) which is similar to the supply price of capital model discussed below. They specify that an excess supply of stocks must give rise to excess demand for stocks and that an excess supply of flows must give rise to an equal excess demand for flows.

Tobin introduces the supply price of capital (SPC) as the transmission mechanism between the real and monetary sectors. The supply price of capital "...is the rate of return that the community of wealth owners require in order to absorb the existing capital stock (valued at current prices) no more, no less, into their portfolios and balance sheets." (Tobin 1961, p. 35)

Tobin's concept of the SPC is related to the price of capital relative to the price of commodities introduced in equation 6 of

the general model. It can be recalled that the price of capital is the discounted value of future income streams. The discount rate used is the return which wealth owners require to hold the existing capital stock, or in Tobin's terminology, the supply price of capital. The discount rate is a subjective return which depends on income, total wealth, and the rates of return on other assets. Any change in these variables will alter the public's subjective preference for capital. That is, the rate at which the public discounts future streams of income created by capital, the SPC, will change. This change in i_K changes the price of capital, and shifts the demand curve for capital. An increase in the demand for capital increases U or lowers SPC. A decrease in the demand for capital decreases U or increases SPC. As U rises, investment increases; as U falls, investment falls. Therefore, the proper gauge in examining a policy's effect on investment is through its effect on U or, alternatively, the supply price of capital.

In Tobin's model, money, bonds, and capital are all assets. However, unlike the IS-LM model or the Radcliffe model, neither capital and bonds nor money and bonds are perfect substitutes. All three assets have some degree of substitutability with each other. Therefore, there are three rates of return to be explained -- the interest rate, the return on capital or the price of capital relative to the price of commodities, and the own return on money. However, the own return on money is assumed zero, which leaves only i and U to be determined, just as in the general model.

The demand for output depends upon consumption and investment.

Consumption is determined by the level of income. Investment depends on the supply price of capital which is determined by the returns on other assets, income, and wealth. Equation 1_T is the analogue to equation 1.

$$C = c(Y)^{+}$$

$$I = I(U)^{+}$$

$$d(Y, U)^{+\ +} \equiv C + I$$

$$(1_T) \quad Y = d(Y, U)^{+\ +} + g_o$$

Tobin (1972b, p. 855) agrees with Leijonhufvud that all that is necessary to assure that output is not supply determined is to assume prices are not perfectly flexible. He points out that it is a caricature to say Keynesians believe prices are constant. The worst Keynes could be accused of is assuming wages are constant. Tobin (1961) does not discuss the determination of output prices. However, since he believes that the worst Keynes could be accused of is assuming wages are constant, the aggregate supply curve is left unchanged from the general model.

The demand for money is given by equation 4_T which is the same as equation 4 except for the definition of money and wealth. Tobin makes the distinction between inside and outside money and between money and monetary wealth. Inside money (M_o^I) consists of demand deposits while outside money (M_o^O) is the monetary base. The supply of money is the sum of both inside and outside money; however, monetary wealth is only outside money plus government securities.

$$(4_T)\ M_o^o + M_o^I = m(\overset{-}{i},\ \overset{-}{i_K},\ \overset{+}{Y},\ \overset{+}{\frac{W}{p}})p$$

In addition to real wealth -- monetary wealth plus the real value of the capital stock -- the demand for money depends upon the interest rate, the return on capital, and income. As alternative rates of return rise, the demand for money decreases; however, as wealth or income rise the demand for money increases.

The demand for bonds increases with increases in wealth, inside money, and the return on bonds but decreases with increases in the return on capital and income.

$$(5_T)\ S_o = b(\overset{+}{i},\ \overset{-}{i_K},\ \overset{-}{Y},\ \overset{+}{\frac{W}{p}},\ \overset{+}{\frac{M_o^I}{p}})ip$$

The demand for capital is given by equation 6_T.

$$(6_T)\quad K_o = \frac{k(\overset{-}{i},\ \overset{+}{i_K},\ \overset{-}{Y},\ \overset{+}{\frac{W}{p}})}{U}$$

In equation 1_T, only by changing U can the asset market affect the output market. A change in the money supply must work either through real wealth or relative supplies to shift the demand for capital and thereby change U. If the money supply is changed by changing outside money, both the supply of money and real wealth change. Since $\frac{W}{p}$ enters equation 6_T as an argument in the demand function, the demand for capital, and therefore U, changes. This is called by Fand (1970) the wealth effect on the SPC. In this model, it is the wealth effect on the price of capital. However this is not

the only effect the change in the quantity of money has on the economy. Due to this change in money supply, either excess demand or excess supply is created in the money market via equation 4_T and excess supply or excess demand in the bond market via equation 5_T. This leads to substitution among assets and a change in the rate of interest. When i changes, the demand for capital and thereby i_K and U change. This is called by Fand the money effect on SPC.

A change in inside money leaves wealth unaffected and changes only the supply of money and, thereby, the demand for bonds. This causes a restructuring of yields as substitution among assets is undertaken to reestablish the desired portfolio balance. To the extent that the i_K and U are affected, the demand for investment will change and so change output. Therefore, a change in inside money can affect output through asset substitution without changes in real wealth.

It should be emphasized that although there are two ways of affecting output, both work through the supply price of capital. A change in the supply of money, or any other asset, must change the demand for investment if output is to change. Nothing in the capital market can affect consumption as the equations for consumption and investment illustrate.

A version of Tobin's model is given in equations 1_T - 7_T. Equation 7_T is real wealth which includes only outside money.

$$C = \overset{+}{c}(Y)$$

$$I = \overset{+}{I}(U)$$

$$C + I = d(Y, U)^{+\ +}$$

$$(1_T) \quad Y = d(Y, U)^{+\ +} + g_o$$

$$(2_T) \quad Y = y(N, K_o)$$

$$(3_T) \quad w_o = Y_N p$$

$$(4_T) \quad M_o^o + M_o^I = m(i^{-}, i_K^{-}, Y^{+}, \frac{W}{p}^{+})p$$

$$(5_T) \quad S_o = b(i^{+}, i_K^{-}, Y^{-}, \frac{W}{p}^{+}, \frac{M_o^I}{p}^{+})ip$$

$$(6_T) \quad K_o = \frac{k(i^{-}, i_K^{+}, Y^{-}, \frac{W}{p}^{+})}{U}$$

$$(7_T) \quad \frac{W}{p} = \frac{M_o^o}{p} + \frac{S_o}{ip} + UK_o$$

$$(8_T) \quad U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

A graphical presentation of Tobin's model is given in Figure IX which looks like Figure VII. However, changes in equilibrium in the asset market shift the AD curve only if U is changed.

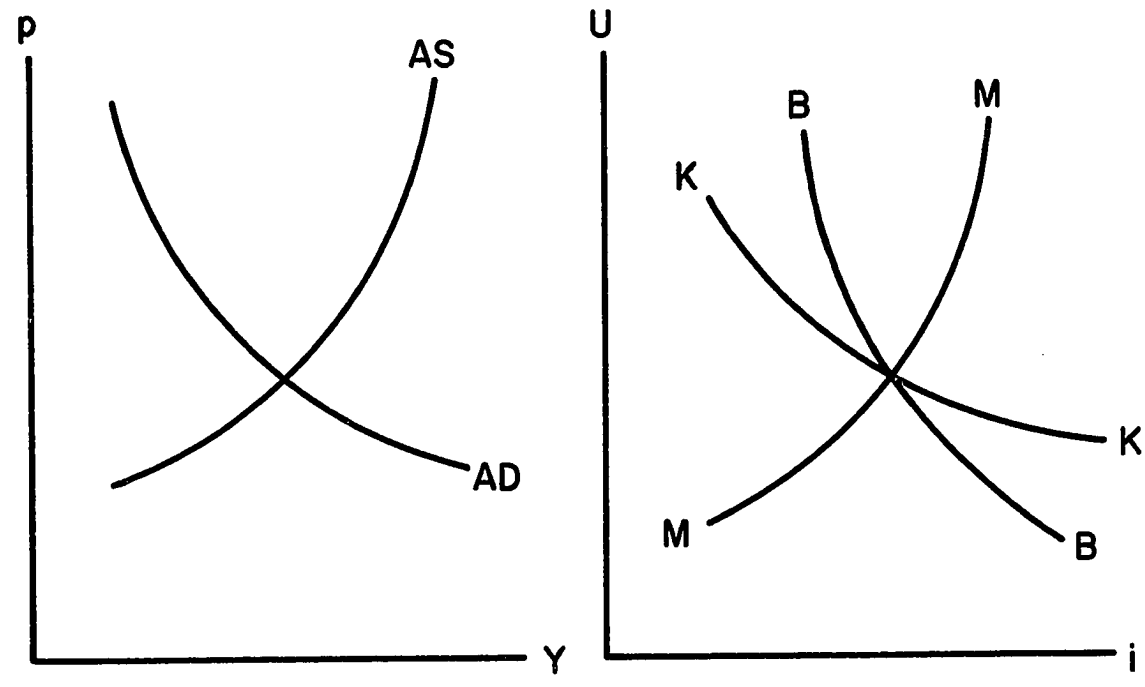
The major differences in the general model and Tobin's model are in the relationship between the asset market and the output market, and the definition of wealth. In both models there are three assets and two rates of return or asset prices which must be deter-

mined. However, in Tobin's model only U is relevant to the demand for output; therefore, money and wealth can affect output only through investment. In the general model money and wealth can affect consumption as well as investment. Wealth effects occur in Tobin's model, but wealth is more narrowly defined to exclude inside money.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	Indirectly via P in the capital market	Indirectly via the substitution of money and bonds for capital which changes U and investment
Money	via $\frac{M^o_o}{p} + \frac{S_o}{ip} + UK_o$	Directly for bonds and capital
Bond	via $\frac{M^o_o}{p} + \frac{S_o}{ip} + UK_o$	Directly for money and capital
Capital	via $\frac{M^o_o}{p} + \frac{S_o}{ip} + UK_o$	Directly for money and bonds

(Figure IX)



Foley and Sidrauski

In their book Monetary and Fiscal Policy in a Growing Economy, Duncan K. Foley and Miguel Sidrauski develop a beginning of the period, two sector production model with three assets -- money, bonds, and capital -- in which stock and flow decisions are sharply distinguished via separate budget constraints. Obviously a two sector production model is not a special case of a one sector model. Therefore, the general model is not used as a framework for the presentation of Foley and Sidrauski's model.

Foley and Sidrauski assume that wages and prices are flexible and so eliminate the possibility of unemployment. Therefore, the total supply of labor and capital can be used either in the production of investment goods or consumer goods; however, each requires a different production technique. The linearly homogeneous production functions for consumer goods (C) and investment goods (I) are

$$(1) \quad C = F_c(K_c, N_c) = N_c F_c\left(\frac{K_c}{N_c}, 1\right) = N_c f_c(k_c)$$

$$(2) \quad I = F_I(K_I, N_I) = N_I F_I\left(\frac{K_I}{N_I}, 1\right) = N_I f_I(k_I)$$

where K_c and N_c and K_I and N_I are the amount of capital and labor employed in the production of consumption and investment goods, respectively. Assuming perfect capital mobility and competition, the wage rate (w) and the rental rate of capital (r) will be equal in both sectors and equal to the value of their marginal product. Foley

and Sidrauski use the price of consumption goods as the numeraire and so

$$(3) \quad r = \frac{\partial F_c}{\partial K_c} = p_K \frac{\partial F_I}{\partial K_I} = f_c'(k_c) = p_K f_I'(k_I)$$

$$(4) \quad w = \frac{\partial F_c}{\partial N_c} = p_K \frac{\partial F_I}{\partial N_I} = f_c(k_c) - k_c f_c'(k_c).$$

Given the price of capital in terms of consumer goods (p_K) and the total supply of labor and capital, the amount of capital and labor used in each sector (and therefore output in each sector), the wage rate, and the rental rate on capital are determined by equations 1 to 4.

Foley and Sidrauski show that a change in the price of capital results in a change in the composition of output, since equilibrium in the output market requires that the marginal rate of transformation in production equal the relative price of investment and consumer goods. The change in output levels requires a change in the capital to labor ratio in each industry. When consumption goods are more capital intensive, the rise in the price of capital decreases the rental rate of capital. Therefore:

$$(5) \quad r = r(\bar{p}_K).$$

A change in the supply of capital and labor changes full employment output. Therefore, the equilibrium output level of consumer and investment goods depends not only upon the price of capital but upon the supply of labor and capital.

$$(6) \quad C = Q_c(K, L, p_K)$$

$$(7) \quad I = Q_I(K, L, p_K)$$

Like equations 1 and 2, equations 6 and 7 are homogeneous of degree one in K and N together, since a doubling of K_c, K_I, N_c and N_I will double output in equations 1 and 2. Equations 3 and 4 will be unaffected since the capital to labor ratio remains unchanged. Per capita output of consumption and investment is:

$$\frac{C}{N} = Q_c\left(\frac{K}{N}, p_K\right) = q_c(k, p_K)$$

$$\frac{I}{N} = Q_I\left(\frac{K}{N}, p_K\right) = q_I(k, p_K).$$

Total per capita output is:

$$q = \frac{C}{N} + p_K\frac{I}{N} = q_c(k, p_K) + q_I(k, p_K) = q(k, p_K).$$

The asset market consists of the money, bond, and capital markets. The per capita demand for assets depends upon per capita nonhuman wealth (a), per capita income (q), and the expected rates of return on assets. Income enters the demand functions as a measure of the transactions demand for money. As income increases, the demand for money increases and the demands for bonds and capital either decline or remain constant; however, the sum of the demand for bonds and capital must fall. Wealth is defined as the value of money, bonds, and capital. A change in wealth results in a change in the demands for money and capital in the same direction, but the demand for bonds may change directly or inversely.

The real per capita demand for an asset varies directly with its own return and inversely with the returns on alternative assets. The return on capital is the rental rate of capital per unit of capital, $(\frac{r(p_K)}{p_K})$, plus the expected capital gain on the unit of capital -- the expected increase in the price of capital ($\P_K$).

$$\rho_K = \frac{r(p_K)}{p_K} + \P_K$$

Since money earns no interest, the return on money (ρ_m) is the expected change in the price of money ($\P_m$) where $\P_m$ is the expected rate of deflation.

Bonds are fixed price, variable interest rate securities issued by the government and individuals. The interest rate on bonds (i) is determined in the bond market so that private individuals are content to hold the net amount of government debt outstanding. Since bonds are fixed in money terms, a change in the price of money gives rise to capital gains on bonds. Therefore, the return on bonds is $\rho_b = i + \P_m$.

At any given level of wealth, the total value of assets demanded must equal the value of actual asset holdings, which equals wealth. This is the budget constraint on the asset market and is necessitated by Foley and Sidrauski's distinction between stock and flow decisions. The demands for assets are demands for stocks, and the total demand for stocks cannot exceed the supply.

At any given moment, the supply of money, bonds, and capital are given, and equilibrium in the asset market requires the supply and demand for each asset to be equal. If the supply of money and

bonds are multiplied by $\frac{\frac{1}{gp_m}}{\frac{1}{gp_m}}$, where g is the accumulated per capita deficit or the sum of money and bonds, the asset market equilibrium conditions for the money, bond, and capital markets are

$$(\frac{1}{\frac{g}{m}})gp_m = L(a, q, \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K)$$

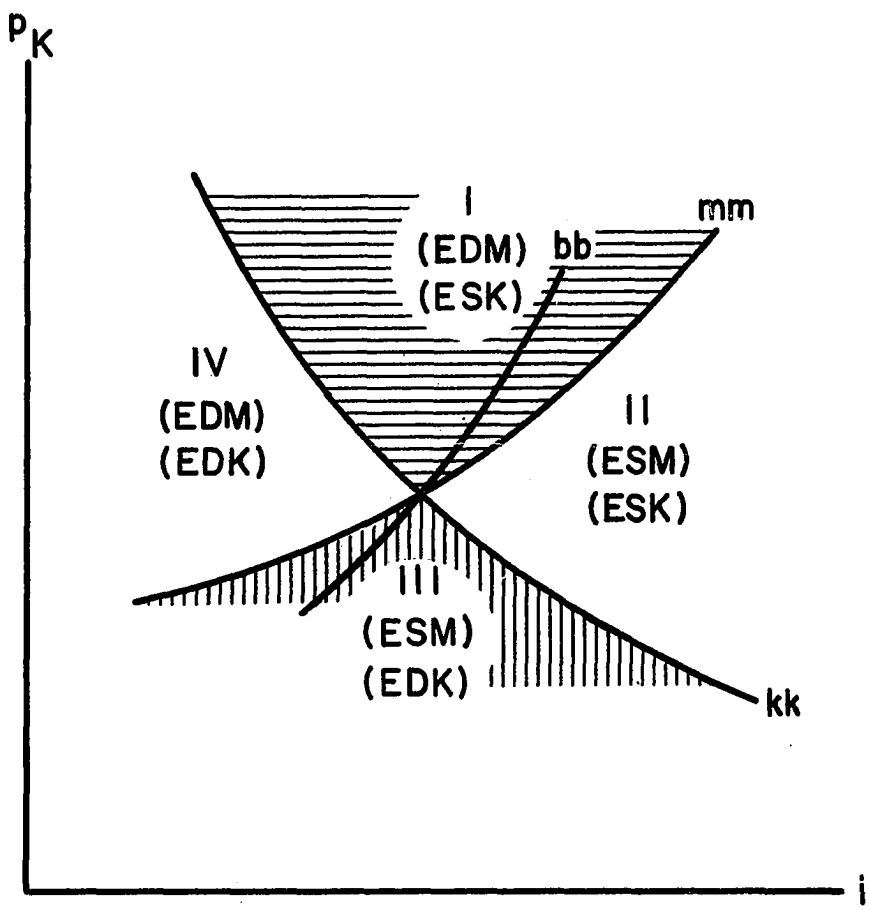
$$(1 - (\frac{1}{\frac{g}{m}}))gp_m = H(a, q, \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K)$$

$$kp_K = J(a, q, \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K),$$

where m is the real per capita supply of money.

The asset market is presented graphically in Figure X in the values of p_K and i which create equilibrium in each market, given the per capita supply of assets, the price of money, and the expected rates of price change. The money market curve slopes upward since an increase in p_K creates excess demand for money which must be offset by a rise in i. The capital market curve slopes downward since a rise in p_K creates excess supply which must be offset by a fall in i. The bond market curve may be positively or negatively sloped, since p_K affects wealth, income and the return on capital. If the net effect is to create excess demand for bonds when p_K increases, i must rise and the bond curve is positively sloped. If excess supply is created, i must fall and the bond curve is negatively sloped. The slope of the bond market curve must exceed the slope of

(Figure X)



the money market curve due to the budget constraint. In quadrants II and IV, excess demand or supply exists simultaneously in both the money and capital markets. To satisfy the wealth constraint, excess demand for bonds must exist in quadrant II, and excess supply of bonds must exist in quadrant IV. Only if bb goes through quadrants I and III can this occur.

The wealth constraint also states that equilibrium in two of the asset markets implies equilibrium in the third. Therefore, one of the markets can be dropped. Foley and Sidrauski drop the bond market.

To complete their model, Foley and Sidrauski introduce the market for consumption goods. The per capita supply of consumption goods was given previously as

$$C_s = q_c(k, p_K).$$

The private demand for consumption goods depends only upon wealth and disposable income (y); total demand includes government expenditures (e).

$$C^d = c(a, y) + e$$

In Foley and Sidrauski's model, disposable income includes not only the value of per capita output ($q_c + p_K q_I$), but per capita government interest payments (ibp_m), per capita net transfers ($(v - t)p_m$), and expected capital gains on money and bonds ($¶p_m g$). g is the accumulated per capita deficit, or the sum of money and bonds. There is no capital gain on the capital stock since the expected change in the price of

capital is assumed zero. Therefore, disposable nominal income becomes:

$$Y = q_c + p_K q_I + ibp_m + (v - t)p_m + \P_m p_m g.$$

The government deficit is the difference between total government expenditures and taxes. Therefore, the value of the government deficit becomes:

$$p_m d = e + ibp_m + (v - t)p_m$$

The rate of change in the per capita national debt is;

$$\dot{d} = g + ng$$

where ng is the rate of growth in the debt which allows the per capita debt to remain constant. Substituting the value of the government deficit into the equation for nominal income yields

$$Y = q_c + p_K q_I + dp_m - e + \P_m g p_m.$$

Equilibrium in the consumption market becomes:

$$q_c(k, p_K) = c(a, q_c + p_K q_I + dp_m - e + \P_m g p_m) + e.$$

Although Foley and Sidrauski do not specify another flow market, it is apparent from their income (or flow sector) budget constraint that the excluded market is the savings market. "To begin with, we note that the private sector income budget constraint requires that private disposable income equal the private demand for consumption goods plus the value of desired additions to asset holding." (Foley

and Sidrauski, pp. 94, 95; 1971) Ignoring capital gains, the income constraint is

$$q_c + p_K q_I + dp_m = c^d + k^d p_K + g^d p_m + e.$$

The deficit is the sum of new government debt (g); therefore, the income constraint can be rearranged as follows:

$$(q_c - (c^d + e)) + ((p_K q_I + \dot{g}p_m) - (\dot{k}^d p_K + \dot{g}^d p_m)) = 0.$$

The expression to the left of the second plus sign is the consumption market. The expression to the right is the savings market. Therefore, the savings market equilibrium condition is

$$(8) \quad p_K q_I + \dot{g}p_m = \dot{k}^d p_K + \dot{g}^d p_m$$

$$\text{or} \quad p_K q_I + dp_m = s(a, y)$$

$$\text{where} \quad s(a, y) \equiv \dot{k}^d p_K + \dot{g}^d p_m.$$

The complete model now becomes:

$$(1_{F-S}) \quad \left(\frac{1}{\frac{g}{m}}\right) gp_m = L\left(a, q(k, p_K), \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K\right)$$

$$(2_{F-S}) \quad p_K K = J\left(a, q(k, p_K), \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K\right)$$

$$(3_{F-S}) \quad \left(1 - \left(\frac{1}{\frac{g}{m}}\right)\right) gp_m = H\left(a, q(k, p_K), \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K\right)$$

$$(4_{F-S}) \quad q_c(k, p_K) = c(a, q(k, p_K) + dp_m - e + \P_m gp_m) + e$$

$$(5_{F-S}) \quad p_K q_I + dp_m = s(a, y)$$

The five equations now determine p_m, p_K, and i given $\P_m$, $\P_K$, K, g, a, d, e, and $-\frac{g}{m}-$. Since two of the five equations are dependent, they can be dropped. However, as Foley and Sidrauski point out, not just any two equations can be dropped. Due to the distinction between stock and flow decisions, there are two budget constraints -- the wealth constraint and the income constraint. Therefore, one equation in the asset or stock market and one equation in the income or flow market are dependent and can be dropped. Foley and Sidrauski drop the bond market and savings market, equations 3 and 5 respectively.

Due to Foley and Sidrauski's specification of the income sector of the model, total equilibrium can occur, and yet the public will not be accumulating assets in the desired amounts. Specifically, total desired savings may equal investment and changes in government debt while the desired changes in capital and debt holdings do not equal the actual changes. Reference to equation 8 shows that while the left side (total actual changes in assets) may equal the right (total desired changes in asset holdings), the corresponding arguments may not be equal. This difference between actual and desired rates of change of asset holdings will cause changes in the price of capital, money, and interest over time as the additions to the asset stocks feed back to change the supply of assets in the asset market. That is, a new static equilibrium will occur in which the per capita stocks of money, capital, and bonds are different. To designate the possible new stocks of assets, Foley and Sidrauski add

two definitions to their model as restrictions on the growth of per capita asset stocks,

$$\dot{k} = q_I(k, p_K) - nk$$

$$\dot{g} = d - ng$$

n is the rate of growth of the population. Therefore, nk and ng are the rates at which the capital stock and government debt must grow to maintain a constant per capita stock.

There are several similarities and differences between the Foley-Sidrauski model and the general model. As previously mentioned, Foley and Sidrauski use a two sector production model and sharply distinguish between stock and flow decisions. They state that the major reason for the stock-flow distinction is that there exists imperfect knowledge. Therefore, individuals cannot make one maximizing decision that determines the whole future path of consumption and asset holdings. Their expectations might be incorrect. Individuals make short run decisions on potentially wrong information and so may adjust their positions from period to period. It is true that without perfect information, one cannot properly integrate stock and flow decisions. However, it is not clear that Foley and Sidrauski's method of distinguishing between stock and flow decisions is desirable. Instead, it seems preferable to at least heuristically integrate the two decisions. Another difference between the general model and Foley and Sidrauski's model is the latter's assumption of full employment. Although Foley and Sidrauski mention that their model

can be made an unemployment model by introducing wage price inflexibility into it, they do not bother to do so and thus seem to treat the case of unemployment rather superciliously. Foley and Sidrauski define income more broadly than it is defined in the general model. Income includes not only the value of output, but net government transfers, and capital gains. In both models there are three asset markets. If money were the numeraire in Foley and Sidrauski's model, there would be three prices to be determined -- the price of consumer goods, the price of capital, and the interest rate. However, since the price of consumer goods is the numeraire, the price of money, the price of capital, and the interest rate are determined. (The interest rate and not the price of bonds is determined since Foley and Sidrauski assume fixed price, variable interest rate bonds.) The price of capital and the price of money affect consumption only by changing disposable income and wealth. In the general model, consumption is determined by not only wealth and income, but by a portfolio decision based upon rates of return, and therefore, the price of capital. However, in the general model the prices of assets do not directly affect the level of income, since only one production sector exists and capital gains are excluded from income.

