(A11) are \( r + 1 \) linear equations in the variables \( \frac{\partial \alpha}{\partial \phi} \) for \( t = 1, \ldots, r \). We can therefore solve for \( \frac{\partial \alpha}{\partial \phi} \) using Cramer’s rule:

\[
(A12) \quad \left( \frac{\partial \alpha}{\partial \phi} \right)_{i, \phi} = \frac{\Delta \sum_{k} G_{r+k}H_{c_k} - \sum_{k} \sum_{i} i_{r+k}H_{c_k}G_{C_i} - \sum_{k} G_{C_k}}{\Delta}
\]

But

\[
\Delta \sum_{k} G_{r+k}H_{c_k} - \sum_{k} \sum_{i} i_{r+k}H_{c_k}G_{C_i} = \Delta \sum_{k} G_{r+k}H_{c_k} - \sum_{k} H_{c_k} \left( \sum_{i} i_{r+k}G_{C_i} \right) = \sum_{k} H_{c_k} \left( \Delta G_{r+k} - \sum_{i} i_{r+k}G_{C_i} \right)
\]

If we now restrict \( \beta(\beta) \) such that

\[
(A14) \quad \beta(\beta) = \gamma^*_i \quad (i = 1, \ldots, n)
\]

and assume \( \beta = 0 \), we can use (A9) and (A7) to evaluate (A12) at \( \phi^* \):

\[
(A15) \quad \left( \frac{\partial \alpha}{\partial \phi} \right)_{i, \phi} = \lambda^*_i
\]

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1. Introduction

The sharply rising inflation rates and high nominal interest rates of the latter nineteenth
centuries have caused renewed interest in Irving Fisher’s work on the relationship of interest
rates and inflationary expectations. Fisher’s proposition that the nominal interest rate
would fully adjust to reflect changes in the anticipated inflation rate leaving the real rate
of interest unaffected has been analyzed by several authors in recent years. Mundell
(1963, 1971) studied the effects on interest rates of changes in the anticipated inflation
rate within a model developed by Lloyd Metzler (1951). Mundell showed that,
‘anticipated inflation or deflation is likely to raise (lower) the money rate of interest
by less than the rate of inflation (deflation) itself.’ Changes in the anticipated rate of
inflation therefore would affect the real rate of interest. Sargent (1972) showed that within
a modified version of the IS-LM curve model changes in the anticipated rate of inflation
will have a short run effect on the real rate of interest and, hence, on the level of real output,
but that an increase in the anticipated inflation rate will eventually cause the nomi-
nal interest rate to rise by the full amount of the increase. The real rate will be unchanged.
Karni (1972) showed that within Mundell’s model the real rate of interest will not be
affected by changes in the rate of anticipated inflation in the long run, where the long run
is defined as the time period within which the economy returns to a point of stationary state
equilibrium, i.e., zero net saving and investment.

This paper uses a modified IS-LM curve framework to carry out a general analysis of conditions under which changes in the anticipated rate of inflation will or will not lead to changes in the real interest rate. The Mundell result is shown to stem from one of several possible properties of the model which cause the real rate to be affected by changes in the anticipated inflation rate. The Sargent and Karni results likewise follow from two of several plausible restrictions on the model which will lead to an unchanged real interest rate. Other cases are considered where, under various assumptions, changes in the anticipated inflation rate will lead to a full adjustment, partial adjustment, no adjustment, or a perverse adjustment in the nominal interest
rate. Such a generalized analysis is helpful to an understanding of the complex relationship which exists between the real rate of interest and the anticipated inflation rate even within those models of a very simple nature. Fisher's own analysis of this relationship was of a partial equilibrium nature focusing on the change in the nominal interest rate needed to restore the investor to an equilibrium portfolio following an increase in the anticipated inflation rate. Any effects of the changes in the nominal interest rate or the change in the anticipated inflation rate elsewhere in the economy were neglected. The essence of Mundell's contribution was the recognition that movements in these variables create disequilibriums in other markets and the adjustments necessary to restore overall equilibrium will in turn feedback upon the nominal interest rate. In Mundell's own model, the price rise necessary to restore equilibrium in the goods market following the rise in the anticipated inflation rate affects real money balances, savings, and, hence, affects the equilibrium nominal and real interest rates. Once such a general equilibrium approach is adopted, there are a number of feedback effects to be considered and a number of restrictions that can be placed on the model which will make such feedbacks inoperative. It is widely recognized that a rise in the anticipated inflation rate will lead to a partial or full adjustment of the nominal interest rate. This paper attempts to explain the various assumptions about the structure of a simple macroeconomic model which will lead to such of these outcomes and some assumptions which lead to other less expected outcomes. A second goal of this paper is to analyze one important effect on the interest rate of changes in the anticipated rate of inflation which previous models have neglected. Changes in the anticipated rate of inflation cause changes in the anticipated relative yields on money, bonds, and equities. For a given level of nominal interest rates, changes in the anticipated inflation rate are shown to have direct effects on desired portfolio composition. Consideration of this effect is shown to alter some of the theoretical comparative statics on the real interest rate of changes in the anticipated inflation rate, and also to have important implications for the proper empirical testing of the relationship between price expectations and interest rates.

