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The Monetary-Interest Rate Mechanism and Determinacy of the Price Level: A Restatement and a Critique of Prevailing Views

By

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The Monetary-Interest Rate Mechanism and Determinacy of the Price Level: A Restatement and a Critique of Prevailing Views

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The Problem

The monetary-interest rate mechanism involves the relationship between changes in the real rate of interest and changes in the stock of money, the demand for money, and in various expenditure functions. Today the mechanism, as usually formulated, suffers from internal contradictions that may leave the price level or nominal income indeterminate. The monetary/macro textbook literature, a venue in which the relationship is frequently discussed, is particularly schizophrenic, offering explanations that not only contradict other texts but also violate assumptions and analyses elsewhere in the same text. This is particularly discouraging since many of the leading economics texts are now written by the leading authorities in the field, rather than by those who are primarily pedagogues.

The literature relevant to this subject is widely scattered and needs to be freshly analyzed and specifically focused on the monetary-interest rate relationship. This I attempt to do using a simple model of one commodity and two financial assets. The commodity can be consumed or, when inventoried, held as a capital good. The financial assets are outside money and a single representative earning asset whose yield or rate of interest varies inversely with its price. The earning asset is an equity security whose real value is independent of the general price level and, in the aggregate, is a claim to all of the existing capital stock. All securities are held by households; the physical stock of capital, financed entirely through security issues, is held by firms; and both sectors hold cash balances. I abstract from changes in interest rates due to inflationary expectations; they can easily be incorporated into any hypothesized mechanism. A large part of the analysis focuses on the market for securities, since it is their price that establishes the interest rate. That market is sharply divided into stocks and flows, which keep their identity until they merge, which they do continually over time. The flow security demand maintains a constant link to saving and the model's ongoing production and income character, while flow security supply reflects investment and the continuing growth of the economy. Moneyflows, in both their stock and flow dimension, are carefully accounted for at all times.

The History

Prior to the publication of Keynes's *Treatise on Money* (1950)[1930], monetary and interest-rate analysis was carried out in the framework of the so-called "classical" model. Wicksell (1935)[1906] was the model's leading expositor. For him, the demand for

money is completely interest-inelastic. Investment and saving, both functions of the interest rate, act directly to determine movements in the market rate and are the only forces other than the banking system to do so. Implicitly, investment in a growing economy is financed entirely by an ongoing (flow) supply of newly-issued financial instruments or simply "new" securities. Saving, originating in current income, is an ongoing flow or "new" demand for securities, which themselves can be new or previously issued. Since the representative security is usually assumed to be a perpetuity, the distinction to savers between new and old securities is unimportant. The equilibrium interest rate, defined by the intersection of saving and investment, is known as the "natural rate."

In the *Treatise on Money*, Keynes carried Wicksell forward by assuming the existence of an interest-elastic demand for money. (In terms of the Hicks *IS-LM* framework, *LM*, vertical in the classical model, takes on a nonvertical positive slope.) The rate of interest enters the demand for money because the economy has developed to the stage where there are significant amounts of physical capital, the financial claims to which are wealthholding substitutes for money. These claims are thus a stock of previously issued or "old" securities. For Keynes, the dynamic significance of the old or existing-security market is that it dwarfs the total supply of new securities in any relevant time period. An increment of new securities is "but a trifling proportion" of the stock of existing securities and the "price of existing securities" does not "depend at all closely over short periods" on the increment (pp. 248-49). Increases in the market rate toward its natural level are thus effected through increases in the demand schedule for real cash balances in response to "bear" sentiments (p. 290). But this, and parallel "bull" sentiments, are hardly a reliable mechanism for pushing market rates in a particular equilibrating direction. Accordingly, Keynes, along with almost everyone else, later resorted to equilibrating changes in the price level or income, rather than psychological states, as the variable directly driving the demand for money and the market rate to their equilibrium.

Keynes's treatment of the monetary-interest rate mechanism in the *Treatise* was in fact inconsistent. While arguing in general that any new-security increment was too small to influence perceptibly the price and yield of securities, Keynes reverted to a pure classical or Wicksellian explanation of interest movements in his chapter on the "Modus Operandi" of bank-induced changes in the money supply (1950, chap. 13). Here banks can lower the market rate below the natural rate only so long as they are extending new loans. When the monetary expansion ceases, the market rate, determined now by saving and investment—the flow variables—moves *instantaneously* back to the natural level. This, of course, ignores the influence of the huge stock of existing securities held outside the banking system and to which Keynes had earlier attributed the predominant proximate force affecting the market rate.

One writer, R. S. Sayers (1938, chap. 10), argued that saving and investment, as security flows, acted directly on the market rate despite the presence of existing assets.¹ But the major younger theorist in the tradition of the *Treatise* was Lloyd Metzler (1951), who reasserted Keynes's assumption that the new securities market has a negligible direct

influence on the market rate.² For Metzler, any gap between desired saving and investment acts not on the securities market and the market rate, but on the goods market and the general price level or nominal income. Thus, if the market rate is below the natural rate, causing $I > S$, the resulting rise in prices lowers the real value of cash balances, inducing a shift out of existing securities in an effort to recoup the balances and thereby raising the market rate of interest. Hence, it is the price level and its effect on the value of real balances that equilibrates the market rate. Fig. 1 illustrates the relationship. The real rate of interest is r , real balances are M/P , and the demand for M/P is L . $I > S$ raises P from P' to P'' , lowers M/P from M'/P' to M'/P'' , and raises r from r' to r'' . The hidden assumption is that the loss of wealth due to the loss of real balances falls exclusively on the stock demand for securities, the complement of L . Thus, as pictured, L does not shift.

Following publication of the *General Theory* (1936), which extends the analysis of the *Treatise* to include changes in real income and output, Keynes provided the basis for a second interest-rate mechanism: changes in real income that impact on the demand for real balances. Thus, if once again we have $I > S$, any resulting increase in real, as opposed to nominal, income, shifts the liquidity preference schedule (the demand for real balances) to the right and the existing demand for securities to the left, thereby raising the market rate of interest. Keynes did not explicitly enunciate this sequence of events in the *General Theory*, but in response to D.H. Robertson's prodding (1936, pp. 180-83, 187-88), acknowledged that this was indeed implied by his analysis (1937a). Fig. 2 shows the relationship.³

I have previously referred to the impact of real income on the market rate, as depicted in Fig. 2, as the "income theory of interest" (Horwich, 1964, pp. 426-38). If we take income to be nominal, Py , where y is real income or output, then the term "income" captures the influence of both the price level and real output and can designate the relationships shown in both Figs. 1 and 2. In Fig. 1, we would place nominal balances M on the horizontal axis and replace L by $PL(y)$, which shifts upward in response to an increase in P or y .

The income theory, whether involving the price level or output, is almost universally accepted today. The graphs, as drawn, are indeed plausible, if not compelling. The difficulty, however, is that they portray static relationships, which, in a dynamic loanable-funds formulation, tend to disappear, leaving the direct effect of saving and investment as the only reliable, internally consistent interest-rate equilibrator. We shall demonstrate that in a stock-flow adjustment following demand-side (i.e., expenditure and monetary) disturbances, changes in nominal income that involve only the price level have no impact on the market rate other than to reverse temporary movements due to lags in the inflationary process. In terms of the money market diagram of Fig. 1, reproduced in Fig. 3, an increase in investment demand (not shown in the graph) raises the market rate of interest directly from point A to point B . Assuming that investment balances thus acquired are held momentarily by firms, the aggregate demand for money is shown as shifting to the right from L' to L'' , passing through point B . As the new investment expenditures are carried out, L returns to its former position and the assumed rise in

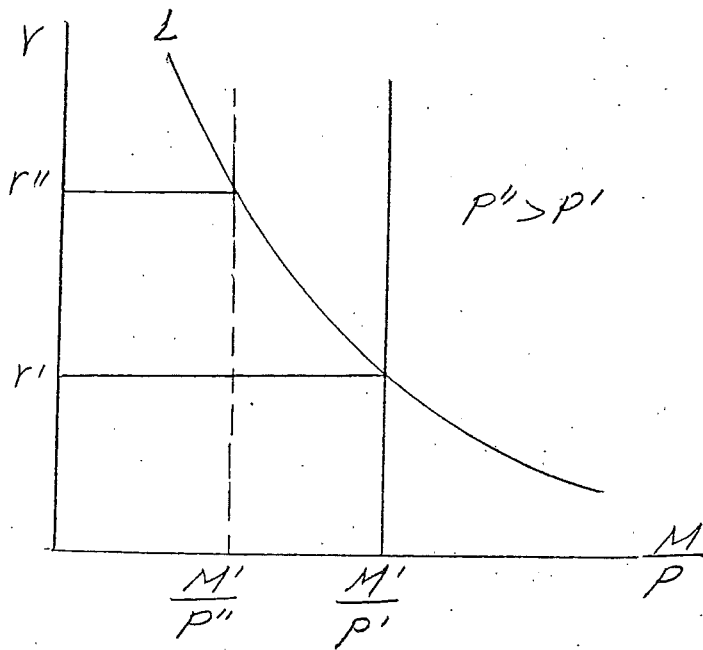


FIG. 1. The Impact of a Rise in the Price Level on the Market Rate of Interest

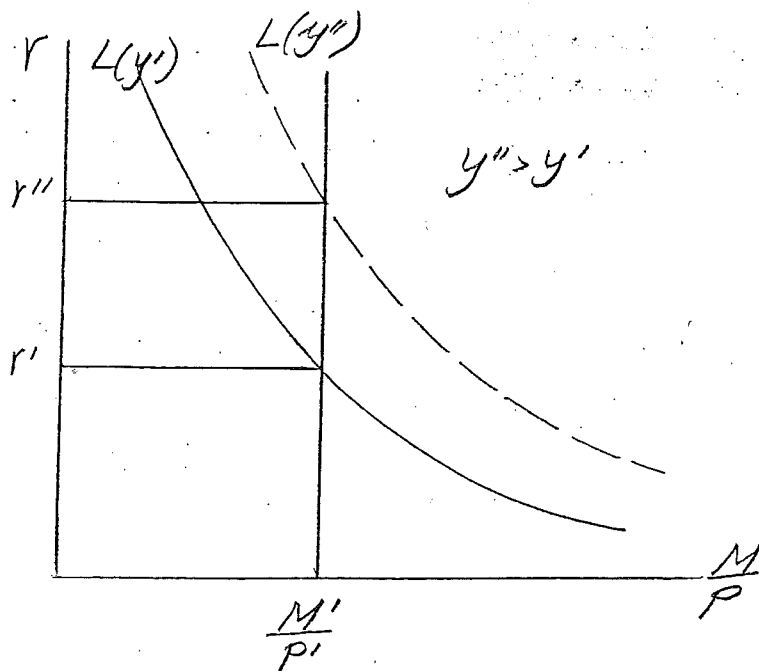


FIG. 2. The Impact of a Rise in Real Income on the Market Rate of Interest

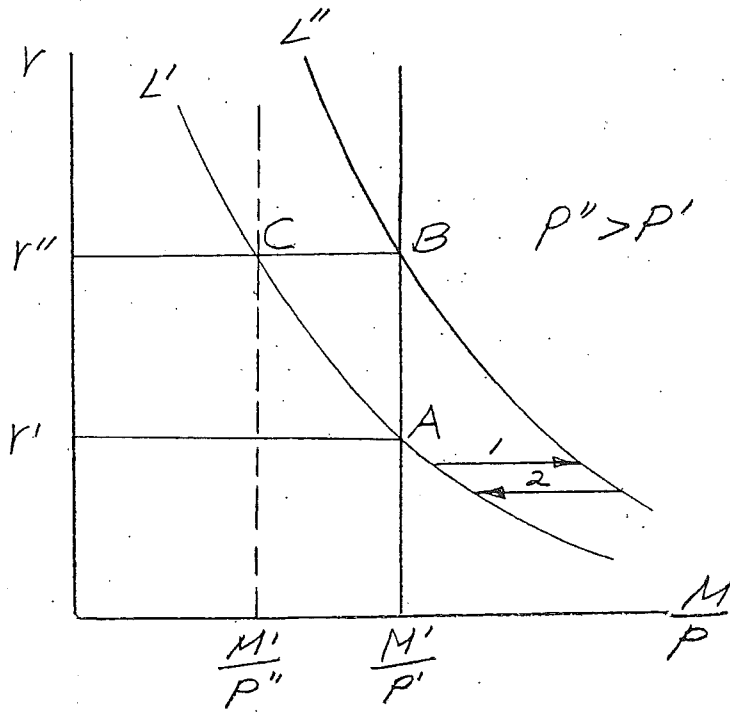


FIG. 3. Path Analysis of a Rise in the Market Rate of Interest

prices moves the money-market equilibrium from B to C , a path along which the market rate remains essentially unchanged.

If the rise in investment should induce a rise in *real* income, the expenditure will be preceded by the same upward vertical path, AB , along which it is financed. But the increase in real income will be accompanied by an increase in the capital stock and wealth, which causes a partially offsetting *fall* in the market rate. If the price level remains constant, the path determined by the income/wealth increment will be downward along the unchanged line, M/P' , starting at point B and ending at a point above A . Even though it partially reverses the initial rise in the market rate, the adjustment is not necessarily disequilibrating since it simultaneously lowers the natural rate (not pictured in the diagram). Finally, we will show that if the disturbance to the system is an *autonomous* change in the supply of output and real income unrelated to a prior demand-side stimulus, the market rate is indeed impacted by the autonomous price-level/real income changes in a roughly equilibrating fashion, but it still requires supplemental equilibration by the direct impact of saving and investment.

Almost every contemporary textbook treatment follows Keynes and Metzler and denies saving and investment a direct impact on the market rate unless the model is classical. The only clear exceptions to the trend are a money and banking text by Pesek and Saving (1968) and a macro text by Auerbach and Kotlikoff (1995), which, in a liquidity-preference model, assert forthrightly that shifts in saving and investment impact directly on the market rate of interest. The failure of the other texts to acknowledge that direct impact, however small, misses the proximate force acting on the market rate. It also leaves any excess of *ex ante* investment over saving due to an increase in investment or an open-market operation without an internally consistent source of financing, and the price level or nominal income indeterminate. Although other disturbances, such as autonomous increases in consumption, are financed directly by reducing saving (or by borrowing or, for briefer periods, by directly dishoarding cash balances), in general their net impact on P or P_y depends on the direct impact on the market rate of any resulting $S \neq I$.

Shortly after publication of the *General Theory*, Keynes acknowledged that his model had failed to provide finance for investment (and ultimately, by implication, for additional income) and so he offered a third interest-rate mechanism (his second) that would simultaneously supply the necessary funding. This was the "demand for finance" in which additional investment expenditures, while having no direct impact on the market rate, have an indirect effect by raising the demand for money needed to carry out the investment (1937a). In a later paper (1937b), Keynes added that any increase in expenditures, whether for investment, consumption, or government programs, must be preceded by an increase in the demand for money. I argued (Horwich 1966) that allowing an increase in the demand for money to raise the market rate while denying (or failing to acknowledge) that an *equal* increase in investment (or decrease in saving) can do so reduces to an absurdity: a *given* excess supply of securities can impact the interest rate only if the securities are seen as funding increased money holdings but not ongoing investment or other expenditures. I believe that this and other internal difficulties

discussed below completely undermine the demand for finance as a possible equilibrating mechanism. And although I cannot find any reference to it in modern (or older) textbooks, it retains support as a viable equilibrator in other literature (Tsiang 1956, 1980; Davidson 1965, 1994 [chap. 8]; Lucas 1982). Notice in Figure 3 that the rightward shift in the demand for money *followed* the increase in the market rate caused by the rise in investment demand (flow security supply) and had no further impact on the rate. An analysis of the post-Keynesian formulation of the demand for finance is offered in the section, "Keynes's Demand for Finance."

There is one circumstance in which Keynes's assertion that the market rate is moved, and perhaps dominated, by the old securities market at the expense of saving and investment has merit. That is if the money market is in disequilibrium—i.e., in the *IS-LM* diagram, the prevailing (y, r) combination is off the *LM* curve. As long as that is the case, equal and opposite shifts in *L* and the stock demand for securities, aimed at moving the market rate to *LM*, could play a significant role in the adjustment process. Saving and investment, however, would continue to be indispensable in moving the market rate and, thereby, output to the *IS-LM* intersection. This out-of-monetary-equilibrium adjustment is not, I believe, of great empirical importance. It is explored with reference to the loanable-funds/liquidity-preference debate in which it first arose.

We turn now to the basic stock-flow model and the process, involving both new and old securities, that is the heart of the adjustment mechanism.⁴

Specification of the Model

The model has two constraints, total wealth and total income. For households, real wealth is held only in the form of financial assets:

$$W = S_E + M_h/P \quad (1)$$

where S_E is the real discounted present value of the stock of pre-existing (or simply "existing") securities, all of which are equities held only by households, and M_h/P is the stock of households' real balances. P is the price of the model's single commodity. The real earnings per share is d , all of which are paid out fully as dividends, and S_q is the total number of shares outstanding. The total value of securities is thus

$$S_E = (d/r)S_q \quad (2)$$

The dividend per share is equal to

$$d = \{\rho K + r(M_f/P)\}/S_q \quad (3)$$

where ρ is the earnings on each unit of the total capital stock, K , held entirely by firms, and M_f/P are firm real balances each of which is assumed to earn a return valued at r . Upon substitution,

$$S_E = (\rho/r)K + M_f/P, \quad W = (\rho/r)K + M/P$$

$$\partial S_E / \partial r = \partial W / \partial r = -(\rho / r^2)K. \quad (4)$$

The stock of money is assumed to be exogenously fixed:

$$M = M'. \quad (5)$$

Household existing-wealth demands are

$$W = D_E + L_h, \quad (6)$$

where D_E is the pre-existing or stock demand for securities, L_h is the demand for real balances, and

$$L_h = L_h(y, r), \quad \partial L_h / \partial y > 0, \quad \partial L_h / \partial r < 0. \quad (7)$$

Upon substituting,

$$\begin{aligned} D_E &= W - L_h(y, r) = S_E + M_h/P - L_h(y, r) \\ &= (\rho / r)K + M_f/P + M_h/P - L_h(y, r) \\ &= (\rho / r)K + M/P - L_h(y, r) \end{aligned} \quad (8)$$

and

$$\partial D_E / \partial r = -(\rho / r^2)K - \partial L_h / \partial r \geq 0 \text{ or } < 0 \quad (9)$$

$$\partial D_E / \partial y = -\partial L_h / \partial y < 0. \quad (10)$$

Since W is not an argument of L_h , all independent wealth changes are assumed to fall on D_E :⁵

$$\partial D_E / \partial W = 1. \quad (11)$$

From (1) and (6), Walras' law for household existing assets is

$$D_E - S_E + L_h - M_h/P = 0. \quad (12)$$

We assume that the existing-asset market adjusts instantaneously to its equilibrium price and yield.

For assets held by firms, Walras' law is

$$K^d - K + L_f - M_f/P = 0, \quad (13)$$

where K^d , the stock demand for capital, is assumed always equal to the de facto stock, K . Hence $L_f = M_f/P$ also holds continuously. Although firms earn no income, they mediate all such payments and hold balances in proportion to it:

$$L_f = L_f(y), \quad \partial L_f / \partial y > 0. \quad (14)$$

Their demand for money is also a function of the level of investment spending, but I is not entered into (14) at this time for reasons explained in the section, "Keynes's Demand for Finance."

There is no government or foreign sector. The income constraint is thus

$$y = C + I \quad (15)$$

where consumption is

$$C = C(y, W), \quad \partial C / \partial y > 0, \quad \partial C / \partial W > 0 \quad (16)$$

and investment is

$$I = I(r), \quad \partial I / \partial r < 0. \quad (17)$$

The expression for saving is

$$S = y - C, \quad (18)$$

where

$$\partial S / \partial y = 1 - \partial C / \partial y > 0, \quad \partial S / \partial W = -\partial C / \partial W < 0, \quad (19)$$

and, from empirical evidence,

$$|\partial S / \partial y| > |\partial S / \partial W|. \quad (20)$$

Substituting saving into the income constraint, (15), we have the equilibrium condition:

$$S - I = 0. \quad (21)$$

Since r has been omitted from the consumption function, we also have

$$\partial S / \partial r = 0. \quad (22)$$

Finally, saving and investment, respectively, are wholly a flow demand (D_F) for, and a flow supply (S_F) of, securities:

$$S = S(y, W) = D_F, \quad I = I(r) = S_F, \quad (23)$$

which gives us a Walras' law for financial flows:

$$S - I + S_F - D_F = 0. \quad (24)$$

In reality, some part of saving might be added continuously to cash balances, shifting L_h constantly to the right and causing $dP/dt < 0$. At the same time, some portion of investment might be funded by reducing previously accumulated cash balances, shifting L_f to the left and creating $dP/dt > 0$. These two tendencies could be offsetting, but if not, would complicate the model without elucidating our main themes in any way. They would enlarge Walras' law for financial flows to include a constant change in the stock variables, L and M/P , causing them to increase if, as seems likely, the ongoing addition to cash balances by savers exceeds the drawdown of investing firms.