Investment is determined in both models by equilibrium in the market for the stock of capital. Graphically, in Foley and Sidrauski's model, the supply of capital is perfectly inelastic with respect to the price of capital. The demand for capital is downward sloping since a rise in the price of capital produces a fall in the return on capital. Once the price of capital is determined,

the supply of investment goods is determined. However, as previously discussed, equilibrium in the whole market does not guarantee that asset holders will want to absorb the new capital into their existing stock. Equations 4_{F-S} and 5_{F-S} say only that the supply and demand of consumption output and the total supply and total demand of savings will be equal in equilibrium. In the general model, the output market, not just the consumption sector, must be in equilibrium. That is, actual physical savings must equal the demand for capital. Therefore, the supply of investment must be equal to the desired accumulation of capital at the equilibrium prices.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	Indirectly via p_K in the capital market	Indirectly via the substitution of money and bonds for capital which changes investment
	Directly via $p_m \frac{M}{N} + \frac{S_o}{N} + p_K \frac{K}{N}$ in the consumption market	
Money	via $p_m \frac{M}{N} + p_m \frac{S_o}{N} + p_K \frac{K}{N}$	Directly for bonds and capital
Bond	via $p_m \frac{M}{N} + p_m \frac{S_o}{N} + p_K \frac{K}{N}$	Directly for money and capital
Capital	via $p_m \frac{M}{N} + p_m \frac{S_o}{N} + p_K \frac{K}{N}$	Directly for money and bonds

Woglom

Geoffrey Woglom (1974) uses a model similar to Foley and Sidrauski's model to examine the Keynesian-Monetarist controversy. He too develops a beginning of the period two sector production model with three assets -- money, bonds, and capital -- in which stock and flow distinctions are sharply distinguished and the price of commodities is the numeraire.

Unlike Foley and Sidrauski, Woglom does not assume that income is fixed at its full employment level by flexible prices. Instead the nominal wage (w_o) is fixed, and the possibility of unemployment exists. Real income (Y) is the sum of consumption output (q_c) and new capital production (q_I), both of which depend upon the amounts of capital and labor employed in production. Since the price of consumption goods is the numeraire, firms in the consumption goods sector hire labor until their marginal product equals the real wage, while firms in the capital goods sector hire until the value of the marginal product equals the real wage. Therefore,

$$q_c = g(K_c, p_m\bar{w})$$

$$q_I = p_K f(K_K, \frac{p_m\bar{w}}{p_K})$$

$$Y = p_K f(K_K, \frac{p_m\bar{w}}{p_K}) + g(K_c, p_m\bar{w})$$

where K_c and K_K are the amounts of capital employed in the production of consumption and capital goods, respectively. p_m is the price of money and p_K is the price of capital.

Consumption is a function of disposable income, $Y(1 - t)$ and wealth (a). Taxes (t) are assumed to be proportional to income. Equilibrium in the consumption market is the flow equilibrium condition and is given by

$$(1) \quad q(K_c, p_m\bar{w}) = c(Y(1 - t), a) + G_c$$

where G_c is government's demand for consumption goods.

The asset market consists of the money, bonds, and capital markets. The demand for each asset depends upon wealth, income, and the expected rates of return on assets. As income increases, the demand for money increases, and the demands for bonds and capital decline. As wealth changes, the demand for all assets rise. Since the assets are gross substitutes, the demand for an asset varies directly with its own return and inversely with the returns on alternative assets.

In Woglom's model, firms finance the purchase of capital by issuing equity. Equity in either the consumption or capital goods sector may be purchased.

Owners of equity are entitled to the expected marginal value product of capital in that sector (v_c^* or v_K^*) plus the next period price of equity in that sector (j_c^* or j_K^*). Therefore, the expected rates of return on equity in the consumer and capital goods sector are given by r_c and r_K respectively.

$$r_c = \frac{v_c^* + j_c^*}{j_c} \qquad r_K = \frac{v_K^* + j_K^*}{j_K}$$

where j_c is the price of equity in the consumption sector and j_K the

price of equity in the capital sector. Although the physical capital stocks of each firm are fixed during the period, it is assumed that equity may be traded freely and that the risk on equity is constant for all firms. Therefore, the real rates of return on the two kinds of equity must be equal.

$$r_c = r_K = r$$

$$(2) \quad \frac{v_c^* + j_c^*}{j_c} = \frac{v_K^* + j_K^*}{j_K} = r$$

Since expectations are exogenously determined, the prices of the two kinds of equity must adjust to equate the expected rates of return.

Firms finance capital stock acquisitions by issuing equity, so they will purchase capital until the cost of the capital (p_K) equals the price of an equity. Since capital is a homogeneous product and so may be used in either sector, the sector with the higher price of equity will bid the price of capital up and absorb the total new supply of capital. Since the firm with the lower price of equity cannot sell their holdings of capital, both firms will be satisfied with their capital holdings. The price of capital will equal the highest price of equity and using equation 2, the following relationships hold:

$$j_c = j_K \frac{v_c^* + j_c^*}{v_K^* + j_K^*}$$

$$z = \frac{v_c^* + j_c^*}{v_K^* + j_K^*}$$

$$j_c = j_K z = p_K z$$

where $0 < z \leq 1$

Substituting p_K and $p_K z$ for j_K and j_c respectively in equation 2, one sees that the expected real return on equity varies inversely with the price of capital. If the total capital stock (K) equals the capital stock in the sector with the higher expected yield on capital (K_K) plus zK_c, then the total real supply of equity during the period equals $p_K K$.

The nominal supply of money (M) at the beginning of the period is an exogenous variable. The real supply is the price of money times the nominal supply ($p_m M$). The expected real rate of return on money (r_m^*) is the expected capital gain due to a change in the price of money.

$$r_m^* = \frac{p_m^* - p_m}{p_m}$$

$$(3) \quad r_m^* = \frac{p_m^*}{p_m} - 1$$

p_m^* is the expected price of money next period. From equation 3 it is seen that the expected rate of return on money is inversely related to the price of money.

Bonds are consols issued by the government. The nominal yield on bonds is fixed in terms of money, and the real yield can be obtained by multiplying the nominal yield by the expected price of money in the next period (p_m^*). The price of a bond (p_B) is the price

of purchasing an amount of bonds whose real yield is some fixed amount. The real supply of bonds at the beginning of the period is obtained by multiplying the sum of the real yields on all outstanding bonds (B) by the expected price of bonds this period. The expected real rate of return on bonds (r_B^*) consists of the real value of the yield on bonds plus the expected capital gain.

$$(4) \quad r_B^* = \frac{p_m^* + p_B^* \cdot p_m^{**}}{p_B p_m^*} - 1$$

p_B^* is the expected price of bonds in the next period. p_m^{**} is the expected price of money in two periods. As is the case with money and capital, the expected return on bonds varies inversely with its price. Since expectations are exogenously determined, equations 2, 3, and 4 make the expected returns on capital, money, and bonds inverse functions of the prices of capital, money, and bonds, respectively.

Equations 1_W- 5_W represent Woglom's model. Equations 1_W - 3_W are the money, capital, and bond markets. Equation 4_W is the consumption market.

$$(1_W) \quad p_m M = L(p_m, p_B, p_K, Y, a)$$

$$(2_W) \quad p_m^* p_B B = J(p_m, p_B, p_K, Y, a)$$

$$(3_W) \quad p_K K = H(p_m, p_B, p_K, Y, a)$$

$$(4_W) \quad g(K_c, p_m \bar{w}) = c(Y(1 - t), a) + G_c$$

$$(5_W) \quad Y = p_K\left(K_K, \frac{p_m\bar{w}}{p_K}\right) + g(K_c, p_m\bar{w})$$

$$(6_W) \quad a = p_m M + p_m^* p_B B + p_K K$$

The model is determinant in five endogenous variables, Y, p_m, p_B, p_K and a, and five independent equations. Since Woglom makes the same stock-flow distinction as Foley and Sidrauski, equation 4_W, the flow equilibrium condition, cannot be dropped. Only an asset market can be dropped, and Woglom chose the bond market.

As with the Foley and Sidrauski model, there are several differences between Woglom's model and the general model. Woglom uses a two sector production function and sharply distinguishes between stock and flow decisions. However, Woglom does not fully specify his flow market. The consumption market cannot be the only flow market if the model is to be consistent. At least one other market must exist analagous to the savings market in Foley and Sidrauski's model. Given equilibrium in equation 4_W, the total demand and supply for non-consumption flows in the economy (new capital and changes in the supply of money and bonds) must be equal. That is

$$(7_W) \quad p_K f\left(K_K, \frac{p_m\bar{w}}{p_K}\right) + p_m\dot{M} + p_m^* p_B\dot{B} = p_K\dot{K}_d + p_m\dot{M}_d + p_m^* p_B\dot{B}.$$

The addition of equation 7_W would leave the model with seven equations of which a flow equation and an asset or stock equation may be

dropped. If Woglom insists on a sharp stock-flow separation, he should completely specify the flow markets.

Woglom uses equation 4_W as the equilibrium condition in the flow sector of the model. He criticizes IS-LM for expressing the equilibrium level of income as that level at which desired consumption and investment expenditures equal income (1974, p. 4). His criticism is that the presence of investment in the "flow" equilibrium condition implies that capital goods are being treated simultaneously as flow goods and stock goods, which is inconsistent with the treatment of money and bonds. "For example, the flow demand and supply of money do not affect equilibrium prices, while the flow demand and supply of capital do." (1974, p. 5). Consequently Woglom rejects the use by IS-LM and the general model of aggregate supply equals aggregate demand as a proper equilibrium condition in the flow market, and he substitutes equation 4_W.

Several observations can be made concerning Woglom's equilibrium flow condition and his stock-flow separation. Woglom's contention that IS-LM treats the asset capital and the assets money and bonds inconsistently is true only if one rejects Leijonhufvud's interpretation of IS-LM as a money, bonds, and commodity model. If capital is a commodity and not an asset, there is no inconsistency -- all assets are treated as stocks. Woglom's flow equilibrium condition essentially dispenses with the important Keynesian contention that equilibrium income is determined when the demand for investment equals the supply of new capital (i.e., savings equal desired investment), not simply when the demand for consumption goods equal the

supply. In the Keynesian case, at any income level at which physical savings exceeds desired investment, income falls. At any income level at which desired investment exceeds savings, income rises. In Woglom's model, savings equals desired investment is ignored, and equilibrium income is determined only by the condition that desired consumption equals the production of consumer goods. It does not matter whether the demand for new investment goods equals the supply or not. The significance of Woglom's rejection of the traditional Keynesian equilibrium condition can be seen from the following example. Assume an initial equilibrium at less than full employment. Assume now that there is a fall in the real wage which should increase employment and equilibrium income. In the IS-LM model, or other Keynesian models, equilibrium will occur at a higher income level only if desired investment can be made to equal savings at the higher level. In Woglom's model, income will increase regardless of the supply and demand for investment goods. Foley and Sidrauski's model has the same characteristic; however, it is less significant because theirs is a full employment model.

It was previously mentioned that the demand for assets in Woglom's model depends upon income, wealth, and asset rates of return. The specification of the demand for assets as a function of the level of income is inconsistent with the model's budget constraint. Woglom describes his model as a "beginning of the period model." That is,

> The asset markets equate the supplies and demands of stocks of assets at the beginning of the period; the flow equilibrium condition equates the supplies and demands of flow commodities at the

> end of the period of analysis...A beginning of period asset market equilibrium model assumes that what happens during the period affects the individual's budget constraints for flow goods (consumption) and therefore the flow equilibrium is assumed to be independent of unforeseen changes in individuals' budget constraints during the period. (1974, pp. 4, 5)

Since income is a flow variable, its value is determined during the period. Therefore, it cannot enter a beginning of the period demand function. If income enters at all, it must be the expected level of income. Finally, if stock and flow decisions are to be separated, a proper treatment must somehow integrate them. Foley and Sidrauski admit that they cannot. Woglom does not address himself to the point. As was stated with regard to Foley and Sidrauski's model, it seems preferable to at least heuristically integrate stock and flow decisions. Perhaps that is what IS-LM attempts to do by putting investment in the flow equilibrium condition and treating flows as quasi-stocks.

Woglom defines wealth more narrowly than the general model, since it includes only outside money. In both models there are three asset markets, and three prices to be determined. If money were the numeraire, the prices determined in Woglom's model would be the price of commodities, the price of capital, and the price of bonds. However, since consumption goods are the numeraire, the prices of, or rates of return on money, capital, and bonds are determined. The prices of money and capital enter the demand for consumption only via the level of income and wealth. As already mentioned, the output, not just the consumption market, must be in equilibrium in the general model.

Woglom uses his model to examine the Monetarist-Keynesian (or Neo-Keynesian) controversy by looking at the effects of fiscal and monetary policy on the equilibrium values of his model. Fiscal policy is examined both as a change in the level of a balanced budget, and as bond financed deficit spending. Monetary policy is examined as a change in the money supply. Woglom considers Monetarist results as relatively ineffective balanced budget fiscal policy, ineffective or countereffective bond financed fiscal policy, and highly effective monetary policy. Keynesians on the other hand believe balanced budget and debt financed fiscal policy to be effective, but monetary policy to be less effective than Monetarists believe. Woglom concludes generally that either Keynesian or Monetarist results can be obtained, depending on the parameters of the model, and that the parameters probably change over time. However, he states that "...while there are many sets of parameter values that cause our model to yield Monetarist or Neo-Keynesian results, there were two sets of parameter values discussed...that seemed to get to the heart of the debate." (1974, p. 36). First, the model yields more Monetarist results as the wealth elasticity of consumption increases and the income elasticity decreases. Second, the model yields more Monetarist results when bonds and equity are good substitutes, but both are poor substitutes for money. The model yields more Neo-Keynesian results when money and bonds are good substitutes, but neither substitute very well for capital.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	Indirectly via P in the capital market. Directly via $p_m M + p_m^* p_B + p_K K$	Indirectly via the substitution of money and bonds for capital which changes investment.
Money	via $p_m M + p_m^* p_B + p_K K$	Directly for bonds and capital
Bond	via $p_m M + p_m^* p_B + p_K K$	Directly for money and capital
Capital	via $p_m M + p_m^* p_B + p_K K$	Directly for money and bonds

CHAPTER IV

MONETARIST MODELS

Friedman

In two articles in the JPE, Friedman outlines his theoretical framework in an adaptation of the IS-LM system. As a prelude to his theory, Friedman examines the Quantity theory and Keynesian theory in the IS-LM framework. Friedman (1970b) states that although it was recognized by classical economists that prices, income, and velocity might change in response to a change in the money supply, their formal analysis simply took over Marshall's assumption that prices will adjust instantaneously while quantity remains constant. Keynes also assumed that one variable adjusted instantaneously while the other adjusted slowly. However, Keynes reversed the roles and assumed that quantity adjusted rapidly while prices adjusted slowly. Therefore, Friedman examines the Quantity theory in the IS-LM framework by assuming that income is fixed at some predetermined level. He examines Keynesian theory in the IS-LM framework by holding prices constant. Friedman's alternative formulation is to allow both prices and income to fluctuate. All three models are now examined in the IS-LM adaptation of the general model.

The Quantity Theory

In Friedman's examination of the Quantity theory, income is exogenously determined, but prices are variable. The IS-LM version of the general model can be altered to represent Friedman's presentation of the Quantity theory. Since income is held constant, the level of income and employment can be dropped as endogenous variables and equations 3_I and 4_I can be eliminated. This leaves two variables, i and p, to be determined by two independent equations.

$$(1) \quad Y = d(i, Y_o) + g_o$$

$$(2) \quad \frac{M^o_o}{p} + \frac{M^I_o}{p} = m(\underset{-}{i}, \underset{+}{Y_o})$$

$$(3) \quad \frac{S_o}{ip} = b(\underset{+}{i}, \underset{-}{Y_o}, \frac{M^o_o}{p} + \frac{M^I_o}{p}, \frac{S_o}{ip})$$

By holding income constant, Friedman (1970b, p. 219) says of the Quantity theory that "In effect appends to this system the Walrasian equations of the general equilibrium..." Consistent with this interpretation, one can make the labor market explicit by making the nominal wage an endogenous variable and adding an equation making the supply of labor a function of the real wage. The labor sector then can be written as

$$Y = Y(N, K_o)$$

$$\frac{w}{p} = Y_N$$

$$N = S(\frac{w}{p})$$

which collapses to the form used by Friedman,

$$Y = Y(N_o) = Y_o$$

where Y_o is full employment output. The complete labor market can be added to equations 1 - 3.

$$(1) \quad Y = d(\overset{-}{i}, \overset{+}{Y}) + g_o$$

$$(2) \quad \frac{M_o^o}{p} + \frac{M_o^I}{p} = m(\overset{-}{i}, \overset{+}{Y})$$

$$(3) \quad Y = Y(N, K_o)$$

$$(4) \quad w = Y_N p$$

$$(5) \quad N = S\left(\frac{w}{p}\right)$$

$$(6) \quad \frac{S_o}{ip} = b(\overset{+}{i}, \overset{-}{Y}, \frac{M_o^o}{p} + \frac{M_o^I}{p}, \frac{S_o}{ip})$$

The existence of flexible wages creates equilibrium or full employment in the labor market and so keeps output fixed at the full employment level. Therefore, in the Quantity theory, the level of real income is independent of the commodity and monetary sectors. The money and output markets combine to determine the interest rate and the price of commodities.

Friedman's Interpretation of the Keynesian System

In Friedman's presentations of the Keynesian system, he assumes that prices are rigid. Therefore, Friedman's analysis can

be presented by holding prices constant but allowing wages to fluctuate in equations $1_I - 5_I$, although he excludes any reference to equations 3_I and 4_I. This modification still allows the real wage to change so that the level of employment can change as the equilibrium level of income changes. Friedman's model includes only equations 1 and 2 below.

$$(1) \quad Y = d(\overset{-}{i}, \overset{+}{Y}) + g_o$$

$$(2) \quad \frac{M^o_o}{P_o} + \frac{M^I_o}{P_o} = m(\overset{-}{i}, \overset{+}{Y})$$

$$(3) \quad Y = Y(N, K_o)$$

$$(4) \quad w = Y_N P_o$$

$$(5) \quad \frac{S_o}{ip_o} = b(\overset{+}{i}, \overset{-}{Y}, \frac{M^o_o}{P_o} + \frac{M^I_o}{P_o}, \frac{\overset{+}{S_o}}{ip_o})$$

The money and output markets combine to determine the interest rate and the level of income, rather than the interest rate and the level of prices. Once income is determined, employment and the real and nominal wage are determined. Monetary changes have no effect on prices.

Friedman's Theoretical Framework

Friedman dislikes both of these models and so presents his own, in which neither prices nor income are assumed constant. In Friedman's 1970b article, changes in real income and prices depend

largely upon expectations with regard to price changes, real income changes, and income levels. Since the general model is not general in the sense of incorporating expectations, Friedman's first analysis cannot be forced into it. However, Friedman outlines his theoretical framework in a second JPE article which can be discussed in the general framework. (Friedman 1971) The demand for output depends upon the real interest rate (ρ), which affects both consumption and investment, and real income, which affects only consumption.

$$C = c(\overset{+}{Y}, \overset{-}{\rho})$$

$$I = \overset{-}{I}(\rho)$$

$$C + I \overset{-}{=} d(\overset{+}{Y}, \overset{-}{\rho})$$

The demand for money depends upon the level of real income and the nominal interest rate.

$$M_d = m(\overset{+}{Y}, \overset{-}{i})p$$

Friedman defines the nominal interest rate as the sum of the anticipated real interest rate and the anticipated future change in the price level $(\frac{1}{p}\ \frac{dp}{dt})^*$. Anticipated values are denoted by asterisks.

$$i = \rho^* + (\frac{1}{p}\ \frac{dp}{dt})^*$$

which can be written as:

$$i = \rho^* + (\frac{1}{pY}\ \frac{dpY}{dt})^* - (\frac{1}{Y}\ \frac{dY}{dt})^*$$

where $(\frac{1}{pY} \frac{dpY}{dt})^*$ is the anticipated growth of nominal income, and $(\frac{1}{Y} \frac{dY}{dt})$ is the anticipated rate of growth of real income. Friedman then assumes that the difference between the anticipated real interest rate and the anticipated growth of real income is constant, either because for short run analysis both may be taken as constant or because they move together, and so the difference will vary less then either. Therefore,

$$\dot{\rho}^* - (\frac{1}{Y} \frac{dY}{dt}) = k_o$$

$$i = k_o + (\frac{1}{pY} \frac{dpY}{dt})^*.$$

If the supply of money, both inside and outside, is exogenously determined, and the elasticity of the demand for money with respect to income is one, the equilibrium condition in the money market becomes:

$$M_o^o + M_o^I = m(i)Yp.$$

After dropping the bond market, the system is:

$$Y = d(Y, \rho)$$

$$M_o = m(i)Yp$$

$$i = k_o + (\frac{1}{pY} \frac{dpY}{dt})^*$$

with real income, the price level, the nominal interest rate, the

real interest rate, the anticipated real interest rate and the anticipated rate of growth in nominal income as variables. Although being inclined to reject this way of making the model determinant, Friedman assumes that the anticipated real interest rate equals the real rate, which is a constant.

$$\rho = \rho^{*} = \rho_{o}$$

By assuming that the anticipated percentage growth in nominal income is exogenously determined, the system of equations becomes:

$$Y = d(Y, \rho_{o})$$

$$M_{o}^{o} + M_{o}^{I} = m(i_{o})Yp.$$

Two independent equations determine real output and the price level.

Friedman's model can now be expressed in terms of the general model, only if the wage rate in equation 3_F is allowed to vary. That is, only if flexible wages and prices exist, can Friedman's model determine employment, prices, and income.

If wages are inflexible at w_o in equation 3_F, the system is overdetermined. Nominal income is determined in equation 4_F and real income in 1_F. Therefore, real income and the price level are determined. Since real output is determined, the required labor to produce it is given by the production function. However, with the nominal wage rate and prices already given, the required employment level need not be consistent with the real wage. Mathematically, there are four independent equations to determine three variables. Therefore, the system with rigid wages is overdetermined, and wages

must be made flexible. However, unlike in most models with flexible wages and prices, the labor market is not in equilibrium.

$$(1_F) \quad Y = d(\overset{+}{Y}, \overset{-}{\rho_o}) + g_o$$

$$(2_F) \quad Y = Y(N, K_o)$$

$$(3_F) \quad w = Y_N p$$

$$(4_F) \quad M_o^O + M_o^I = m(i_o)Yp$$

$$(5_F) \quad S_o = b(\overset{+}{i_o}, \overset{-}{Y}, \frac{M_o^O}{p}\overset{+}{} + \frac{M_o^I}{p}\overset{+}{}, \frac{S_o}{ip}\overset{+}{})ip$$

The difference between Friedman's model and the general model can be summarized as follows. Friedman's model need determine only one rate of return -- the interest rate -- since there are only two aggregate assets. However, a distinction is made between the real rate of interest and the nominal rate. The nominal rate exceeds the real rate by the anticipated change in the price level, which is exogenously given. Therefore, only the real interest rate need be explained. It is determined in an interesting way -- exogenously. This leaves only prices and income as variables. Real income is then determined in the real sector and nominal income in the monetary sector. Therefore, only the price of output can be affected by

changes in the money supply. Friedman excludes wealth effects for simplicity.[1]

Brunner and Meltzer

The most complete, and perhaps the only formal theoretical Monetarist model is presented by Brunner and Meltzer in several alternative versions, which differ only in the appoggiaturas. (Brunner and Meltzer 1972a, 1972c, 1973) There are several characteristics of the Brunner-Meltzer model which make the general model undesirable as a framework for analysis. Brunner and Meltzer introduce banks into the bond market as the net holder of securities. The nonbank private sector is made a net debtor, along with the government. Together the two sectors issue securities to be purchased by banks. Therefore, as in the general model, there are four markets which must be in simultaneous equilibrium -- the money market, the bond or credit market, the capital market, and the output market. Due to the specification of the credit market, the money supply must be an endogenous variable (this point is discussed thoroughly later). Brunner and Meltzer also incorporate a government budget constraint into their model. Due to these differences, the general model is not

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[1] B. T. McCallum (1974) suggests another way of making an IS-LM model determinant when allowing wages and prices to vary. He adds an equation, making changes in prices a function of excess demand. For example, if Y is endogenously determined in equations $1_F - 3_F$ another equation is needed to make the system determinant. McCallum adds

$$\frac{dp}{dt} = f(Y - q)$$

where Y is aggregate demand and q is full employment income, which is exogenously determined.

used as a framework to analyze the Brunner and Meltzer Monetarist model. Instead, their model is presented below in what Brunner and Meltzer (1972c) call its more formal form. The asset markets and the government sector's equilibrium condition are in nominal terms; the capital market is excluded by Walras' Law.

Exogenous Variables	Endogenous Variables
(1) $\P$ = anticipated rate of price change	(1) Y
(2) Y*= anticipated real income	(2) p
(3) n = net worth multiplier for the banking system	(3) i
(4) K = existing capital stock	(4) P
(5) i_t= interest rate paid on bank deposits	(5) B
(6) B_2= other sources of the monetary base	(6) S

$$(1_{B-M}) \quad Y = \underset{- \; + \; + \; -}{d(i, P, Y, p, \ldots)} g_o$$

$$(2_{B-M}) \quad p = \underset{+}{p(Y, \ldots)}$$

$$(3_{B-M}) \quad \underset{+ \; + \; +}{\alpha(i, Y, P, \ldots)} B = \underset{- \; - \; + \; + \; +}{\sigma(i, P, Y, p, S, \ldots)}$$

$$(4_{B-M}) \quad \underset{+ \; - \; -}{m(i, Y, P, \ldots)} B = \underset{- \; + \; + \; +}{L(i, P, Y, p, \ldots)}$$

$$(5_{B-M}) \quad \underset{+ \; + \; + \; +}{G(i, Y, S, g, \ldots)} = \underset{+ \; +}{t(Y, p, \ldots)}$$

The dots represent anticipations, policy variables, and the capital stock, all of which are exogenously determined. This leaves six unknowns and five equations. To complete the system either B or S must be determined either exogenously or by making both a function of a single variable and substituting it for B and S. In either case, the system is determinant with five endogenous variables.