Section Two of this paper describes the model to be used for the analysis. Section Three considers the effects on the real interest rate of changes in the anticipated rate of inflation under various assumptions about the structure of the model. Section Four summarizes the results of the paper and discusses their implications for the proper construction and interpretation of empirical tests of the relationship between interest rates and the anticipated inflation rate.

2. The Model

Equations (1)-(6) comprise the basic forms of the model to be used for this study:

\[ c = c(y, W), \quad 0 < c, \quad c_y < 1, \quad c_W \geq 0 \]

\[ e = e(p^*, \epsilon), \quad \epsilon < 0 \]

\[ e_y = 0, \quad e_\epsilon = -e_p \]

\[ y = c + e \]

\[ L = L(y, p^*, W), \quad L_y > 0, \quad L_\epsilon < 0, \quad L_p \leq 0, \quad L_W \geq 0 \]

\[ M = M \]

\[ \frac{M}{P} = L \]

where,

- \( e \) = real consumption
- \( y \) = real GNP
- \( v \) = real investment

\( i \) = nominal rate of interest (percent)
\( L \) = demand for real money balances
\( M \) = nominal money stock
\( P \) = price level
\( W \) = real wealth
\( p^* \) = anticipated rate of inflation (percent)

Substitution of (1), (2) into (3) and (4), (5) into (6) yields the following equilibrium conditions for the money and product markets,

\[ 0 = y - c(y, W) - \epsilon(y, p^*) \]

\[ \frac{M}{P} = L(y, p^*, W). \]

The expected rate of inflation \( (p^*) \) is econometric to the model. The inclusion of the anticipated inflation rate as a variable in the money demand function is explained below. Investment is assumed to depend on the real rate of interest, hence, changes in the nominal interest rate and anticipated interest rate have effects of equal magnitude in opposite directions. The price level and the level of real income cannot both be determined endogenously within the model. Either \( P \) or \( y \) will be assumed to be fixed in the following analysis. The model is a two asset model with money and one alternative asset being a nominal rate of interest. The nature of this alternative asset and the definition of real wealth will be given further consideration below.

3. The Effects of Changes in the Anticipated Rate of Inflation

a. A Simplified Version of the Model

Initially, it is assumed that \( W \) equals zero, \( W \) is fixed at \( W_0 \) and \( P \) is fixed at \( P \). With these assumptions the model corresponds to the usual textbook version of the IS-LM curve model (with the addition of the \( p^* \) variable).

\[ \frac{di}{dp^*} = \frac{-\epsilon_y}{\Delta}, \quad 0 \leq \frac{-\epsilon_y}{\Delta} < 1, \]

where,

\[ \Delta = \left| 1 - \epsilon_p \right| \]

\[ \frac{dL}{dp^*} = \frac{-\epsilon_p}{\Delta} \]

A rise (fall) of one percent in the expected rate of inflation leads to a rise (fall) of less than one percent in the nominal interest rate. The real interest rate falls and real income rises as a result of an increase in the anticipated inflation rate. Initially, the increase in the anticipated inflation rate causes a fall in the real rate stimulating investment and income. As income rises, the transactions demand for money rises and the nominal interest rate rises. Since equilibrium at any given level of income now requires a higher nominal interest rate to achieve the same level of investment) and, hence, a lower demand for real balances than before, the new equilibrium must be at a higher level of income and, therefore, lower real interest rate.

b. Two Special Cases

The real rate of interest will be constant if either of the following restrictions are placed on this simplified version of the model:

Case 1: The real rate of interest will remain constant if \( L_\epsilon = 0 \). For this case (9) reduces to

\[ \frac{di}{dp^*} = \frac{-\epsilon_y}{\epsilon_p}. \]

If the LM curve is vertical the level of real income is fixed. Since saving depends only on the level of income, saving is fixed and it follows that investment and the real rate of interest are fixed.