Whatever our specification of the flow functions, the crucial consideration is that we accord them their own Walras' law with respect to their financial character. Although saving and investment are both influenced by the level and composition of existing wealth, they exercise considerable autonomy—particularly with regard to their financial character—during adjustment processes. Our Walras' law for financial flows makes that explicit. Saving, as noted, derives its basic flow character from production and income, while aggregate net investment is sustained by assumed growth and constant technological progress.

Disturbances

We turn now to the process by which the market rate of interest, which equilibrates the total asset market, is brought to the level of the natural rate of interest, at which saving and investment, the flow security components, are individually in equilibrium. Although, to highlight the character of the adjustment, we describe it as a sequence of very brief, discrete intervals, the process may be thought of as proceeding continuously over time. Thus, following a spontaneous increase in investment demand and the natural rate, firms float new securities in excess of savers' demand, sell the excess issues to wealth holders (households) in exchange for cash balances at gradually rising market rates, and spend the balances on new investment projects, thereby returning the balances to households, on a more or less ongoing basis. Over time, the market rate rises smoothly to its new equilibrium level. The price level (and/or output) rises continuously by diminishing amounts, responding to the declining saving-investment gap, the excess supply of new securities, and the subsequent transfer of balances from households to firms.

An Increase in Investment

We show the adjustment process in Fig. 4, where the markets for saving and investment, flow securities, pre-existing securities, and real balances are all initially in equilibrium at an interest rate r_N' and real income y' . At the opening instant of a brief

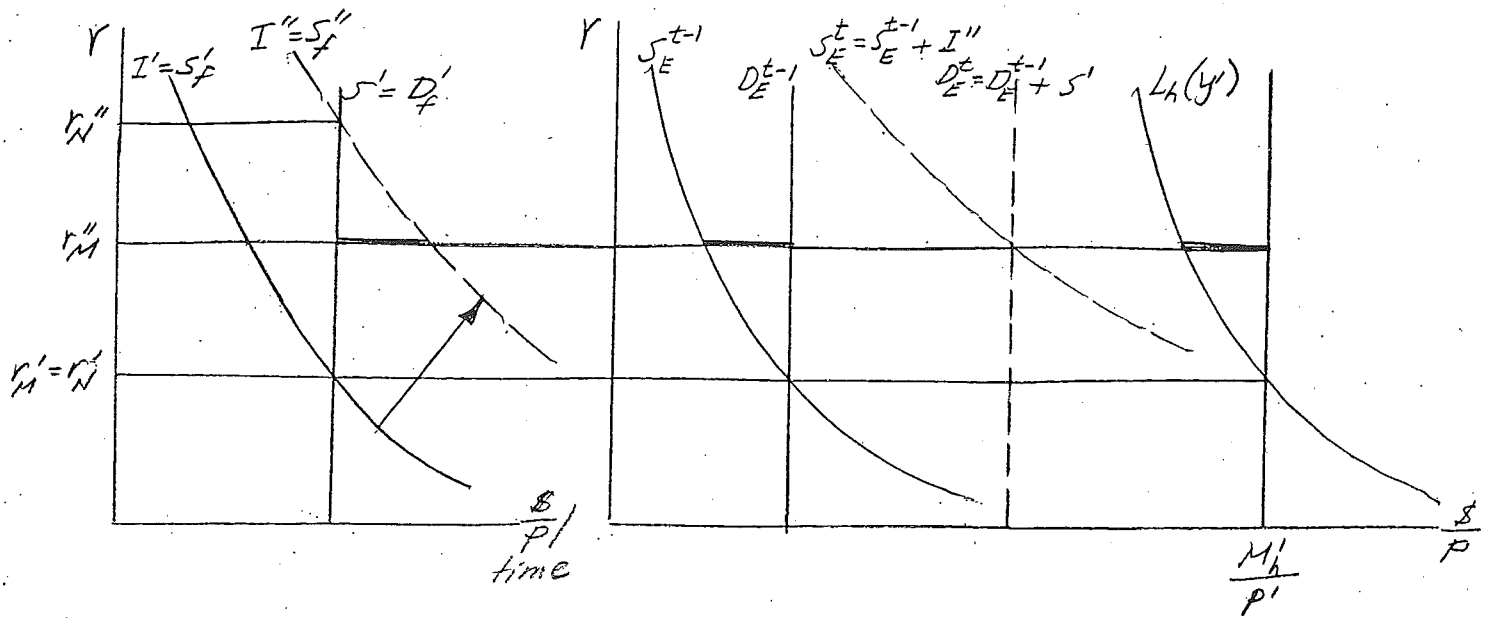


FIG. 4. The Interaction of Stock and Flow Asset Markets in an Initial Interval Following an Increase in Ex Ante Investment

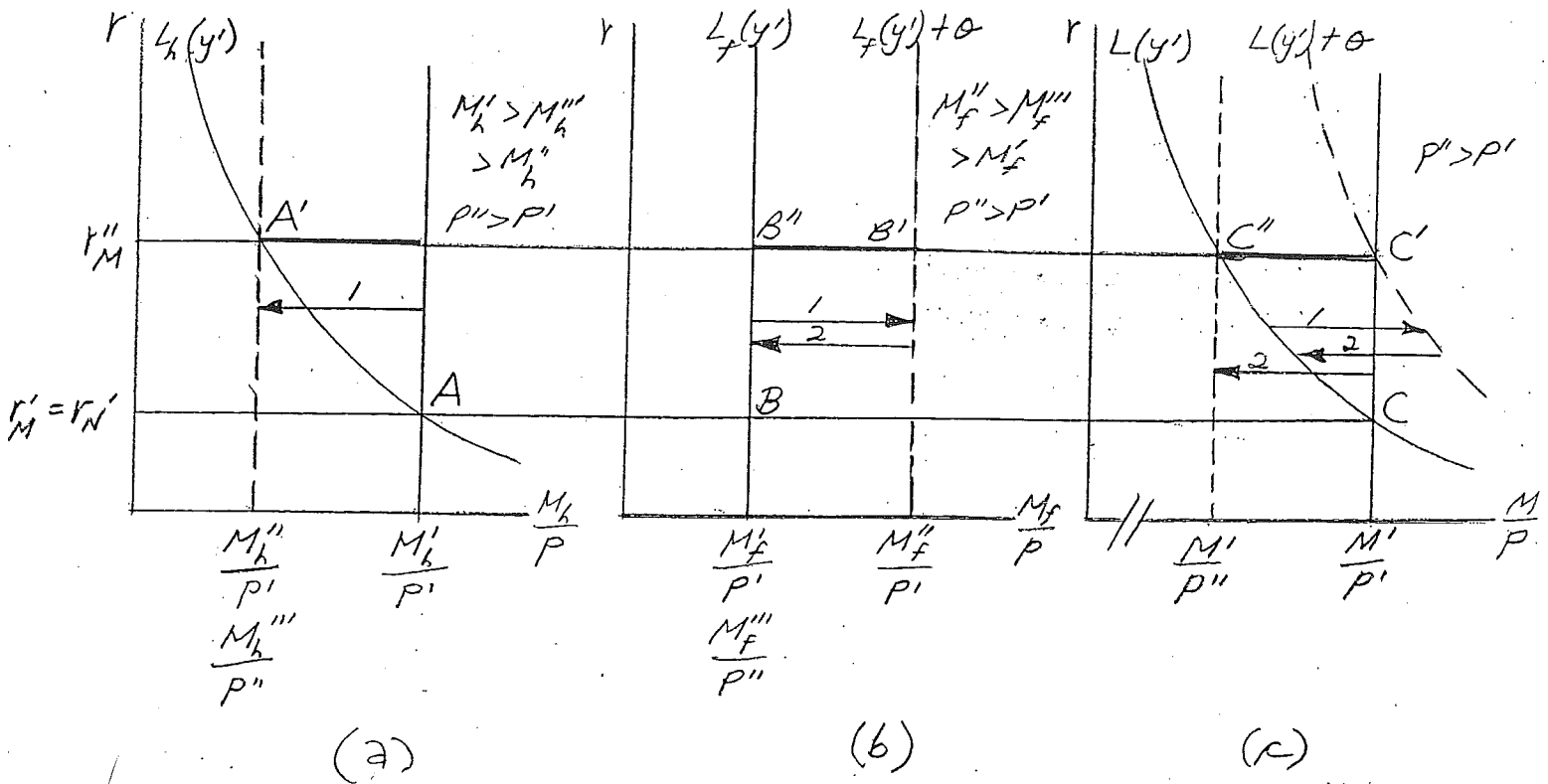


FIG. 5. The First-Interval Adjustment in the Money Market Following an Increase in Investment; the Price Level Variable, Output Fixed: (a) Households, (b) Firms, (c) Total

interval t , the investment schedule and its flow-security counterpart shift spontaneously from I' to I'' and from S_F' to S_F'' , respectively, raising the natural rate from r_N' to r_N'' . The latter is above the initial market rate, $r_M' = r_N'$, which, for the moment, still prevails. During the interval the stock and flow security markets merge with the addition of $S_F'' = I''$ to S_E^{t-1} and of $D_F' = S'$ to D_E^{t-1} . The merger raises the market rate because at the beginning interest rate, $I'' > S'$ in financial terms is an excess of securities being issued by firms over those that households wish to purchase out of current saving. This excess flow supply of securities depresses the price of securities, raising the market rate of interest. The rise in the market rate simultaneously creates an excess quantity demand for securities on the part of pre-existing asset holders and, by Walras' law for stocks [(12)], an equal excess supply of real balances. The rise continues until the excess stock-security demand is exactly equal to the excess flow-security supply. Thus, at the close of the interval, the interest rate r_M'' is one at which

$$\begin{aligned} I''(r_M'') - S'(r_M'') &= S_F''(r_M'') - D_F'(r_M'') = D_E^{t-1}(r_M'') - S_E^{t-1}(r_M'') \\ &= M_h'/P' - L_h(y', r_M'') > 0, \end{aligned} \quad (25)$$

as shown in Fig. 4 by the equal boldface horizontal segments.

Households' de facto holdings of money are reduced by the desired amount when, during the merger process, existing-asset holders spend their excess balances on the excess new securities. The money is thereby transferred to firms, who have now obtained financing for their intended higher investment outlays.

We shall describe the events occurring in the money market in more detail. But notice first that the market rate of interest has risen prior to any increase in income or the price level. Only a portfolio adjustment has occurred, with firms offering additional securities at a lower price and higher yield, inducing households to buy the securities in exchange for cash balances and to carry on given expenditures in the future with lower average money holdings.⁷

Fig. 5(a) and Fig. 5(b) picture the demands for real balances by households and firms, respectively, and the real stocks held by each. Firm demand is a vertical schedule coinciding with the line representing firm holdings of real balances. The sectoral demand schedules are summed to form the total demand in Fig. 5(c). The initial values of the interest rate, the price level, the investment level, and real income are r_N' , P' , $I'(r_N')$, and y' , respectively. At these levels the quantity of real balances demanded and held by households is $L_h(r_N', y') = M_h'/P'$, the quantity demanded and held by firms is $L_f(y') = M_f'/P'$, and the total quantity demanded and held is $L(r_N', y') = M'/P'$, where $L = L_h + L_f$ and $M' = M_h' + M_f'$. The letters A , B , and C denote the initial points of equilibrium in the respective panels.

During the first adjustment period the interest rate rose to r_M'' as firms issued securities to finance additional investment. We assume that when firms plan new

expenditures, they temporarily raise their demand for money from $L_f(y')$, to $L_f(y') + \theta$. The quantity θ is equal to the anticipated new investment outlay and to the sectoral transfer of balances from households to firms:

$$\theta = I''(r_M'') - S'(r_M'') = M_h'/P' - M_h''/P' = M_f''/P' - M_f'/P'. \quad (26)$$

In Fig. 5(a) the household equilibrium point moves along the demand schedule $L_h(y')$ from A to A' , and in Fig. 5(b) the firms' equilibrium moves from B to the momentary equilibrium at B' . The increase in L_f is reflected in Fig. 5(c) as an equal shift of the total demand from $L(y')$ to $L(y') + \theta$, the point of equilibrium moving vertically from C to C' . The total stock of real balances M'/P' is, of course, unchanged. The quantity θ is represented in each figure by the boldface horizontal segment.

Firms are assumed to carry out their investment expenditure in the instant following the first adjustment interval. That expenditure can be characterized as a direct shift from money into currently produced commodities. The shift is reflected in our money market panels in a tendency for firm balances to return to their original level and for nominal balances to be restored to households as factor payments. The net movement of these variables depends on the degree to which the expenditure raises prices and total output.

Prices Variable, Output Fixed

Suppose first that the impact of the investment outlay is on the price level only, which rises from P' to P'' , while total output, including real investment ex post, remains constant. In this case L_f in Fig. 5(b) returns exactly to its initial position, since θ goes to zero and y is unchanged at y' . But not all of the nominal balances received through the excess security issues are returned to households since firm *nominal* demand for money rises along with the price level and nominal income. While at the new equilibrium point B'' , firms' *real* holdings are $M_f'''/P'' = M_f'/P'$, the closing nominal balances stand in the relation $M_f' < M_f''' < M_f''$, and for households are $M_h' > M_h''' > M_h''$. Meanwhile household real balances in Fig. 5(a) are unchanged at the level $M_h'''/P'' = M_h''/P'$ since, with output fixed, any balances received by households as income stimulate a proportionate (and presumably immediate) rise in the price level. The equilibrium point remains A' . In the total money market in Fig. 5(c) the shift of L_f , as investment is undertaken, is reflected in an equal leftward shift of the total demand schedule from $L(y') + \theta$ back to $L(y')$. Since household real balances are constant during the investment expenditure, total real balances are reduced by an amount equal to the reduction of firm balances: $M'/P' - M'/P'' = M_f''/P' - M_f'''/P''$. From an aggregate point of view, one can simply say that in the money market the investment outlay by firms—the movement from money into commodities—is manifested in an equal leftward shift of the demand for, and the supply of, total real balances. The reduction in the real stock of money is caused directly by the reduction in the demand for the stock, with the result that the

components fall equally and synchronously and thereby provide no tendency to alter the market rate of interest. The money-market equilibrium moves horizontally from C' to C'' .

Fig. 6 summarizes the adjustment graphically in terms of excess-security stock and flow supply functions. The initial equilibrium is given at $r_M' = r_N'$ by the intersection of the schedules $I'(r_N') - S' = S_F' - D_F'$ and $M_h'/P' - L_h(y) = D_E^{t-1} - S_E^{t-1}$. In the first adjustment interval $I'' - S' = S_F'' - D_F'$ intersects the beginning-period excess stock supply at r_M'' as previously described. When the transferred balances are spent and prices rise to P'' , the household real-balance excess-supply function shifts leftward to $M_h''/P'' - L_h(y)$, intersecting the vertical axis at the unchanging market rate r_M'' . (Since D_E and S_E were equal at the close of the stock-flow adjustment, as shown in Fig. 4, they remain equal during the expenditure phase because L_h does not shift.⁸) The adjustment continues in a like manner with the excess-supply real-balance function intersecting the fixed $I'' - S'$ flow function at successively higher interest rates and shifting, after each interval, back to the vertical axis until the market rate reaches the equilibrium (natural) rate r_N'' . In the final equilibrium, the price level is P'' , where $M_h''/P'' = L_h(y', r_N'')$.

Prices Fixed, Output Variable

The case where prices are constant at P' and output rises from y' to y'' , reflecting the increase in investment, is illustrated in Fig. 7. Returning to our period analysis, the reversal of the temporary θ rise in firm demand for real balances again tends to shift L_f back to its original position. But now the rise in real income is associated with both a higher firm and household demand for real balances. Instead of describing the individual sectors first, it is more convenient to begin with the total money market in Fig. 7(c). Here we see in static terms that with prices and hence total real balances assumed constant, the final point at the end of the interval generated by the investment expenditure must lie along M'/P' , as do points C and C' . Thus the shift of L to the left as θ goes to zero is met by a shift to the right as y increases, producing a final schedule, $L(y'')$, intersecting M'/P' at C'' . $L(y'')$ lies in the indicated intermediate position because as L attempts to shift from $L(y') + \theta$ back to its initial position $L(y')$, real income y rises by a maximum of θ while L increases by a fraction of that amount since $\partial L_h / \partial y < 1$ ($\partial L_h / \partial y \geq 1$ would imply, implausibly, that additional balances received as income generate no additional expenditures). At C'' the interest rate is r_M''' , which, given that income and L are higher than initially, is above the beginning yield r_M' (i.e., the Hicks LM curve is upward-sloping). But it is below r_M'' , the yield created during the stock-flow interaction. This is a fact best explained by reference to the wealth changes occurring in the existing-asset market.