The output market is represented by equations 1_{B-M} and 2_{B-M} which are, respectively, aggregate demand and aggregate supply. As the returns on assets rise, the demand for output falls. As the price of output rises or income falls, demand for output falls. Equations 3_{B-M} and 4_{B-M} are the credit and money markets, where supply of credit and money are multiples of the monetary base. The supply of credit depends positively on i since an increase in the interest rate increases the profitability of making loans. The money supply also increases since at least some loans are made by creating demand deposits. The money supply is defined as currency plus demand deposits and so any increase in the proportion of money held on time account lowers the money multiplier and raises the bank credit multiplier. Therefore, as income increases or the price of capital rises, the supply of credit rises and the supply of money falls, since rising Y and P increase the proportion of deposits held on time account. The demand for credit increases when the cost of borrowing falls. As P rises, the return on capital falls, making capital less attractive than bonds and so decreasing the net creditor position of the public. As income and prices increase, the demand for credit rises. An increase in government securities is an increase in the government's demand for loans. The demand for money is the same as in the general model, with the exception that the price of output enters with a positive sign.

Equation 5 states that the model can be in equilibrium only when nominal government expenditures are financed by taxation. Otherwise either the monetary base or the supply of government

securities will be increasing. Taxes depend on income and prices. Nominal government expenditures depend not only on real government expenditures, but on the price level and total interest payments. If B and S are assumed exogenously determined, equation 5 can be dropped. The following graphical presentation is given by Brunner and Meltzer which shows the interaction of the markets for assets and the output market. Figure XIa gives equilibrium in the output market as a function of p and Y, given a constant i and P. Figure XIb shows what Brunner and Meltzer call equilibrium in the asset market as a function of P and i, given a constant p and Y. Along MM the money market is always in equilibrium, and along CM, the bond market is always in equilibrium. Their intersection gives partial equilibrium of the asset markets.

Although wealth is not included in their more formal presentation, Brunner and Meltzer explicitly include it in their discussions of their model. They define wealth as the sum of human (W_H) and nonhuman wealth (W_N).

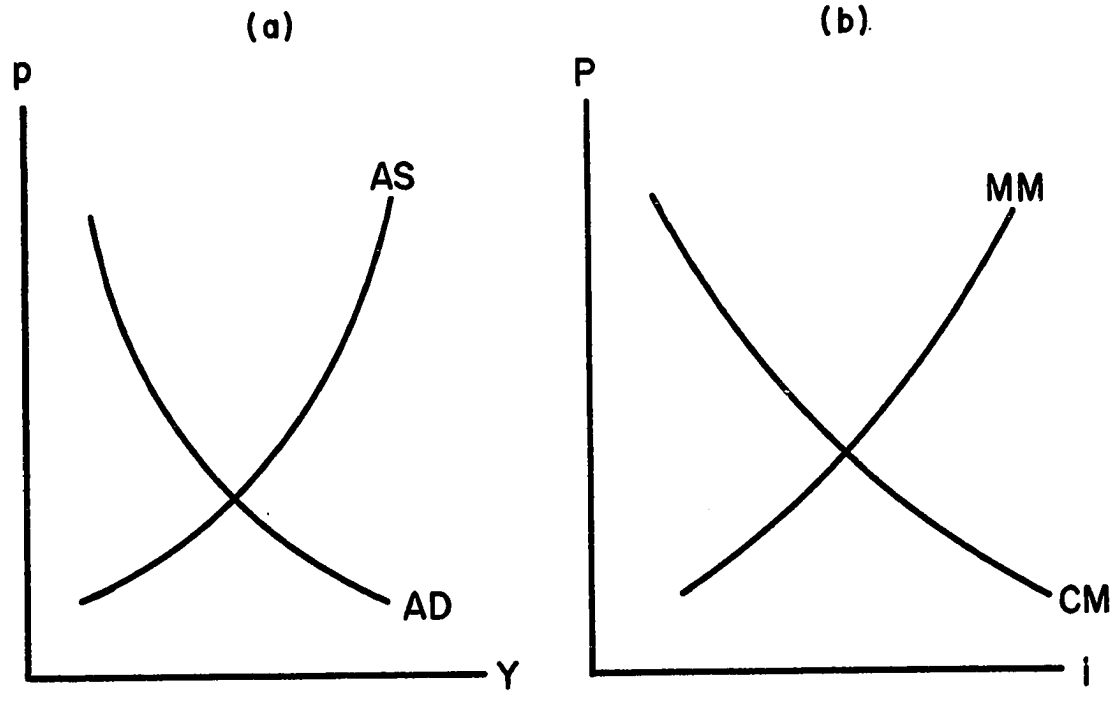
$$W = W_H + W_N$$

$$W_N = PK + (1 + w)B + v(\bar{i})S$$

$$W_H = W_H(\overset{+}{Y}, \overset{*}{\underset{+}{p}})$$

n is the net worth multiplier of the banking system while v(i) is the price of bonds. The nominal value of nonhuman wealth is the sum of the market value of capital, government securities, and the wealth

(Figure XI)



component of the total money supply. Human wealth is some function of anticipated real output and current prices. An equation can easily be added defining wealth, and the variable wealth can be added to all the demand functions.

Like the general model and Tobin's model, Brunner and Meltzer have three assets and two rates of return or asset prices to be determined -- the interest rate and the price of capital. However, income, wealth, the interest rate, and the prices of capital and output are relevant to the demand for output, and so money and wealth can affect output without necessarily changing the price of capital. Only income and the price of capital enter the demand for output in Tobin's model. Wealth is a broader concept in Brunner and Meltzer than in Tobin's model, but it does not include all of inside money as does the concept of wealth in the general model.

SUMMARY

Markets	Effects	
	Wealth	Substitution
Output	via $(1 + n)B + PK_o + v(i)S$	Indirectly via the substitution of money, bonds, and capital which changes i and P and thereby consumption and investment
Money	via $(1 + n)B + PK_o + v(i)S$	Directly with bonds, capital and output
Bonds	via $(1 + n)B + PK_o + v(i)S$	Directly with money, capital and output
Capital	via $(1 + n)B + PK_o + v(i)S$	Directly with money, bonds and output

Thus far, the discussion of Brunner and Meltzer has been limited largely to the "formal demonstration" of their model. However, in Brunner and Meltzer's papers such a discussion is limited to one page. The balance of their remarks is directed toward explaining and developing their model and, therefore, deserves some attention. The Monetarist model they present is an important advancement in the theoretical development of Monetarist ideas; unfortunately, their presentation is sometimes incorrect and is at all times a paradigmatic obfuscation. The following discussion does not even attempt to note all of the errors or obscurities but only to point out a few palpable ones.

To begin, one must know a great deal of math indeed to take the elasticity of an exogenous variable with respect to an endogenous one (Brunner and Meltzer, 1972, see pp. 976, 958; 1973, see pp. 54, 57). However, Brunner and Meltzer do that when they speak of the elasticity of expected output to actual output after having defined expected output as an exogenous variable (1972c, p. 958). This error can be remedied by making expected output (Y*) a function of an endogenous argument and an exogenous argument.

$$Y^* = t(Y, A)$$

where A is the exogenous effect on Y^*. Brunner and Meltzer do not define Y^* in this manner. However, they continue their misuse of anticipated income as an endogenous variable with important implications for their analysis. For example, they define their output effect as the response of P and i with respect to $\frac{dY}{Y}$. This is determined by the effect of $\frac{dY}{Y}$ on the money and credit markets, or

in Figure XIb, the shifts of CM and MM with respect to relative changes in incomes. Part of this effect includes the elasticity of anticipated income with respect to current income, $E(Y^*, Y)$ as a multiplicative term (1972, p. 962, 963)

$$E(CM, Y) = E(Y^{*+}, Y)\ \{(E(\sigma, W_H)^{+\text{ or }-} - E(a, W_H)^{+})\ E(W_N, Y^*)^{+} +$$

$$(E(\sigma, e)^{+} - E(a, e)^{-})\ E(e, Y^*)^{+}\}^{+} + E(\sigma, p)^{+}\ E(p, Y)^{+} > 0$$

The signs above each term are the signs of the elasticities as specified by Brunner and Meltzer. A similar expression is given for the money market.

$$E(MM, Y) = E(Y^{*+}, Y)\ \{(E(L, W_H)^{+} - E(m, W_H)^{-})\ E(W_H, Y^*)^{+} +$$

$$(E(L, e)^{+} - E(m, e)^{+})\ E(e, Y^*)^{+}\}^{+} + E(L, p)^{+}\ E(p, Y)^{+}$$

There are two problems with these expressions. First, as already discussed, there can be no elasticity of anticipated real income with respect to current output. One cannot endogenously use an exogenous variable. Second, if the expressions are accepted, there is no reason to assert that (CM, Y) exceeds zero. The signs do not necessarily show that unless some assumption with regard to the magnitude of the elasticities is made. Brunner and Meltzer do not explicitly make such an assumption. In their Economica article, Brunner and Meltzer state that given producers' and purchasers' anticipations, the existing capital stock, current policy decisions, and

the past history of the economy, the Monetarist model is determinant in seven variables (1973, p. 54). Brunner and Meltzer then proceed to examine the effects of a government deficit financed by the issue of new debt. In achieving a new equilibrium point, they state, "Rising prices also stimulate producers' and purchasers' anticipations and raise the anticipated price level. Every increase in purchasers' anticipations shifts the OM curve to the left" (1973, p. 57) They go on to say, "The direct effect of rising prices and the induced change in producers' anticipations eventually dominate other variables affecting the position of OM." In other words, an endogenously induced change in an exogenous variable eventually dominates endogenous variables. Enough examples it seems to make the point. Brunner and Meltzer have incorrectly mixed endogenous and exogenous variables. That is not to say that rising prices might not change anticipations. In fact one would think that they would. Brunner and Meltzer's model might indeed be determinant if they were to explicitly make endogenous all the variables they implicitly make endogenous. However, without formally specifying such relationships, and thus the entire model, it is impossible to determine whether the model is consistent or not.

Aside from the question of consistency, other problems exist. For instance, slope is a derivative not an elasticity. Brunner and Meltzer (1972c, p. 958) state, "The slopes... are written as elasticities."[2] There follows an elasticity equation, the first of many

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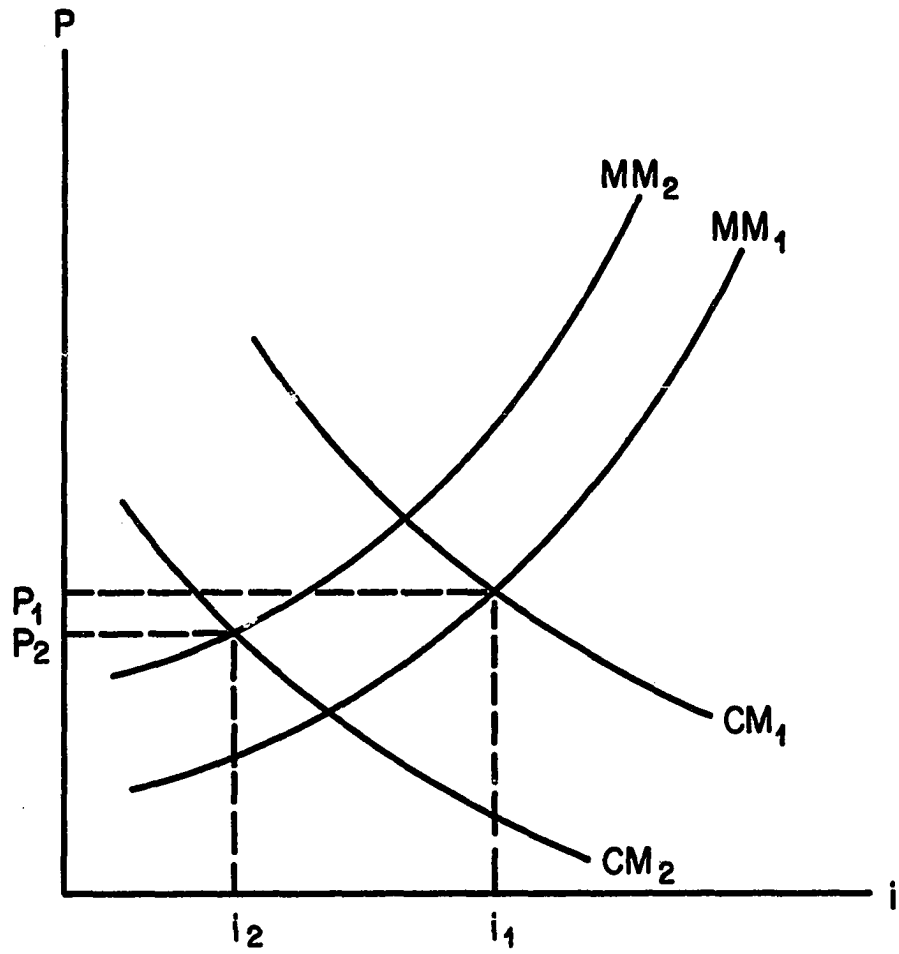
[2]It is true that slope can be obtained from an elasticity equation. However, it is not the elasticity equation. Brunner and Meltzer obviously know this. Their statement is simply an example of the incautiousness which contributes to the obscurity of their articles.

elasticity equations, which they do not explicitly derive in the article. (It is worth noting that (Y^*, Y) incorrectly appears in the numerator of many of these elasticity equations).

Brunner and Meltzer (1972c, p. 965) state that in the asset market the response to issuing base money to finance a deficit raises both the CM and MM curves. However, CM shifts by more than MM and so lowers the interest rate and increases the price of capital. Both a rising price of capital and falling interest rate expand output. While the interest rate may indeed fall and the price of capital rise when the supply of base money increases, a greater shift in CM than MM is not a sufficient condition for that to occur. Starting at i_1 and P_1 in Figure XII, let CM_1 shift to CM_2 and MM_1 shift to MM_2. Consistent with Brunner and Meltzer's analysis, the shift of CM is greater than the shift of MM. However both P and i fall. Therefore, in the Brunner and Meltzer model the monetary effect does not necessarily increase output, although they conclude that it does. They state that, "Financing a deficit by issuing base money raises asset prices and lowers interest rates."

Brunner and Meltzer (1972c, p. 963) note that interest rates and prices generally rise in periods of expansion and fall during contractions. They proceed to discuss the conditions necessary for a ceteris paribus change in income to assure such a result. It is not necessary, or even desirable, to assure such a result. In an expansion or contraction, not only income, but other aggregates change. It could easily be due to movements in alternative variables that interest rates and asset prices move as they do. To attribute such movement solely to income is erroneous.

(Figure XII)



In discussing the determinancy of their model, Brunner and Meltzer (1972c, p. 960) state that simultaneous equilibrium of the money and credit markets shows an equilibrium position of the asset market. They also state that changes in money and credit market equilibrium can disturb the output market. These two statements are inconsistent if Brunner and Meltzer have either an end of the period or a static model. The simultaneous equilibrium of the money and credit markets can only be asset market equilibrium if the capital market is also in equilibrium. Since there are only four markets, if any three are in equilibrium the fourth must also be in equilibrium. Consequently, the output market must be in equilibrium. No excess demand or supply can exist in the output market, due to equilibrium changes in i and P, because there is no offsetting excess supply or demand in the asset market. Therefore, Brunner and Meltzer apparently have a beginning of the period model. In that case, the two statements are consistent. There is another reason to believe the model is a beginning of the period model. In discussing output market equilibrium, Brunner and Meltzer (1972c, p. 954) assume that, although asset markets are cleared by suitable adjustment of asset prices within the time units relevant for their analysis, output prices do not adjust rapidly enough to maintain equilibrium in the output market. This raises an interesting question. How can the output market be in disequilibrium if no other market in the model is in disequilibrium? There are several possible answers. One is that, either the labor market or the capital market must be in disequilibrium. However, the labor market is not even a part of the model. (Brunner

and Meltzer (1972c, pp. 953, 954) refer to their previous inclusion of the labor market in this model. The author has yet to find that discussion.) If the capital market is the other market in disequilibrium, then only two asset markets are cleared by suitable adjustment of asset prices within the relevant time units. The capital market must have sticky prices, but why should the prices of two asset markets adjust quickly while the price in the other lags. A second explanation is that there may be several output markets and many of them are in disequilibrium. However, this explanation is not consistent with equation 1_{B-M}. It is also possible that the output market really is in equilibrium. That is, producers willingly supply what purchasers are demanding, even though inventories may be either increasing or decreasing. The output market is in disequilibrium to the extent that current output does not equal aggregate demand even though supply does. None of these explanations seem satisfactory which leads one to believe the Brunner and Meltzer separate stocks and flows like Foley and Sidrauski. If that is what they are doing, they should have said so.

Brunner and Meltzer (1972c, p. 951) charge that in the standard IS-LM or Meltzer-Patinkin model, "The only simultaneous solution for the price level and real output is the full employment solution; elsewhere, real output is determined only if the price level is constant." As shown in the general model, this statement is false. With rigid wages, the price level and real income can be simultaneously determined at less than full employment. Brunner and Meltzer (1972c, p. 953) also state that, "If we were willing to assume

that changes in the stock of government securities held by the public have no wealth effect -- by any of a number of devices that make the government debt and real capital perfect substitutes -- our model could be pressed into the standard IS-LM framework." This statement is a puzzle. Even if government securities have no wealth effect, this model cannot be pressed into the IS-LM framework. Second, making government debt and real capital perfect substitutes would compress the model into the IS-LM framework, as was seen in the discussion of IS-LM; however, such an aggregation does not prevent government debt from being considered as wealth. Government debt can be excluded from wealth if individuals totally discount future tax liabilities, and still be either a perfect substitute or a gross substitute for capital.

Finally, it was previously stated that when Brunner and Meltzer introduce banks as net creditors in the economy, the money supply must be made endogenous. This is one of the main reasons Brunner and Meltzer are not examined in the general model. However, Brunner and Meltzer (1972c, p. 966) state that, "Yet, there is no point at which any main conclusion of our analysis would be altered if the stock of money was a constant multiple of the base and independent of any feedback from the output or asset markets." Perhaps no main conclusion would be altered; however, the model would be inconsistent. When a bank purchases securities it either does so with cash or by creating demand deposits. If demand deposits are created, the supply of money increases. Therefore, the supply of money cannot be a constant multiple of the base independent of any feedback from the output or asset market unless all loans are cash loans or unless

the supply of credit is a constant multiple of the base. It does not appear that Brunner and Meltzer intend for either of these alternatives to characterize their model.

Again it should be emphasized that these are not the only problems one finds in the papers by Brunner and Meltzer, nor should these problems detract from the importance of their contribution. However, they do make the model most difficult to comprehend or even finish reading. Perhaps secreted in the morass of elasticity equations and expressions are dilations which make Brunner and Meltzer more comprehensible. Unfortunately, discovering such details seems to have been left as exercises for the reader.

CHAPTER V

KEYNESIAN AND MONETARIST THEORY

Keynesian Models

Tables 3 through 8 summarize the structures of the macroeconomic models generally considered Keynesian. After examining these models, one must conclude that there is no single model which can be called "the Keynesian model." True, if asked to formally specify Keynesian macroeconomics, most economists would probably specify an IS-LM type model. However, IS-LM is only one of many possible Keynesian models, and, unfortunately, the models cannot be reduced to a single model by dropping the appurtenant characteristics of each. Although the models are significantly different from each other, they share some significant similarities. Both the similarities and differences among the Keynesian models are discussed in this chapter.

Keynesians deny that automatic adjustments will bring the economy to full employment equilibrium. Two of the reasons suggested by most macroeconomic texts, especially when discussing Keynesian and Classical theory, are that either negative prices and interest rates are required to create full employment, or that prices and wages may be constant and thus prevent automatic labor market equilibrium. However, in none of the Keynesian models is it necessary to assume

either a negative equilibrium price vector or constant prices. Leijonhufvud (1967, p. 404) states that "It is not necessary to deny the existence of a vector of non-negative prices and interest rates consistent with the full utilization of resources. To be Keynesian, one need only realize the difficulties of finding the market clearing vector." With respect to constant prices, Tobin (1972, p. 855) says, "Keynes certainly did not make this suggestion, nor did Hansen -- and neither has any careful version of a complete neo-Keynesian macro-economic model." Therefore, all that Keynesians need to assume in order to dispense with the tatonnement mechanism of Walrasian general equilibrium theory and, thereby, insure that income is not supply determined is that perfect information about market clearing prices is not available. Thus prices will not adjust rapidly -- they will not be perfectly flexible -- and full employment will not be automatic. In the models just examined, this assumption was approximated by rigid wages. An exception to this generalization is the model of Foley and Sidrauski, which assumes flexible wages and prices. However, as they state, their primary goal is to study resource allocation not resource utilization. They note that their model is just as useful to study unemployment situations in a world of wage and price rigidities. "If unemployment were introduced the close relation of our model to conventional Keynesian models would be quite apparent." (1971, p. 2).

Keynesians generally contend that the economy is oscillatory or subject to fluctuations around the underemployment equilibrium position (Klein, 1973). These movements may be due to such things as

changes in the propensities to consume and save, or changes in entrepreneurial expectations. The fluctuations provide a situation in which monetary and fiscal policy can be used to stabilize the economy. For example, if entrepreneurial expectations of future income streams fall, the price of capital falls, and so the demand for investment falls. The government can correct this problem by either an increase in government spending or an increase in the money supply. When expectations recover, the government can reverse its policy. Thus discretionary monetary and fiscal policy can play an important role in stabilizing the private economy.

In Keynesian models, the demand for output is divided into two components -- the demand for consumption goods and the demand for new capital or investment. Output may be supplied as one good which serves both as a consumer and investment good, or a two sector production model may be specified. In every model except Patinkin's, consumption demand depends on income and sometimes wealth, but never on the rates of return to assets. (That Patinkin's model is a special case and is only arbitrarily called Keynesian has already been discussed). When wealth does enter the consumption function, its influence is generally considered weak. Since rates of return do not enter the demand for consumption, the financial sector has no affect on consumption. The demand for investment is the only channel through which financial shocks are transmitted to the real sector; however, the financial variable which enters as the argument in the investment demand function varies from the interest rate in the IS-LM and the Patinkin models to the price of capital relative to the price of

commodities in the Radcliffe, Tobin, and Foley-Sidrauski models. However, in the money, bond-capital, commodity interpretation of the IS-LM and Patinkin models, the price of capital relative to the price of commodities could be used as the strategic variable, instead of the interest rate. Since bonds and capital are perfect substitutes, the discount rate applied to the expected income on capital is equal to the interest rate. Given the expected income, a rise in the interest rate is the same as a fall in the price of capital relative to the price of commodities. Therefore, only in the money, bond, commodity model is the interest rate necessarily the strategic variable.

A change in the supply of money (or any financial asset) can work only through the strategic variable or through wealth. In no Keynesian model does a change in the money supply create excess demand for output. Instead, excess demand for another asset or assets causes rates of return or asset prices to change which, through the strategic variable in the investment function, changes the demand for output. Thus the transmission of monetary policy is highly limited. This narrow mechanism has caused many Keynesians to reject monetary policy in favor of fiscal policy on the grounds that monetary policy discriminates against a small sector of the economy.

Perhaps more important than the similarities, are the differences in Keynesian models. As just discussed, all of the models integrate the real and financial sectors through the demand for investment goods. However, the strategic variable used to integrate the two sectors varies. The reason for this variation is that the Keynesian models do not have a unique asset structure either in

number of aggregate assets or in the types of aggregate assets considered. The IS-LM and Patinkin models come with two asset structures to choose from. They can be interpreted as money, bond, commodity models in which capital is a commodity not an asset. They can also be interpreted as money, bond-capital, commodity models in which capital is a perfect substitute for bonds. In the former case, the price of capital equals the price of commodities and the interest rate is the strategic variable. In the latter either the interest rate or the price of capital relative to the price of commodities may be used as the strategic variable.

In the Radcliffe model, money and bonds are perfect substitutes, and so the aggregate asset structure is money-bonds, capital, commodities. As a result, the price of capital relative to the price of commodities is the strategic variable. The Tobin and Foley-Sidrauski models are three asset models. Money, bonds, and capital are gross substitutes and so the models are money, bond, capital, and commodity models. The price of capital relative to the price of commodities is the strategic variable in both. Foley and Sidrauski also allow wealth and the price of money to affect aggregate demand, but only because they are a part of disposable income.

The different asset structures also cause different policy conclusions. In the money-bond, capital, commodity model, pure monetary policy, defined as an open market operation, has no effect on aggregate demand, because only the composition of the money-bond

asset and not relative asset supplies has been changed. In the three asset models, the IS-LM models, or Patinkin's model, pure monetary policy is effective except in the liquidity trap, or when entrepreneurial expectations are falling rapidly. Consider also the results of an increase in the supply of government securities. In the Patinkin model, the supply of bonds relative to money increases. This lowers the price of bonds or increases the interest rate and decreases investment. However, in the Radcliffe model the interest rate is fixed. The increase in the supply of liquidity relative to capital lowers the return required to hold capital, thereby raising the price of capital relative to the price of commodities and increasing investment. In the IS-LM models, the increase in the supply of money creates its own demand.[1] Therefore, the interest rate is unaffected and investment remains the same. In the three asset models, the assets are gross substitutes and the price of capital may either rise or fall. Therefore, investment may either rise or fall.