Case 2: The real rate of interest is unchanged if it is assumed that there is a unique full-employment level of income (\( y_e \) and the
price level adjusts instantaneously to maintain this income level. In this case equations (7) and (8) determine \( P \) and \( I \). Totally differentiating (7) and (8) with respect to \( p^* \), solving for \( \frac{dq}{dp^*} \) yields,

\[
\frac{dq}{dp^*} = \left( \frac{M}{\bar{p} p^*} \right) \Delta = 1. \tag{11}
\]

where,

\[
\Delta = \left( \frac{M}{\bar{p} p^*} \right) \frac{\partial L}{\partial p^*} < 0.
\]

This version of the model is the comparably static equivalent of the dynamic model used by Sargent (1973) and in equilibrium yields the same result. If the assumption is made that equilibration requires that the level of real income be unchanged and saving depends only on real income, then investment must be unchanged, and for this the real rate of interest must be unchanged. The nominal rate of interest must adjust completely.\(^5\)

c. Wealth Effects in the Consumption Function

Next, consider the case where \( W \) is not fixed at \( \bar{W} \). Changes in real wealth will be allowed to affect consumption and saving, but for now we will assume \( L_w = 0 \) changes in wealth will not be allowed to affect the demand for real balances. This assumption will be dropped in Section 3d. We specify real wealth as follows,

\[ W = W_0 + \bar{M} L_0, \quad W_0, W_0 > 0, \quad W_0, W_0 < 0. \]

Real wealth depends positively on the fixed nominal stock of money \( \bar{M} \) and on the fixed income stream from the alternative asset in the model \( \bar{E} \). The discounted value of this income stream depends negatively on the nominal rate of interest \( r \), and, finally, the real value of a given level of nominal wealth varies inversely with the price level \( p^* \).

The consumption function is now given by

\[ c = c^0 L_0 \frac{\bar{E}}{\bar{p} p^*}, \quad 0 < c^0 < 1, \quad c_0 c^0 < 0. \tag{13}\]

Substituting (13), in place of the consumption function given by (1), into the equation for the IS curve (7) and again holding income fixed at the full-employment level \( y_0 \), total differentiation with respect to \( p^* \) and solution for \( \frac{dp}{dp^*} \) yields,

\[ \frac{dp}{dp^*} = \left( \frac{\bar{p} p^* - \bar{P}}{\bar{p} p^* p^*} \right) \frac{\bar{E}}{\bar{p} p^*}, \quad 0 < \frac{\bar{E}}{\bar{p} p^*} \frac{\bar{E}}{\bar{p} p^*} < 1, \quad c_0 \frac{\bar{E}}{\bar{p} p^*} < 0. \tag{14}\]

the last two terms in the denominator, both of which lower the magnitude of the effect.

\( d \)

For example if costs were the alternative asset we would have,

\[ W = \bar{W} + \bar{M} \frac{\bar{E}}{\bar{p} p^*} \]

where costs pay \( \bar{D} \) dollars per period. If in the Metzler model used by Mundell, the alternative asset is equities and the predicted income stream is fixed in real terms (Mundell, 1973, p. 30), the \( W_0 \) will consist only of the negative effect of price increases on real balances.

\[ d \]

\[ \text{Wealth Effects in the Money Demand Function} \]