The return of real balances, via firm investment expenditure, to households is an increase in household wealth equal to the increment in new capital goods (which, in a macro perspective, supports the earlier increase in the value of excess new securities purchased by households). The balances are also equal to the simultaneous rise in output and real income. For an individual household, the receipt of balances-as-income

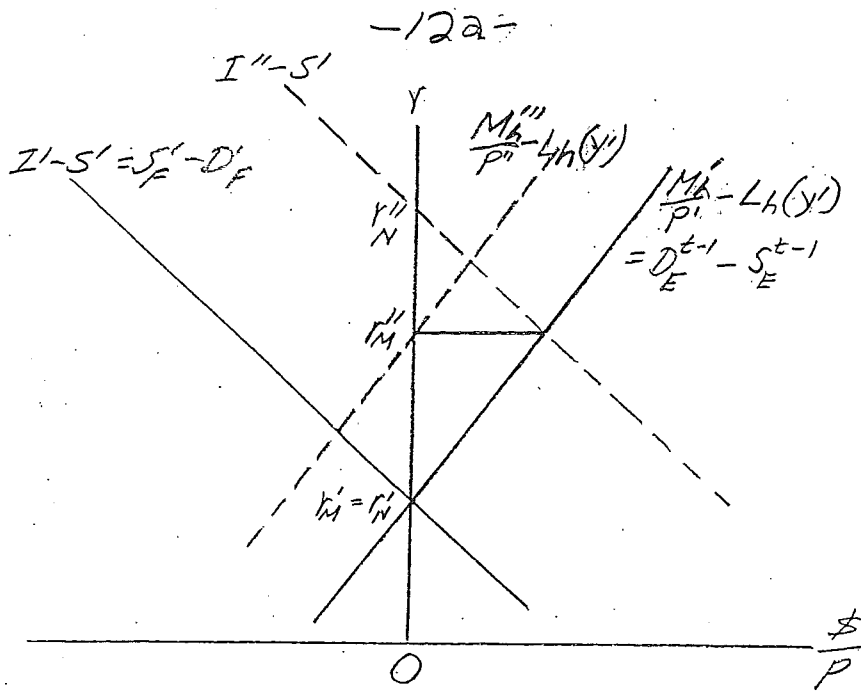


FIG. 6. The Adjustment Process in Terms of Excess-Security Stock and Flow Functions

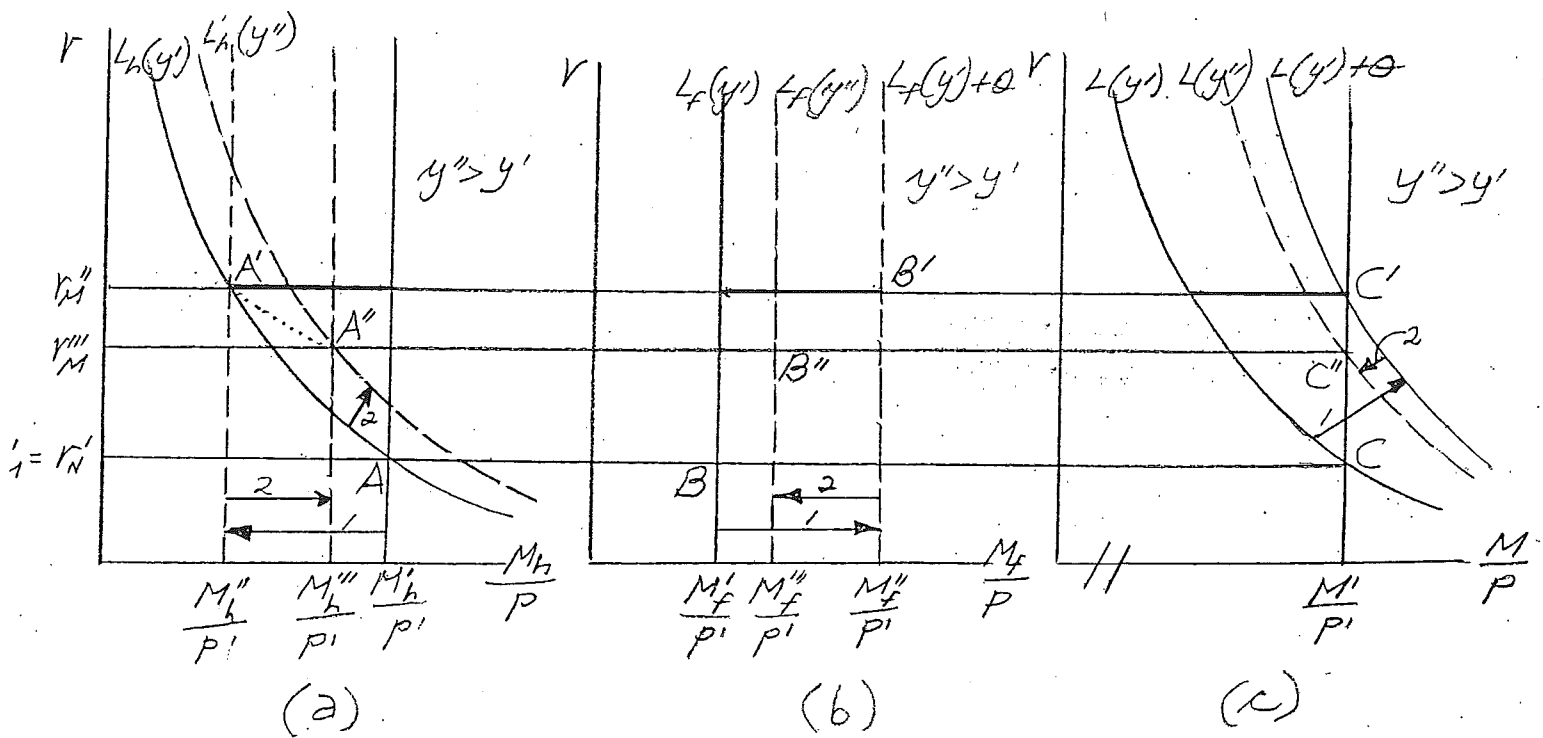


FIG. 7. The First-Interval Adjustment in the Money Market Following an Increase in Investment; the Price Level Fixed, Output Variable: (a) Households, (b) Firms, (c) Total

generates an expenditure pattern over a typical income interval that leaves their average level somewhere between the beginning and ending levels. Adjusted downward for transactions costs, the increment in the average level of balances is the limiting amount of monetary wealth available during the interval for raising D_E (shifting it to the right), manifested as an instantaneous expenditure on the stock of existing securities.⁹ This is the force driving down the market rate of interest from r_M'' to r_M''' . Since there is only one stock of money held by households in the aggregate, even though it performs dual functions (transactions and wealth holding), the shift of D_E is reflected in an opposite shift in $L_h(y'')$ [(10)], which passes through C'' , as noted above.

The effect of the return of balances on the aggregate of all households is diagrammed in Fig. 8, which shows the impact on both money and security holdings. The household money market omits the transfer of funds to firms occurring at the beginning of the interval. The return of balances at the close of the interval raises holdings from M_h''/P' to M_h'''/P' , which is an increase in real income to which $L_h(y)$ shifts by a smaller amount from $L_h(y')$ to $L_h(y'')$. The equilibrium moves downward from point A' to A'' , and the market rate from r_M'' to r_M''' , as noted above. The direct action on the market rate occurs in the existing-security market where D_E^{t+1} , which prevails at the close of the interval, shifts rightward by $(M_h'''/P' - M_h''/P') - [L_h(y'') - L_h(y')]$. This shift in D_E may seem to contradict our claim above that the real balances received and spent as income would, because of their turnover, leave a smaller average amount on hand for expenditure on existing securities. That was true for an individual household, not for the aggregate of all households shown in Fig. 8. In that representation, money spent by a household during an income interval is received by other households; all money is held by the sum total of all households at all times.

We complete our description of the first adjustment interval by allocating the net increase in L , relative to its starting position, to both firm and household sectoral demands for money. The sectoral schedules respond to the increase in output in accordance with their respective income coefficients. In the firm sector, in Fig. 7(b), the final demand schedule is $L_f(y'')$, lying between $L_f(y') + \theta$ and $L_f(y')$. Thus as firms apply the θ quantity of real balances to investment expenditure, the resulting rise of aggregate output raises their transactions demand for balances. Since firms earn no income, this increment to demand is financed by security sales. We can assume, in fact, that in the first instance some portion of new securities issued by firms is earmarked to finance both the purchase of new capital goods and the holding of cash balances needed to service those purchases. The final quantity of firm nominal balances is the indicated amount M_f''' . The closing point of the interval, at the interest rate r_M''' , is B'' . Households, in Fig. 7(a), as in Fig. 8, complete the interval with balances, including those received as incremental factor income, equal to M_h''' , a quantity intermediate between beginning and post-transfer amounts. The final point A'' lies on the greater demand schedule $L_h(y'')$ and is reached along the dotted path from A' to A'' traced along rightward shifting L_h schedules. The sectoral supplies and demands sum to the totals already described in Fig. 7(c).

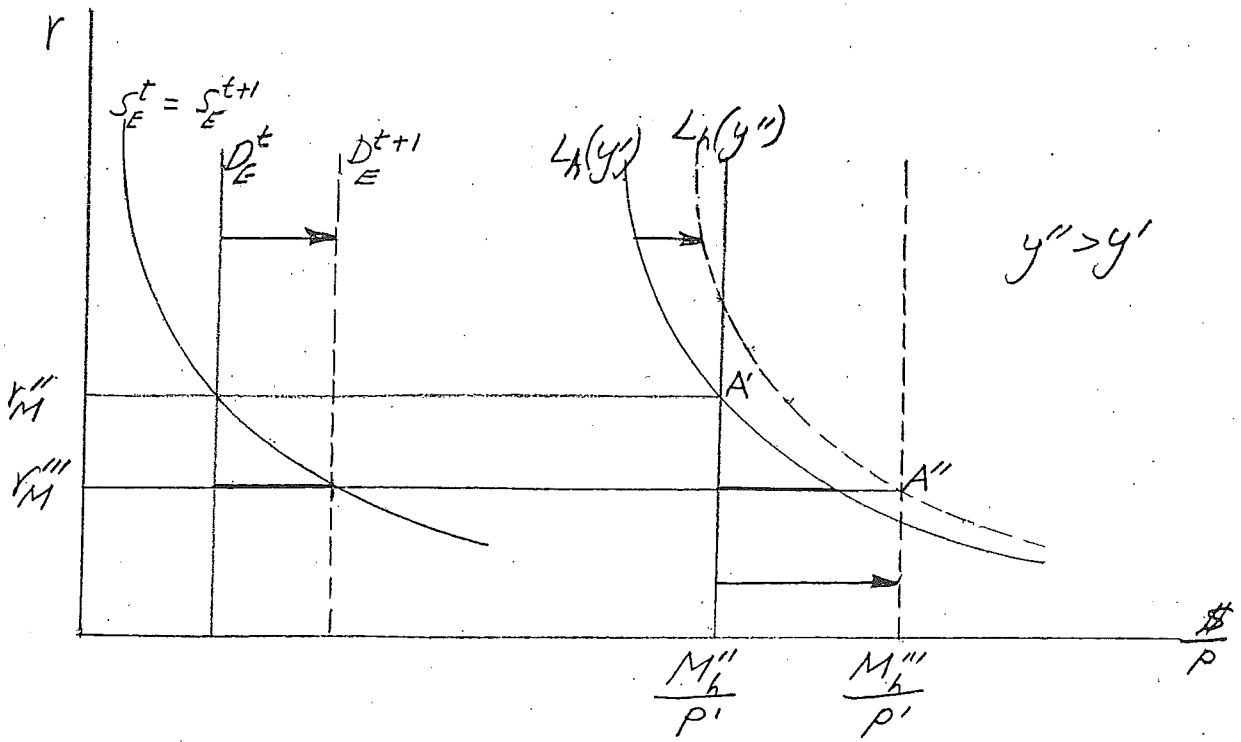


FIG. 8. The Existing-Asset Market Following an Increase in Investment and the Return of Balances to Households at the Close of the First Adjustment Interval; the Price Level Fixed, Output Variable

In terms of Fig. 6, at the close of the first interval the excess stock security-supply function, intersecting the vertical axis at r_M'' , would shift rightward, meeting the axis at a market rate $r_M''' < r_M''$. At the same time the excess flow function, $I'' - S' = S_F'' - D_F'$, falls vertically as S rises from $S(y', W')$ to $S(y'', W'')$ (see [19][20]) and the natural rate falls to $r_N''' < r_N''$. The events described in Fig. 7 thus continue through a sequence of intervals in which the price level is constant, the market rate gradually rises—though less in any period than if real income were constant—and the natural rate falls until they meet each other.

An Increase in Saving

The analysis is readily applied to other disturbances, but those involving a deflationary or contractionary adjustment of the economy are not simple mirror images of expansions. Consider an autonomous simultaneous increase in saving and decrease in consumption. As shown in Fig. 9, this creates $S'' > I'$, which is an excess flow demand for securities, $D_F'' - S_F' > 0$. This excess demand spills into the existing-asset market where, by bidding up the price and reducing the yield to, say, r_M'' , it is spent on an equal excess supply of pre-existing securities, which in turn is equal to an excess demand for real balances:

$$\begin{aligned} S''(r_M'') - I'(r_M'') &= D_F''(r_M'') - S_F'(r_M'') = S_{E^{t-1}}(r_M'') - D_{E^{t-1}}(r_M'') \\ &= L_h(r_M'') - M_h/P' > 0. \end{aligned} \tag{27}$$

Asset holders want to add the receipts from existing-security sales to cash balances, raising their average level relative to given expenditure levels. But since the shift from consumption to saving to old securities to cash balances occurs entirely within the household sector, bypassing firms, the act of hoarding will tend to reduce firms' sales and households' subsequent inflow of real balances as current income. The circular flow is maintained, however, when, with output fixed, the decrease in consumption (increase in saving), accompanied by an excess demand for real balances, causes the price level to fall. The fall in prices then raises real balances until they exactly fill the gap (the third bold-face segment in Fig. 9) between the beginning-period level, M_h/P' , and, as shown in Fig. 10, the desired level at the end of the period, $L_h(y', r_M'') = M_h''/P''$, where $M_h'' > M_h'$ and $P'' < P'$. Household balances are greater because firms find that as the price level and their nominal receipts from sales of consumption goods fall, they can maintain their unchanged desired real balances with $M_f'' < M_f'$, where $M_f''/P'' = M_f'/P'$.

Notice that while the fall in P plays an enabling role in meeting the excess demand for balances at r_M'' , it cannot be credited with lowering the market rate. If excess savers, instead of purchasing additional securities and reducing the market rate, had transferred their balances directly into hoards, P would again have fallen, but L_h and M_h/P would have shifted to the right by equal amounts, leaving the market rate unchanged at r_M' .

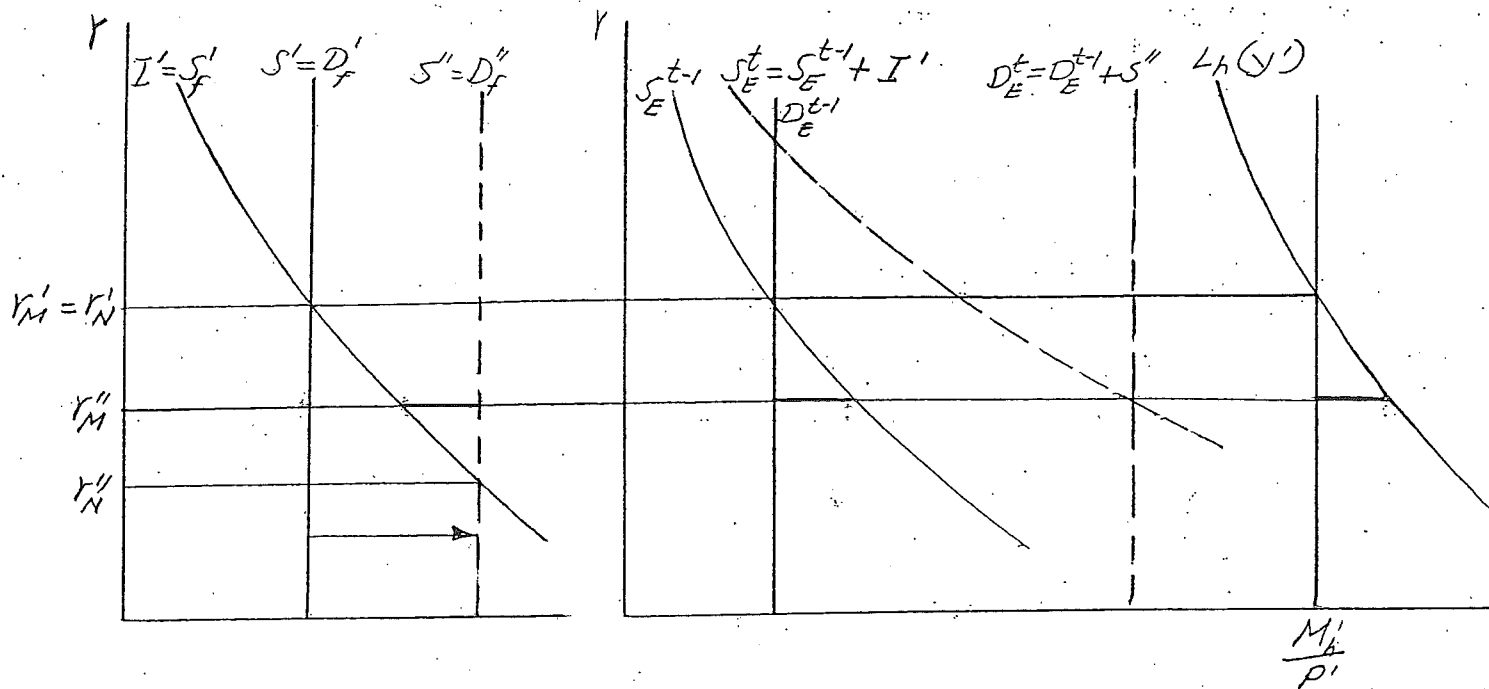


FIG. 9. The Interaction of Stock and Flow Asset Markets in an Initial Interval Following an Increase in Ex Ante Saving

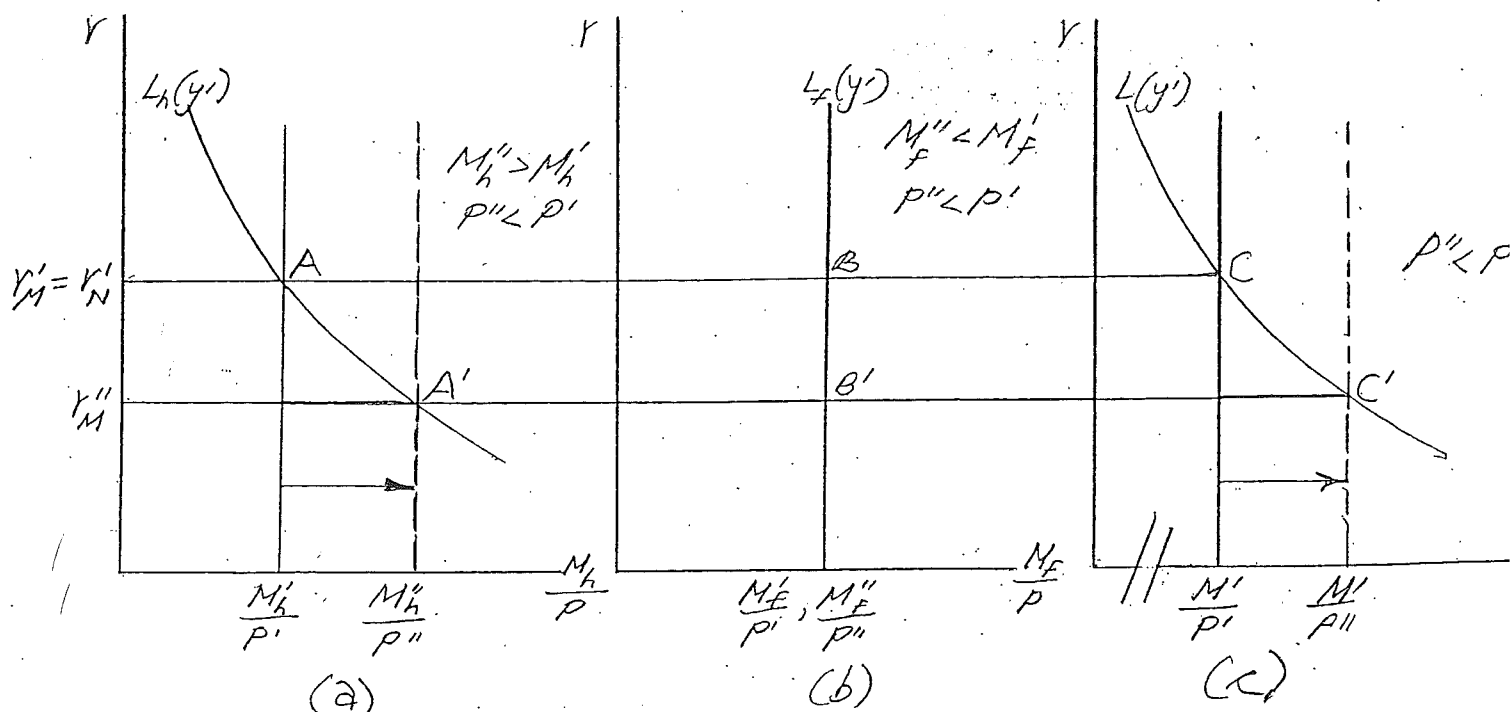


FIG. 10. The First-Interval Adjustment in the Money Market Following an Increase in Saving; the Price Level Variable, Output Fixed: (a) Households, (b) Firms, (c) Total

The adjustment continues through additional periods until the market rate has fallen to the level of the new natural rate, r_N'' , at the intersection of S'' and I' . In the new equilibrium the price level will be $P'' = M_h'/L(y', r_N'')$.

In the event that the price level is fixed and output is variable, the expenditure of excess savers' balances on old securities is simultaneously a reduction in effective demand, which reduces aggregate output and real income to y'' . In monetary terms, hoarding occurs—i.e., following excess savers' purchases of existing securities and the fall in r_M , desired and de facto average balances in portfolios rise in relation to expenditure levels. As a result, monetary velocity is lower, the circular flow shrinks, and households experience a reduced inflow of real (and nominal) balances during any period—a loss of both income and wealth. In terms of the total money market in Fig. 11(c), the final equilibrium must lie along the M'/P' line, since the total stock of both nominal and real balances is constant. In static terms, the loss of income would reduce the transactions component of L_h' and tend to shift that schedule and thus L downward to pass through r_M'' , the yield created directly by the excess saving. But by (10) and (11), the simultaneous loss of balances-as-income and as wealth shifts D_E leftward and L_h rightward, raising the market rate to r_M''' , where $r_M' > r_M''' > r_M''$. In response to the net loss of balances as income and wealth, L_h (and thus L) end up to the left of their initial positions, intersecting M_h'/P' (and M'/P') at r_M'' , as shown in Figs. 11(a) and (c).

Since income is down, firms' desired balances fall to $L_f(y'') = M_f''/P' < M_f'/P'$. The new level is reached automatically as firms' receipts from sales of consumption goods fall off, partially offset by increased investment demand in response to $r_M''' < r_M'$.¹⁰ Finally, since income, on net, has fallen, S will shift leftward, raising the natural rate and reducing the saving-investment gap to some degree. We assume this response occurs at the close of the interval, bringing the economy somewhat closer to equilibrium at the start of the next period.