Another difference in Keynesian models is that only the IS-LM system makes the investment inelasticity or the liquidity trap an integral part of Keynesian conclusions. In contrast, Leijonhufvud (1967), who states that the money, bond, commodity interpretation of IS-LM is a "singularly inadequate" interpretation of Keynes, maintains that Keynes never doubted the interest elasticity of investment. He cites changing entrepreneurial expectations as a major cause of

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[1]For a discussion of the role of debt financed fiscal policy in the IS-LM model see Silber 1970 and Stephens and Rush 1974.

economic fluctuations. (In other words, the R's in equation 8 change, thus changing U and creating fluctuations in Y). The Radcliffe model assumes that money and bonds are perfect substitutes, and so neither the interest inelasticity of investment, nor the liquidity trap have any significance. The interest rate is either inconsequential or constant -- tied to the zero return on money. What is important is the supply of money-bonds relative to capital and, therefore, the price of capital. Similarly, the price of capital is what is important in the three asset models. An infinitely interest elastic demand for money means that individuals will not exchange an excess supply of money for bonds, but they might still exchange their money for capital and thus affect aggregate demand through the price of capital.

The conclusion drawn from the discussion of Keynesian models is that Keynesian macroeconomics is not a completely homogeneous field of theory. There exists differences between the models especially with regard to policy, and even the variable which transmits monetary policy. However, the models share enough significant characteristics to allow them to be classified together as Keynesian macroeconomic models.

Monetarist Models

Tables 9 and 10 summarize the structures of the Monetarist models. In discussing Keynesian economics, the conclusion was that no one model could be called the Keynesian model. One is tempted to conclude just the opposite with respect to Monetarist theory. There are few formal theoretical Monetarist models. Friedman's

model has been criticized severely by both Keynesians and Monetarists, and for good reason. It is more Keynesian than Monetarist. Tobin (1972, p. 857) states "Fiscal policy, however, can control real income.... As this result suggests, the model is bizarre, and it is hard to imagine that it is seriously intended." He goes on to say that the model concedes "....fiscal policy more control over output and employment than virtually any Keynesian would claim." Brunner and Meltzer (1972, p. 846) state "We regard Friedman's discussion as either misleading or a complete reversal of his often stated position." The main reasons for both the Tobin and Brunner-Meltzer criticisms are Friedman's use of the interest rate as the strategic variable integrating the real and financial sector, and the subsequent assumption that the interest rate is constant. As Brunner and Meltzer state (1972, p. 846) "Friedman's acceptance of the IS-LM framework and this view of the transmission mechanism (1970, pp. 216-17) brings him into general agreement with the neo-Keynesians about the transmission of monetary policy...." Friedman (1972, p. 910) answers this criticism by Brunner and Meltzer by stating that his idea of the transmission mechanism is much broader than the Keynesian idea. "We, on the other hand, stress a much broader and more "direct" impact on spending...." Given Friedman's obvious position in the Keynesian-Monetarist controversy, his model is classified as Monetarist. However, one cannot interpret the formal specification of his model as characteristic of Monetarist thinking.

Unlike the Classical theorist, Monetarists generally consider wages and output prices as less than perfectly flexible. Fand

(1970, p. 74) states, "....nominal money stock changes may significantly affect the real endogenous variables in an economy where output can easily expand and where quantities adjust faster than prices." In their model, Brunner and Meltzer assume an aggregate supply curve which is positively sloped and that "Cost of information prevents output prices and quantities from adjusting instantaneously." (1972, p. 951). They later drop the latter assumption, but the upward sloping aggregate supply curve remains.

Brunner and Meltzer contend that the distinction between the money market and the credit market is an important one. "Our analysis assigns...greater short-run importance to the distinction between credit and money." (1972, pp. 33-34). Therefore, Brunner and Meltzer separate the money and credit markets. The effect of this separation is to make the nonbank public as well as the government sector a net creditor and forces a study of the public's desired indebtedness. Individuals obtain credit from banks by issuing private I.O.U.'s (or bonds). The government obtains credit from individuals or banks by issuing bonds. Therefore, the credit market is really the bond market where banks are net holders of bonds, and individuals and the government are net issuers of bonds. The credit market distributes the government debt between banks and individuals, determines private indebtedness, and determines equilibrium stock of money and credit.

Like Keynesians, Monetarists believe that changing entrepreneurial expectations may lead to fluctuations in the economy. However, they generally argue that changes in the rate of monetary

expansion are the main source of instability. Fiscal policy financed by borrowing is a smaller, but not negligible, source of instability. Therefore, Monetarists do not favor discretionary use of policy variables. (Brunner and Meltzer, 1972).

Monetarists generally argue that consumption depends upon more than income and wealth. The purchase of semi-durable and durable consumer goods depends on the returns on assets. As Friedman (1972) says, these consumer goods should also be treated as assets. If these goods are considered physical assets like physical capital, then the transmission mechanism between the real and financial sector is not just through investment, and the strategic variable is not limited to either the interest rate or the price of capital. More rates of return or prices would be included in the mechanism. Monetarists also believe that an excess supply of money might directly create an excess demand for output. Fand (1970, p. 75) states, "Monetarist....suggest that increase in money may directly affect expenditures, prices, and a wide variety of implicit yields on physical assets, and need not be restricted to a small set of conventional yields on financial assets."

In assessing Monetarist theory, one concludes that, as was the case with Keynesian theory, Monetarists generally agree on enough propositions that they may be classified together. However, unlike Keynesian theory, numerous formal models do not exist. In fact, one could easily point to the Brunner and Meltzer model as the only formal theoretical Monetarist model. At least it is the only one which has not been rejected, yet, by Keynesians and Monetarists alike.

Differences Between Keynesian and Monetarist Models

What is the difference between Keynesian economic theory and Monetarist theory?[2] First, it must be said that many arguments between Monetarists and Keynesians do nothing to illuminate the real differences between the two. Instead, they only sink the debate into a morass from which most economists cannot, and perhaps should not, take the time to extricate it. The issues are only clouded by arguments over what Keynes did or did not actually say, let alone what he did and did not mean. What matters is what Keynesians say now. That is, what do the Keynesian models represent as opposed to the Monetarist models. It is also useless to continue to argue over such things as whether or not Keynesians have historically considered prices as institutional datum and whether or not Monetarists have considered prices as perfectly flexible. Certainly prices can be and have been made an endogenous part of many Keynesian models, and Monetarists recognize and incorporate imperfect information into their model. As Tobin (1972) implies, it does no good to deal in caricatures. Nor does it benefit anyone to argue that the differences hinge on the shapes of the IS-LM locus. As already discussed, the IS-LM model cannot even incorporate all Keynesian models (not even all the two asset models) let alone all the Monetarist models. Finally, if Monetarists and Keynesians are going to argue over the relative effectiveness of monetary and fiscal policy, they should agree on what to argue about. Pure monetary policy and pure fiscal policy must be defined, and the definitions consistently used.

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[2]It is tempting to escape that question with a truthful answer. It simply depends upon the Keynesian and Monetarist models compared.

To begin with, there is little evidence in the theoretical models to support the extreme positions sometimes attributed to the Keynesian and Monetarist. "Money doesn't matter." "Money is all that matters." Only in the Radcliffe model is pure monetary policy, defined as an open market operation, ineffective. Money is significant only as part of the aggregate asset money-bonds. In all other Keynesian models, pure monetary policy is effective. However, the sophisticated Keynesian three asset models as well as the Radcliffe model question the uniqueness of money. If a change in money can affect output, why can't a change in other assets? Therefore, the Keynesian question has changed from, does money matter, to does money uniquely matter.

Likewise, no Monetarist model denies that fiscal policy, defined as bond financed government expenditures, can be effective. However, Monetarists question whether it will be effective in the long run if monetary aggregates and other assets are held constant.

Both Keynesians and Monetarists believe that changing entrepreneurial expectations can cause fluctuations in the economy. Keynesians argue that discretionary policies can be used to offset these movements. However, Monetarists generally argue that past discretionary policies are the cause of such fluctuations. Therefore, many Monetarists tend to favor "rules", rather than discretionary policies, especially with regard to changing the money supply. Though both schools agree that entrepreneurial expectations are important, none of the models actually specify an anticipations function.

Monetarists, at least Brunner and Meltzer, insist that a three asset model be used to examine economic activity, because Keynesian two asset models ignore the effects of financing government deficits. Brunner and Meltzer (1972, p. 845) charge that "Keynes avoided the discussion of the bank credit market by identifying 'bonds' and debt with real capital and by treating the 'Walrasian' money market as a market for both 'credit' and real capital. Given the stock of money, the quantity of money demanded determined (proximately) the interest rate on financial assets and the price of real capital." They further claim that Keynesians have changed this analysis by treating interest rates as borrowing cost. In either case, financing of a given deficit by issuing government securities has no effect on interest rates via the credit market. Instead, changing government securities changes the interest rate only by changing wealth, and thereby raising or lowering the demand for money. Since "many and perhaps most Keyneisans deny any effect of this kind by denying any effect of wealth on the demand for money...", Brunner and Meltzer (1972, p. 845) contend of Keynesian theory, that it "...dismisses (or minimizes) the role of existing securities."[3] In order to properly analyze the role of securities -- government or private -- Brunner and Meltzer introduce a third market in which credit is distinguished

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[3]It should be pointed out that not all Keynesian two asset models ignore the credit or bond market. The money, bond, commodity interpretation of IS-LM does not "identify 'bonds' and debt with 'real capital.'" However, the role of securities is still minimized by either assuming their supply constant or ignoring their effect on the demand for money.

from money, and bonds are distinguished from real capital. Therefore, Brunner and Meltzer insist on a model with three aggregate assets -- money, bonds (credit instruments), and capital -- and two rates of return or asset prices.

Perhaps the most significant difference between Keynesian and Monetarist models is the transmission mechanism which integrates the real and financial sector. As Fand (1970, p. 72) points out, "Far more important are the substantive differences between Monetarist and Fiscalist concerning the precise manner in which money matters -- the theory of the transmission mechanism explaining how changes in the nominal money stock may affect real output, employment, the price level, capital formation, and economic growth." Keynesians limit the transmission mechanism to the demand for investment through either the price of capital or the interest rate, and possibly wealth effects in the consumption function. However, since Keynesians seriously question the significance of the wealth effect, monetary policy mainly works indirectly by altering the strategic variable, and thereby investment spending.

Monetarists reject the investment mechanism as too narrow. Instead, they insist that the demand for many goods that Keynesians consider consumption goods are also affected by a change in the money supply, either directly or through rates of return and asset prices. As Friedman (1972, p. 910) says,

> The difference between us and the Keynesians is less in the nature of the process than in the range of assets considered...We insist that a far wider range of assets and interest rates be taken

> into account....As a result, we regard the market rates stressed by the Keynesians as only a small part of the total spectrum of interest rates that are relevant."

Brunner and Meltzer broaden the transmission mechanism by making the demand for output depend not only on income and the price of capital, but the interest rate, wealth, and the price of output as well.

The synthesis model examines many of these differences in Keynesian and Monetarist theory. Of most concern are the effects of pure monetary and pure fiscal policy, the effects of the liquidity trap and changing entrepreneurial expectations, the uniqueness of money as a policy variable, and the significance of using a narrow or broad transmission mechanism.

TABLE 3

IS-LM
(Money, Bond, Commodity)

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money 2. Bonds	Capital is not an asset; it is a commodity. The existing capital stock has no more effect on equilibrium than any other durable commodity.	Y, i, p, N	i The return on bonds through the demand for new capital goods.

Market Specifications

1. Money

$$M_o^o + M_o^I = m(i, Y)p$$

2. Bond

$$S_o = b(i, Y, \frac{M_o^o}{p} + \frac{M_o^I}{ip}, \frac{S_o}{ip})ip$$

3. Output

$$Y = d(i, Y) + g_o \qquad C = c(Y)$$

$$Y = Y(N, K_o) \qquad I = I(i)$$

$$w_o = Y_N p \qquad Y = C + I$$

TABLE 4

IS-LM
(Money, Bond - Capital, Commodity)

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money	Bonds and capital are perfect substitutes forming the aggregate asset bonds-capital.	Y, i, p, N	i The return on bonds-capital through the demand for new capital goods.
2. Bonds-Capital			

Market Specifications

1. Money

$$M_o^o + M_o^I = m(i, Y)p$$

2. Bond-Capital

$$S_o = b(i, Y, \frac{M_o^o}{p} + \frac{M_o^I}{ip}, \frac{S_o}{ip})ip$$

S_o = stock of bonds and capital

3. Output

$$Y = d(i, Y) + g_o \qquad C = c(Y)$$

$$Y = Y(N, K_o) \qquad I = I(i)$$

$$w_o = Y_N p \qquad Y = C + I$$

TABLE 5

RADCLIFFE

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money-Bonds	Money and bonds are perfect substitutes. Therefore, the proper money concept is liquidity.	Y, U, p, N,	U
2. Capital		i_K	The price of capital through the demand for new capital goods.

Market Specifications

1. Liquidity

$$M_o^o + M_o^I + S_o = m(i_K, Y, UK_o)p$$

2. Capital

$$K_o = \frac{(i_K, Y, \frac{M_o^o}{p} + \frac{M_o^I}{p} + \frac{S_o}{i_o p}, UK_o)}{U}$$

3. Output

$$Y = d(Y, U) + g_o \qquad C = c(Y)$$

$$Y = Y(N, K_o) \qquad I = I(U)$$

$$w_o = Y_N p \qquad Y = C + I$$

$$U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

TABLE 6

PATINKIN

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
Alternative I	Capital may be treated as a substitute for bonds or treated as a commodity. It is not entirely clear which Patinkin intends.	Y, i, $\frac{W}{p}$, p, N	i, $\frac{W}{p}$
1. Money			The return on bonds through the demand for new capital and consumption goods. Wealth affects the demand for both investment and consumption goods.
2. Bonds-Capital			
Alternative II			
1. Money			
2. Bonds			

Market Specifications

1. Money

$$M_o^o + M_o^I = m(i, Y, \frac{W}{p})p$$

2. Bond

$$S_o = b(i, Y, \frac{W}{p}, \frac{M_o^I}{p})ip$$

3. Output

$$Y = d(i, Y, \frac{W}{p}) + g_o \qquad C = c(i, Y, \frac{W}{p})$$

$$Y = Y(N, K_o) \qquad I = I(i, Y, \frac{W}{p})$$

$$w_o = Y_N p \qquad Y = C + I$$

4. Wealth Distribution

$$\frac{W}{p} = K_o + \frac{S_o}{ip} + \frac{M_o^o}{p}$$

TABLE 7

TOBIN

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money	Money, bonds and capital are gross substitutes making Tobin's a three asset model.	Y, U, i, i_K, p, N, $\frac{W}{p}$	U
2. Bonds			The price of capital through the demand for new capital goods.
3. Capital			

Market Specifications

1. Money

$$M_o^o + M_o^I = m(i, i_K, Y, \frac{W}{p})p$$

2. Bond

$$S_o = b(i, i_K, Y, \frac{W}{p}, \frac{M_o^I}{p})ip$$

3. Capital

$$K_o = \frac{k(i, i_K, Y, \frac{W}{p})p}{P}$$

4. Output

$$Y = d(Y, U) + g_o \qquad C = c(Y)$$

$$Y = Y(N, K_o) \qquad I = i(U)$$

$$w_o = Y_N p \qquad Y = C + I$$

5. Wealth Definition

$$\frac{W}{p} = \frac{M_o^o}{p} + \frac{S_o}{ip} + UK_o$$

TABLE 7
(continued)

$$U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

TABLE 8

FOLEY AND SIDRAUSKI

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money 2. Bonds 3. Capital	Money, bonds, and capital are gross substitutes.	p_m, p_K, i	a, p_K, p_m Wealth affects the demand for consumption goods. The price of capital and the price of money affect consumption and investment by changing disposable income. The price of capital additionally affects investment since it determines the supply of new capital.

Market Specifications

1. Money

$$(\frac{1}{-\frac{g}{m}})gp_m = L(a, q(k, p_K), \P m, i + \P_m, \frac{r(p_K)}{p_K} + \P_k)$$

2. Bond

$$kp_K = (S(a, q(k, p_K), \P m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K)$$

3. Capital

$$(1-(\frac{1}{-\frac{g}{m}}))gp_m = H(a, q(k, p_K), \P_m, i + \P_m, \frac{r(p_K)}{p_K} + \P_K)$$

TABLE 8
(continued)

4. Consumption

$$q_c(k, p_K) = c(a, q_c + p_K q_I + dp_m - e + \pi_m g p_m) + e$$

5. Savings

$$p_K q_I + dp_m = s(a, y)$$

6. Wealth Definition

$$a = kp_K + (b + m)p_m$$

TABLE 9

FRIEDMAN

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
Alternative I 1. Money 2. Bonds-Capital Alternative II 1. Money 2. Bonds	Capital may be treated as a substitute for bonds or treated as a commodity. It is not entirely clear which Friedman intends.	Y, N, p, w	ρ The real interest rate through the demand for new capital goods. However, the real interest rate is assumed constant and so real income is unaffected by the financial sector.

Market Specifications

1. Money

$$M_o^o + M_o^I = m(i_o)Yp$$

2. Bond-Capital

$$S_o = b(i_o, Y, \frac{M_o^o}{p} + \frac{M_o^I}{p}, \frac{S_o}{ip})ip$$

3. Output

$$Y = d(Y, p_o) + g_o \qquad C = c(Y, p_o)$$

$$Y = Y(N, K_o) \qquad I = I(p_o)$$

$$w = Y_N p \qquad Y = C + I$$

TABLE 10

BRUNNER AND MELTZER

Asset Structure	Asset Substitutability Assumption	Variables Endogenously Determined	Transmission Mechanism Between Real and Financial Sectors
1. Money	Money, bonds, and capital are gross substitutes.	Y, P, i, W,	i, P, p, W
2. Bonds		S	The interest rate, the price of capital, the price of commodities, and wealth affect the demand for new commodities. Brunner and Meltzer do not distinguish between consumption and investment spending.
3. Capital			

Market Specifications

1. Money

$$m(i, Y, P)B = 1(i, P, Y, p, S, W)$$

2. Bond

$$\alpha(i, Y, P)B = \sigma(i, P, Y, p, S, W)$$

3. Output

$$Y = d(i, P, Y, p, W) + g_o$$

$$p = p(Y)$$

CHAPTER VI

INFLATION

The major emphasis in this discussion of Monetarists and Keynesians has been the comparison of their respective income determination models. Before concluding the comparison, a succinct discussion of their respective inflation theories is in order. According to H. G. Johnson (1963), Keynesian income determination theory is highly adaptable to the analysis of inflation for two reasons. First, the savings-investment equilibrium condition provides a direct approach to the question in terms of the supply and demand for goods, without reference to the demand for money. The equilibrium condition savings equals investment can be used to determine real income, or prices, or both. At less than full employment, the level of output and prices will adjust so that savings equals investment. At full employment, the price level moves to equate savings and investment via whatever channel the price level is related to the amount of savings or investment. A second reason given by Johnson is that in the General Theory money wages are exogenously determined. This leaves a great deal of freedom for the development of cost-push type inflation. (Johnson 1963, p. 117)

Keynesian inflation theories can be divided into three broad categories -- demand inflation, cost inflation, and mixed inflation.

By reference to the aggregate supply and demand curves developed in the general model, these theories can be examined.

Demand pull inflation theory generally assumes that at some level of income the labor market is in equilibrium at full employment. Therefore, in Figure XIII, the aggregate supply curve becomes perfectly inelastic at the full employment level of income (Y_F). Above the full employment level, any increase in aggregate demand and supply are again in equilibrium. When aggregate demand shifts from AD_2 to AD_3 the economy experiences pure inflation, since only prices rise to establish equilibrium. However, below full employment income, any increase in aggregate demand results in both a rise in real income and a rise in prices. When aggregate demand shifts from AD_1 to AD_2, income increases to Y_F and prices to p_F.[1]

An extension of demand induced inflation to include not only the commodity market but the factor market is presented by Bent Hansen. Like most Keynesian models of inflation, Hansen's model did not include an analysis of the money market (Martin Bronfenbrenner and Franklyn D. Holzman 1963, p. 605). Figure XIV can be used to illustrate Hansen's model. The AS curve represents the amount of output producers would supply if there existed an unlimited amount of labor. As the real wage falls (the inverse of the real wage rises), AS rises. The aggregate demand curve slopes downward reflecting, according to Hansen, the fact that the marginal propensity to spend of wage earners exceeds that of nonwage earners. N_s represents the amount of output

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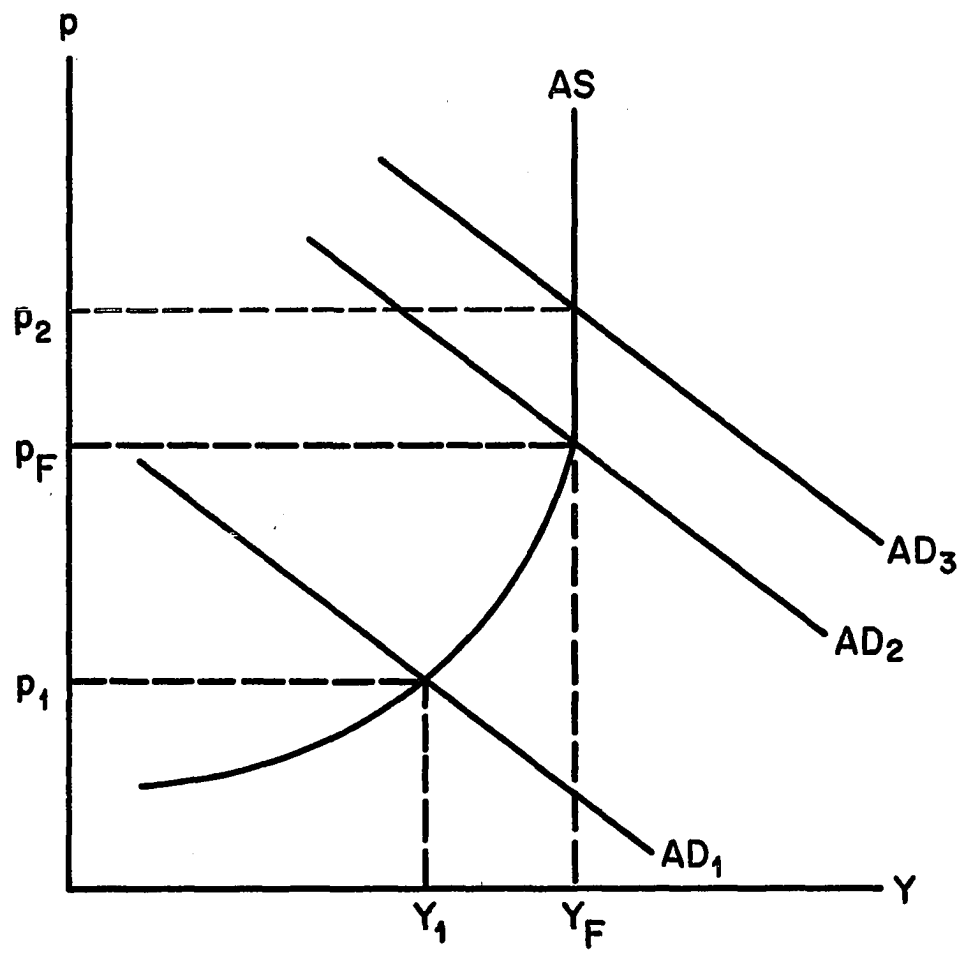
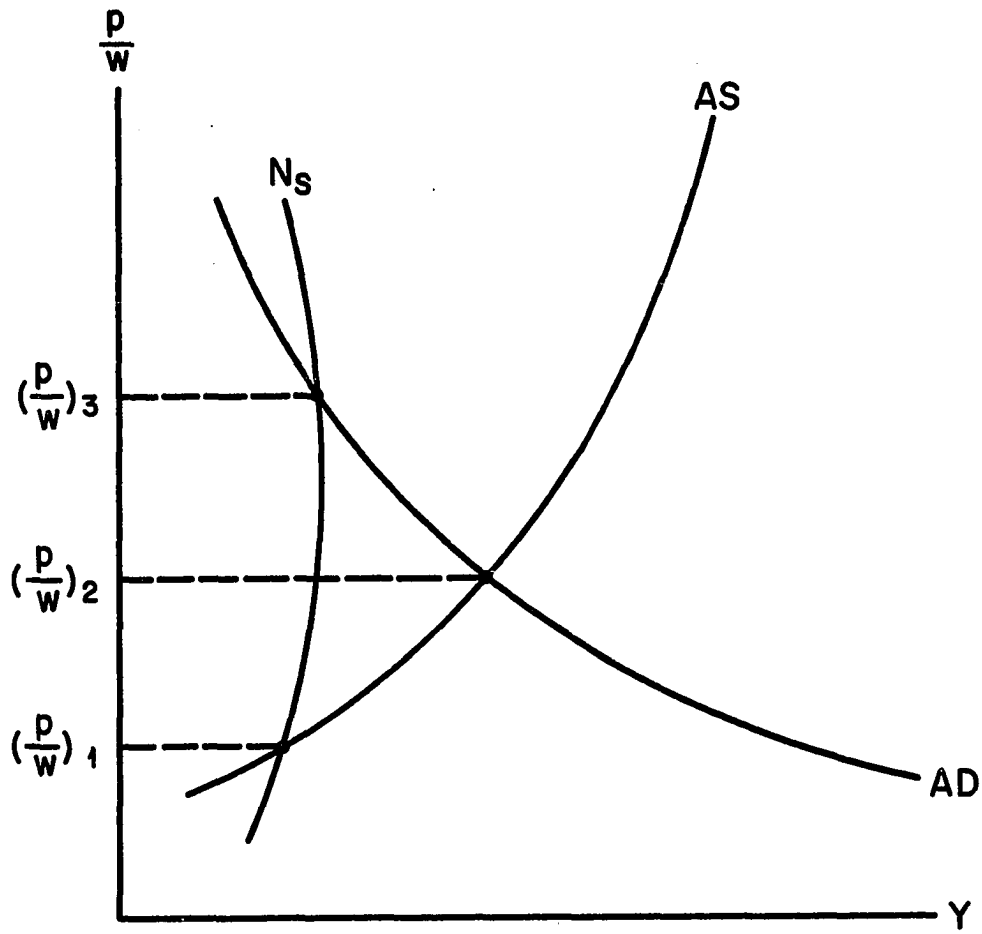
[1]It is generally supposed that during a general inflationary period the prices of capital and consumer goods are moving up together.