An Increase in the Stock of Money

An instantaneous increase in the stock of money from M' to M'' through a central bank's open-market purchase of pre-existing securities would reduce the market rate from $r_N' = r_M'$ to r_M'' .¹¹ The ensuing adjustment would resemble that following increased investment, except that, in the final equilibrium with output fixed, interest returns to r_M' and prices rise to P'' at which $M''/P'' = M'/P'$. If the central bank were to maintain r_M at r_M'' by buying all excess flow securities forthcoming at r_M'' after the initial purchase, $I' - S'$ would be financed directly by a continuous, constant increase in real balances.

If the bank were to continue to increase the stock of money by a fixed percentage over time, the adjustment process would gradually fix the real market rate at some level below the natural rate. To show this, we assume that the bank carries out an instantaneous open-market purchase at the beginning of each successive period. We assume L is log

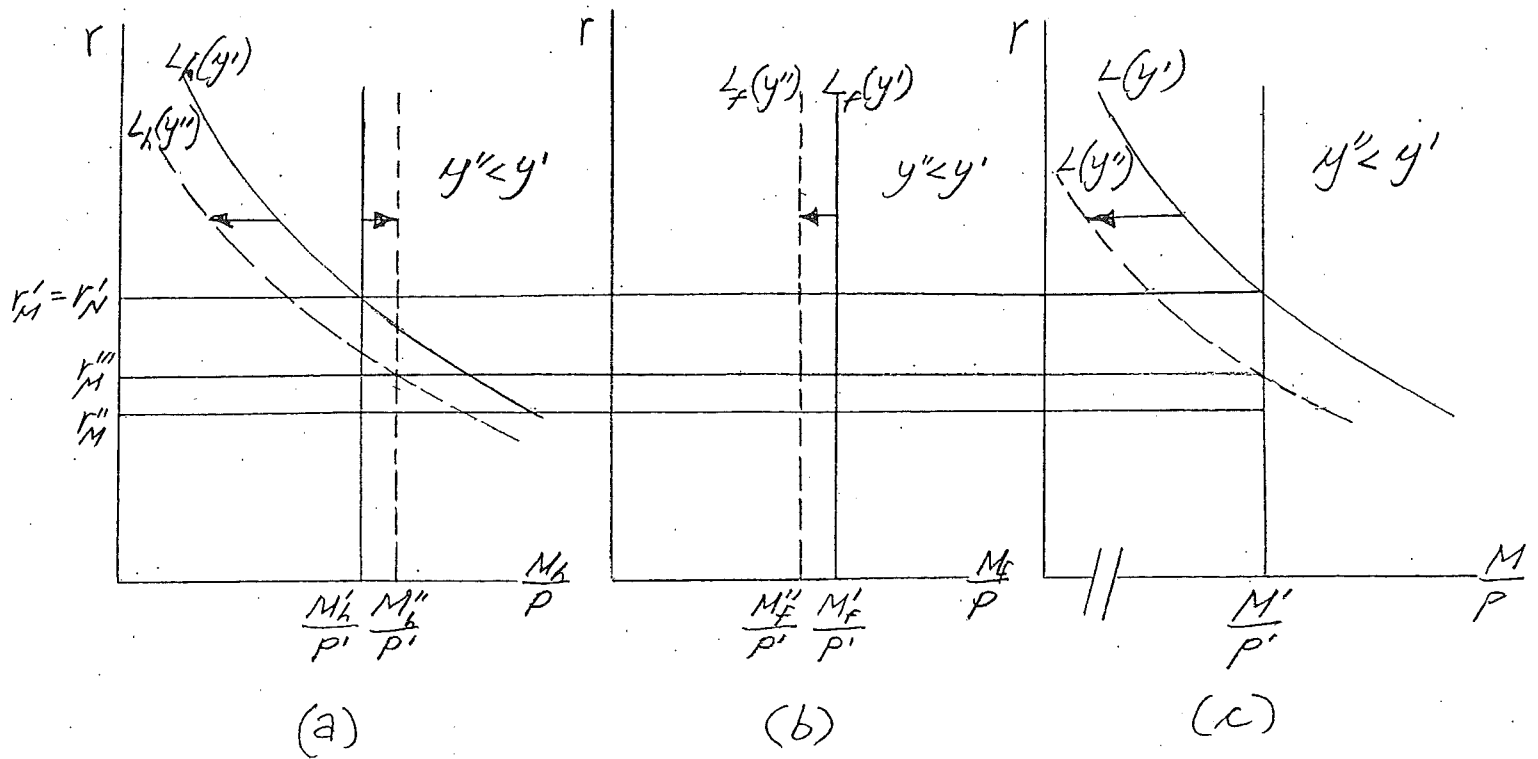


FIG. 11. The First-Interval Adjustment in the Money Market Following an Increase in Saving; the Price Level Fixed, Output Variable: (a) Households, (b) Firms, (c) Total

linear in r , so that the constant percentage increase in money lowers the market rate by a constant absolute amount. During each period, however, the fall in the market rate is partially reversed by an excess flow-supply of securities, which funds excess investment expenditures. Over time the reversal grows since $I - S = S_F - D_F$ increases as r_M falls. Thus, while the bank's given periodic reduction in r_M is constant, the *net* reduction in any period diminishes as r_M falls and $I - S$, the underlying source of the reversal, grows. Eventually the purchase will be met by an exactly equal level of $I - S$, the security counterpart of which raises r_M exactly as much as the bank lowers it. In the moving equilibrium, the market rate is constant, the stock of money grows at a fixed rate, the bank's injections feed directly into additional expenditures, and—with output fixed (or on a fixed trend)—the price level rises proportionately.

The same mechanisms operating on the interest rate in a single period prevail when the purchase is repeated over a sequence of periods. At no time does the price level or income equilibrate the market rate. And the analysis is essentially unchanged if we replace the period analysis with a purchase that is continuous over time. The bank will then buy new and old securities simultaneously. The market rate will gradually fall and $I - S$ and the excess flow supply of new securities will increase until they are exactly equal to the magnitude of the bank's purchase.

The paths of money and prices are shown in Fig. 12. The shift from a fixed stock of money to a constant growth rate begins at time t_0 . P rises by gradually increasing amounts as $I - S$ and $S_F - D_F$ increase, financing increasing levels of investment spending. At time t_n the market rate is stabilized and the bank's entire purchase goes into new securities and investment; M and P rise at the same rate. At time t_{n+j} the purchase is assumed to end and money again is constant. From t_{n+j} until t_{n+j+i} the market rate rises gradually to the level of the unchanged natural rate. During the i th interval funds from the existing-asset market are transferred to investing firms, but at a diminishing rate as the market rate increases. The price level also rises at a decreasing rate until t_{n+j+i} when it is again constant.

A Qualification: Stability

James Witte (1967) argued that the stock-flow financial analysis of an increase in investment is valid only if the excess new securities successfully fund an increase in the real capital stock. Since, in the context, an increase in capital would have resulted from an excess of I over S , the capital increment is characterized as "forced saving." In the absence of forced saving, Witte claimed, the rise in the market rate during the adjustment would later be reversed.

I replied (Horwich 1967) that without forced saving, the value of the excess security issues (or an equi-proportionate fraction of all outstanding securities) would indeed fall to zero and simultaneously total wealth would decline. I had assumed (Horwich 1957, pp. 629-30; 1964, pp.32-33), however, that all autonomous wealth changes fall exclusively on the stock demand for securities [(11)]. In that event, the loss of security value causes S_E and D_E to shift equally to the left, their intersection remaining

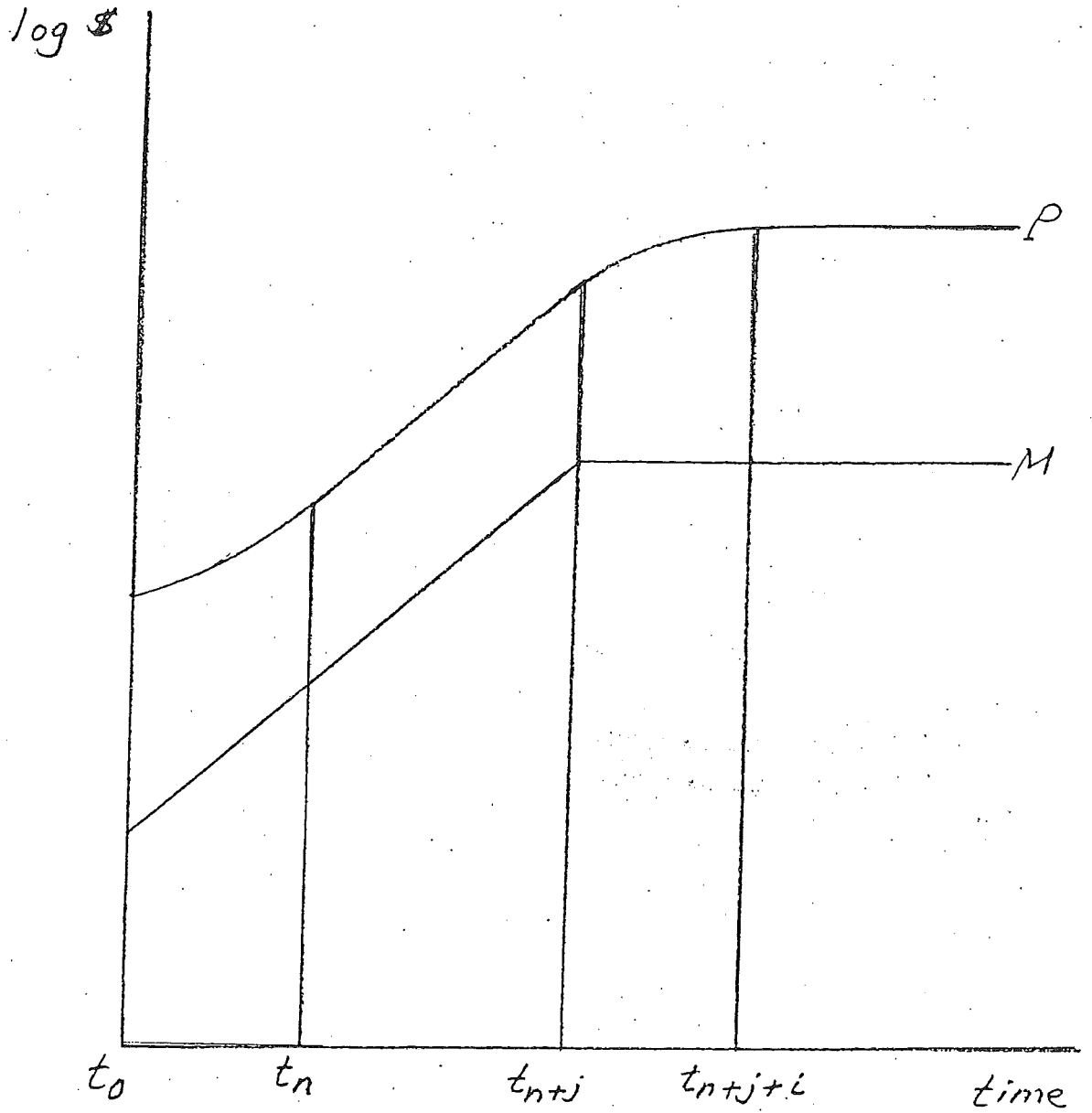


FIG. 12. The Time Paths of Money and Prices Produced by a Continuing Monetary Injection

at the prevailing market rate of interest. In the money market, neither M/P nor L undergoes a shift.

If an opposite assumption is made—namely, that only L responds to wealth changes, then the loss of security value would shift S_E (a declining schedule in r_M) to the left, moving its intersection with an unchanged D_E function to a lower rate of interest. In the money market, the loss of S_E and total wealth would be reflected in a shift of L_h to the left, lowering the interest rate at which it intersects the unchanged M_h/P line. In effect, the equilibrating process, by which r_M was raised, is reversed.

I rationalized the assumption that autonomous wealth changes fall only on D_E by assuming that all asset demands respond to autonomous wealth changes proportionately. Since securities, which represent the entire capital stock, have a total value at least 10 or 20 times greater than all real balances (the only other financial-wealth component), existing-security demand would, on that assumption, absorb most of any wealth change. Indeed, there is little empirical evidence that L responds at all to independent changes in wealth.

Keynes's Relative-Size Assumption

Keynes's comparison of new and old security sizes is in fact a misleading indicator of the likely impact that increments in saving and investment will have on the market rate. As we have seen, a saving-investment gap becomes an excess new-security flow that in any interval is converted into an equal excess supply or demand for household real balances, which is offset by an equal excess stock-supply or demand for securities (see Fig. 4 and Fig. 6). But when the excess real balances are compared to the total stock of money, they will be relatively much greater than is the *equal* excess security flow relative to the existing stock of securities. That is because the existing-security market, a claim to the entire capital stock, is at least 10 to 20 times greater than the stock of real balances (depending on the definition of money used). An increase in saving, for example, directed to securities over a 3-9 month period, is infinitesimal compared to the stock of existing securities, but it will elicit an equal increase in the household excess demand for real balances, which is much more sizable when compared to the total stock of money.

The resolution to these conflicting impressions lies in the *slope* of the excess existing-security schedule to which the excess security flow is added. Excess stock-security demand is in fact relatively steep and interest-inelastic. This enhances the ability of any excess security flow to alter the price and yield of securities in any brief period. The evidence for the high absolute slope and low elasticity of excess stock-security demand is indirect: We know from empirical studies that the demand for real balances, L , has an absolute elasticity of 1/2 or less over the usually prevailing range of short-term interest rates. (Mankiw 2000, p. 500.) This means that $M_h/P - L_h$ has a slope with respect to the real-balance market that is more or less accurately depicted by the graph of Fig. 6: $M_h/P - L_h$ is steep enough so that a shift in $I - S$, drawn for a relevant time period, will have a perceptible impact on the market rate within that period. But $D_E - S_E$ is equal to

$M_h/P - L_h$ —they are coinciding schedules—and so $I - S$ moves simultaneously along both of them.

Fig. 13 illustrates the two related asset markets more realistically, with the old securities market larger than that of real balances. L_h is drawn so as to reflect its relatively low absolute elasticity in the range of the prevailing interest rate. D_E is drawn so as to maintain $D_E - S_E = M_h/P - L_h$, and is thus a relatively inelastic downward-sloping schedule in the larger old securities market. But, in general, L_h does not have to be interest-inelastic and D_E does not have to be negatively sloped.¹² The actual objects of supply and demand in the securities market are numbers of securities, whereas D_E and S_E are measured in real-value units. The latter are in fact the revenue functions for underlying security-quantity supply and demand curves. They are also drawn, of course, with respect to r , which, for given income payment, varies inversely with the security price. Thus, since the upper half of D_E in Fig. 13 decreases as r increases or, equivalently, as security-price decreases, D_E is the revenue function for the inelastic portion of the security-quantity demand from which it is derived. It follows that D_E , as pictured in its lower half in Fig. 13, can also be a rising schedule in r , reflecting an underlying elastic security-quantity demand. That elasticity would enable D_E and its security-demand counterpart, at some low interest rate (high security price), r_T , to go to zero. When that occurs, L_h becomes absolute—a horizontal schedule, the irrepressible Keynesian liquidity trap.¹³

When D_E goes to zero and L_h becomes perfectly flat, the excess supplies and demands are also effectively flat and, as seen in a diagram such as Fig. 6, they render shifts in S or I and $I - S$ ineffectual in moving the market rate. In this world, asset holders regard securities and money as perfect wealth substitutes. Existing-asset holders, for example, will purchase any amount of excess flow-supply of securities, but with a surge of demand that will always be large enough to maintain the price and yield at the liquidity-trap level. Thus does Keynes's denial of saving and investment's impact on the market rate find support in a model whose existence he rejected (but cited frequently) and yet which is often invoked by others when Keynesian results are not otherwise comprehensible. In a liquidity trap the interest rate, of course, no longer equilibrates the system. The task of bringing S and I together falls to income or wealth or some combination of the two. (Horwich 1964, pp. 438-447, and 1997, p. 243.)

No matter how large is the existing-asset market, saving and investment, acting through the loanable funds market, will nevertheless interact, and cannot be prevented from interacting, with the existing-asset market. Apart from the liquidity trap, or states close to it, the only limitation on the impact of S and I on the market rate occurs when the non-liquidity-trap existing-asset market is out of equilibrium; i.e., given their determinants, L_h and D_E are not at their desired levels. In that event those schedules would no longer be stationary and would tend to shift so as possibly to overwhelm and offset the stock-flow adjustment process involving excess security flows. That possibility is discussed in the section, "Loanable Funds, Liquidity Preference, and Out-of-Monetary-Equilibrium Adjustment Paths." In the normal adjustment, however, with the existing-asset market in equilibrium at an interest rate above the liquidity-trap level, saving and investment, in their financial manifestation, are the only automatic, built-in, and

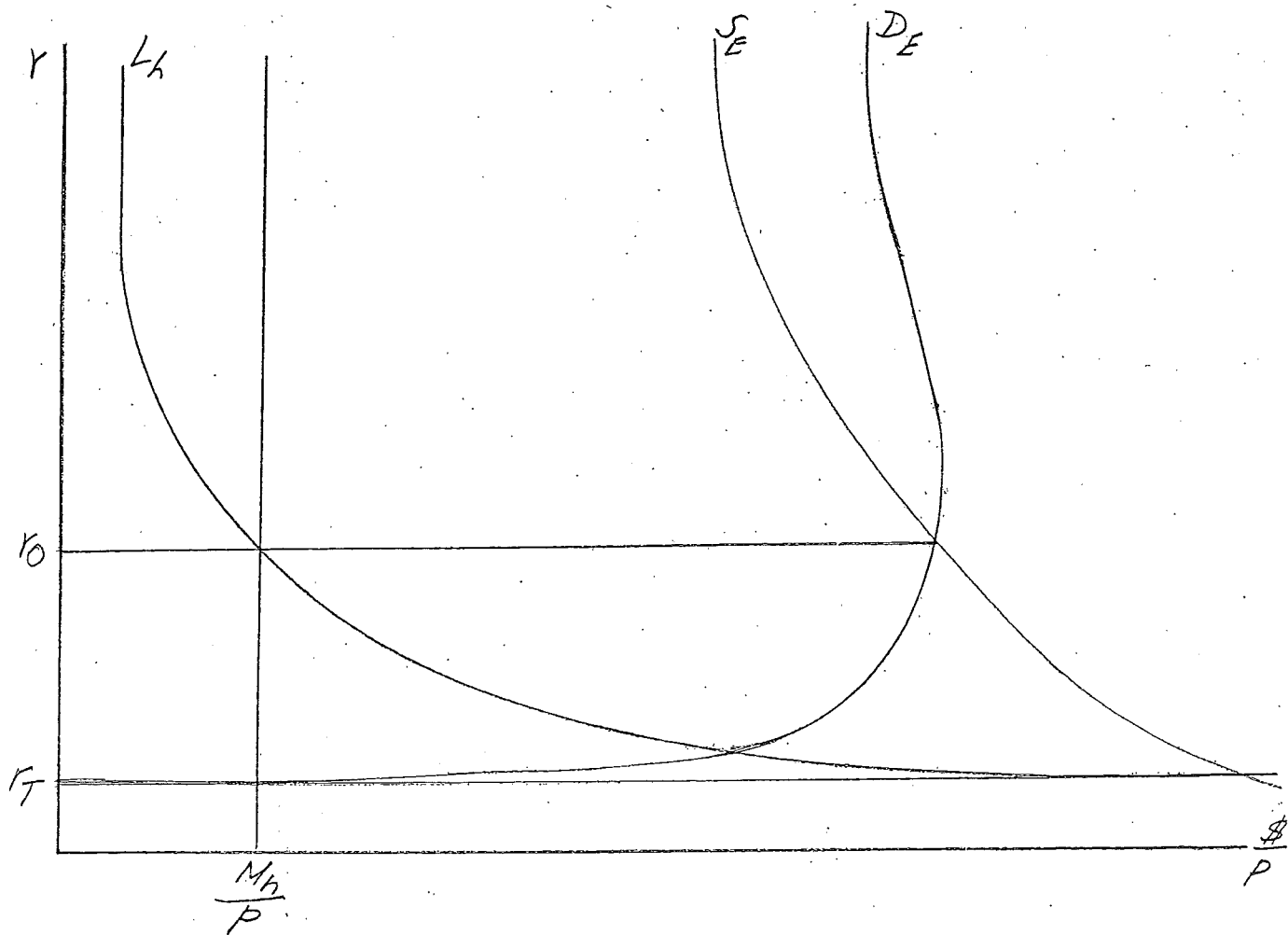


FIG. 13. Limiting Forms of the Existing-Asset Demand Schedules

internally consistent mechanism for equilibrating the interest rate while being funded by the existing-asset market.

An Alternative Mechanism: The "Income" Theory

The most widely cited interest mechanism attributes movements in interest to the direct impact of changes in income on the demand for money. We shall discuss that relationship in the context of both demand-side disturbances and independent supply-side shocks.

Income and Transactions Balances

That the market rate is equilibrated by changes in income is the beguiling message of Figs. 1 and 2, a static representation of the money market with the rate of interest scaled on the vertical axes. We have seen, however, that following an increase in desired investment or an instantaneous open-market purchase, the rise in interest is a *precondition* to the rise in income, the very means by which additional spending is financed. The increase in income will alter the interest rate only by raising an expected inflation premium, from which we abstract and which is not in any case equilibrating (both the market rate and the natural rate incorporate the premium), or by *lowering* the market rate if the income increment is real. We have seen in the latter case that interest falls because, following an increase in real balances as income, the balances *as wealth* create a net increase in the stock demand for securities. In the pure inflationary adjustment (with output fixed), after additional investment had been financed, the supply and demand for real balances moved equally and synchronously without altering the real market rate.

The analysis is somewhat less sharply delineated in the case of a contractionary adjustment owing to a higher degree of simultaneity in the movement of the variables. That was the case following an increase in saving, where nominal income fell immediately following the household shift from consumption to saving and the purchase of securities on a continuing basis. But even there the direct impact of excess saving on the market rate, and the absence of any interest impact of the price level, were clearly identified.

To understand how income impacts the demand for money, we need to distinguish between Keynes's transactions demand, which depends on income, and his "speculative" demand, which varies with interest. An increase in the transactions demand, when income rises, must begin with the fact that in a money economy the income increment is experienced as an increase in real balances received. The rate at which the balances then flow out of coffers results in an average level of money holdings over the payment period that will be higher in accordance with the higher income. It is in this sense that the "demand" for money rises—by *spending* money at a rate that permits the average holdings to rise—not by *liquidating* existing securities and raising interest rates, a generally dubious response to a general rise in liquidity.¹⁴ Any dissatisfaction with the resulting level of balances ordinarily can be met by adjusting the rate of *spending*, not by selling securities, new or old. Such security sales, moreover, would only be a corrective for accidental overspending, including security purchases that temporarily

reduced interest rates; they cannot qualify as an interest-rate *equilibrator*. Meanwhile, arguing that money income typically increases without being fueled by additional money receipts ignores the most fundamental tenets of monetary theory: the use of money as a medium of exchange and the circular flow of income.¹⁵

The argument is exactly equal and opposite in the case of monetary contraction. The decline in nominal income is experienced as a loss of real balances, the “demand” for which falls by spending remaining balances at a rate that reduces the average level held over the income interval. If output is fixed, real security prices, and thus interest rates, are not affected by this response. If output falls, the wealth effect on the market rate is upward.

Autonomous Changes in Output

The analysis is somewhat altered if changes in real income originate on the supply side of the economy in response to independent productivity or other resource changes. Such aggregate output increases, for example, are best seen initially in the context of individual markets where product supply curves shift spontaneously to the right along individual product demand curves. The resulting price reductions will depress the general price level and raise real balances, signaling a general rise in both real income and wealth. We have seen that additional real balances, as income, will generate a flow of spending that brings average balances of the payment period to a desired higher level—though, because of $\partial L_h / \partial y < 1$, to a level below that created by the initial spontaneous increase in balances. This increase in transactions and the transactions demand for money appears as a rightward shift of L_h , but with no direct effect on the market rate of interest. Simultaneously (see [10][11]), as wealth, the additional average balances held during the payment period following expenditure raise stock-security demand, D_E , increasing security prices and reducing the market rate of interest. For individual households, the fall in the market rate, a movement along the L_h schedule, is thus constrained by the fact that the increase in balances falls upon both L_h and D_E . But in the aggregate, since all balances are constantly held somewhere, the full increase in balances is available simultaneously for both transactions needs, on income account, and for wealth and security purchases on wealth account.¹⁶

The fall in the market rate caused by the increase in income and wealth is roughly equilibrating since the process begins with $r_M = r_N$ and the rise in income raises saving, lowering the natural rate to some extent (the positive effect on saving of the increased balances-as-income outweighs their negative effect as wealth [20]). If the wealth effect, acting on D_E , drives the market rate below the natural rate, the direct impact of excess security flows will raise the market rate as part of an expansionary adjustment, as described above. If the market rate is reduced but remains above the natural rate, it will move toward it as excess saving flows into, and directly impacts, the existing securities market in a contractionary process as summarized by (27). In our earlier analysis, the rise in real income that followed a monetary or expenditure increase tended to be nonequilibrating because the process reduced both r_M and r_N at a time when r_M was below r_N , and r_M needed to rise.

Lags in the Price Level Response

A common assumption of the textbook literature is that in the short run, increases in effective demand are normally met by a perfectly-elastic increase in aggregate output at the prevailing price level. Later, output returns to its predisturbance level while the price level adjusts upward. The interest-rate effects of this lagged price-level scenario can be analyzed as a combination of the fixed price-level/increased output response to increased expenditures followed by an autonomous reduction in output—opposite to the autonomous increase described above. Thus, let increased expenditures fueled by additional real balances be met by increased output and hence income at a fixed price level. In response, saving increases and lowers the natural rate. A higher transactions demand for money, as before, materializes as a higher average level of balances over the income interval with no direct effect on the interest rate. But the balances-as-wealth raise stock-security demand, depressing the market rate. Then output contracts spontaneously to its original level; households experience a simultaneous increase in the price level and a reduction in real balances and income. The loss of balances-as-wealth reduces stock-security demand and raises the market rate; the simultaneous decline in balances-as-income reduces saving, raises the natural rate, and reduces the transactions demand. Thus can lags in price-level response, commonly assumed, be accounted for.

Keynes's Demand for Finance

Is an increase in Keynes's demand for money "for finance" necessary in order to fund additional spending and does it impact on the market rate of interest? In our stock-flow analysis of an increase in investment spending, the resulting increase in the demand for loanable funds (the excess flow supply of securities) immediately and directly raised the market rate. We assumed a temporary increase in the total demand schedule for money as firms, prior to expenditure, momentarily held the funds secured from wealth holders. This increase in L was introduced essentially for expository convenience and, in the case of fixed output, is reversed over time: the process by which firms spend their acquired balances on investment goods is one of L_f and thus L shifting leftward to their original positions, simultaneously and synchronously raising the price level and reducing real balances. Thus at no time do these shifts in the demand for money affect the interest rate. In the event that output increases, however, the simultaneous increase in household real balances, as wealth, will raise the existing demand for securities, *lower* the market rate of interest, and raise the quantity of money demanded in the sense of a downward movement *along* the rightward shifting L_h schedules.

Increased output due to a higher ex post investment level could, moreover, raise the aggregate transactions demand for money by increasing the proportion of total funds that pass through financial markets, lengthening the interval before final expenditure. This would imply that the combined rightward and leftward shifts in L do not occur instantaneously and in fact leave L and real balances at a permanently higher average level over time. This tendency to higher L could be offset by firms processing their cash

balances more efficiently than do households, holding lower average balances in relation to investment expenditures than households do in their purchase of consumption output or of securities out of saved income. But even if these offsets are not equal and the overall demand for money is affected, the impact will be on the transactions demand and the price level or nominal income, not directly on the market rate of interest, except to decrease it in the event that output rises.

Part of the investible funds raised by firms through excess new security issues was, of course, earmarked as cash balances to be held over the payment period to service firms' higher investment spending (see Fig. 7[b]). To this extent, the leftward shifts in L_f and L were never intended to offset completely the earlier rightward shifts (unless only prices, and neither real income nor investment ex post, rises, in which case only an additional nominal demand for balances, $\Delta(PL_f)$, would remain). It can then be said that increased investment demand is in fact accompanied by a smaller increase in the demand for money. But the only force acting on the market rate remains the increase in investment demand manifested fully in the excess supply of newly issued securities.

It would be plausible to identify the direct force moving the interest rate as the increased demand for money for finance only if firms failed to issue new securities—sooner or later, if not concurrently—to fund the new investment outlay (where “investment” is defined both as capital goods and additional firm balances) and instead secured funding by selling (and not replacing) existing securities held permanently in their portfolios. The increase in the market rate would then be due to a simultaneous excess demand for money and excess supply of existing securities, consistent with Keynes's view that only shifts in the supply or demand for money, including the demand for finance, can move the interest rate. Keynes suggested that the demand for money for finance could in fact entail the issuance of new securities as well as the sale of old ones, but his belief, expressed in the *Treatise* and never relinquished, precluded any impact of the new issues on the market rate.¹⁷

It should be noted that the necessity of finance cannot really be limited to *increases* in aggregate investment spending. If finance, Keynesian or otherwise, is necessary, it is necessary for all investment spending, including the current ongoing level, all the time. In fact, there is no objective way for individuals to distinguish their investment expenditures from those that add to, rather than merely maintain, the aggregate level. Even when total investment is constant, the identity of investing entrepreneurs is constantly changing. And all investing entrepreneurs, whoever they are and whether they add to total investment or not, must secure financing from either current savers or existing wealth holders.¹⁷ Security sales by firms to current savers can be analyzed in the same way as sales to existing-asset holders. In the first instance after firms sell securities, there can again be a temporary increase in the firm demand for money, following which the expenditure on investment goods returns L_f to its original position or short of it, depending on whether only prices rise or if output also rises. Again, Keynes's demand for finance plays no independent role in securing finance or in determining interest rates. In general, finance for investment is secured, sooner or later, through new security issues, which, in equilibrium, are met by an equal flow of saving

directed to their purchase. Without the existence of newly issued securities, or their equivalent, there is in fact no way to tie saving to investment on an ongoing basis.¹⁸

Keynes's claim that additional consumption, like all other expenditures, needed to be financed by a prior increase in the demand for money also has little justification. We saw in our analysis of an increase in saving and decrease in consumption ([27]) that funds were transferred directly from consumption to whatever assets the flow of saving was applied. An *increase* in consumption would thus tend to be funded directly and fully by a simultaneous reduction in current *ex ante* saving. Whether savers normally dispose of their balances at the opening instant of a payment period or gradually, and whether applied to additional security purchases or the holding of additional cash balances, current saved income can be fully converted, at will, into an equal amount of consumption expenditure. Such funds would presumably be spent at the same rate as other consumption balances, creating an average level that could be higher than that normally held to service savers' asset acquisitions.¹⁹ Notice, incidentally, that the increase in consumption, while immediate and self-financed, does not raise aggregate expenditures in the economy. The simultaneous reduction in saving, an instantaneous reduction in a rate of flow, reduces investment by an equal amount. That is because in equilibrium, investment—the flow demand for loanable funds—is equal to and, for the moment, constrained by the flow of saving—the flow-supply of loanable funds. Aggregate spending and nominal income go up only when the resulting decrease in flow-security demand creates $I > S$ and an excess supply of new securities, which raise the market rate and fund net additional spending. (See a further discussion of this point in the section below on direct outlays.)

An increase in consumption could also be financed by a sale of securities (analogously to an increase in investment)—in this case, by an increase in “consumer credit.” Or it could be funded by actively dishoarding existing holdings of cash balances; i.e., by shifting from money held (a leftward shift of L_h) directly into consumption outlays. There are, of course, limits to these funding alternatives that do not apply to a reduction in saving. But in neither case is the financing for consumption accompanied by an increase in the demand for money that exerts upward pressure on the market rate.

Post-Keynesian writers, notably Tsiang (1956) and Davidson (1965, 1994 chap. 8; see also Lucas 1982, p. 336), who have endorsed the importance and necessity of Keynes's demand for finance, prefer to express the demand for money as Keynes did in his 1937 papers. For them L —specifically, the transactions component—is a positive function not of income received, but of the grand sum of *planned* expenditures, including consumption, investment, and government (G) outlays:

$$L = L\{C(y) + I(r) + G\}. \quad (28)$$

This formulation has a plausible ring to it, but collapses under closer scrutiny. For what spenders demand is not “money”—at best an ambiguous term in this context—but rather a reliable and, for the economy as a whole, a continuing source of funding. In the case of additional aggregate investment—an excess flow-supply of securities—we saw that an

immediate rise in the market rate drew money ("loanable funds") initially both from wealth holders and current savers; eventually, in equilibrium, from savers only. In order to raise consumption, households needed only to divert balances directly from their own saving flow. The market rate rose, not as a condition of the diversion, but as a result of the reduction in saving, which is simultaneously a reduction in flow-security demand. To finance additional ongoing government spending, government can issue new securities or increase taxes. In all cases, planned expenditures, after being funded, materialize as transactions balances. Households, firms, and government then express their demand for these balances by spending them at a rate that maintains the desired average level over the income period.

We saw in our earlier analysis that any increase in the market rate is driven by events originating in the flow-securities market. These events are unaffected by any accompanying or subsequent increase in the demand for money—either as a stock temporarily held, following funding, or as an increased average level resulting from a higher ongoing expenditure. As described in the preceding section on the "income" theory of interest, the expenditure of transactions balances influences only the general price level and nominal income and does not, through induced excess security sales of any kind, tend to raise the market rate. We conclude that there is no case at all for attributing the increase in the market rate to increases in the demand for money for finance.

Ironically, Tsiang and Davidson, like Keynes, mention as possible funding sources for planned expenditures the sale of new securities, the disposal of other assets, and, in a new equilibrium (but not earlier), additional saving. But neither attributes to excess new security sales the ability to move the market rate. In accordance with liquidity-preference orthodoxy, all three identify a shift of the demand-for-money schedule as the proximate force that drives the interest rate to its equilibrium. Davidson (1964, pp. 52-3), following Keynes, goes further and reminds us that the presence of y in (28) will lead to additional increases in r_M as the multiplier process raises C , and thus L , to still higher levels. A further irony is that Tsiang, alone among the three, seems to understand the loanable funds determination of interest rates, at least as expressed statically. But he fails to grasp the way in which a loanable funds (security-market) *process* impacts on the market rate as a movement *along* the demand-for-money schedule (see [29] and n. 20 below).

A case, finally, can be made for entering C , I , and G as independent variables in the L function on the grounds that the demand for transactions balances varies with the type and sector of expenditure. This may indeed be justified, as our earlier discussion indicates. The variables would be relevant, however, not in their pre-financed planned state, but rather as fully funded magnitudes whose holders spend them at one rate or another, resulting in different average money levels over time. Although, in our model, we were able to use y as the only variable in the L_f function because eventually all ex post investment is contained in it, we were forced to employ the temporary variable θ as a monetary bridge between funded ex ante and realized ex post investment. Adding I , fully funded ex ante investment, as an argument in the L_f function would have avoided that ad hoc procedure.

Loanable Funds, Liquidity Preference, and Out-of-Monetary-Equilibrium Adjustment Paths

This section looks further into the literature on interest rate determination in terms of the loanable-funds/liquidity-preference debate. We focus first on Tsiang and Ackley and the possible relevance of an adjustment process in which the money market is out of equilibrium. We then consider a recent interpretation of the historic debate by Jorg Bibow.

Tsiang and Ackley

The discussion surrounding Tsiang's analysis of liquidity-preference and loanable-funds theories of interest provides some additional insight into the circumstances under which Keynesian-like equilibrating mechanisms might be relevant. For if the money market is in a state of disequilibrium, defined as $L(y, r) \neq M/P$, shifts in the demand for real balances could operate as an interim or supplemental equilibrating force. These shifts in the demand for money, however, are not a Keynesian response to changes in income or the demand for finance but rather are the movement of L , given y and r , attempting to move r from a nonequilibrium to an equilibrium level. Because the shifts of L are equal and opposite to existing-security demand, Keynes's emphasis on the dominance of the existing-security market and the negligible direct influence of saving and investment on the interest rate could be relevant in such circumstances. There is, in fact, little empirical evidence that the money market ever approaches such a state, or, if it reaches it, stays in it very long. But the a priori implications are worth exploring.

Tsiang is generally credited with reconciling the loanable-funds and liquidity-preference theories of interest. Fig. 1 of his 1956 paper (p. 544) is perfectly consistent with our (25) and Fig. 4, except that Tsiang omits the existing-security market, replacing it with $L - M/P = L_h - M_h/P = S_E^{t-1} - D_E^{t-1}$. Hence his dynamic period equilibrium is given by

$$S - I = L - M/P. \quad (29)$$

But his later diagram, Fig. 2 (p. 549), seems incompatible with his Fig. 1, and his mathematical expression, eq. (9) (p. 552), appears also to deny the relationship in (29).²⁰ Given these inconsistencies, it is not surprising that Tsiang's verbal account of the direct force acting on the market rate is unsatisfactory. For him, as we saw in the preceding section, the force directly moving the market rate is the Keynesian demand for money for finance—a shift of the demand-for-money schedule. Tsiang correctly emphasizes that the resulting movement of the interest rate precedes any induced changes in income (pp. 551-52), but he adheres to the Keynesian inhibition against acknowledging any direct impact of S and I on the market rate. On p. 551 (bottom paragraph), for example, changes in planned expenditures are said to cause accompanying shifts in the demand-for-money schedule in order to secure (or reduce the level of) transactions balances. Even when an

increase in saving (“thrift”) directly causes a contraction of income, he interjects a simultaneous leftward shift of the demand for money to account for the decline in the market rate of interest (p. 551). The analysis is essentially unchanged in Tsiang 1980.

A similar approach to loanable-funds doctrine appears in Ackley’s comment (1957) on Tsiang’s 1956 paper, except that Ackley is willing, under the right circumstances, to allow S and I to share directly in moving the market rate. Ackley accepts the essentially static representation of loanable funds in Tsiang’s Fig.1 and reproduces it, adding a banking sector (p. 668).²¹ But in an earlier passage, Ackley objects vigorously to Tsiang’s assumption that the speed of adjustment in the money market is very rapid. This, Ackley argues, implies that “the hoarding-dishoarding component should completely swamp saving and investment in the supply and demand for funds” (p. 667). Ackley defines hoarding as an excess supply or demand for money (ΔL) or, more precisely, the difference between the speculative component of the demand and supply of money, frequently designated “idle” balances: $L_2 - M_2$. Although, unlike Tsiang, Ackley does not specifically refer to a shift in the demand for money as funding additional expenditures, he assumes implicitly that such a shift is necessary to create the excess-money supply or demand. Neither he nor Tsiang realize that the merger of saving and investment security-flows with the existing-security market entails an interest movement *along* the liquidity-preference schedule, generating an *equal* excess demand or supply of money. With reference to (29), a shift in S or I creates ΔS or $\Delta I = \Delta L$; in the stock-flow equilibrating process, there is no possibility that one increment can dominate the other since, by changing the market rate, the left side of the equation gives rise to the right side. Because L (or L_2) is stable while r_M is changing during the funding process, even an infinite speed of money-market adjustment poses no threat to the loanable funds mechanism, as presented here in terms of security-market interaction. Ackley’s concern with adjustment speed is not shared by Tsiang, who assumes that ΔL , the increased Keynesian demand for money for finance, will automatically equal the ΔS or ΔI that gave rise to it. Ackley seems less committed to the necessity for Keynesian finance, though he does not disavow it. He simply lacks a clear understanding of the stock-flow security-market process and feels that a *shift* of L or L_2 must undergird it.