(Figure XIII)



(Figure XIV)



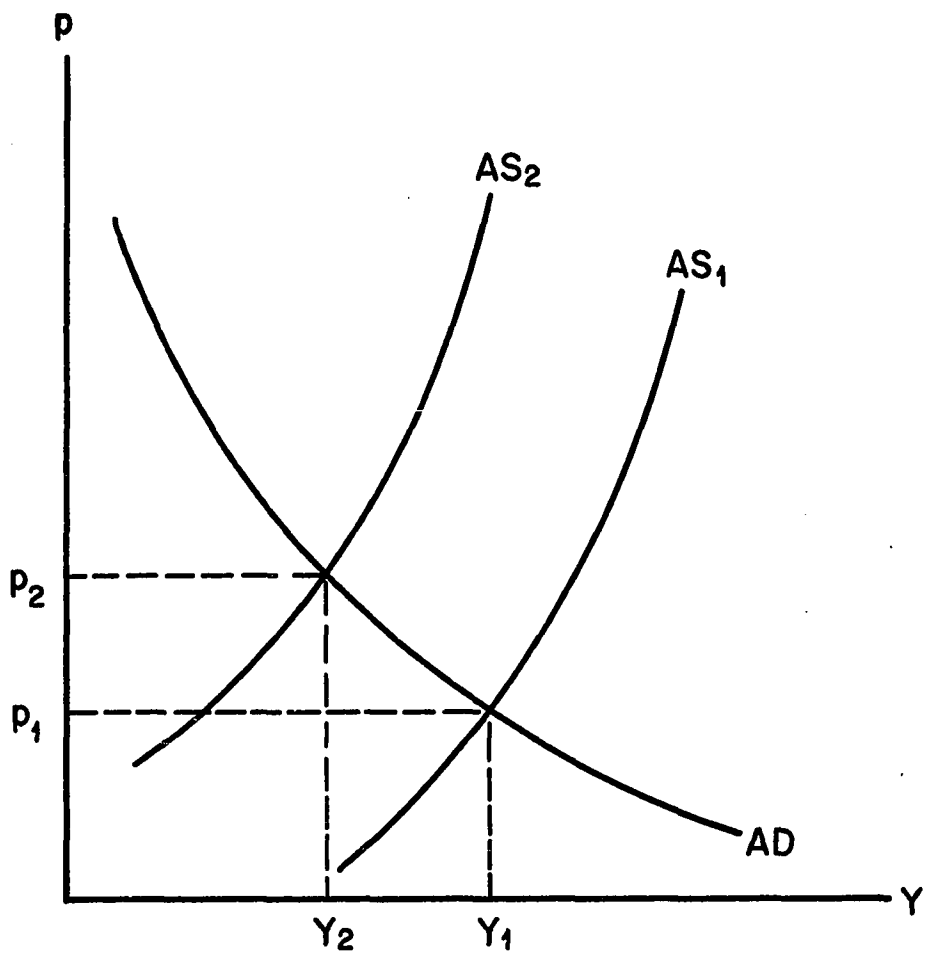
producers can actually supply by employing the labor force available at any given real wage. As the real wage increases, the supply of labor, and therefore the amount of output it is possible to produce by employing them, increases up to the point where the supply of labor becomes backward bending. The horizontal difference between AS and N_s is called the inflationary gap in the factor market. At $(\frac{P}{W})_1$ no gap exists because producers desire to produce just the amount of goods they can produce with the available labor. However, above $(\frac{P}{W})_1$ producers will increase the nominal wage rate in an attempt to hire more labor and produce more goods. The horizontal difference between AD and N_s is the inflationary gap in the goods market. When AD exceeds N_s, there is excess aggregate demand and so prices rise. Hansen then assumes that the rate of change in the nominal wage rate and the price level depends upon the size of the inflationary gaps. Assume that initially the inverse of the real wage is at $(\frac{P}{W})_3$. No "goods gap" exists; however, there is an inflationary factor gap and so the nominal wage rises. This increases the real wage and reduces the factor gap, but creates a gap in the goods market causing prices to rise. Both wages and prices will be rising. The real wage will continue to rise, and thereby the factor gap decreases and the goods gap increases, until wages and prices are increasing at the same rate somewhere between $(\frac{P}{W})_1$ and $(\frac{P}{W})_3$, creating a quasi-equilibrium in which inflation exists in both the goods market and the factors market.

Price increases due to shifts in the aggregate supply curve are referred to as cost-push or supply inflations. Cost-push infla-

tion can occur as a result of wage or profit push; however, it can only occur as a result of market power under non-competitive conditions (Bronfenbrenner and Holzman 1963). The existence of powerful labor unions or ologopolistic firms with market power could result in shifts in the aggregate supply curve from AS_1 to AS_2 in Figure XV. For example, in equation 3 of the general model, if the nominal wage is successfully increased, a higher price level is necessary to equate the real wage with the marginal product of labor at every level of employment. This means that the aggregate supply curve must shift upward from AS_1 to AS_2. As a result, prices rise from p_1 to p_2 and real income falls from Y_1 to Y_2.

In addition to demand-pull and cost-push theories of inflation, several theories exist which combine some attributes of both and are called mixed theories of inflation. One such theory maintains that shifts in aggregate supply and aggregate demand are interrelated. According to this theory, shifts in aggregate supply increase as the economy approaches full employment; that is, the closer the economy comes to full employment the more unstable the aggregate supply curve becomes. This increases the difficulty of, if not making impossible, the achievement of full employment with price stability. An alternative mixed theory is the "sectoral demand shift" theory proposed by Charles Schultz. Schultz proposes that wages and prices may not rise due to exogenous forces nor by general excess demand. As demand shifts from one sector to another, prices rise in the sector into which demand has shifted, and prices should fall in the sector experiencing reduced demand. To the extent that prices fall

(Figure XV)



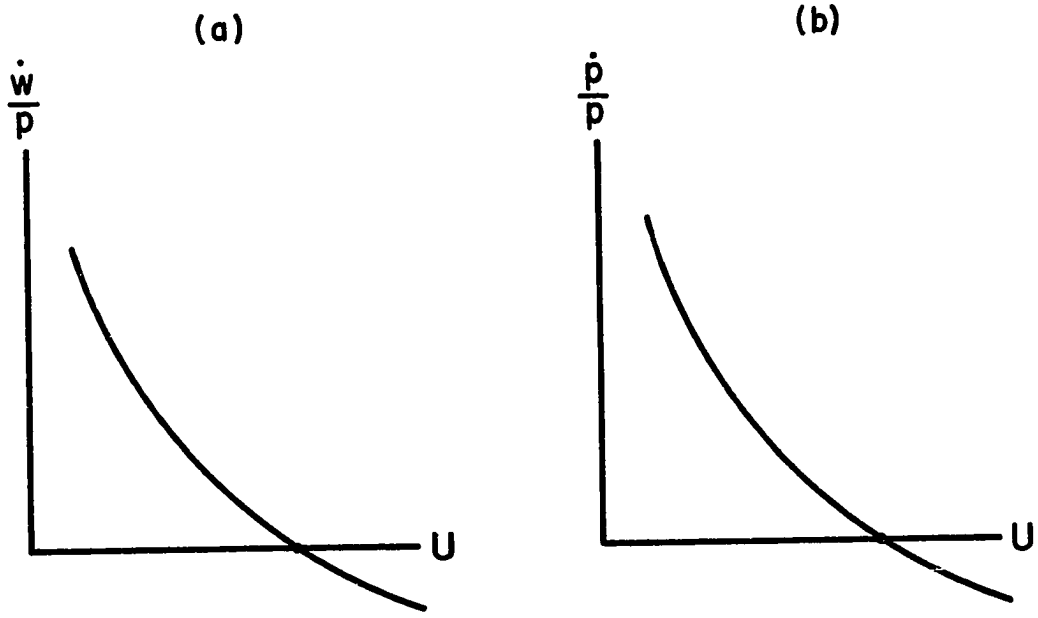
slowly in the sector from which demand has shifted, the economy will experience general inflation. However, neither general excess demand nor cost-push forces are entirely responsible for the rise in prices.

The Phillips curve is often advanced as an explanation of inflation in which the rate of inflation is inversely related to the level of unemployment. In the theory of the Phillips curve, when excess demand for labor exists, the nominal wage rises; when excess supply exists, the nominal wage falls. The rate of change in wages is then assumed to depend directly on excess demand as a proportion of the labor force.

$$(1) \quad \frac{\dot{w}}{w} = \alpha\left(\frac{N_d - N_s}{N_s}\right)$$

Excess demand as a proportion of the labor force is directly related to unemployment. When no excess demand for labor exists ($N_d - N_s = 0$), there will be jobs available for all those who want to work at the going wage rate. However, frictional unemployment still exists since laborers continuously change jobs and some time is needed to accomplish the change. Therefore, when $N_d - N_s = 0$, the rate of unemployment equals the frictional or natural rate of unemployment. As excess demand for labor increases from zero, the easier it will be for workers changing jobs to find jobs and thus the unemployment rate will drop. Any increase in excess supply increases the rate of unemployment. Since the rate of change in wages is positively related to excess demand and excess demand is inversely related to the rate of unemployment, the rate of change in wages is inversely related to the rate of unemployment. (Figure XVIa)

(Figure XVI)



The Phillips curve is the relationship between either the rate of price change or the rate of change in wages and the rate of unemployment. In order to relate the rate of unemployment to the rate of change in prices, some relationship between wages and prices is needed. Equation 2 provides such a relationship

$$(2) \quad \frac{\dot{p}}{p} = \frac{\dot{w}}{w} + \left(\frac{\dot{Y}}{N}\right)\frac{N}{Y}$$

where $\left(\frac{\dot{Y}}{N}\right)\frac{N}{Y}$ is a measure of the productivity increase of the labor force. As long as wages grow no faster than the rate of productivity, prices will not rise. If the rate of productivity is assumed constant, any change in wages causes an equal change in prices. Therefore, the rate of inflation will increase as wages increase and, thereby, as unemployment decreases. Figure XVIb is the normal representation of the Phillips curve.

Monetarists generally reject the hypothesis that inflation can reduce the unemployment rate below the natural rate for any significant period, on the grounds that the supply and demand for labor depends on the expected real wage $\left(\frac{w}{p^*}\right)$ - the nominal wage over the expected price level, p*. Therefore, the rate of change in the expected real wage, not the nominal wage, should depend directly on excess demand as a proportion of the labor force and thereby be inversely related to the rate of unemployment.

$$(1_M) \quad \frac{\dot{w}}{w} - \frac{\dot{p}^*}{p^*} = \alpha\left(\frac{N_d - N_s}{N_s}\right)$$

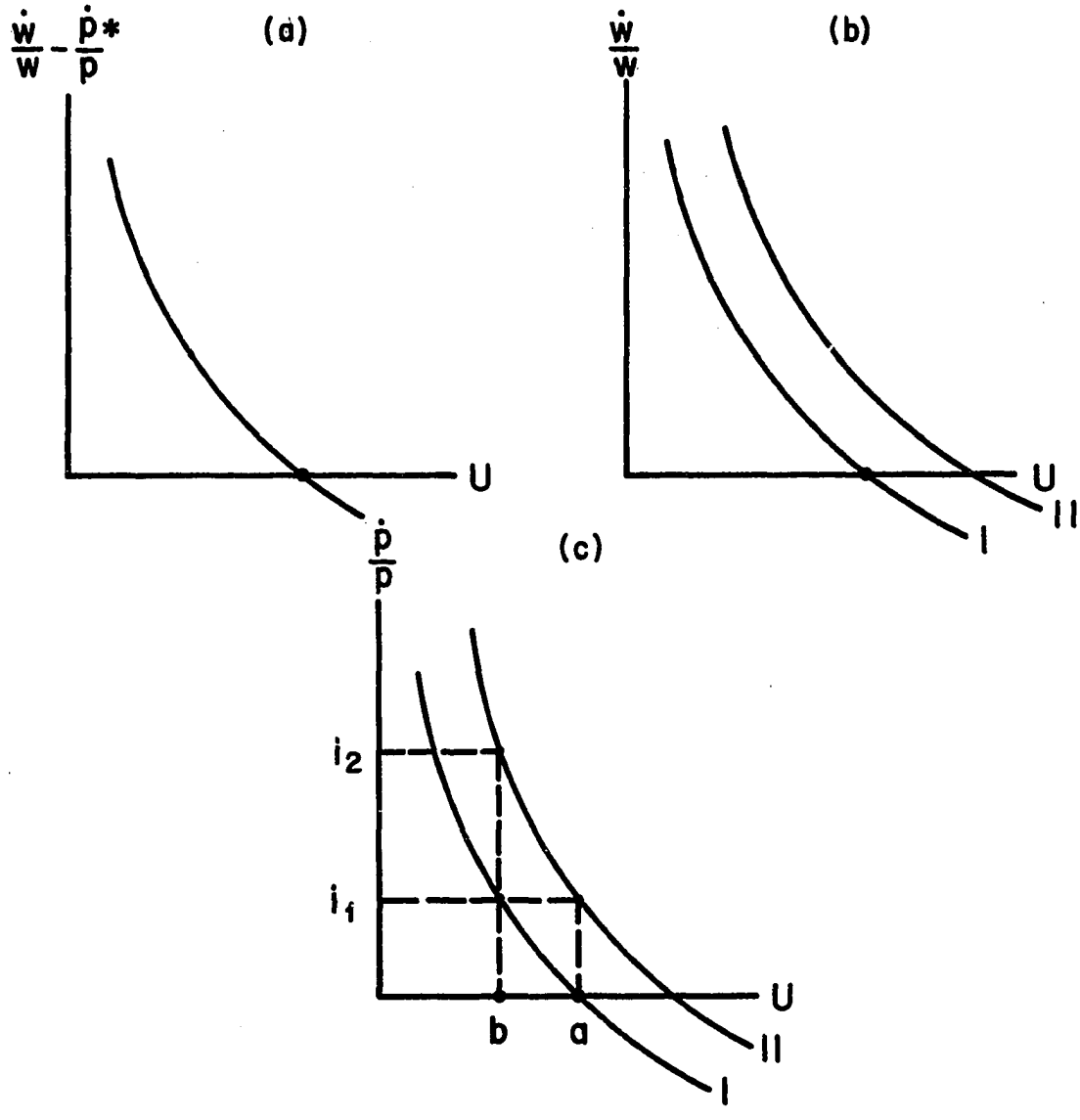
Figure XVIIa graphs the relationship of the rate of change

in the expected real wage to the rate of unemployment. Given the level of expectations, the rate of change in nominal wages can be related to the rate of unemployment as in Figure XVIIb. By equation 2, Figure XVIIc relates the actual rate of inflation to the unemployment rate, given the level of expectations. As $-\frac{\dot{p}^*}{p^*}$ increases, the Phillips curve shifts outward as from I to II in both XVIIb and XVIIc.

In Figure XVIIc, assume that the economy is in equilibrium on curve I at the natural rate of unemployment (a) where the actual rate of price increase is zero and the anticipated rate of price increase is zero. As the economy attempts to move up the Phillips curve from a to b and reduce unemployment below the natural rate, the rate of inflation increases to i_1. The actual unemployment rate is reduced below the natural rate because price anticipations have not changed. However, if price anticipations are a function of past prices, workers eventually begin to anticipate the higher rate of inflation. If i_1 is fully anticipated, the Phillips curve shifts from I to II, where the natural rate of unemployment is associated with the inflation rate i_1.

In this analysis, only by increasing prices at a higher rate than i_1 will an unemployment rate lower than the natural rate be maintained. Unfortunately, such an inflation rate will soon be anticipated and the Phillips curve will shift upward again. Therefore, Monetarists conclude that, since in the long run all inflationary increases will be fully incorporated into anticipations, unemployment rates below the natural rate can be maintained only by ever-accelerating rates of inflation.

(Figure XVII)


$\frac{\dot{w}}{w} - \frac{\dot{p}}{p}^*$
(a)
U
$\frac{\dot{w}}{w}$
(b)
U
II
I
$\frac{\dot{p}}{p}$
(c)
i_2
i_1
U
b
a
II
I

The major Monetarist criticism of Keynesian inflation theory is that neither cost-push nor demand-pull inflation can generate a sustained inflation without assuming that the demand for money can be indefinitely reduced, or that permissive monetary policy provides the additional money required to circulate output at ever-increasing prices (Johnson 1963, p. 128). Monetarists shift their attentions from the real sector to the monetary sector and examine the relationships between the supply and demand for money in a manner resembling the quantity theory approach. Specifically, Monetarists assert that there exists a stable demand function for real balances aside from the effects of two major factors: the level of real income per capita and the cost of holding money. As real income increases, the demand for money increases more than in proportion. As the cost of holding money increases, the demand for real cash balances falls (Johnson 1963, p. 175). The cost of holding money depends on the interest on alternative assets and the expected rate of price change -- the expected rate of inflation (¶). As ¶ increases, the cost of holding money increases and therefore the demand for money falls. Given this behavioral relationship, the rate of increase of the nominal money stock determines the rate of inflation. (Johnson 1963, p. 123) Assume that initially the demand and supply for money are equal and that the money supply is increased creating excess supply in the money market. Individuals attempt to rid themselves of their excess real balances. However, in the aggregate they cannot do so. In trying to, they will raise their level of expenditures and in so doing increase their money income. The extent to which the economy

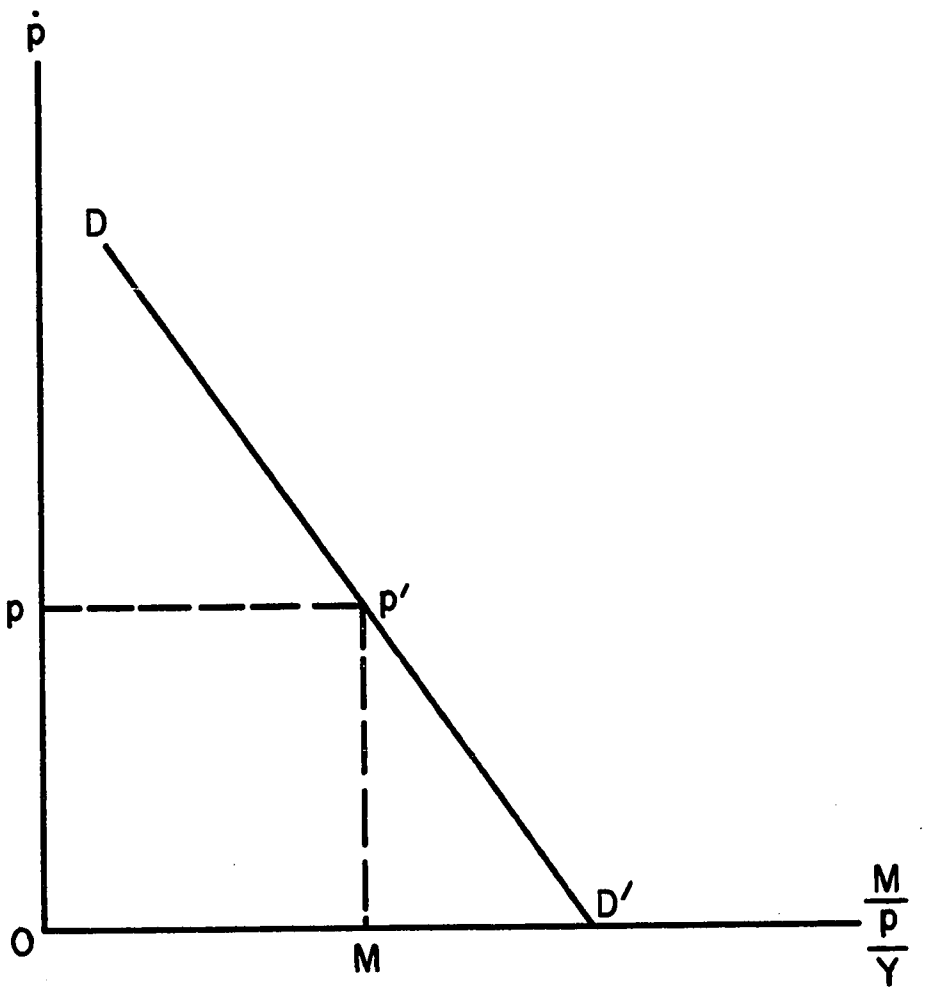
is near full employment determines the relative rise in prices and real income. The rise in prices reduces the level of real balances and the rise in real income increases the demand for real balances, both of which help establish equilibrium. As inflation continues, individuals begin to anticipate the rate of inflation and adjust their desired real balance downward since the cost of holding money is rising. This further increases expenditures and upward pressure on prices until the supply of real balances is reduced to equal the demand for real balances. The extent to which inflation continues depends upon the rate of increase in the nominal money stock.

To Keynesians, the major costs of inflation are the redistribution of wealth and income, and incorrect anticipations of future prices. Incorrect anticipation of future price levels has its major effect in the distortion of relative prices. As inflation continues, the public begins to expect it and incorporate it into prices. However, only to the extent that the inflation rate is correctly anticipated will relative prices be unaffected. Incorrect relative prices contribute to the redistribution effects of inflation. Inflation, additionally, changes the distribution of income and wealth, because prices of alternative goods and assets are not all equally flexible. For example, the prices of some monetary assets like insurance policies and savings bonds are fixed. Many monetary rent and interest incomes are contractually fixed and can vary only slowly over time, while the prices of physical assets generally adjust proportionately to inflation (Bronfenbrenner and Holzman 1963, p. 646).

Different income groups are also affected differently by inflation. Individuals on fixed salaries experience decreasing real incomes as prices rise while others capable of increasing their incomes may not be adversely affected and may even gain. Debtors gain at the expense of creditors. It also has been hypothesized that money wages lag behind prices and so income is redistributed from labor to business. The degree to which inflation redistributes income by distorting relative prices depends upon the relative flexibility of prices and the accuracy with which future price increases are anticipated.

Monetarists disagree that the major cost of inflation is the undesirable redistribution of income, because wealth owners will become accustomed to inflation and incorporate the rate of inflation in the money rate of interest on fixed price loans. Instead they view the relevant redistribution as between the holders of cash balances and controllers of the money supply rather than between income groups (Johnson 1963, pp. 124, 125). This concept of inflation as a tax is illustrated by Figure XVIII. DD' is the demand for money curve as a function of inflation. With no inflation the ratio of real balances to real income is OD'. As inflation reaches OP and is fully anticipated to continue at that rate, the demand for money falls to OM since the cost of holding money has increased. With the price level rising, real balances are falling. To maintain a constant level of real balances holders of money must accumulate nominal balances. The area OPP'M is the proportion of real income that holders of real balances must, due to the rising price level,

(Figure XVIII)



accumulate in the form of money balances to maintain their real balances intact at the level which gives a real balance to real income ratio of OM. This is considered an inflation tax expressed as a proportion of real income, and represents the amount of real income redistributed from holders of cash balances to controllers of the money supply. The real cost of inflation results because the public desires to reduce their level of real balances due to their anticipation of more inflation. To reduce their real balances they substitute real resources for it. Johnson calls this waste of resources the "collection cost" of the tax and it is represented by P'MD'.

Keynesians and Monetarists disagree not only on the causes of inflation but the effects as well. Keynesians concentrate on the real sector and explain inflation in terms of the commodity or labor market or both, and view the major cost of inflation as a redistribution of income among groups of participants in the economy. Monetarists view inflation as a product of disequilibrium in the money market, and see it as a tax which increases the proportion of national income put at the government's disposal.

CHAPTER VII

THE ROLE OF THE CONSTRAINT IN THE KEYNESIAN-MONETARIST CONTROVERSY

Unlike Monetarists, most Keynesians argue that the effects of monetary policy are transmitted only indirectly via the demand for new capital. Thus, a change in the supply of money will not directly imply an excess demand for commodities. Instead, excess supply of money will give rise only to excess demand in the other asset markets. This asset market disequilibrium in turn results in a change in asset prices and thereby creates excess demand for commodities. For example, Dernburg, and McDougall (1972, pp. 159, 160) state,

> The supply of and the demand for different types of earning assets will not be in equilibrium unless the supply of and the demand for money are also in equilibrium...An excess supply of money, other things being equal, implies the presence of excess demand for bonds and other earning assets, and this in turn implies that bond prices will be rising and interest rates will be falling.

Tobin (1961, p. 29) states that "The first requisite of a theory of wealth composition is that decisions about assets and debts must, in the aggregate as for the individuals, add up to the net worth of the moment, neither more nor less." Both these statements assert that excess demand in one asset market must be completely offset by excess supply in the other asset markets, and not by excess supply in the

model as a whole. If there are three assets -- money, bonds, and capital -- the following condition must hold.

$$(1) \quad (M_s - M_d) \equiv (B_d - B_s) + (K_d - K_s)$$

$$(M_s - M_d) + (B_s - B_d) + (K_s - K_d) \equiv 0.$$

Excess supply of money creates a corresponding excess demand for bonds plus capital.

If equation 1 is actually what Keynesians propose, they have created a rather interesting situation. In either a static, or end of the period, three asset model with four markets -- the money market, the bond market, the capital market and the output market -- the budget constraint for the system is:

$$(2) \quad (M_s - M_d) + (B_s - B_d) + (Y_s - Y_d) + (K_s - K_d) \equiv 0$$

The sum of excess demand or supply in the model must equal zero. Equation 1 is actually a second budget constraint stating that excess demand in the asset market must be zero. If it is substituted into the budget constraint given in equation 2, the following result is obtained:

$$(3) \quad (Y_d - Y_s) \equiv (M_s - M_d) + (B_s - B_d) + (K_s - K_d)$$

$$(Y_d - Y_s) \equiv 0.$$

The excess demand for output is zero regardless of the value of any

variables in the model, and so the output market is always in equilibrium.

Patinkin (1965) presents an argument applying to a two asset model similar to the one just examined and points out that Keynesians must not really mean to imply the identity expressed in equation 1. Instead, they want to assume that there exists such an identity only when the money supply changes. In other words, an increase in the supply of money creates an excess supply of money which is exactly offset by excess demand in the bond market and capital market. This is different than saying an excess supply of money generated by any cause is offset by an excess demand for other assets. To the contrary, in equations 1 through 6 of the general model, a rise in the interest rate should create excess demand for bonds and excess supply of money, capital, and output. Therefore, the Keynesians must mean only that the partial derivative of the demand for output with respect to money supply is zero, and so the disequilibrium created in the money market by a change in the money supply must be offset by disequilibrium in the other asset markets. However, the partial derivative of the demand for output with respect to the interest rate is not zero, and disequilibrium created in the money market by a change in the interest rate is offset by disequilibrium in the other asset markets and the output market. This interpretation of Keynesian intentions allows output market disequilibrium in their static and end of the period models.

Although the analysis is more complicated, the same and additional problems occur in beginning of the period models where stocks

and flows are distinctly separated. However, they are usually ignored since the suppressed flow market is generally not discussed. In beginning of the period models, there are two budget constraints -- a stock constraint and a flow constraint. The stock constraint is given by equation 1. Any excess demand for stocks must be offset by an excess supply of stocks. Likewise, the sum of excess demand or supply in the flow markets must be zero. Assuming that the explicitly specified equilibrium condition is output market equilibrium rather than just consumption market equilibrium, then

$$(4) \quad (\dot{M}_s - \dot{M}_d) + (\dot{B}_s - \dot{B}_d) + (Y_s - Y_d) \equiv 0.$$

If any excess demand for money must be completely offset by excess supply of bonds and not by excess supply in the flow sector as a whole, then

$$(\dot{M}_s - \dot{M}_d) \equiv (\dot{B}_d - \dot{B}_s)$$

$$(5) \quad (\dot{M}_s - \dot{M}_d) + (\dot{B}_s - \dot{B}_d) \equiv 0.$$

Substitution of equation five into equation 4 leaves

$$(6) \quad (Y_s - Y_d) \equiv 0.$$

Again, excess demand for output must equal zero regardless of the value of any variables in the model, and so the output market is always in equilibrium. However, the identity of equation 5 may hold only when excess demand is created by a change in the flow supply of financial assets. Consider an open market operation which increases

the money supply. The resulting excess supply of money and excess demand for bonds leads to changes in the arguments in the flow demand functions and, thereby, disequilibrium in the output market. The implication is that a change in the flow of assets can affect asset prices, as can a change in the stock of assets; however, it is not clear how these two effects should be integrated. In addition, when two flow markets are added and only one dropped, any model which was determinant before the change will be overdetermined after it. Therefore, if another variable is not added, only one equation can be added.

All the beginning of the period models previously examined specify only one flow market -- either the output or consumption market. Since the suppressed market is mentioned only by Foley and Sidrauski, one can only guess that the other models intend to include all the remaining flows of assets in the suppressed market. Assuming this is true, equation 4 becomes

$$(6) \quad (\dot{M}_s + \dot{B}_s - \dot{M}_d - \dot{B}_d) + (\dot{Y}_s - \dot{Y}_d) \equiv 0.$$

This specification gives rise to several interesting observations. One is that an open market operation will not show up in the flow sector. A change in $\dot{M}_s$ is offset by an equal and opposite change in $\dot{B}_s$. Consider also the implications of an increase in the supply of bonds. If the partial derivative of the demand for output with respect to the flow supplies of assets is zero, the change in $\dot{B}_s$ can have no direct effect on output. Neither can it have an indirect effect, because no disequilibrium can be created in

the financial flows market if none is created in the output market.[1] An increase in $\dot{B}_s$ only increases $\dot{M}_d + \dot{B}_d$ by the same amount, so there is no pressure on rates of return to change.

It is possible that rather than having either two flow markets or a composite market, that the suppressed flow market is only the money, bond, or capital market. If the suppressed market is the capital market, then equilibrium in the flow sector can be expressed as the supply equals the demand for output. However, in this specification, a depression is impossible. Any excess supply of consumer goods equals the excess demand for investment goods, since no financial flow market exists. Capital is the only asset into which savings can be channeled, so investment and savings are always equal. On the other hand, if the specified market is the output market, and the suppressed market is either the money market or the bond market, then the supply of the excluded asset must always remain constant. Any change in a stock must be due to flow. Therefore, regardless of which market is ignored, the specification excludes the possibility of open market operations. Depending upon which market is ignored, either a bond financed deficit or a deficit financed by creating money is excluded.

Finally, consider those beginning of the period models in which the explicit market is the consumption market. The models by Foley and Sidrauski and Woglom are examples. As was shown when discussing Woglom, when equilibrium income is defined as the level where

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[1]There will be an indirect effect in the next period when the flow is incorporated into the stock of bonds and rates of return change.

desired consumption equals the production of consumer goods, a depression is not a possibility. Therefore, this specification is no more desirable than the one making the capital market the suppressed market.

As has been shown, all the possible specifications of the suppressed market in the beginning of the period models have serious consequences for the model. Therefore, it is important that economists who use such models explicitly specify the suppressed market.

Patinkin states that Keynesians do not really mean to imply that a separate budget constraint applies to the asset markets. This may be true, but they often talk as though one does. Monetarists also believe in a balance sheet constraint, but their concept of the proper assets to be included is much broader than just financial assets and capital. The simple inclusion of a broader range of assets in the balance sheet constraint does not correct the problem. Equation 1, or a similar equation, still holds in either static or end of the period models, and in both the stock and flow sectors of beginning of the period models.

Both Friedman (1972, p. 910) and Fand (1970, p. 75) state that changes in the supply of money may have a direct effect on output. However, Friedman's direct effect seems to be different than Fand's. Friedman apparently means only that Monetarists think a broader range of assets are relevant for monetary policy than Keynesians.

> The difference between us and Keynesians is less in nature of the process than in the range of

> assets considered. The Keynesians tend to concentrate on a narrow range of marketable assets and recorded interest rates. We insist that a far wider range of assets and interest rates must be taken into account -- such assets as durable and semi-durable consumer goods, structures and other real property.

If the partial derivative of output with respect to the supply of financial assets is zero, output will not be directly affected by a change in the money supply. However, the money supply change creates not only excess demand for bonds and capital, but for other existing goods such as consumer durables as well. Therefore, the prices of these goods change, just as the prices of bonds and capital change, and all asset prices should enter the demand for output. As Friedman (1972, p. 910) states,

> The attempt by holders of money to restore or attain a desired balance sheet after an unexpected increase in the quantity of money will tend to raise the prices of assets and reduce interest rates, (thus a direct effect on the demand for old assets) which will encourage both spending to produce new assets and spending on current services rather than on purchasing assets, (thus an indirect effect on the demand for output). (Parenthetical comments added)

There is no direct effect on the demand for output. Only indirect effects via prices and, or interest rates. Therefore, it appears that there is no substantive difference between the Keynesian and Monetarist transmission mechanisms. (Or as Friedman says, they can be reconciled on a formal level). An extreme Keynesian position is that a change in the money supply creates excess demand for bonds and only bonds. This changes the interest rate and thus investment.

Monetarist on the other hand, would argue that a change in the supply would create excess demand for bonds, capital, and the stock of existing consumer goods. The rates of return, or prices, of all these existing goods change and thus change the demand for output.

Perhaps Fand (1970, p. 75) believes that an increase in money may not only affect prices and implicit yields on a broad range of assets, but may also directly affect expenditures on new consumer durables.

> Monetarists favor a transmission mechanism in which an increase in money may directly affect expenditures, prices, and implicit yields on physical assets. They suggest that money may be substituted not only for bonds but also for other assets, and that individuals may re-establish portfolio equilibrium by purchasing either a financial or a physical asset...Moreover, if we define assets to include consumer durables, (e.g., cars, appliances) it would be reasonable to suppose that these expenditures -- which are now classified as consumption -- can be directly stimulated by an increase in the money supply.

It is not at all clear that Fand's direct effect is different than Friedman's. One suspects they are really talking about the same thing. Therefore, Monetarists may not mean for an excess supply of money to create an excess demand for output. However, if by direct effect, Monetarists have in mind that money and other assets are substitutes for output in an individual's portfolio, an excess demand for assets regardless of the cause may be offset by an excess supply of output.

CHAPTER VIII

THE SYNTHESIS MODEL

$$C = c(i, U, Y, p, W) \qquad C = c(Y, p, W)$$

$$I = I(U) \qquad I = I(U)$$

$$C + I = d(i, U, Y, p, W) \qquad C + I = d(U, Y, p, W)$$

$$(1)\quad Y = d(i, U, Y, p, W) + g_o \qquad (1_a)\quad Y = d(U, Y, p, W) + g_o$$

$$(2)\quad Y = Y(N, K_o)$$

$$(3)\quad w_o = Y_N p$$

$$(4)\quad \lambda(i)B_o = l(i, i_K, Y, p, W)$$

$$(5)\quad a(i)B_o = \sigma(i, i_K, Y, p, W) + \frac{S_o}{i}$$

$$(6)\quad \frac{W}{p} = UK_o + \frac{B_o}{p} + \frac{S_o}{ip}$$

$$(7)\quad U = \frac{R_1}{(1 + i_K)} + \frac{R_2}{(1 + i_K)^2} + \ldots + \frac{R_n}{(1 + i_K)^n}$$

Equations 1 or 1_a through 7 form the synthesized Keynesian-Monetarist model and consists of four markets: the output market, the money market, the bond market, and the capital market. It is, therefore, a model with three aggregate assets molded after the suggestions of Tobin, Foley and Sidrauski, and Brunner and Meltzer that a two asset model inadequately describes economic activity, since neither money and bonds nor capital and bonds are perfect substitutes.

The Money Market

Equation 4 is the equilibrium condition for the money market when the demand for money $1(i, i_K, Y, p, W)$ equals the supply of money $(\lambda(i)B_o)$; money is defined as currency plus demand deposits. The endogenous money supply is consistent with the theories of excess reserves expressed by numerous writers in monetary theory (Meigs 1962; Frost and Sargent 1970). In general, they state that excess reserves are held by banks in contingency against withdrawals in excess of required reserves. The opportunity cost of these idle reserves is the interest rate (i) which could be obtained by lending to either the government through the purchase of government securities, or to the private sector through the purchase of private bonds or I.O.U.'s. An increase in the interest rate creates excess demand for interest earning assets, which is eliminated as bank loans are increased and excess reserves decreased. Since it is assumed that all bank purchases of securities are made via the creation of demand deposits for the debtor, the money supply is increased when the bank purchases securities. Therefore, the money supply is an increasing function of

the interest rate. (It is acknowledged that there are other determinants of the money supply; however, they are of little importance to the conclusions which follow and so are ignored).

The demand for money is a function of the interest rate, the return on capital, income, the price of commodities, and wealth. Money represents a store of value in addition to bonds and capital. However, money alone is assumed to be the medium of exchange in the economy. Since payments and receipts of cash do not coincide, nor is there perfect knowledge with respect to cash inflows and outflows, individuals hold cash for transactions purposes. As income increases, transactions increase and so the demand for money increases.[1] The own yield on money is assumed to be zero. However, even though money bears no interest, the real value of money balances fluctuates with changes in the price level. If ¶ is the expected rate of increase in the price level, -¶ is the return on money due to capital gains. If ¶ increases -- inflation increases -- the return on money falls and conversely when ¶ falls, the return on money increases. Therefore, money does bear some risk of capital gain or loss as prices fluctuate. If the risk on all three assets were the same, or returns were subjectively certain, individuals would try to maximize their wealth by simply holding only that asset with the highest return. The assets would be perfect substitutes for one another, and equilibrium would

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[1]Foley and Sidrauski (1971) view disposable income as a measure of the return in kind to cash balances, which results when payments and receipts do not coincide.

be obtained when the returns were equal. However, it is assumed that the returns on assets are not certain and that the assets are subject to different types of risk. If individuals are risk averters, they will diversify their portfolio while attempting to maximize their return per unit of risk. With this behavior in mind, one can examine the remaining variables in the demand for money.

As the interest rate increases, bonds become more attractive compared to money, since for a given risk, the difference between the two returns ($i + \P$) increases. Individuals attempt to switch from money to bonds. Likewise, when the return on capital rises demand shifts from money to capital. Therefore, the derivative of 1 with respect to i and i_K is negative. Likewise a fall in the return on money would decrease the attractiveness of money relative to the other assets; however, since ¶ is assumed exogenously determined and is constant over the period of analysis, this situation is not a possibility, and so ¶ is deleted from the demand for money function.[2]

When the price of commodities rises there are two effects on the demand for nominal money balances. First, as p rises, a larger quantity of nominal balances is needed to constitute a given quantity of real balances. As p falls, the reverse is true. Second, when p rises, commodities become more expensive and fewer are demanded since real wealth has fallen.[3] The result could be a larger or smaller

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[2]It is not proposed that ¶ is constant over an extended period of time. Indeed it is not; the assumption is that expectations are exogenously determined and that the period of analysis is short enough so that expectations can be considered constant.

[3]The effects of prices on the demand for commodities in this instance should not be confused with the Keynes effect which changes the real supply of money and ultimately aggregate demand.

transactions demand for money, depending on the elasticity of the demand for output with respect to real wealth. Since the wealth effect is generally considered weak, it is assmumed that the total amount spent on commodities increases, and so the transaction demand for nominal balances rises. Since both effects increase the demand for nominal balances, demand is directly related to the price level.

W is the nominal value of the public's wealth and equals the quantity of each asset available for the public to hold times its price. When the size of wealth increases, it is assumed that the demand for money rises along with the demand for commodities, bonds, and capital.

The Credit Market

Consistent with Brunner and Meltzer's analysis, the credit market is the market which distributes the stock of outstanding government securities and regulates the borrowing and lending at commercial banks. In essence, it is the bond market in which the nonbank public and the government are assumed to be net debtors. As such, they supply securities or "bonds" in an amount equal to their demand for credit. Banks supply credit in an amount equal to their demand for bonds. When the return on bonds rises, banks supply more credit since loans become more profitable to make ($a(i)B_o$). The aggregate volume of outstanding bank credit is equal to loans made to the nonbank public plus loans made to the government, and equals the portfolio of private I.O.U.'s, corporate bonds, and government securities held by banks. S_o is the stock of government securities, S_p is the amount of govern-

ment securities held by the nonbank public, and L_p is the amount of loans made to the nonbank public. The total amount of outstanding credit, E, is:

$$(8) \quad E = L_p + S_o - S_p.$$

The difference between the total supply of money and the supply of outstanding credit is the amount of outside or base money. This may be seen by recalling that the money supply equals currency held by the public plus demand deposits, and that all loans are made by creating demand deposits. If M equals the money supply, C_p equals currency held by the public and DD equals demand deposits, then

$$M = C_p + DD$$

$$E = L_p + S_o - S_p$$

or

$$E = L_p - S_p + S_o.$$

However, the stock of loans consists of the total stock of demand deposits minus unborrowed reserves, or inside money, since it is assumed that banks can raise reserves only by borrowing or attracting demand deposits. The result of this assumption is to ignore capital raised by selling equities in banks.

$$(9) \quad E = DD - UR$$

$$(10) \quad M = C_p + DD$$

Subtracting the supply of outstanding credit from the money supply yields

$$M - E = C_p + DD - DD + UR$$

$$(11) \quad M - E = C_p + UR = B_o.$$

Therefore, the difference between the total money supply and the supply of credit is simply outside money. Continuing this reasoning one can see the relationship between the money multiplier λ and the credit multiplier a. The supply of outstanding credit, E, is equal to $a(i)B_o$, while the supply of money equals $\lambda(i)B_o$, therefore,

$$M - E = \lambda(i)B_o - a(i)B_o = B_o$$

$$(\lambda(i) - a(i))B_o = B_o$$

$$\lambda(i) - a(i) = 1$$

$$(12) \quad \lambda(i) = a(i) + 1$$

From equation 12 one sees that although λ exceeds a by 1, the derivatives of each with respect to the interest rate are equal. When the interest rate rises, the profit on securities increases; banks demand more private or government securities and in acquiring them supply more money in the form of demand deposits. The result is that the money and credit multipliers increase by the same amount.

The net demand for credit or the net supply of bonds by the nonbank public is given by $\sigma(i, i_K, Y, p, W)$ which equals $L_p - S_p$, and is added to the exogenously determined supply of government

securities to obtain the total demand for credit or supply of securities. It is assumed that bonds are perpetuities paying one dollar per period, and so their price is the reciprocal of the interest rate.[4] This simplifying assumption is easily made, since in this model the distinguishing characteristic of financial assets is the own rate of return paid on them. Money yields no return, while bonds yield a positive return. Unlike most models, individuals are assumed net debtors or issuers of bonds and banks net creditors or demanders of bonds. The interest rate is determined in the market so that banks desire to issue the amount of credit individuals and the government demand. When the supply of credit exceeds the demand, the interest rate falls to create equilibrium; the interest rate rises to create equilibrium if excess demand prevails.

The derivative of the private demand for credit with respect to the interest rate is negative. A fall in the rate of interest decreases the cost of borrowing and so encourages the public to increase their indebtedness to the bank. In addition, for those individuals who own securities, the profitability of those securities relative to other assets falls, encouraging them to reduce their bond holdings. Recalling that the $L - S_p$ is the net debtor position of the public, a rise in desired L_p and a fall in desired S_p both increase the demand for credit $\sigma(i, i_K, Y, p, W)$.

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[4] If bonds are not specified as perpetuities yielding one dollar per period, the price of bonds is no longer the reciprocal of the interest rate. However, the price of bonds is still a function of the interest rate, and the nominal value of securities can be written $f(i)S_o$.

When the return on capital falls, capital becomes less attractive relative to bonds. Demand shifts from capital to bonds, and it is this desired portfolio adjustment which creates the positive derivative of σ with respect to i_K. The public's demand for bonds increases, thus lowering the net demand for credit.

Income enters the demand function for credit with a positive derivative because as income rises, the public finds itself with a higher transaction demand for money. Individuals attempt to exchange bonds for money, and so increase their net credit position. Although individuals can increase their nominal money holdings, the general public cannot unless they increase their net debtor position. As Patinkin has pointed out, (Patinkin, 1965, p. 224)

> There is nothing unrealistic about assuming that households may increase their borrowings in order to increase their money holdings. For the liquidity services of these households are a good, like any other one. Indeed (to turn for a moment to the real world) any economic unit which is both a creditor and a debtor of a bank, which holds demand deposits at the same time that it is indebted to the bank for loans received is in this position.

When the price of commodities rises, it is assumed that the demand for credit rises. To maintain the same real level of indebtedness when the price level rises, individuals must increase their nominal net credit positions. Holders of bonds demand a higher nominal quantity of bonds and debtors demand a larger amount of credit. Since the transaction demand for money increases, so does the demand for credit. The aggregate public cannot increase money holdings unless they borrow. Therefore, the price derivative is positive.

When wealth increases, the demand for assets by the nonbank public increases. This means the demand for government securities increases and thus lowers the desired net debtor position of the nonbank sector. The sign of W is negative since the demand for credit has fallen.

The Output Market

The output market of equation 1 is the same as the output market discussed in the general model. Equation 1a, however, deletes the interest rate and U as variables directly affecting consumption. Instead, i affects output only indirectly by affecting the demand for capital and thereby U. Wealth is still assumed to affect the demand for consumption goods. As reference to the comparison chapters shows, this alternative interpretation makes the model more Keynesian than Monetarist. Equation 1 makes the model more Monetarist than Keynesian.

Wealth

Equation 6 states that the real value of wealth is the sum of the market value of the capital stock, the value of outside money, and the value of government securities all deflated by the price of output. When real wealth increases, the demand for assets and commodities increases. (The positive effect on the demand for bonds makes the sign of W negative in the credit market).[5]

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[5]Wealth may not be the appropriate variable to use in the asset demand function (see Stephens and Rush, 1974). In considering the effects of asset supplies on consumption, both inside money and private bonds are excluded, since each is a liability as well as an

Equations 1 through 7 form a model in 7 independent equations and seven endogenous varialbes -- i, i_K, U, W, Y, p, and N. The capital market has been excluded by Walras' Law; equilibrium in three of the four markets implies equilibrium in the fourth. Since the

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asset to the private sector. However, in the asset markets, one is concerned not with the distribution of wealth among various assets, but the distribution of the asset holder's portfolio among various assets. Therefore, wealth could be replaced in the nonbank public's demand for assets by the size of the nonbank public's portfolio (F). The total nominal supply (TS) of assets is

$$TS = \lambda(i)B_o + PK_o + \frac{S_o}{i} + L_p.$$

However, the bank holds private and government bonds equal to

$$\frac{S_o}{i} + L_p - S_p.$$

Therefore, the portfolio of the nonbank public equals

$$F = \lambda(i)B_o + PK_o + \frac{S_o}{i} + L_p - \frac{S_o}{i} - L_p + S_p$$

$$F = \lambda(i)B_o + PK_o + S_p.$$

S_p is the amount of government bonds held by the nonbank public and depends positively on the return on bonds, and the size of the nonbank public's portfolio and negatively on income and the return on capital. Therefore,

$$S_p = q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{F})$$

$$F = \lambda(i)B_o + PK_o + q(\overset{+}{i}, \overset{-}{i_K}, \overset{-}{Y}, \overset{+}{F}).$$

Replacing wealth by the size of the nonbank portfolio in the asset markets complicates the discussion of monetary and fiscal policy but does not change the results.

sum of excess demands in all the markets must be identically zero due to the budget constraint, the capital market is implicitly specified by equation 13.

$$(13)\quad (Y_s - d_{(\ )} - g_o) + (\lambda(i)B - 1(\ )) + \left(\frac{S_o}{i} + \sigma(\ ) - a(i)B_o\right) \equiv (k(\ ) - PK_o)$$

Therefore, the model is determined in seven endogenous variables and seven independent equations.

To facilitate the examination of the model, each asset market will be solved in the price of capital relative to price of commodities, and the interest rate. This is possible as long as the expected income from holding capital is exogenously determined. Via equation 7, a change in the return on capital is the same as a change in the price of capital relative to the price of commodities. The commodity market will be solved in price and income.

As previously discussed, the supply of money increases and the demand for money falls as the interest rate rises. The intersection of the money demand and supply in Figure XIXa determines the rate of interest that equilibrates the money market, given the supplies of bonds and capital, the price of capital relative to the price of commodities, wealth, and the price level, and income.

An increase in the price of capital relative to the price of commodities from U to U' increases the demand for money and so shifts the demand curve from M_d to M'_d. Excess demand at the original interest rate must be reduced by a rise in the interest rate which reduces demand and increases supply. Therefore, the locus of all

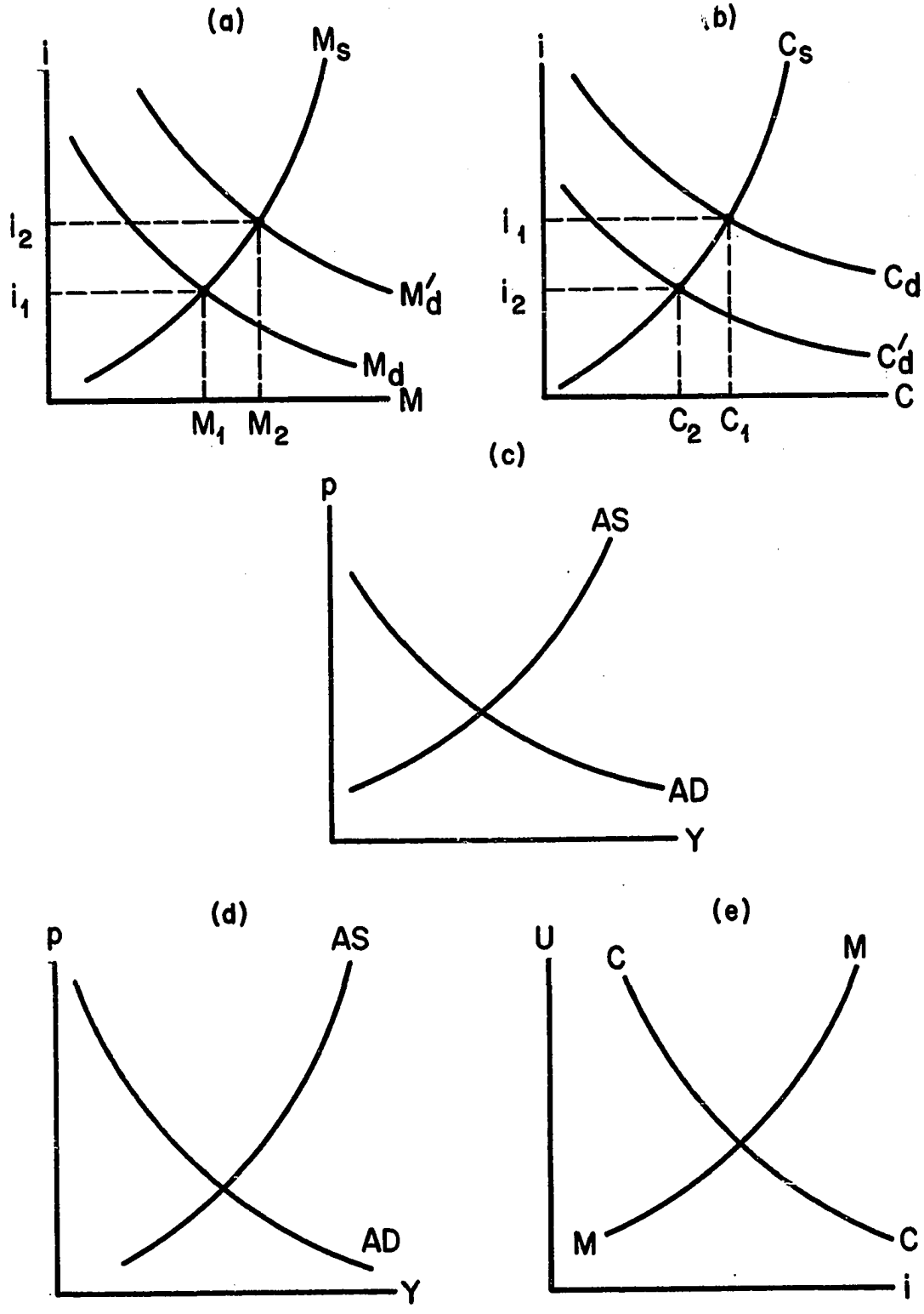
values of i and U for which the money market is in equilibrium is upward sloping. Such a line is represented by the MM line in Figure XIXe.