Ackley’s concern with adjustment speed has more relevance in a nonequilibrium monetary process. For if the money market is out of equilibrium, interest-rate movements are indeed likely to be determined by shifts of L or L_2 to the partial or total exclusion of saving and investment. And this exclusion will be greater the more rapid is the money market’s speed of adjustment. To see this, consider the $IS-LM$ diagram in Fig. 14. A point A , which lies on neither schedule, is below (or to the left of) IS and above (or to the left of) LM . If we construct a traditional “phase” drawing at A , we assume that at points off the IS curve, $I \neq S$ acts to change y . At points not on LM , $L \neq M$ acts directly on r . Thus, at A , we show the directional movement of r by a downward vertical vector aimed at LM . This means that given y , r , and M/P at point A , L is at a higher level than wealth holders want it to be, as indicated by the LM curve, and will shift downward, lowering r . We show the directional tendency in y , caused by IS , by a rightward horizontal vector aimed at the IS curve. But we know that the increase in y must be preceded by an increase in r due to the direct effect of $I > S$, an excess flow-security supply that funds the excess

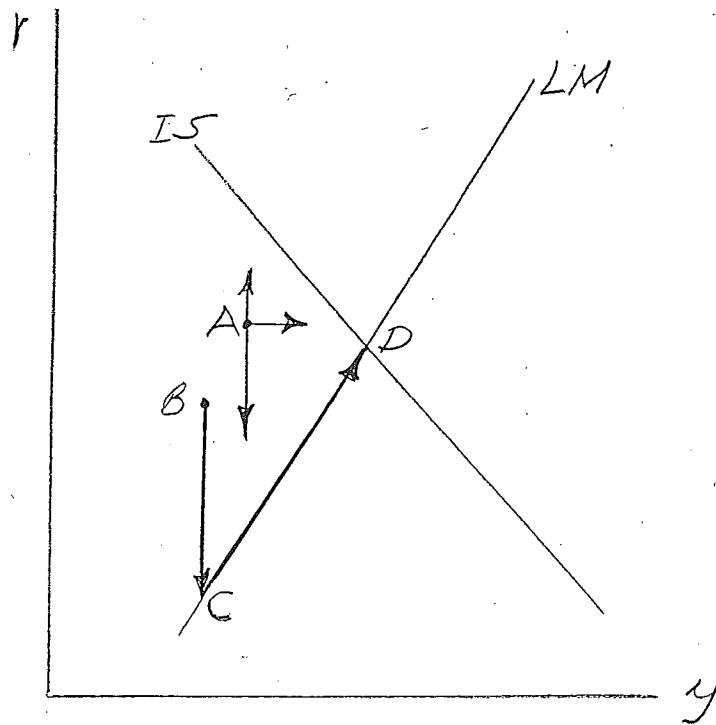


FIG. 14. Phase Drawing and a Path to Equilibrium from Points in $IS-LM$ Space

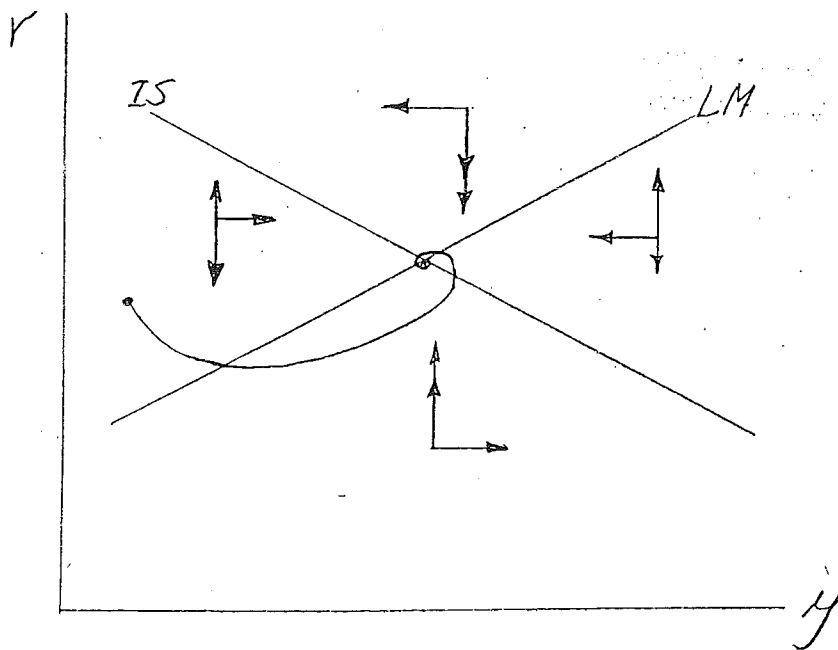


FIG. 15. Cyclical Path to $IS-LM$ Equilibrium

investment. An upward vertical segment aimed at IS , showing this upward tendency in r , is added to the phase drawing at point A . The net effect on the movement of the interest rate in any period will be the difference between the upward and downward vertical vectors. Given the overwhelming empirical evidence that the money market adjusts very rapidly, the downward vector will almost certainly dominate and carry the market rate quickly from a point B to a point C on the LM curve. From there, at a point in money market equilibrium but still below IS , the stock-flow security-market adjustment proceeds, more or less along the path CD on the LM schedule. (See Hendershott and Horwich 1974 and the critique of the pedagogical literature below for a more detailed account of the movement along the LM schedule.)

Given Ackley's denial of very rapid money-market adjustment, we can reasonably infer that in his 1957 comment he sees the entire adjustment as a gradual path, starting at a nonequilibrium point and shaped by the phase vectors of each of the four $IS-LM$ quadrants. An example is drawn in Fig. 15. For Ackley, the path would appear to be driven by (a) the shift in L , given M/P and any (y, r) point not on LM , to bring L and the interest rate to the level of the LM curve; (b) the shift in the demand for money that creates an excess supply or demand for money and which, though not explained, is somehow due to $I \neq S$ in the loanable-funds process; and (c) the simultaneous shift of the income-induced transactions demand for money, which again, unexplained, raises the market rate when income is rising and lowers it when income is falling (see Ackley 1961, pp. 371, 380 and 1978, pp. 316, 378). Ackley's later work is consistent with this interpretation. In 1978, p. 381, his paths from points off LM approach the $IS-LM$ intersection asymptotically, not as the damped spiral in our Fig. 15. But the spiral path would seem to converge to $IS-LM$ rapidly, in view of the usual slopes we give these schedules and the added stricture that the path is vertical when crossing IS and horizontal when crossing LM . Ackley also seems comfortable with constructing infinitely rapid vertical paths, such as our Fig. 14, which then move along LM to the equilibrium. The forces operating along LM for him are (b) and (c) above.

It is tempting, and possibly useful, to speculate why Keynes might have attributed overwhelming dominance in interest determination to an out-of-equilibrium existing-security market. It may be relevant that he himself was an active securities trader in his capacity as bursar of King's College in Cambridge. Traders are surely impressed by the daily volume of trading in huge existing portfolios, compared to the relatively small volume of new issues that appear in any given time period. Nor would a trader likely be able to distinguish trading in the existing stock driven by an altered flow and a new equilibrium interest rate from trading in—or, more succinctly, the churning of—the existing stock reflecting only the divergence of sentiment in a market already in equilibrium. That churning, combined with the absence of timely, precise macro data, could have misled Keynes into believing that trading in existing securities was so pervasive as to completely dominate security prices and without necessarily reflecting a market in equilibrium.

Bibow

Bibow (2000) reiterates Keynes's belief that an increase in saving cannot directly lower the market rate of interest because firms, experiencing an increase in inventories as a result of the reduction in consumption, will issue securities to finance the new inventories. Thus an equal increase in supply will offset savers' additional demand for securities, preventing the interest rate from falling. Robertson responded that the inventory gain was a transitory phenomenon that would soon fade from the adjustment process (1940, p. 18, n.3). But Bibow argues (p. 803) that beyond the inventory effect, saving can affect the interest rate only if there exist, as a "counterpart" to savers, "deficit" units willing to spend above their income by an amount equal to the saving increment. That, he asserts, is something that will almost certainly not occur in the downturn that additional saving will trigger. The appearance of such deficit units, however, might be elicited by a fall in the interest rate induced by savers; it is, in any case, circular and illogical to make their existence a precondition to savers' attempts to evoke them. Bibow, in fact, misconstrues the entire nature of the security market adjustment process. He ignores the huge stock of previously issued securities, which invariably form the bulk of savers' initial purchases; new securities to cover new borrowing are neither necessary nor likely to form a large part of the initial acquisition. Meanwhile, as we have seen, savers' purchase of pre-existing securities, while the interest rate falls, generates receipts that wealth holders hoard, moving *along* their liquidity-preference schedules. Were additional saving, in accordance with Bibow's precondition, met by an equal increase in new issues, neither interest nor income would fall and there would be no economic downturn. Alternatively, if the supply of new securities were to fall (due to a leftward shift of the *I* schedule), as Bibow seems to expect, that would exacerbate the drop in the market rate, supplementing the direct effect due to the increased saving.

Bibow (pp. 810-12) attempts to buttress his argument that saving cannot directly affect the interest rate by reverting to positions taken by Keynes in the *General Theory* or shortly thereafter. Thus he quotes Keynes (1936, pp. 179-181) as pointing out that, given investment and an interest rate " r_2 ," as determined by liquidity preference and the supply of money, only one income level will bring saving to equality with investment at that interest rate. Standing alone, as it does both in Keynes's analysis and Bibow's reference to it, the statement ignores the fact that there are infinitely many combinations of interest rate and income at which $S = I$, as Hicks's *IS* curve (1937) makes explicit. It is thus difficult to avoid the conclusion that Keynes and Bibow are in fact treating r_2 as a constant, imposed on the system by, say, a liquidity trap—an infinitely elastic demand for money—and which no attempted increase in saving could possibly alter. Later, Bibow (p. 820) quotes Keynes approvingly: "Increased investment will always be accompanied by increased saving, but it can never be preceded by it." (Keynes, 1939, p. 281) It is, of course, in a liquidity trap—for Hicks, a perfectly horizontal *LM* curve—that an independent increase in saving will be completely aborted by the resulting fall in income, the interest rate remaining constant. In that model an increase in saving is sustainable only if it is preceded by an independent increase in investment and thus income.

Direct Outlays: A Viable Monetary Mechanism?

An issue raised in the early postwar literature was whether the monetary transmission mechanism was limited to the impact of lower interest rates on spending and did not also entail direct movements from money into commodities (Wright, 1952).²² The latter were often characterized as part of the "spillover" effects emanating from a monetary injection. The desire to seek alternative channels of monetary transmission was fueled by concern for the existence of a liquidity trap, the circumstance in which nominal interest rates are so low that monetary increases cannot reduce them further. That may have happened to the monetary system in the United States in the 1930s and, some believe, in present day Japan. The illustration of the transmission process first provided by Hume (Rotwein, 1955, pp. 51, 62-3, 192, 197-8) also encouraged the search for alternatives to the interest-rate mechanism. Hume described people as waking up one morning to find money miraculously placed in their bureau drawers (or, in a modern version, dropped from helicopters). Such balances are clearly prime candidates for spending—through any channel on anything money can buy.

But balances are not so broadly earmarked if they are created by open-market purchases or extensions of credit by the banking system in a single-security stock-flow model. In that context, a single open-market purchase instantaneously carried out evokes only a desire to substitute money for securities in pre-existing portfolios. The movement in the market rate, traced along the real-balance and existing-security demand schedules, is precisely what is required to make that happen. The lower market rate does not also motivate a decision to *spend* some of the additional balances over time on current output—that is, to actively *dishoard* the balances, reducing the average level held, along with total wealth. Conceivably, such disharding and instantaneous wealth reduction may be a built-in monetary feature of a model or, more plausibly, a reaction to an unanticipated wealth gain, such as a stock-market runup. But that is not a programmed outcome of mutually agreed-upon monetary transactions between a central bank and the private sector in this or any mainstream macro model.

In the real world, of course, a broad portion of the proceeds from the sale of pre-existing securities to the monetary authority will be spent on a whole range of financial-asset substitutes. This will bring the many market rates of interest into realignment. But these outlays are aimed purely at securities and, assuming rapid adjustment, will not involve any significant direct contact with financial, or for that matter, commodity flows. Commodities can be purchased at this stage only if, contrary to our assumption, wealth holders hold some of the capital stock directly, alongside financial assets. In that event the asset substitution process would likely entail some purchases of the existing capital stock, but again with little or no immediate or direct spillover into the flow markets of currently produced goods and services. A significant impact on flows will occur only when the lower interest rate stimulates an investment-saving gap and an excess new security flow.

An expenditure that may appear to be a direct commodity outlay arises in response to the wealth gain caused by the reduced market rate. The increased wealth, a capital gain on existing securities (4), induces an immediate increase in consumption (16). But the additional consumption is funded by an equal decrease in saving and thereby, in *instantaneous* time, in investment. That is because income is as yet unchanged and, as we have seen, there is no behavioral basis in the model—in any time frame—for the alternative source of funding: active dishoarding, entailing an immediate reduction in the demand for money *and* the level of wealth. During the momentary equilibrium of the stocks, the flows must therefore be self-financing. Since, at the natural rate, saving had been flowing directly into investment, then at the lower market rate, the wealth-induced decline in saving (19) and increase in consumption curtail the flow of funds to investment—total spending, for the moment, remaining unchanged. Over time, however, the reduction in saving creates a saving-investment gap—our basic mechanism—and increases the rate at which excess new securities draw additional money into investment, raising total expenditures.

A final possible source of direct outlays springs from the action of the monetary authority when, following an open-market purchase, it offsets the private sector's lost security income with tax reductions. As observed in note 11, the most wealth-neutral way to do this is to reduce personal taxes. That would also minimize any impact on total income, shifting security income to personal income. But the authority could, of course, apply the whole tax reduction to property. In that event, the securities sold to the central bank would be replaced by an equal upward revaluation of remaining securities. The net effect of the operation and the tax reduction would simply be an increase in the quantity of money, with no change in the value of securities held. With reference to the wealth expression in (4), both ρ (incorporating the greater return on property, net of taxes) and M would be higher. But the action would not raise the market rate since, by (11), the restoration of S_E due to the tax cut will evoke an equal increase in D_E , the market rate remaining where the open-market purchase left it. The increase in ρ would also tend to raise investment prospects and hence the I schedule and the natural rate of interest, further increasing the $r_M - r_N$ gap.²³

Additional real balances, increased by an open-market purchase and then becoming a de facto gift as the securities are restored by a tax cut, would likely be spent across the board. Their expenditure can be seen as the operation of "real-balance effects" in Patinkin's framework. (1956, 1965) If, with output fixed and prices flexible, the additional "freed" money were spent immediately, prices would respond quickly and real balances would decline to their pre-operation level. That process could resemble the "0" interest-neutral expenditure phase following the funding of investment, with the supply and demand for real balances declining synchronously. In fact, the expenditure of freed balances would more likely proceed unevenly over time. Given the more rapid response of the existing-asset market, interest rates would fall as portions of the new money were used to buy pre-existing securities, even as flow-commodity purchases and the general price level rose. Eventually, at a higher price level, all monetary values would be proportionately higher. Apart from distributional effects, there would be no impact on relative prices and values. (Patinkin, 1965, pp. 72-77) The rise in prices, delayed at first, would reduce real balances and act as an equilibrator of market rates that were

temporarily reduced because of the delay. If real income were to rise, both the natural rate and the market rate would fall, the former because of the increase in saving, the latter due to the wealth impact of real balances.

In no event does the rise in prices or real income promise to equilibrate the interest rate lowered by the open-market purchase. In all cases, the task of bringing the two interest rates together falls to the stock-flow security market interaction, as before.

Within the stock-flow model, and in the absence of tax reductions, the only way new money can raise total commodity spending immediately following an open-market purchase is if the authority remains in the market and buys some or all of the excess new securities issued in response to the lower market rate (see above). Such purchases, proceeding over time, will increase balances and investment spending directly, rather than increase the average size of balances with no immediate effect on total spending, as in an instantaneous open-market purchase.

Patinkin and Friedman

Two writers who have had a major influence on the analysis of the monetary mechanism in the postwar textbook literature are Patinkin and Friedman. We shall critique their analyses before turning to the pedagogical literature.

Patinkin

Elsewhere I have detailed my reasons for interpreting crucial elements of the Patinkin model as essentially characteristic of an exchange economy (Horwich, 1964, pp. 408-416; see also Robertson 1953-54, pp. 136-37). This is a view Patinkin does not dispute, arguing that the essential features of a money economy can be adequately described in such a framework. (Patinkin, 1956, pp. 60-61) But in spite of the explicit claim of the macroeconomic section that the model contains production, saving, and investment flows, the analysis fails, in my opinion, to accord these variables the active, sustained role they merit in dynamic processes. Patinkin's basic analytical handicap springs from his use of a single Walras' law to constrain total behavior, whatever may be the mix, the relative magnitudes, or the autonomy of the component stocks and flows. For example—and most relevant for our purposes—Patinkin argues that if saving and investment are assumed to be wholly a demand and supply, respectively, of securities (purchasing-power bonds in his model), the price level is indeterminate. (1965, pp.272-3) This follows from the fact that his exchange-economy model has only three markets—commodities, bonds, and money. Then, if an inequality between saving and investment, which is an excess supply or demand for commodities, is identically equal to the excess demand or supply of bonds, the excess supply or demand for money is invariably zero and the price level is indeterminate.

An enlargement of the model to include flows that have substantial autonomy and are distinguishable from stocks will, of course, restore price-level determinacy. We saw in (27) that an excess of saving over investment, which is an excess (flow) commodity supply, directed entirely at securities spills into the existing-asset market where it lowers

the market rate and (by Walras' law for stocks) creates both an excess supply of existing securities and an excess demand for cash balances. Savers buy the excess existing securities, transferring current income receipts to wealth holders to meet their greater desired holding of cash balances in relation to given expenditures. With output fixed, the price level falls, more or less simultaneously, by a precisely determinate amount. Patinkin's reliance on the exchange model serves his primary interest of explicating the basic role of money in a multi-asset economy in more or less static terms. But the exchange framework cannot capture the dynamic monetary process in which saving and investment exercise considerable autonomy in an explicit production-growth economy. This limitation is further highlighted in Patinkin's analysis of monetary change.

Patinkin sees the dynamic process determined by the injection of new money as depending on the way the money is introduced. In one scenario, government spending on commodities, financed by printing money, increases for one period only. The price level rises. Though in subsequent periods, government spending reverts to its previous level, aggregate commodity demand falls only partially because the inflation has not yet completely eliminated the stimulatory increase in real balances. At the same time, the additional balances impact the bond market where, by increasing the "supply of loans" and decreasing the demand, they cause the interest rate to fall. In Wicksellian terms, we are told, the market rate is now below the unchanged natural rate:

Hence the investment component of the aggregate demand curve rises, further strengthening the inflationary pressures of the commodity market. But as these pressures push the price level upwards, there is a reaction back on the bond market. Specifically...the price rise causes a real-balance effect which pushes the excess-demand [bond] function down again...In brief, as the rising price level eliminates the initial increase in the *real* quantity of money in the economy, it also eliminates the excess demand for bonds (excess supply of loans) which temporarily depressed the rate of interest. [p. 239]

The equilibrator of the market rate in this account is clearly the price level, whose rise reduces the value of the greater quantity of balances. From an aggregate, stock-flow point of view, however, one would expect the price level to rise *immediately* and proportionately to an increase in money introduced by an increased *rate* of government spending. The price rise would include all nominal values—of commodities, bonds, labor, and the interest payments on bonds, all of which would rise immediately and equiproportionately. The lag in the rise of prices, while not implausible empirically, is nevertheless arbitrary since there is nothing in the structure of the model to bring it about.²⁴ The new money is injected by a flow of expenditures, analogously to the increased investment spending with balances secured from our earlier stock-flow security-market interaction (and corresponding to the simultaneous shift of the demand for money from $L + \theta$ to L). Thus, while the price level performs an interest-rate-equilibrating role, it does so in a context of ad hoc lags without which the market rate would not have fallen in the first place.

In a second scenario, Patinkin assumes that the new money is introduced by the banking system. With additional excess reserves, the banks buy bonds instead of commodities, depressing the market rate. Once again, lower interest raises investment and thereby the price level. At this point, Patinkin asserts, the movement to a higher equilibrium price level and the return to the predisturbance interest rate proceed exactly as in the previous scenario. (p. 241) But, in fact, the two adjustment processes cannot be the same. In Scenario 1, the market rate fell because of a lag in the movement of the price level following an increase in government spending. Once prices responded fully to the expenditure, the real-balance effect in the bond market, which reduced the interest rate, was eliminated. But in Scenario 2, the process is more circuitous. Real balances spent by the banks on bonds are unlikely, in the first instance, to go directly to investing firms. Indeed, Patinkin's single-period monetary injection is almost certainly spent primarily on the stock of pre-existing bonds, raising wealthholder balances and leaving any new investment as yet unfinanced. In our stock-flow adjustment process, firms then issue new securities through which they tap into the new balances while raising the market rate. When, under fixed output, firms execute their investment expenditure, we assumed that their temporarily higher demand for, and the stock of, real balances fall equally and synchronously (the θ term in $L + \theta$ goes to zero), the market rate during the expenditure thereby remaining constant. The price rise and reduction in real balances occur as intended, *dependent* outcomes of the stock-flow interaction. The price rise, in fact, brings the aggregate economy to the lower level of real balances wealth holders desire at the higher market rate (the added demand for real balances by firms was only temporary) and exerts no further influence on the asset markets. For Patinkin, by contrast, the rise in the price level creates an *independent* reduction in real balances that reduces the excess demand for bonds and raises the market rate.

Patinkin does not hesitate to suggest that when investment increases autonomously, additional bonds are issued simultaneously. (p. 269) But in Scenario 2 he makes no reference to that source of funding. It is, of course, possible that firms, selling bonds out of their existing portfolios to the banks, may themselves become direct recipients of the banks' monetary infusion, which they apply to new investment. Patinkin, at times, also describes firms as possibly drawing down previously accumulated cash balances to finance investment. But these are essentially ad hoc alternatives and cannot replace new bond flotations as a general funding source.

It might be argued that in describing the bank-induced monetary increase, Patinkin reverts to the unadorned exchange economy. In that framework, the movement of the price level, pure and simple, equilibrates the interest rate: a fall in r_M caused by an increase in M is readily reversed when the additional M is spent, raising the nominal prices of all goods and reducing M/P . No further explanation involving the funding of investment (which does not exist in an exchange economy) or any other expenditure is required. A second possible alternative is that Patinkin in Scenario 2 has reverted to a pure Wicksellian model in which saving and investment are the only source of security demand and supply. In that framework, all bonds sold would be new issues, the proceeds of which go directly into investment expenditures. But that, of course, assumes the absence of liquidity preference and a stock of pre-existing securities, the demand for

money having become completely interest-inelastic—assumptions Patinkin does not make.

Compared to Patinkin, Metzler and Keynes in the *Treatise* take the commodity and financial flows much more seriously. Saving and investment, discrepancies between which impact on total spending and income, are seen by the earlier writers as generating both demand and supply security *flows*. Implicitly, they distinguish sharply between stocks and flows: they see no threat to price-level determinacy from the complete identification of saving and investment with the flow securities market, neither Keynes nor Metzler limiting the degree to which S and I can be so identified. Nevertheless, they rule out any direct *contact* between the stock and flow security markets. Their models are thus unable to equilibrate the interest rate—either by the direct impact of the S and I financial flows, which they preclude on the grounds of insufficient size, or by the movement of the price level, which they would like to invoke but in fact cannot. The price level in their models is indeterminate because of the absence of a mechanism to fund additional expenditures. Such a mechanism would emerge automatically in the commingling of stock and flow security markets, which they feel compelled to preclude.

Friedman

An equally influential monetary economist of the postwar period is Milton Friedman, who differs in significant ways from Keynes, Metzler, and Patinkin. His monetary-interest mechanism, however, suffers from many of the same analytical contradictions as theirs plus several others.

Friedman begins his analysis with an increase in the rate of growth of the quantity of money. This produces an initial interest rate effect, a downward movement along the liquidity preference schedule. Subsequently the monetary increase and reduced interest rate “stimulate spending” and raise income. Then,

Rising income will raise the liquidity preference schedule and the demand for loans; it may also raise prices, which would reduce the real quantity of money. These three effects will reverse the initial downward pressure on interest rates fairly promptly, say, in something less than a year. Together they will tend, after a somewhat longer interval, say a year or two, to return interest rates to the level they would otherwise have had (1968, p. 6).

We have seen that the constant rate of increase of money lowers the market rate, gradually building up $I - S = S_F - D_F$ until the excess security flow is exactly equal to the central bank's purchase. At that point the market rate is stabilized at some level below the natural rate and the bank purchases a constant real quantity of securities. The bank's purchases directly finance excess investment spending and, with output fixed, a continuing rise in the price level. The internal force offsetting the bank's downward pressure on the market rate is precisely the excess security flow we have identified as the fundamental monetary-interest mechanism. That mechanism, exerting upward pressure

on the interest rate, transfers balances to firms, first from existing-asset holders and then directly from the bank in the fixed-market-rate dynamic equilibrium.

The most striking feature of Friedman's equilibrating interest-rate mechanisms is that they all occur *after* spending, nominal income, and the price level have risen. None precedes the increase in spending as part of a funding process. There are two circumstances, however, in which funding would not be necessary: (a) holders of the new balances engage in a "direct" outlay—a spontaneous dishoarding; (b) the model is "classical" in that L is interest-inelastic and LM is vertical; as a result, the bank can buy only new securities, placing all new money directly into the hands of investing firms. As for (a), only in an exchange economy would one expect much expenditure to take the form of direct outlays or Patinkinesque real-balance effects. There is nothing to suggest that Friedman has such an economy in mind. Although at other times he has shown some proclivity to the classical model, his explicit use of liquidity preference—the interest-elastic demand for money—rules out the (b) alternative. Finally, in any model, the helicopter source of money creation would clearly generate direct outlays (see our section, "Direct Outlines"), and this may be the world Friedman precisely has in mind.

Meanwhile, Friedman's reference to the rise of "the liquidity preference schedule" and the increase in "prices" as forces raising the market rate have been seen to have no merit at all in an analysis that accounts both for an economy's stocks and its flows. Friedman's reference to an increased "demand for loans" as raising the market rate neglects the other blade of the scissors, the nominal supply of loans, which can be expected to rise more or less equally with the demand for loans in an inflationary process.²⁵ His assertion that after a year or two, interest rates will return to "the level they would otherwise have had" is unexplained and manifestly untrue in the stock-flow framework or even in a pure flow (classical model) framework. It would be true only following a one-time increase in the stock of money, which is not the disturbance Friedman started out to analyze.²⁶

The Pedagogical Literature

To my knowledge, only one macroeconomics textbook currently in use (Auerbach and Kotlikoff 1995, p. 323) attributes a direct impact on the market rate to an imbalance between saving and investment (or government spending) in a Keynesian-type model—that is, one containing an interest-elastic demand for money. At most, texts will guardedly assert that an increase, say, in S , I , or G increases the "equilibrium" rate of interest. They then proceed to explain the equilibrating movement of a market rate below equilibrium as resulting from the induced higher level of income and the resulting increased demand for money. There is no awareness of the need to finance additional I or G by raising the market rate at the very beginning of the adjustment process, inducing wealth holders to fund the additional expenditures by economizing on their holdings of money. Nor is there any recognition that the additional transactions demand for balances due to the higher income is met by *spending* the balances, which the added income itself supplies, at a rate that raises their *average* level by the desired amount. As we have seen,

there is generally no need, necessity, or likelihood that income recipients will sell or issue securities, driving up their yield, to reach that higher level.

The following texts explain the equilibrating movement in the market rate in terms of the “income” theory. Bailey and Baumol-Blinder refer to the price level and, by implication, nominal income, as the equilibrator. The others simply refer to “income”: Ackley (1961, p. 371 and 1978, p. 379); Bailey (1970, pp. 36, 37); Baily and Friedman (1995, p. 107); Barro (1997, p. 777); Barron, Loewenstein, and Lynch (1989, p. 390); Baumol and Blinder (1999, pp. 271-2); Branson (1989, p. 90); Case and Fair (1996, p. 728); Dornbusch, Fischer, and Startz (2000, p. 244); Froyen (2002, pp. 154-5); Hall and Lieberman (1998, pp. 302-303; Hall and Taylor (1997, pp. 192, 221); Jaffee (1989, p. 583); Jansen, Delorme, and Ekelund (1994, pp. 197-8); Lipsey and Courant (1996, p. 586); Mankiw (1997, p. 713 and 2000, p. 275); McElroy (1996, p. 94); Mishkin (2000, pp. 584, 586); Sachs and Larrain (1993, p. 366); Skaggs and Carlson (1996, p. 403); Sheffrin, Wilton, and Prescott (1988, pp. 127-8); Thomas (1997, p. 555); Wachtel (1989, p. 100); Williamson (2002, p. 380).

Following an increase in money, Abel and Bernanke (2001, pp. 324-327) offer an *IS-LM* adjustment process that is essentially a sequence of comparative-static equilibrium states. The supply of output is, at first, infinitely elastic at the going price level, so that P is constant. The increase in M thus shifts LM to the right and creates a temporary equilibrium in y and r_M at the intersection of the new LM schedule and the given IS curve. But output at that point is greater than firms want it to be; they reduce output to its predisturbance level, causing the price level to rise, LM to shift upward back to its original position, and y and r_M to move up along IS to their predisturbance values. The explanation of the entire process, however, is not very satisfactory. We are told initially (p. 325) that adjustment in the financial markets (LM) is most rapid (in fact, virtually instantaneous), in the labor market (and hence the supply of output) least rapid, and in the goods market (IS) of intermediate speed. But then, “...when the economy isn’t in general equilibrium, the asset market and the goods market are in equilibrium, so that *output and the real interest rate are given by the intersection of the IS and LM curves*” (italics in original). Nothing is said about the process of reaching such a temporary equilibrium and of what role disequilibrium in the money, or at least the goods (S and I) market, might play in it. Similarly, the reverse upward shift of LM as P rises says little about underlying events occurring simultaneously in the money or goods market. Since the rise in the price level is said to restore all variables to their predisturbance levels, one might infer that P has served as the Keynesian equilibrator of the market rate of interest. But the authors do not explicitly state that. A similar *IS-LM* analysis by Hall and Taylor (1997, pp. 193-97), in which output again expands temporarily, explicitly attributes the equilibrating rise in r_M to the rise in prices and income.²⁷

Tracing the adjustment in terms of the *IS-LM* diagram, as well as the derived aggregate demand (AD) and aggregate supply (AS) schedules, is in fact a useful exercise.²⁸ But all of these schedules are market-equilibrium curves and cannot themselves provide de facto paths *between* equilibrium points. In a slightly different approach, authors sometimes construct phase diagrams to indicate the dynamic

tendencies, without committing themselves to specific paths or relative speeds of adjustment. For examples of the *IS-LM* phase drawings, see our Figs. 14 and 15 above, Froyen 2002, p. 148, and Gordon 2000, pp. 102-103 and 112-113. Gordon describes the phases more or less verbally, but his account seems consistent with the more explicit drawings of Froyen. For Froyen, points off *LM* are in money-market disequilibrium and move along vertical vectors directly to *LM*; only r changes. Points off *IS* are in goods-market disequilibrium and, on that account, are driven horizontally toward *IS*, with only y changing. There is no suggestion that to be effective, $I \neq S$ must also act directly on the market rate, lengthening or shortening the vertical vectors drawn toward *LM*.²⁹

Our assumption earlier of rapid adjustment in the money market would keep the dynamic path hovering close to the *LM* curve at all times. More fundamentally, our attempt to account for the financing of expenditures and the simultaneous role of the interest rate forces us to distinguish between y as the de facto supply of output and y as the effective demand for output. (See Hendershott and Horwich 1974.) Effective demand, y_d , is the expenditure that gets financed (or unfinanced) in any period through the interaction of stock and flow security markets and reductions (or increases) in the holding of cash balances in response to changes in the interest rate. An expansionary effective-demand path would begin with an upward vertical vector emanating from a point on *LM*. This would reflect the rise in the market rate as stock-security (the complement of $L_h - M_h$) and flow-security (equal to $I - S$) markets merge. When funds so obtained are spent, y_d moves rightward along a horizontal vector that stops short of the *LM* schedule. Assuming, at that point, a fixed price level due to an infinitely elastic supply of output, the resulting rise in output and capital stock lowers the rate of interest along a downward vertical vector that meets the *LM* curve. If we summarize each adjustment interval by a northeast vector followed by a downward vertical return to the *LM* curve, the path to the *IS-LM* equilibrium is a dampening sequence of saw-toothed movements.

The textbook literature extends its foray into dynamic process by making the same or similar mistakes with respect to the *AD-AS* diagram. Some show movements along *AD*, comparable to those along *IS*, except that *AD* is based on both *IS* and *LM* being in equilibrium. (Dornbusch, Fischer, and Startz 2001, pp. 93-94; Froyen, 2002, pp. 220-223; Abel and Bernanke, 2001, pp. 335-336, 428-429; Hall and Taylor, 1997, pp. 232-233). Once again, however, we need to make a sharp distinction between the supply of output and effective demand. The output supply response, moreover, must be specified in terms of how supply reacts to changes in effective demand—e.g., whether it is Marshallian, in which supply quantity responds to the difference between effective demand price and supply price, or whether it is Walrasian, in which supply price (and ultimately supply quantity) responds to the gap between effective demand quantity and supply quantity.³⁰ (See Horwich and Hu 1981, pp. 250-51.) If we assume that supply adjustments are more rapid than those of aggregate demand, paths to equilibrium will tend to cling to the aggregate supply curve. For example, starting with a point below *AD-AS* equilibrium on a rising *AS* schedule, an expansionary path to that equilibrium will begin with a rightward horizontal vector, reflecting the stock-flow financing of effective demand. This will be followed by a northwest vector ending on *AS* in response to the rise

in P , which reduces the value of y_d to the supply-quantity level. And so the path continues in a diminishing saw-toothed pattern on the right side of AS to equilibrium.

One text that asserts a direct impact of saving and investment on the market rate is Alan Stockman's *Introduction to Macroeconomics* (1999). However, I interpret his basic model as "classical" (LM is vertical), even though he specifies the demand for money as being interest-elastic (pp. 217-19). But when describing monetary injections (pp. 267-69), saving and investment (the "supply and demand for loans") appear to be the sole determinants of the interest rate. In the classical model, as in Stockman's account, monetary injections (e.g., open-market purchases) appear as simple additions to the saving schedule, creating, under normal circumstances, an immediate rise in the price level and a depressed market rate for only as long as the monetary authority is actually purchasing bonds. When the monetary authority ends its purchase, the flow S and I schedules immediately regain their equilibrium or natural rate, which is also the market rate. Stockman argues that only "sticky" commodity prices keep the nominal demand for loans (I) from rising equally with the monetary-enhanced supply of loans ($S + \Delta M$) and the interest rate therefore below its $S = I$ equilibrium (pp. 296-98). Clearly there are no impediments in Stockman's mind to instantaneous price-level response or equilibration of the market rate due to the interest-elastic demand for money and the huge stock of accumulated securities through which all financial transactions must initially pass (see his explanation of price stickiness as resulting from menu costs and the like, p. 279). One could argue that Stockman is abstracting from the very short run and the complications that result from an accumulated stock of physical and financial capital, as a principles text might advisedly do. But he is not consistent. When analyzing expenditure impacts, multipliers, and the like, he treats monetary velocity as very much a positive function of the interest rate (due to the interest-elastic demand for money) and the source of the income multipliers.

Conclusion

In his 1930 *Treatise on Money*, Keynes asserted that saving and investment, as sources of security demand and supply, are normally too small, relative to the stock of existing securities, to exert a discernible direct impact on the price and yield of securities. This simple, and in my view, indefensible, premise has dominated the analysis of the monetary-interest rate mechanism in almost all subsequent literature of the twentieth and early twentieth-first centuries. Only in pre-Keynesian models, such as the Wicksellian "classical" model in which the demand for money does not depend on interest rates, are saving and investment seen as impacting freely on security markets and market rates of interest. In Keynesian-type models, which contain a liquidity preference function (an interest-elastic demand for money), the forces usually invoked to equilibrate the market rate are changes in the price level or real income that shift the supply or demand for real balances. An additional mechanism identified by Keynes, the demand for money for finance, is unlike the other two in that it precedes any change in expenditures or income and, as its name suggests, accounts for the financing of additional spending. But like the other Keynesian mechanisms, the demand for finance relies on a shift in the demand schedule for money to move the market rate.

None of the Keynesian variables—the price level, real income, or the demand for finance—are shown to have any necessary or automatic equilibrating power with respect to the interest rate in a production economy, one in which loanable funds are made up of both stocks and flows. Except for autonomous changes in the supply of output, the price level responds as a dependent variable to changes in the supply or demand for money and has no reciprocal effect on the real market rate of interest. Changes in real income, experienced as a change in real balances, exert a net positive wealth effect on existing-security demand that pushes the market rate in a direction opposite to the change in income. Excess flow-security demand and supply originating in *ex ante* saving and investment are, in fact, the only forces acting automatically, unequivocally, and consistently to equilibrate market rates of interest. The excess flow impacts the existing-asset market directly, creating interest movements that are traced *along* the liquidity preference schedule. In this way, an excess flow-security supply obtains finance for increased investment or government outlays and, when additional consumption comes out of saving, the excess flow funds investment otherwise curtailed. An excess flow-security demand, reflecting reductions in desired expenditures, will simultaneously reduce financing levels and the market rate. Ongoing finance for a flow expenditure function is logically met by ongoing flow-security supply. Thus a shift in the demand for money for finance or any other purpose is at most a temporary or dependent element in the broader stock-flow security-market process and has no independent impact on the interest rate.

The only qualification to the above occurs when changes in the price level are due to spontaneous changes in output, rather than to the demand-side changes (in I , S , L , or M) that most of the preceding analysis has focused on. If prices fall, for example, because of spontaneous productivity gains that raise output and lower product prices simultaneously, households will experience the resulting increase in real balances both as additional wealth and as income. As in our earlier analysis, additional balances as income raise the transactions demand for money, which has no impact on the market rate of interest. But as additional wealth, the balances raise the existing demand for securities and lower the market rate. Whether this impact of the price-level on the market rate is equilibrating depends on whether the lowered market rate lies above or below the natural rate, which itself falls as a result of the simultaneous increase in saving.

Another exception to the pure structured stock-flow security-market process occurs when an adjustment is characterized by a money market out of equilibrium. The path to equilibrium, though still guided by the stock-flow equilibrating process, could be accompanied by significant offsetting shifts in existing-security demand and liquidity-preference in traditional Keynesian fashion. Similarly, money dropped from a helicopter will give rise to “direct outlays” on all goods, including securities, whose yields could drop if, and as long as, the rise in the price level is delayed. For that to happen, however, the supply of output must be very price elastic in the short run and less so over time.

Finally, it should be noted that a rigorous account of monetary-interest rate interaction uncovers elements in shorter-run and intermediate macro analysis usually

consigned to growth models. Changes in saving, investment, financial assets, and the real capital stock—both ex ante and ex post—are intrinsic to the briefest macro adjustments and can not be simply ignored or assumed away. Dismissing the capital-stock increments as small relative to the existing stock of capital, as is often done, misses the point. The increments are not small and play a major role relative to increments in the other variables comprising the short-run adjustment process: changes in real balances, in real interest-bearing financial assets, in real wealth, and income.

References

- Abel, Andrew B. and Ben S. Bernanke. 2001. *Macroeconomics*. New York: Addison-Wesley.
- Ackley, Gardner. 1961. *Macroeconomic Theory*. New York: Macmillan.
- , 1978. *Macroeconomics: Theory and Policy*. New York: Macmillan.
- Auerbach, Alan J. and Laurence J. Kotlikoff. 1995. Cincinnati: South-Western.
- Bailey, Martin J. 1971. *National Income and the Price Level*. New York: McGraw-Hill.
- Baily, Martin and Philip Friedman. 1995. *Macroeconomics*.
- Barro, Robert J. 1997. *Macroeconomics*. Cambridge, Mass.: MIT Press.
- Barron, John, Mark Loewenstein, and Gerald Lynch. 1989. *Macroeconomics*. New York: Addison-Wesley.
- Baumol, William J. and Alan S. Blinder, 1999. *Macroeconomics: Principles and Policy*. New York: Dryden.
- Bibow, Jorg. 2000. "The Loanable Funds Fallacy in Retrospect." *History of Political Economy*, 32, pp. 789-831.
- Branson, William H. 1989. *Macroeconomic Theory and Policy*. New York: Harper & Row.
- Case, Carl, and Ray Fair. 1996. *Principles of Economics*. Upper Saddle River, NJ: Prentice Hall.
- Davidson, Paul. 1965. "Keynes's Finance Motive." *Oxford Economic Papers*, 17:47-65.
- , 1994. *Post Keynesian Economic Theory*. Brookfield, VT: Edward Elgar.
- DeLong, J. Bradford. 2002. *Macroeconomics*. New York: McGraw-Hill Irwin.