The supply of credit increases as i increases due to increased profitability of lending; however, demand falls since loans become more expensive and bond holdings more attractive. When the price of capital relative to the price of commodities rises from U to U', bonds become more attractive relative to the capital and the demand for credit falls to C'_d in Figure XIXb. At the original interest rate there is excess supply of credit which must be eliminated by a fall in the return for financial assets. The combinations of U and i which equate the credit or bond market are plotted with a negative slope as line CC in Figure XIXe.

Figure XIXc shows aggregate demand (AD) as a negative function of the price level due to the effect of real wealth. The aggregate supply curve is upward sloping since producers must hire more workers to increase real output. The increase in labor relative to capital lowers the marginal product of labor, and thus, increases the price level to equate the value of the marginal product with the nominal wage rate, as previously discussed.

All the markets for assets have now been made determinant in i and U if p, Y, W and N remain constant, and the output market has been made determinant in p, Y, and N if i, U, and W remain constant. Figures XIXd and e show the system in equilibrium where AS intersects AD, and the asset markets for money and bonds intersect. Since there is one dependent equation in the system due to Walras' law, the

(Figure XIX)


(a)
i
M_s
i_2
i_1
M'_d
M_d
M
M_1
M_2
(b)
i
C_s
i_1
i_2
C_d
C'_d
C
C_2
C_1
(c)
p
AS
AD
Y
(d)
p
AS
AD
Y
(e)
U
C
M
M
C
i

capital market is excluded from Figure XIXe. We can examine the system by looking at the effect equilibrium in the money and bond markets has on the output market, and then the feed-back effects of the output market on the asset market, and so on and on until the system converges to a final equilibrium.

The Model at Full Employment

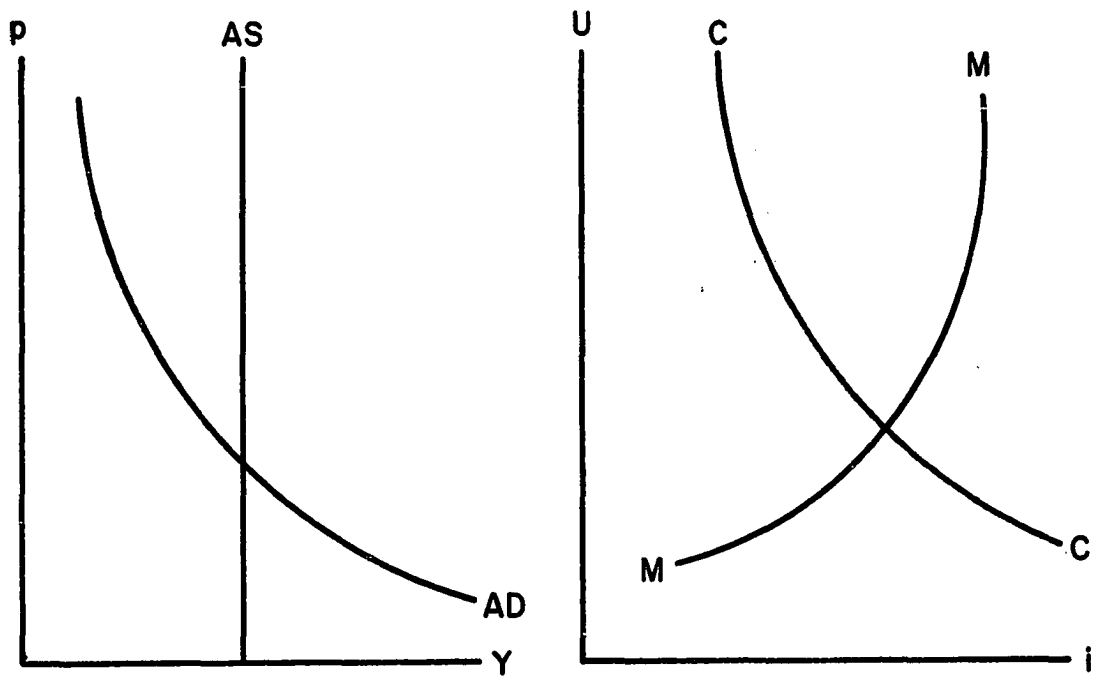
The model can be converted into a full employment model by allowing the nominal wage rate to vary. This adds an additional endogenous variable to the system. To make the model determinant, the supply of labor, and thereby the complete labor market, can be introduced. The supply of labor is:

$$(14) \quad N = s(\overset{+}{\frac{w}{p}}).$$

The assumption of flexible wages assures equilibrium in the labor market and therefore full employment regardless of the price level. If excess supply exists in the labor market, the real wage will be driven down and full employment established. If excess demand exists, the real wage will rise to eliminate the excess demand.

Graphically, the assumption of flexible wages makes the aggregate supply curve perfectly inelastic at the full employment level of output. Aggregate demand and the asset markets are unaffected as Figure XX shows. There are now 8 endogenous variables: i, i_K, U, p, Y, W, N, and w to be determined by eight independent equations. Equilibrium in the labor market determines the real wage, employment, and income. Therefore, the level of employment and output are inde-

(Figure XX)



pendent of the commodity, money, credit, and capital markets. Equilibrium in the money, credit, and commodity markets determine p, W, U, i, and i_K. The effects of monetary and fiscal policy can be examined in the same manner as in the rigid wage case. However, any change in aggregate demand will now effect only equilibrium prices and not real income.

Alternative Graphical Representations

Although Figures XIXd and e will be used to examine the effects of monetary and fiscal policy in the synthesized model, it is by no means the only way to graphically represent equations 1-7. Figure XXI graphs all three markets separately. The output market is determined in p and Y holding i, U, and W constant. The money market is determinant in U if i, Y, N, p, and W are constant, and the credit market is determinant in i given U, Y, N, p, and W. As in Figure XIX, equilibrium in each market feeds back into the other markets until the whole system converges to final equilibrium.

Figure XXIIa shows the combinations of interest rates and real income levels which give equilibrium in each of the three markets if W and U are held constant. IS' shows equilibrium in the output market. As income increases, aggregate demand increases; however, from equations 2 and 3, prices also rise and decrease aggregate demand. The net effect may be to either increase or decrease aggregate demand; however, regardless of the net effect on aggregate demand, excess supply will be created since $-\frac{\partial \bar{d}}{\partial Y}$ is less than one.[6] Therefore, i

[6]Although it is possible that the net effect might decrease aggregate demand, it is implausible.

must fall to increase aggregate demand and reestablish equilibrium at a higher level of real output. IS' slopes downward; however, it differs from the Hicks IS curve because the interest rate affects consumption and savings rather than investment. A fall in i necessitates a rise in the level of income to equate intended savings and intended investment, not because investment rises but because savings falls.

LM' and CC' have positive slopes since both an increase in Y and an increase in p cause an increase in the demand for money and credit which must be offset by a rise in i. Although both are positively sloped, the relative slope of the two curves is indeterminant. Figure XXIIa shows the model in equilibrium.

Figure XXIIb is derived in a manner similar to XXIIa except equilibrium is stated in terms of U and Y for given levels of W and i. Excess supply in the output market caused by a rise in income must be offset by a rise in the price of capital relative to the price of commodities. Therefore, OM, the output market curve, has a positive slope. CC has a positive slope since U must rise to offset the excess demand for credit. The relative slope of CC and OM is indeterminant. MM slopes downward since U must fall to offset the increase in the demand for money.

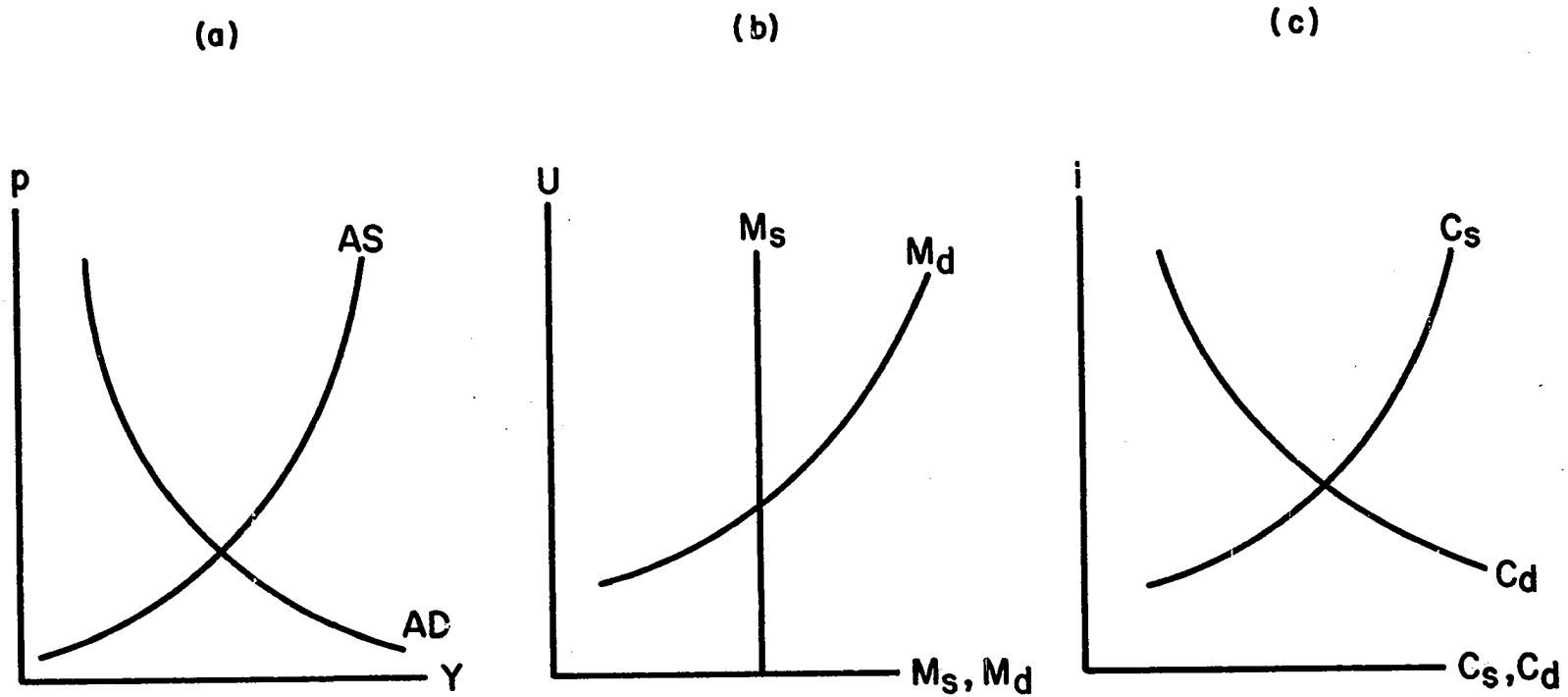
Figure XXIII expresses the model in terms of the interest rate and income when W is held constant. OM shows output market equilibrium and AM shows simultaneous equilibrium in the money and credit markets. AM is derived by solving equations 4 and 5 for equilibrium levels of i and U given the prevailing level of income

and the corresponding price level. The resulting asset market equilibrium values of i are graphed against Y. OM is then derived by substituting the solution for U obtained from the asset markets and solving for the interest rate which creates output market equilibrium. The resulting equilibrium value of i is graphed against Y to form the OM curve. This is the same procedure used by Brunner and Meltzer (1972c, 1973) to express their model in terms of asset and output market equilibrium in the i, Y plane.

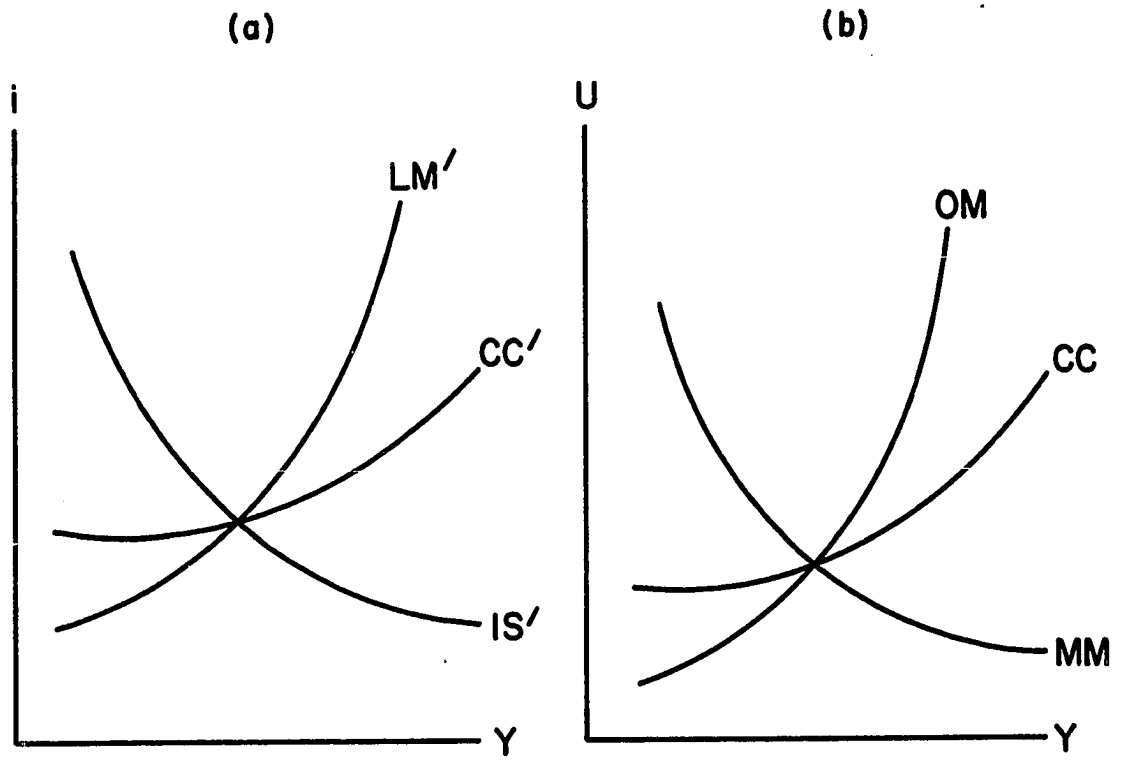
A similar procedure can be used to express the model in terms of OM and AM in the U, Y plane. The only difference being that the simultaneous solution of equations 4 and 5 will be graphed in terms of U and Y and the equilibrium value of i substituted into equation 1 to find the output market solution in terms of U and Y. Since the partial derivatives of U in the money and credit markets have different signs, the slope of AM is indeterminant. OM would have a positive slope.

As these examples illustrate, the synthesized model can be graphed in numerous ways. However, only the method shown in Figure XIX is used in the succeeding analysis.

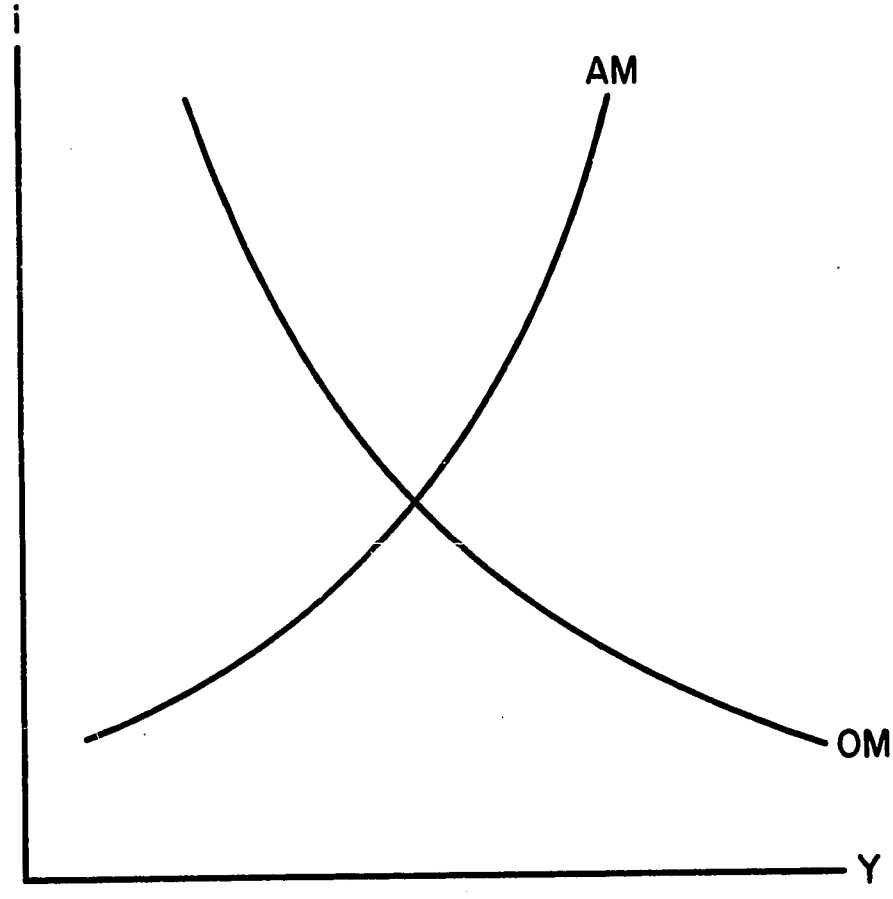
(Figure XXI)



(Figure XXII)



(Figure XXIII)



CHAPTER IX

THE DEBATE IN THE SYNTHESIS MODEL

Arguments concerning the effects of pure monetary and pure fiscal policy are basic to the Keynesian-Monetarist debate. A favorite point offered by Monetarists is that the method of financing a government deficit may limit the impact of fiscal policy and that only if fiscal policy somehow affects the quantity of money or its rate of growth will it have a significant impact on the economy. In Brunner and Meltzer's words (1972, p. 71), "changes in fiscal policy are seen as having aggregative effects primarily (but not entirely) because they give rise to changes in monetary policy." Therefore, it might be useful to review the alternative means available to finance a government debt. There is essentially only one way to finance the excess of government expenditure over revenues -- issue government debt instruments. However, there exists alternative debt instruments and alternative ways to issue them.

When a deficit is incurred, the treasury may finance the deficit by issuing new paper currency; i.e., paper money. Obviously, an issue of currency to the public -- individuals, banks and businesses -- increases the money supply. An alternative and more frequently used method is to print treasury securities and sell them. The sale of

securities raises demand deposits at commercial banks in the government's account. The money form available to the government is demand deposits rather than currency. However, it is less obvious that this sale of securities increases the money supply. It depends on who the ultimate purchaser of the new securities happens to be. If the Fed buys the securities directly from the Treasury, the deposits of the Treasury at the Fed are increased by the amount of the sale. The Treasury pays for the purchases made in the economy and when the check clears, ownership of the deposits shifts from the government to the private sector. The banking system now has more reserves; i.e., deposits at the Fed, and the public more demand deposits; therefore, the money supply has increased.

Rather than sell directly to the Fed, the Treasury could sell securities to either banks or the nonbank public. If all sales are to the nonbank public, the demand deposits used to purchase securities are transferred from the purchaser's account to the Treasury's. Demand deposits are now owned by the Treasury, rather than the nonbank public. The money supply has not changed. However, to the extent that banks use excess reserves to purchase securities from the Treasury, new demand deposits are created and the money supply increases. To entice purchasers of securities, the Treasury, like any other issuer of bonds, would likely offer a higher rate of return in order to get either the nonbank public to switch their asset holdings from money and capital to bonds, or the banks to decrease excess reserves. The amount of the rise would depend upon conditions in the asset market. Frequently, the process of financing the deficit does

not stop at this point. Instead, the Fed enters the securities market in an attempt to restore interest rates to their previous level. To lower the interest rate, the Fed provides additional loanable funds by purchasing from the public an amount of securities equal to the amount initially issued by the Treasury. The interest rate remains at its initial level and the money supply is increased. The public has been used as a go-between in the indirect purchase of securities by the Fed from the Treasury.

Since the short term interest rate is considered by some as the proper indicator of monetary policy, the last alternative might be considered pure fiscal policy since the interest rate remains unchanged. (Hamburger 1970, Zecher 1970) However, few if any, Monetarists would disagree that a deficit financed by an increase in base money would not expand the economy. In fact, that is precisely what they do argue, and so the debate can easily degenerate at this point into an argument over how does one properly define monetary and fiscal policy. To avoid this definitional problem, pure fiscal policy is defined as a deficit whose financing does not affect the amount of base money. Examples are deficits financed by the issuance of securities to the public, by taxation, or a surplus accompanied by the retirement of outstanding securities. To the extent the money supply changes endogenously, due to the purchase or sale of securities by the banks, the increase is considered a part of fiscal policy. Only the deficit financed by the sale of securities is discussed below.

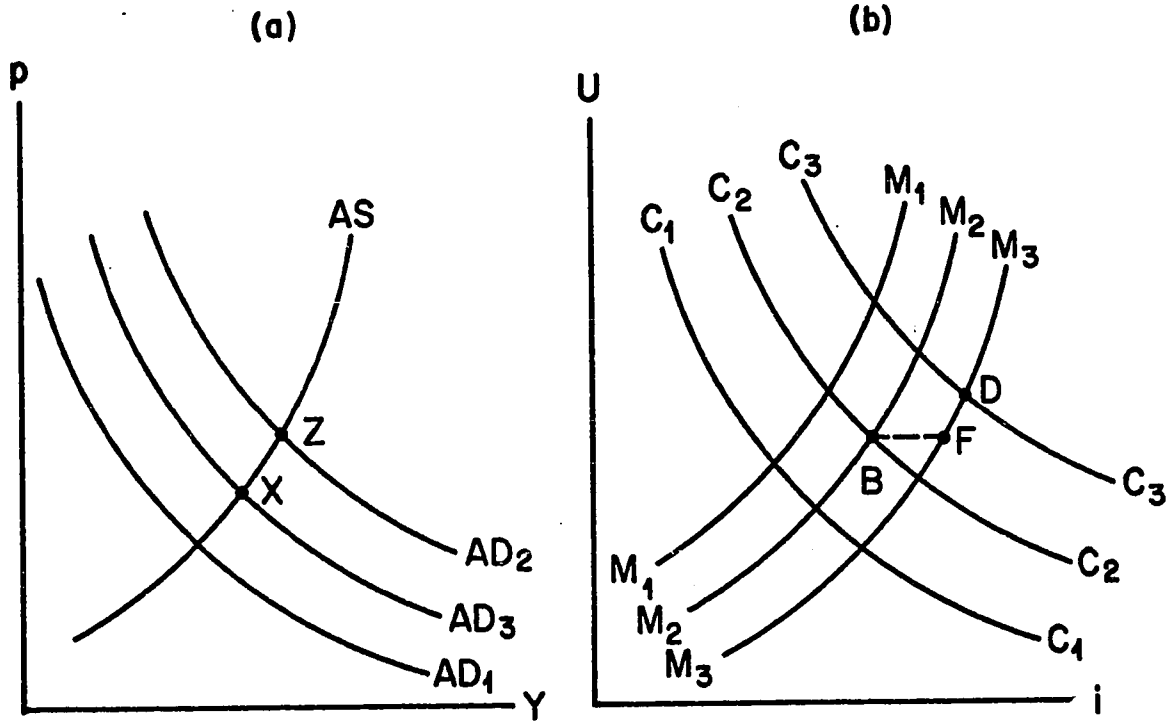
Pure monetary policy is defined as an increase in the money supply due to open market operations rather than any exogenous increase

in the money supply. This definition keeps total nonhuman wealth constant. Few Keynesians would argue that a helicopter dropping money would not result in economic expansion. Such an action increases total wealth and increases income just as any other transfer payment and, consistent with Keynesian theory, when income is increased, consumption increases. However, in an open-market operation wealth and income remain constant, and any effect on the economy results simply from the increased supply of money relative to other assets.