Dornbusch, Rudiger, Stanley Fischer, and Richard Startz. 2000. *Macroeconomics*. New York: McGraw-Hill.

Froyen, Richard T. 2002. *Macroeconomics: Theories and Policies*. New York: Macmillan.

Gordon, Robert J. 2000. *Macroeconomics*. New York: Addison-Wesley.

Haley, Bernard F. 1948. "Value and Distribution," in *A Survey of Contemporary Economics*, Vol. 1, H.S. Ellis, ed. Philadelphia: The Blakiston Co., pp. 1-48.

Hall, Robert E. and Marc Lieberman. 1998. *Macroeconomics*. Cincinnati: South-Western.

Hall, Robert E. and Taylor, John B. 1993. *Macroeconomics*. New York: Norton.

Hansen, Alvin H. 1949. *Monetary Theory and Fiscal Policy*. New York: McGraw-Hill.

Hendershott, Patric H. and Horwich, George. 1974. "IS-LM As A Dynamic Framework." In G. Horwich and P.A. Samuelson, Eds. *Trade, Stability, and Macroeconomics*. New York: Academic Press.

Hicks, John R. 1937. "Mr. Keynes and the 'Classics'; A Suggested Interpretation." *Econometrica*, 5, pp. 147-59.

Horwich, George. 1957. "Money, Prices and the Theory of Interest Determination." *Economic Journal*, 67, pp. 625-43.

-----, 1962. "Real Assets and the Theory of Interest." *Journal of Political Economy*, 70, pp. 157-69.

-----, 1964. *Money, Capital, and Prices*. Homewood, Ill.: Irwin.

-----, 1966. "Keynes's Finance Motive: Comment." *Oxford Economic Papers*, 18, pp. 242-51.

-----, 1967. "Real Assets and the Monetary-Interest Rate Mechanism: A Reply." *Journal of Political Economy*, 75, pp.769-70.

-----, 1997. "Forced Saving." In D. Glasner, Ed. *Business Cycles and Depressions*. New York: Garland Publishing.

----- and Sheng Cheng Hu. 1981. "The Stability of Macro Models." In G. Horwich and J.P. Quirk, Eds. *Essays in Contemporary Fields of Economics*. West Lafayette, Ind.: Purdue University Press.

- Jaffee, Dwight. 1989. *Money, Banking, and Credit*. New York: Worth.
- Jansen, Dennis, Charles Delorme, and Robert Ekelund, Jr. 1994. *Intermediate Macroeconomics*. St. Paul, MN: West.
- Johnson, Harry G. 1951-52. "Some Cambridge Controversies in Monetary Theory." *Review of Economic Studies*, 19, pp. 90-104.
- Keynes, John Maynard. 1950 [1930]. *A Treatise on Money*. Vol. I. London: Macmillan.
- . 1936. *The General Theory of Employment, Interest and Money*. New York: Harcourt Brace.
- . 1937a. "The General Theory of Employment." *Quarterly Journal of Economics*, 51, pp. 209-23.
- . 1937b. "Alternative Theories of the Rate of Interest." *Economic Journal*, 47, pp. 241-52.
- . 1937c. "The 'Ex-Ante' Theory of the Rate of Interest." *Economic Journal*, 47, pp. 663-69.
- . 1939. "The Process of Capital Formation." In D. Moggridge, Ed. *The Collected Writings of John Maynard Keynes*. Vol. 14, pp. 278-85. London: Macmillan.
- Klein, Lawrence R. 1947. *The Keynesian Revolution*. New York: Macmillan.
- Lipsey, Richard, and Paul Courant. 1996. *Economics*. New York: HarperCollins.
- Lucas, Robert E. 1982. "Interest Rates and Currency Prices in a Two-Country world." *Journal of Monetary Economics*, 10, pp. 335-59.
- Mankiw, N. Gregory. 2000. *Macroeconomics*. New York: Worth.
- . 1997. *Principles of Economics*. New York: Dryden Press.
- May, Joseph. 1970. "Period Analysis and Continuous Analysis in Patinkin's Macroeconomic Model." *Journal of Economic Theory*, 2, pp. 1-9.
- McElroy, Michael. 1996. *The Macroeconomy*. Upper Saddle River, NJ: Prentice-Hall.
- Metzler, Lloyd A. 1951. "Wealth, Saving, and the Rate of Interest." *Journal of Political Economy*, 59, pp. 93-116.
- . 1952. "A Reply." *Journal of Political Economy*, 60, pp. 249-52.

Mishkin, Frederick S. 2000. *The Economics of Money, Banking, and Financial Markets*. New York: Addison-Wesley.

Patinkin, Don. 1965 [1956]. *Money, Interest, and Prices*. New York: Harper & Row.

Pesek, Boris, and Thomas Saving. 1968. *The Foundations of Money and Banking*. New York: Macmillan.

Robertson, D.H. 1936. "Some Notes on Mr. Keynes' General Theory of Employment." *Quarterly Journal of Economics*, 51, pp.168-91.

-----, 1938. "Mr. Keynes and 'Finance'." *Economic Journal*, 48, pp. 314-18.

-----, 1940. *Essays in Monetary Theory*. London: Staples Press.

-----, 1953-54. "More Notes on the Rate of Interest." *Review of Economic Studies*, 21, pp. 136-41.

Romer, David. 2001. *Advanced Macroeconomics*. New York: McGraw-Hill Irwin.

Rotwein, Eugene, ed. 1955. *David Hume: Writings on Economics*. Madison: University of Wisconsin Press.

Sachs, Jeffrey and F. Larraine. 1993. *Macroeconomics in the Global Economy*. Englewood Cliffs, NJ: Prentice-Hall.

Sayers, R.S. 1938. *Modern Banking*. London: Oxford University Press.

Scitovszky, Tibor de. 1940. "A Study of Interest and Capital." *Economica*, N.S. 8, pp. 293-317.

Sheffrin, Steven, David Wilton, and David Prescott. 1988. *Macroeconomics*. Cincinnati: South-Western.

Skaggs, Neil and J. Lon Carlson. 1996. *Macroeconomics*. Cambridge, Mass.: Blackwell.

Smith, Warren L. 1970. *Macroeconomics*. Homewood, Ill.: R.D. Irwin.

Stockman, Alan. 1999. *Introduction to Macroeconomics*. New York: Dryden.

Thomas, Lloyd. 1997. *Money, Banking, and Financial Markets*. New York: McGraw-Hill.

Townshend, Hugh. 1937. "Liquidity-Premium and the Theory of Value," *Econ. J.* 47(1), pp. 157-69.

Tsiang, S.C. 1956. "Liquidity Preference and Loanable Funds Theories, Multiplier and Velocity Analysis: A Synthesis." *Amer. Econ. Rev.* 46(4), pp. 539-64.

-----, 1980. "Keynes's 'Finance' Demand for Liquidity, Robertson's Loanable Funds Theory, and Friedman's Monetarism." *Quarterly Journal of Economics*, 94(3), pp. 467-91.

Wachtel, Paul. 1989. *Macroeconomics*. New York: McGraw-Hill.

Wicksell, Knut. 1935 [1906]. *Lectures on Political Economy*, Vol. II (*Money*). London: Macmillan & Co., Ltd.

Williamson, Stephen D. 2002. *Macroeconomics*. New York: Addison-Wesley.

Witte, James G. 1967. "A Comment on 'Real Assets and the Theory of Interest'." *Journal of Political Economy*, 75, pp. 767-8.

Wright, David M. 1952. "Professor Metzler and the Rate of Interest." *Journal of Political Economy*, 60, pp. 247-49.

Endnotes

1. Sayers claimed in the opening footnote to his chap. 10 that the analysis was based on Keynes's *Treatise* (1930), chaps. 3 and 23. Both of Keynes's chapters describe the characteristics of income, savings, and other kinds deposits, but do not address the general process by which one deposit category is converted into another over the course of the business cycle. Keynes's belief that shifts in the saving and investment schedules could not influence the distribution of deposits by acting directly on the market rate was expounded in chap. 15 of the *Treatise*, the relevant passages of which Sayers either missed or disregarded. Oddly enough, Sayers dropped his commendable chap. 10 in editions of his book published after 1951.
2. Other writers who reiterated Keynes's position that the saving and investment flows were too small to impact significantly on the market rate were Townshend (1937, pp. 167-79), de Scitovszky (1940, pp. 299-300), Klein (1947, p. 123), Haley (1948, p. 41) and H.G. Johnson (1951, p. 92).
3. Keynes's influential American expositor, Alvin Hansen, recounted this chain of events: "An upward shift in the marginal efficiency schedule will affect the rate of interest through its effect on income, which in turn will affect the liquidity preference schedule and so the rate of interest" (1949, pp. 81-2).
4. It should be noted that very few of the conclusions that follow would surprise Dennis Robertson. In papers published immediately after the *General Theory* (see *Essays in Monetary Theory*, 1940), he saw, with penetrating logic and rapier wit,

the relationships between saving and investment, both ex ante and ex post; between statics and dynamics, involving both stocks and flows; between money as a store of value and as a medium of exchange; and between new and old securities. In a word, he understood the essence of the monetary-interest rate process. Robertson was not, however, willing to reject the income theory unconditionally because, he once wrote to me, he felt he had invented it! (Regrettably, I have misplaced his letter, sent to me, I believe, in 1956.)

5. See the section, "A Qualification: Stability," for the reasoning behind (11).
6. See Ackley 1978, chap. 6, where $\partial S/\partial y$ is valued at .10 to .25, and p. 390, where $\partial S/\partial W$ is cited as equal to $-.05$.
7. The transfer of balances from wealth holders' "portfolios" can be thought of as a transfer of "idle" or speculative balances (usually designated M_2) to entrepreneurs who, by spending them on investment projects, convert them to "active" or transactions balances (M_1). Similarly, in the following section, we can regard the increase in saving as causing active balances of savers to be deactivated when they are spent on old securities and held idle by wealth holders at a resulting lower market rate of interest. The idle-active terminology was used extensively in the 1930s and 1940s in the Keynesian-dominated literature, and occasionally since then. It is a vivid metaphor and useful in understanding the separate functions and impacts of money expressed by the separate motives, $L(r)$ (designated L_2 , the demand for M_2) and $L(y)$ (L_1 , the demand for M_1). But the distinction *is* a metaphor and I have chosen to avoid it here. I regard all money as part of an aggregate that simultaneously performs both speculative and transactions functions, and for which there is no solid evidence to the contrary. I should point out, however, that the dichotomized money supply, rigorously interpreted, does result in price-level effects on the real market rate of interest. For a discussion of these issues, see Horwich 1964, pp. 4-5, 18-19, 368-88.
8. The S_E schedule prevailing at the end of the interval will not be the one pictured in Fig. 4. Instead, following the merger of stock (S_E) and flow ($I = S_F$) security schedules, a new S_E function, incorporating the ex post addition of new securities at r_M'' , would be drawn to replace S_E' . Like S_E^{t-1} , the new function would be hyperbolic. See Horwich 1964, pp. 91-92, for a linear derivation of the new existing-security supply schedule.
9. The increase in D_E occurs repeatedly following the return of balances to households each period. As such, the increment to D_E is part of an ongoing undifferentiated total demand for securities that includes D_N , flow security demand originating in and equal to current ex ante saving. The increment to D_E is the addition to total security demand caused by the wealth (ultimately, the capital-stock) gain due to $I > S$ (produced by $r_M < r_N$). In equilibrium, when $r_M = r_N$, D_E returns to a steady-state growth equal only to the addition of D_N .

10. See the section, "Keynes's Demand for Finance" (including the last paragraph) for a fuller discussion of firms' demand for cash balances.
11. An assumption made by Metzler (1951, p. 109, n. 15) is that following an open-market purchase, the monetary authority restores income received on its new security holdings to the private sector. Failing this, national income and expenditures will constantly decline. Metzler argued that the wealth-neutral way for the authority to offset its new security income would be to reduce taxes on personal, rather than on property, income. If property taxes were lowered, securities corresponding to property would rise in value, exactly offsetting the private sale of securities to the authority. Metzler wanted to avoid this result because he was analyzing the pure wealth impact of open-market operations. For our purposes, which focus on the interest rate, changes in the composition of wealth are less important because changes in security wealth for any reason, including tax changes, will create equal changes in existing-security demand, leaving the market rate of interest unmoved ([11]). We do, nevertheless, follow Metzler in assuming that the authority restores its earnings on newly acquired securities by reducing taxes on persons only. This simplifies the analysis by keeping money securely in the portfolios of those directly involved in open-market operations and avoids the broader range of impacts and expenditures that would result from property tax reduction and the freeing of these balances for immediate across-the-board expenditure. For further discussion of this issue, see the section below, "Direct Outlays: A Viable Monetary Mechanism?" For a broader discussion of the wealth effects of ex post saving and investment occurring during the adjustment process to any equilibrium position, see Horwich, 1962 and 1964, chap. 5.
12. See (9) for the interest-rate coefficient of D_E . We can relate (9) to the present discussion by writing the interest-elasticity of L_h ,

$$\eta = (\partial L_h / \partial r)(r/L_h),$$

solving for $(\partial L_h / \partial r)$,

$$\partial L_h / \partial r = \eta(L_h/r),$$

and substituting in (9):

$$\partial D_E / \partial r = -(\rho/r^2)K - \eta(L_h/r).$$

Hence,

$$\partial D_E / \partial r \geq \text{or} < 0 \text{ as } -\eta \geq \text{or} < (\rho/r)(K/L_h).$$

If we let $\rho = r$, an equilibrium condition, and set $K = 10L_h$, then

$$\partial D_E / \partial r < 0 \text{ when } -\eta > 10.$$

Thus D_E reverts from downward sloping to upward sloping, as in Fig. 13, when the absolute interest elasticity of the household demand for real balances becomes greater than 10. If $K = 20L_h$, then the threshold absolute L_h interest elasticity is 20. As noted below, the upward-sloping D_E schedule is the enabling condition for an eventual liquidity trap.

13. See Horwich (1964), pp. 22-32 and 452-56 for the relationships between security-value and security-quantity schedules.
14. The only occasion on which an increase in income would be expected to cause a rise in the market rate would be if simultaneously households experience huge capital gains, as from a spontaneous run-up in stock prices. In that event the combined effect of the increases in income and wealth could cause additional consumption spending to exceed the income increment. To fund such a spending level, households might decide to dishoard or, more to the point, sell securities out of existing portfolios, raising the market rate.
15. If households anticipate that market rates will continue their upward climb, that could induce an immediate sale of securities held in portfolios, quickly raising the market rate to the natural level. Such a "rational" expectation would supersede any other forces acting to move the market rate. Whether, and in what circumstances, there is enough regularity in adjustment processes, following disturbances, to trigger such behavior is, of course, an open empirical question.
16. We would expect the productivity gains also to raise the value of the existing stock of capital and thus the value of outstanding shares. By our assumption (11), this wealth gain would fall entirely on the stock demand for securities and have no impact on security yields and r_M . However, by (19), saving would fall, raising the natural rate and gradually, the market rate. At the same time, the increase in the value of the capital stock would tend to raise the investment demand schedule.
17. The only other possible exception to direct new-security funding (though not an option in the present model) would be if the funding for investment were acquired through a diversion of firm revenues (the use of retained earnings). That would represent a simultaneous act of saving followed by investment, which, if acquiesced in by shareholders, would have no effect on the market rate of interest. When the investment materializes and raises the value of the firm's previously issued securities, S_E and, by (11), D_E will move equally to the right, the rate of interest remaining constant. The net effect is equivalent to the sale of new securities by firms to an equal forthcoming rate of saving. If shareholders do not acquiesce in the reinvestment of earnings, they will sell

their previously purchased shares, causing the market rate to rise.

18. See Robertson (1938) for a criticism of Keynes's notion of a "revolving fund" out of which new investment could be financed following the completion of each investment project.
19. Should households wish to add further to the balances that service their consumption, they could make a one-time additional allocation out of current or future saving. That would be the household analogue to firms applying some portion of the flow of investible funds to their cash balances. As with additional investment, however, it would be misleading to attribute the simultaneous increase in the market rate to any increase in the demand for money rather than the prior underlying events occurring in the flow securities market. The increase in consumption, funded by a decrease in current saving and a reduction in flow security demand, acts directly to raise the market rate of interest. Finally, note that any increase in average household balances held as a result of the increase in consumption will be offset to some degree by the reduced level of firm balances due to the reduction in saving and thus investment.
20. Tsiang (1956, p. 554, eq. 9) writes a loanable-funds equation, which, using our symbols, omitting a term involving the monetary base, and rearranging, is:

$$I - S = dM/dr(\Delta r) - dL/dr(\Delta r). \quad (30)$$

Verbally, the excess of intended investment over saving is equal to the change in the excess supply of money induced by a change in the interest rate. But, with reference to (29), we cannot take the derivative of the right side only—we must differentiate both sides. The left side of (30) should be $dI/dr(\Delta r) - dS/dr(\Delta r)$.

21. The addition of a banking system to the model creates an upward-sloping Supply of money with respect to the rate of interest. This increases the absolute interest elasticity of the excess-supply-of-money function. A more interest-elastic liquidity preference function would have the same result.
22. Wright suggested direct outlays as a likely additional channel for the monetary process in Metzler's analysis (1951). Metzler (1952, p. 251) accepted Wright's suggestion.
23. Increased taxes on personal income would, in a longer-run period, reduce the value of human capital and possibly diminish work effort, risk-taking, and investment in the form of education. Such induced effects would presumably be felt well after the shorter-term time frame of monetary policy or other macro disturbances.

24. See the section above, "Lags in the Price Level Response," for a rationalization of the delayed increase in the price level following increases in effective demand. The source of the delay rests on fluctuations in output, which Patinkin's exchange model cannot draw on.
25. At a session of the Midwest Economics Association in Chicago in 1971, Friedman conceded that his third mechanism, the increased demand for loans, was an error on his part for having neglected the accompanying rise of the supply of loans—the other blade of the scissors. He added, however, that he believed the former would lead the latter. But whether lagged or otherwise, the second blade of the scissors will undo what the first blade accomplished.
26. Romer (2001, pp. 472-473), like Friedman, concludes that the real market rate, in response to a change in a continuing rate of monetary increase, will eventually return to the predisturbance level of the real natural rate. Romer does not explain the result; he simply assumes it. Barro (2000, pp. 280-286) and DeLong (2002, pp. 230-231) also find, in a closed economy, that changes in the growth rate of money have no effect on the real rate of interest. Both writers, like Romer, abstract completely from the mechanism by which money is introduced or withdrawn and hence any initial effects on interest that such changes might have. Earlier editions of Dornbusch and Fischer similarly follow the Friedman analysis; e.g., 1990, pp. 634-637. The analysis in later editions, however, is not comparable since it is carried out in a model of an open economy in which the interest rate is largely fixed by international markets.
27. The clear implication of Abel and Bernanke's assumed relative market speed of adjustment is that, in the *IS-LM* diagram, the monetary injection in fact moves along two separate segments. The initial movement, coinciding with the fall in the market rate, is a vertical downward path along the given supply-of-output line. The (r_M, y) points on that path connect the initial and new *LM* schedules, or can be thought of as lying on a downward shifting *LM* schedule at all times. There then follows an upward path along the new *LM* curve to the intersection with *IS*. This last segment, lying below *IS*, would involve interest-income combinations for which $I > S$, so there would appear to be impacts along that path on r_M as well as y . Finally, firms decide to restore their initial output and reduce aggregate demand by raising prices. *LM* returns to its initial position, moving along *IS*, as do both r_M and y . Abel and Bernanke make no attempt to spell out the dynamics or the causality along any of these paths.
28. Phase diagrams are sometimes also constructed for the movement of P and y in the *AD-AS* framework (see Metzler 1951 and Patinkin 1965 for phase diagrams in $P-r$ space).
29. See Fig. 15 above, which shows that within the opposite vertical angles created by the intersecting *IS* and *LM* curves, the force contributed to the movement of r by the direct action of $I \neq S$ supplements that of $L \neq M$; within

the opposite horizontal angles of IS and LM , $I \neq S$ moves r in a direction opposite to that of $L \neq M$.

30. Supply price is the price level corresponding to q_s , the given (prevailing) quantity on the AS schedule; demand price is the price level at which q_d , real effective demand including funding by the stock-flow security market process, is reduced exactly to the level of q_s . The adjustment path follows the saw-toothed pattern along the AS curve described below for both the Marshallian and Walrasian cases, but the stability conditions are different for each.