Pure Fiscal Policy in the Synthesized Model

In all the discussions which follow, wealth effects caused by asset price changes are ignored, since it is assumed that such effects are only on the magnitude and not the direction of changes in equilibrium. This is not consistent with some approaches (Brunner and Meltzer, 1972c); however, this assumption can be dropped and the effects examined. Assume the government increases g_o and issues securities, S_o, to finance the deficit. The increase in S_o increases wealth. The rise in W creates excess demand in the money market. Since the absolute value of $-\frac{\partial \sigma}{\partial W} < 1$, the new issue of government securities offsets the fall in the demand for credit due to a rise in W and so creates excess demand for credit. In Figure XXIV, the excess demand for money shifts M_1M_1 to M_2M_2 since some combination of i rising and U falling must occur to create equilibrium. C_1C_1 moves to C_2C_2 since excess supply of bonds is eliminated by some combination of increasing i and U. In equilibrium, the rate of interest must rise, but U may either rise or fall. Whether U rises or falls is determined by the

(Figure XXIV)



degree of substitutability of the assets for each other. To gain some insight into the possible movement in U, the three extreme cases of asset substitution conditions are examined. If bonds and capital are perfect substitutes, the increase in securities increases the supply of the aggregate asset bonds-capital relative to money. Generally, a rise in the supply of one asset relative to another increases its rate of return. Therefore, the interest rate and the required return on capital rise. This results in a fall in U.

If money and bonds are perfect substitutes, the increase in S_o decreases the capital stock relative to money-bonds and so lowers the return required to hold capital. This causes U to rise.

If money and capital are perfect substitutes, the supply of securities relative to money-capital rises. Since capital is tied to the zero return on money, U will remain constant. Since the two most reasonable cases, money and bonds or bonds and capital as perfect substitutes, result in opposite movements in U, it is difficult to hypothesize the direction of change and so both possibilities are examined.[1]

In the output market, an increase in g_o and W shifts AD_1 to the northeast. However, the adjustment of the asset market to the debt financing caused i to rise. If i rising decreases the demand for

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[1]Though the model rules out the possibility of perfect substitutes, it is possible that two of the assets might be close substitutes relative to the third asset. It is also possible that the degree of substitutability between assets changes over time. If bonds and capital were close substitutes, i would rise and U fall although the discount applied to capital would not strictly equal the interest rate. If money and bonds were perfect substitutes, i would not be strictly tied to the zero return on money, and so both i and U rise when the relative supply of bonds is increased. If money and capital were close substitutes, U would rise since the higher stock of securities reduces the required rate of return on capital.

output through its effect on consumption, as in equation 1, it reduces the effect of g_o on aggregate demand. If U falls, aggregate demand falls still more. It is possible that i and U could combine to offset the effect of g_o. If U rises and offsets the effect of i, aggregate demand increases even more. Assume that the net effect of the government deficit and its financing are positive, which is shown by AD_2. This causes Y and p to rise and feed back to the asset market. M_2M_2 shifts out to M_3M_3, since a higher Y and p create excess demand for money. Excess demand is also created by higher Y and p in the credit market, where C_2C_2 shifts to C_3C_3. i rises while U again may either rise or fall. The conditions necessary for U to rise, remain constant, or fall are given in expression 1.

$$(1) \quad -\frac{\partial \bar{1}}{\partial Y}\Delta Y + -\frac{\partial \bar{1}}{\partial p}\Delta p + -\frac{\partial 1}{\partial i}\Delta i \lesseqgtr -\frac{\partial \sigma}{\partial Y}\Delta Y + -\frac{\partial \sigma}{\partial p}\Delta p + -\frac{\partial \sigma}{\partial i}\Delta i$$

Given the change in Y and p, excess demand exists in both the money and credit markets. Assume that U remains constant until i moves and creates equilibrium in one of the asset markets. U and i can then move simultaneously to create equilibrium in both asset markets. As initially i rises, if equilibrium is established simultaneously in the credit and money markets, U remains constant; expression 1 is an equality. If equilibrium is established first in the money market, U must rise to eliminate the excess demand for credit. In Figure XXIVb, U is constant along the dashed line from B to F where i has established equilibrium in the money market. Now i and U must rise to establish equilibrium in both markets simultaneously at point D.

This occurs if the right side of expression 1 exceeds the left. However, if credit market equilibrium is established first, U must fall to eliminate excess demand for credit. In this case the left side of expression 1 exceeds the right. Therefore, if some conclusion can be drawn concerning the size of the partial derivatives in expression 1 the direction U moves can be hypothesized.

Income increases the demand for money for transactions reasons. It is precisely this increase in the demand for money which gives rise to the demand for credit. Therefore, $-\frac{\partial \sigma}{\partial Y}$ cannot exceed $-\frac{\partial l}{\partial Y}$. If individuals also sell capital to acquire money, $-\frac{\partial l}{\partial Y}$ must exceed $-\frac{\partial \sigma}{\partial Y}$.

There are two reasons that the demand for money and credit rise as p rises. First, larger nominal quantities are needed for any given level of real quantities. Therefore, since there is more money outstanding than credit, (by an amount equal to base money) this effect of p is greater on money. The second effect corresponds to the transaction effect above and can be analyzed the same way. Therefore, $-\frac{\partial l}{\partial p} > -\frac{\partial \sigma}{\partial p}$.

When the interest rate rises, the demand for credit falls, since the cost of borrowing increases and bonds become more attractive to hold. As individuals attempt to increase their holdings of bonds, they do so by attempting to reduce their holdings of money and/or capital. This is what gives rise to the negative derivative of money with respect to i. Therefore, in absolute value $-\frac{\partial l}{\partial i} < -\frac{\partial \sigma}{\partial i}$. Since the logic of the model seems to dictate that the left side of expression 1 exceeds the right, it is assumed that U falls.[2]

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[2]However, if U does rise, in equation 1a aggregate demand rises. In equation 1, aggregate demand may rise if the effect of U

The rise in i combines with the fall in U to decrease aggregate demand to AD_3 somewhere above AD_1 and reduce Y and p. This reduction shifts the money and credit curves toward M_2M_2 and C_2C_2 reducing i and increasing U. This shifts AD_3 back toward AD_2, and oscillation has begun between X and Z, and between B and D, which leads to equilibrium in which the economy experiences increased Y, N, i and p. U may either rise or fall, depending upon its initial reaction to an increase in S_o. However, the expansion may be short lived. In the next period, S_o must increase while g_o remains constant since the deficit must be financed again. (i.e., an ever-rising S_o is needed to finance a given deficit). The increase in S_o increases wealth and thus AD, but it also shifts both M_1M_1 and C_1C_1 out, increasing i and lowering or raising U. A falling U combines with the rise in i to decrease aggregate demand. If the wealth effect on consumption is offset by the rise in i and fall in U, then AD falls as S_o increases. Unless the stock of other assets rise along with the increase in government securities, or unless some dampening of the effect occurs, the continued issuance of government securities must eventually offset the "first round" expansion effect of the government deficit. U falls when capital and bonds are perfect substitutes. However, if U rises and combines with the increase in W to offset the effect of i, or if i does not enter the demand for output, AD expands as S_o is increased.

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offsets the effect of i. This shifts the aggregate demand curve out further than AD_2, raising Y and p again and creating the potential for instability unless some dampening effects occur or unless the stock of assets changes to counteract the movement.

U will rise if money and bonds are perfect substitutes or if money and capital are perfect substitutes.[3]

In summary, the effect of an increase in the deficit is somewhat ambiguous. It is possible that from the very beginning the deficit may be deflationary rather than expansionary, due to the need to finance it through selling of government securities, even if i does not enter the output function. However, if this initial effect of the asset market does not offset the government spending, the effect of a deficit is to increase output and employment and prices. However, as S_o is subsequently increased to finance the continuing higher level of government spending, the asset markets must adjust to the higher demand for credit. The adjustment may result in either a rise or a fall in U, but always a rise in i. If the effects in the asset market offset the effects of an increase in wealth on consumption, the economy begins contracting, and it is conceivable that the continuing flow of government securities could lead to a fall in output below the original level. It is also possible that the rising S_o may continuously expand output and prices when the effect of an increase in wealth on consumption offsets the effects of the asset market. It is

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[3]Silber (1970) discusses the role of bond-financed government deficits in the IS-LM system. He shows that the traditional IS-LM analysis has not treated the bond-financed and money-financed cases of government deficits symmetrically. Introducing wealth into the demand for money corrects this problem and raises the possibility that a government deficit financed by selling bonds will be contractionary. See also Stephens and Rush (1974).

interesting to note that in the most common Keynesian case of treating capital and bonds as perfect substitutes, an increase in S_o results in a fall in U and so increases the likelihood that the economy will contract.

Pure Monetary Policy in the Synthesized Model

Pure monetary policy is a change in government securities ($-\frac{S_o}{i}$) matched by an equal and opposite change in the monetary base (B_o). In Figure XXV initial equilibrium is at A and X.

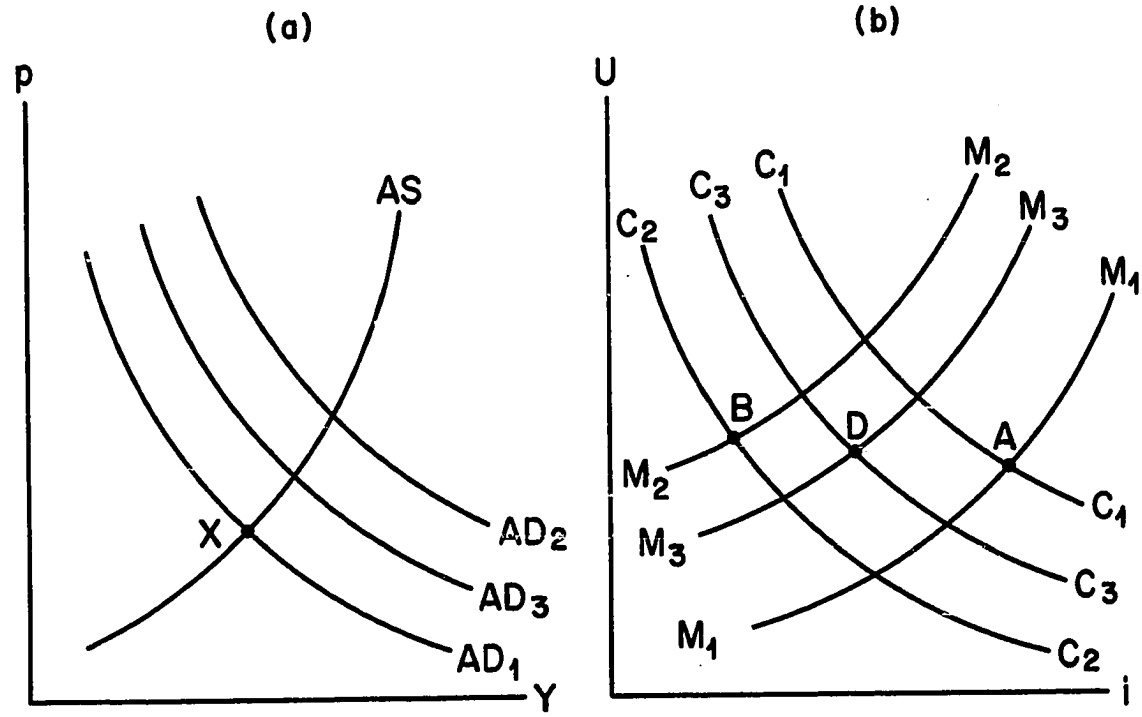
The increase in the monetary base creates excess supply of money. To induce people to hold more money, the interest rate must fall or the price of capital rise or both to make the other assets less attractive. This shifts the equilibrium values of i and U to the left from M_1M_1 to M_2M_2.

In the credit or bond market, the open market operation reduces the demand for credit and increases the supply of credit, creating excess supply in the credit market, or equivalently excess demand for bonds. To create equilibrium, i must fall or U must fall or some combination of both. Therefore, C_1C_1 shifts to C_2C_2. The new equilibrium could be at a lower or higher U but a lower i.

If money and bonds were perfect substitutes, the open market operation would leave the relative supply of money-bonds to capital unchanged. With the return on money fixed at zero, the interest rate will remain constant. Therefore, U will remain constant.

If bonds and capital are perfect substitutes, the supply of bonds-capital falls relative to money. This reduces the interest rate and the return required on capital, and so raises U.

(Figure XXV)



If money and capital are perfect substitutes, the open market operation increases the supply of money-capital relative to bonds. If the return on capital is strictly tied to the zero return on money, the prices of capital remain constant. Since in none of the cases does U fall, it is assumed that U rises.[4]

A higher U and lower i unequivocally increase the demand for output and shifts AD_1 to AD_2. Prices and income rise, and have effects on the asset market. Demand for money increases and shifts M_2M_2 back toward M_1M_1 to say M_3M_3. The C_2C_2 line shifts to C_3C_3 since an increase in Y and p creates excess demand for credit. This moves equilibrium to a point like D where i rises and U either rises or falls. As previously discussed it is assumed that i rises and U falls when an increase in Y and p create excess demand in the money and credit markets.[5]

As i increases and U falls, aggregate demand falls and AD_2 shifts back to AD_3. p and Y fall, which feeds back into the asset

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[4]If money and bonds are only close substitutes, the interest rate is not strictly tied to the zero return on money. Therefore, i will fall since the supply of bonds is reduced relative to money. A fall in i lowers the return required to hold capital and increase U. If bonds and capital are perfect substitutes, the supply of money increases relative to bonds, lowers i and raises U. If money and capital are close substitutes, the return on capital is no longer strictly tied to the zero return on money. Therefore, U will fall, since the supply of bonds relative to money and capital has fallen.

[5]However, if U rises instead of falls, instability could result, just as in the case of fiscal policy if the rising price of capital succeeds in increasing the demand for output. AD_2 shifts out rather than back to AD_3. This creates instability in the system. However, the chance of this possibility seems remote.

market, moving M_3M_3 and C_3C_3 back toward M_2M_2 and C_2C_2, lowering i and increasing U. Equilibrium is being established since the feedbacks are now resulting in the output market oscillation between AD_3 and AD_2 and the asset market between B and D. The new equilibrium results in a rise in Y, N, U, and p, but a fall in i. The open market operation unequivocally expands employment and output.

In the IS-LM model the major obstacle to monetary policy is the existence of a liquidity trap, which establishes a lower boundary for the interest rate. Any increase in the supply of money is then simply absorbed by the public and there is no effect on the rate of interest, and therefore output. The concept of a liquidity trap is slightly more complex in this synthesized model.

Equation 1a expresses the demand for output as depending upon only two financial variables -- the price of capital relative to the price of commodities and the nominal value of wealth. Assume that the wealth effect on output is relatively weak. This leaves U as the transmission mechanism between the money and the real sectors. Therefore, the liquidity trap must be in terms of an upper level for U.

There are essentially three factors affecting the determination of the price of capital relative to the price of commodities which are important to examine in this context -- the expected future income stream, returns on alternative assets, and the supply of money and bonds relative to capital. The latter two factors determine the rate of return at which holders or potential holders of capital discount the future incomes expected to be generated by the capital assets.

Therefore, an infinitely elastic demand for money with respect to the interest rate may not be a sufficient condition to create a liquidity trap. Assume that i cannot fall past its present level. If the supply of money is increased via open market operations, individuals will gladly substitute money for bonds in their portfolio; however, there is no reason to believe they would not then exchange the money for capital. The supply of money relative to capital has increased and so the return required to hold capital falls; this increases the price of capital relative to the price of output even though the interest rate has not changed. Only when bonds and capital are perfect substitutes, or when capital is not considered an asset, do the normal concepts of a liquidity trap leave monetary policy ineffective; only then is the interest rate the only link between the financial and real sectors.

However, even though an infinitely interest elastic demand for money does not negate monetary policy, it is possible to limit the effects of monetary policy even without assuming a perfectly elastic demand for money. For, unlike a model in which bonds and capital are perfect substitutes, a fall in the interest rate is not a rise in the price of capital. A fall in the rate of interest may lead to an increase in the price of capital and one would normally expect that it would. However, it is possible that the needed rise in U cannot be generated by lowering i. If an increase in the money supply causes only a small change in i, as for instance would occur if the interest rate had an asymptotic boundary, U could rise, but the potential

magnitude of the rise might be too small to change aggregate demand. The usefulness of money would then be limited to its effect via the relative supply of money and capital.

Throughout the entire analysis, the future income expected from holding capital has been held constant. However, as R fluctuates, the price of capital fluctuates in the same direction, as equation 7 explicitly shows. Therefore, rising and falling expectation of holders of capital can play a significant part in the determination of output and employment.

It is possible that monetary policy could be offset by falling entrepreneurial expectations. Beginning at a point of full employment, a fall in expected future income from capital would decrease investment and contract the economy. Assume now that the monetary authorities increase the money supply and lower i_K. The result is the expected expansion unless R is falling along with i_K. It is possible that R might fall low enough that i_K cannot be lowered sufficiently to increase U. (This is more likely to occur if i has a lower bound). In this case, monetary policy could not correct for deficient aggregate demand. The importance of expectations concerning future streams has been emphasized by, among others, Leijonhufvud (1967, 1968b). According to Leijonhufvud, Keynes' central theme was that "...changing views of the future are capable of influencing the quantity of employment."

In comparing the effects of monetary and fiscal policy, it is apparent that only empirical findings will solve the question of which is more effective. However, interesting theoretical results have been

obtained. In general, both can be expansionary; however, the financing of the deficit causes the asset market variables to react in a manner which counteracts some of the effects of the direct increase in government demand. i always rises due to the increased demand for credit, not just due to increased transactions as income increases. U may fall due to the increase in securities. Both a rising i and a falling U decrease aggregate demand. Continued financing of even a one-time deficit could reverse the expansionary effects of a government deficit.

Pure monetary policy initially affects only the asset market. However, U increases and i falls. Both these effects increase aggregate demand, and so unless there is a liquidity trap with respect to U monetary policy is unequivocally expansionary even when equation 1a is used. However, if entrepreneurial expectations are causing a falling U, monetary policy might be rendered ineffective. This is especially true if i has a lower bound. Since a continued deficit can render fiscal policy ineffective, conditions exist in which neither monetary nor fiscal policy by itself is sufficient. However, in no case does it appear that neither monetary policy, nor fiscal policy, nor some combination will be effective.

The synthesis model also shows that money does seem to be a unique asset with respect to its effect on output. This is demonstrated by comparing the effects of a change in the supply of money with a change in the supply of bonds. For simplicity, assume the narrow transmission mechanism of equation 1a. An increase in the supply

of money creates excess supply of money and excess demand for bonds. To create equilibrium i must fall but U may either rise or fall. If money and bonds were perfect substitutes, the increase in the money supply would increase the supply of money-bonds relative to capital and thus increase the price of capital relative to the price of commodities. If bonds and capital are perfect substitutes, the supply of bonds-capital relative to money falls which raises U. If money and capital are perfect substitutes, the supply of money-capital rises relative to bonds. If the return on capital is tied to the zero return on money, U remains the same. Therefore, it can be concluded that U can be expected to rise, since it is constant only in the most unlikely case. Therefore, the substitution effect is to increase output and employment. If the increase in money is an increase in base money, the wealth effect expands output even more.

The expansion of output is not so easily accomplished by changing the supply of bonds. As was pointed out in the discussion of fiscal policy, an increase in the supply of government securities may expand or contract output, because although wealth increases, U may either rise, fall, or remain constant. Therefore, it is possible that the wealth and substitution effects will move against each other. If the supply of bonds decreases, wealth falls but U may either rise, fall, or remain constant depending upon the asset substitutability assumption. Again, the ultimate effect on output is nebulous.

Clearly, the economy can be expanded by increasing the money supply and contracted by decreasing the money supply. This conclusion

does not as certainly hold for changing the supply of bonds. Therefore, in terms of its use as a policy tool, money is a unique asset.

Tobin (1969) has stated that the secret of the special role of money in economic policy is that it has a fixed rate of return, not that it is a means of payment or has any other intrinsic properties. Assume momentarily that money has a variable return and securities a fixed return. An increase in the money supply increases wealth and creates excess supply of money and excess demand for bonds. In the new equilibrium, U might rise or fall. If bonds and capital were perfect substitutes, U would remain constant. If money and bonds were perfect substitutes, U would rise. If money and capital were perfect substitutes, U would fall.

If the supply of bonds increases, wealth increases. U would remain constant if bonds and capital were perfect substitutes. U would rise if money and bonds were perfect substitutes and if money and capital were perfect substitutes.

The results when money bears the fixed return and the results when bonds bear the fixed return are symmetric. In the former, an increase in the money supply increases U under two substitutability assumptions, and leaves U constant under the third. A change in the supply of bonds increases U under one assumption, decreases U under another, and leaves U constant under the third. In the latter, an increase in the supply of bonds increases U under two substitutability assumptions and leaves U constant under the third. A change in the money supply increases U under one assumption, decreases U under another, and leaves U constant under the third.

Interestingly, when bonds have a fixed return and bonds and capital are perfect substitutes, neither increasing the supply of bonds nor changing the supply of money changes U. Therefore, outside of the wealth effect, no financial operation will effect output. When money bears the fixed return no financial operation will affect output when money and capital are perfect substitutes.

The results illustrate that the uniqueness of money is not simply that money rather than securities bears a fixed return. Instead, money is unique because it is the means of payment and therefore more "liquid" than either securities or capital. Because money is liquid, the likelihood that money and capital are good substitutes can be considered remote, but the likelihood that bonds and capital are good substitutes cannot. Therefore, one can conclude that it is improbable that monetary policy will be ineffective when money bears the fixed rate of return. However, when securities bear the fixed rate of return one must conclude that it is distinctly possible that "bond policy" will be ineffective.

It has already been stated that a major distinction between Keynesian and Monetarist theory is the transmission mechanism. In the synthesis model, both a broad, Monetarist like, transmission mechanism and a narrow, Keynesian like, transmission mechanism were examined. In no case did any conclusion change with the transmission mechanism used. It is true, that due to fluctuations in the interest rate, equation 1 makes monetary policy more effective and increases the likelihood that bond financed fiscal policy will be contractionary.

However, using equation 1a does not make monetary policy ineffective nor eliminate the contractionary possibility of debt financed fiscal policy. Differences in the transmission mechanism used create results which differ only in degree and not in kind.

The synthesis model has been used to examine the following points of contention between Keynesian and Monetarist theory: the effects of pure monetary and pure fiscal policy, the effects of the liquidity trap and changing entrepreneurial expectations, the uniqueness of money as a policy variable, and the significance of using a narrow or broad transmission mechanism. The results show that monetary and fiscal policy are both generally effective. However, continued deficit financing may offset the expansionary effects of a deficit, and falling entrepreneurial expectations might render monetary policy ineffective, as will a liquidity trap which places an upper bound on U. Money is a unique asset with respect to its effect on output, because it is the medium of exchange. None of the major conclusions of the synthesis model depend upon the use of either the Monetarist or Keynesian transmission mechanism given by equations 1 and 1a.

It is not proposed that the Keynesian-Monetarist debate has been settled. Indeed it would be presumptious to expect to be able to finally settle the issue. Hopefully a framework has been provided in which the participants can agree on what it is they disagree about.

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GLOSSARY

Definition of Major Variables in the General, IS-LM, Radcliffe, Patinkin, Tobin, Friedman, Brunner-Meltzer, and Synthesis Models

B_o = monetary base

B_2 = other sources of the monetary base

C = consumption

g_o = real government expenditures

I = investment

i = the rate of return on bonds

i_k = rate of return on capital

i_t = interest rate paid on bank deposits

K = stock on capital

M^I = stock of inside money

M^O = stock of outside money

N = supply of labor

n = net worth multiplier for the banking system

P = price of capital in terms of money

p = price of commodities, or output

R = expected real income from holding capital

S = stock of government securities

U = price of capital relative to the price of commodities

W = nominal wealth

W_H = human wealth

W_N = nonhuman wealth

w = nominal wages

Y = aggregate real income

Y^* = anticipated real income

$\P$ = expected rate of inflation

ρ = the real interest rate

Additional Variables in the Foley-Sidrauski and Woglom Models

a = per capita wealth in Foley and Sidrauski's model; wealth in Woglom's model

B = sum of the yields on all outstanding bonds

b = outstanding per capita stock of bonds

d = rate of change in the per capita national debt

e = government expenditures in Foley and Sidrauski's model

g = accumulated deficit in Foley and Sidrauski's model

G_c = the government's demand for consumption goods

$\frac{g}{m}$ = the debt money ratio

j_c = the price of equity in the consumer goods sector

j_k = the price of capital in the capital goods sector

j_c^* = the next period price of equity in the consumer goods sector

j_k^* = the next period price of equity in the capital goods sector

k = capital to labor ratio

k_c = stock of capital used in consumption sector

k_1 = stock of capital used in capital sector

M = supply of money

m = the real per capita supply of money

n = rate of growth of the population

N_c = labor employed in the consumption sector

N_I = labor employed in the capital sector

p_B = the price of bonds in this period

p_m = the price of money in this period

p_B^* = the expected price of money in two periods

p_m^* = the expected price of money in the next period

p_m^{**}= the expected price of money in two periods

q = total per capita output

q_c = per-capita output of consumption goods

q_I = per-capita output of investment goods

r = rental rate of capital in Foley and Sidrauski's model; the real rate of return on equity in Woglom's model

r_c = the expected rate of return on equity in the consumer goods sector

r_k = the expected rate of return on equity in the capital goods sector

r_B^* = the expected real rate of return on bonds

r_m^* = the expected real rate of return on money

t = nominal per-capita taxes in Foley and Sidrauski's model; the tax rate in Woglom's model

v = per-capita transfers

v_c^* = the expected marginal value product of equity in the consumer sector

v_K^* = the expected marginal value product of equity in the capital sector

y = disposable income

$¶_K$ = expected increase in the price of capital

$¶_m$ = expected rate of deflation

ρ_b = rate of return on bonds

ρ_K = rate of return on capital

ρ_m = rate of return on money