In the Mundell model changes in real wealth affect consumption and saving but not the demand for real balances. The implicit assumption being that all increments to wealth are held in the form of alternative asset and none are held as money balances. If this assumption is dropped, we must take account of changes in wealth on money demand. To do this we assume \( L_w > 0 \), and substitute (12) for \( W \) in the money demand function to yield,

\[ L = L_0(\bar{p} p^*, \bar{M}_0, \bar{E}_0, \bar{P}), \quad \bar{L}_0, \bar{L}_0, \bar{P} > 0, \quad L_w > 0, \quad L_w < 0, \quad L_w, \bar{P} \leq 0, \]

where \( L_w \) is now negative due to wealth effect as well as the substitution effect and \( L_w \) is equal to \( \bar{L}_0 \bar{W}_0 \). \( \bar{L}_w \) will be assumed to be zero until the next section. For the case where the price level is fixed and real income varies, the inclusion of wealth effects in the money demand function leaves the qualitative results given above unchanged. When the price level is allowed to vary, holding real income constant at a full employment level, substitution of (18) into the equation for the LM curve (8) and total differentiation of (7), (8) with respect to \( p^* \), results in the following solution for \( \frac{dp}{dp^*} \).

\[ \frac{dp}{dp^*} = \frac{-\bar{M} p^*}{\bar{p} p^* - \bar{P}} \frac{\bar{E}}{\bar{p} p^*}, \quad \text{which is positive but less than one. If there are no wealth effects (14) collapses to} \]

\[ \frac{dp}{dp^*} = \frac{\bar{M} p^*}{\bar{p} p^* - \bar{P}}, \quad \text{since in the absence of wealth effects} \quad c_0 = 0. \quad \text{Adding the real rate of interest as an argument in the savings function leaves the conclusions in the test unchanged.} \]

\[ d \]

\[ \text{Wealth Effects in the Money Demand Function} \]

For the case where the price level is fixed and real income varies, the inclusion of wealth effects reinforces the qualitative results given by (9). A rise in the anticipated rate of inflation causes the real rate of interest to fall by a greater amount than for the case where wealth effects were excluded. Real savings is higher for any given income level due to the higher nominal interest rate (lower level of wealth). For this case \( d \) can be computed as

\[ \frac{dp}{dp^*} = \frac{-\bar{L}_0 \bar{W}_0}{\bar{L}_0 \bar{W}_0 + \bar{P}} \]

which is again positive and less than one. A combination of (9a) with (9d) shows that the nominal interest rate rises by less than with wealth effects excluded.
\[ \frac{dt}{dp^2} = \frac{-\alpha - \frac{\lambda}{p} + \lambda}{\Delta^2} = 0, \]
\[ \Delta^2 = \frac{c(p + \lambda)}{\lambda} \]

The effect of a change in the anticipated inflation rate on the nominal interest rate may be positive, zero, or negative depending on the relative magnitudes of \( I_p \) and \( \frac{M}{p^2} \). There are three possibilities:

1. If \( |I_p| \) is greater than \( \frac{M}{p^2} \), a rise in the price level will result in an excess supply of money. In this case the sign of the numerator of (17) will be positive. The sign of the denominator is indeterminate. Application of the correspondence principle will guarantee that the sign of \( \Delta^2 \) is negative implying that the nominal interest rate will fall when the anticipated inflation rate rises.

2. If \( |I_p| \) is less than \( \frac{M}{p^2} \), a rise in the price level will create an excess demand for money. A rise in the anticipated inflation rate will cause a rise in the nominal interest rate. By comparing (17) with the result given in (16) above it can be verified that including a wealth variable in the money demand function reduces the rise (fall) in the nominal interest rate for a given rise (fall) in the anticipated inflation rate as long as wealth is also a variable in the consumption function. If, however, a wealthy variable is not included in the consumption function, (17) reduces to

3. If \( |I_p| \) is equal to \( \frac{M}{p^2} \), a rise in the price level does not disturb the equilibrium in the money market. The numerator of (17) will be zero. A rise in the anticipated inflation rate will not affect the nominal interest rate.

What can be said about the relative likelihood of each case and, hence, about the probable effects of a change in the anticipated inflation rate on the nominal interest rate when wealth appears as a variable in the money demand function? If we assume that increases in the price level reduce real wealth proportionately, i.e., wealth is fixed in nominal terms, and if we further assume that the wealth elasticity of the demand for money is unitary, it follows that

\[ L_p = \frac{L^{aw} W_p}{W} = -\frac{M}{p^2} \frac{W}{p} = \frac{M}{p^2} \]

since by assumption,

\[ \frac{L_p W}{M} = 1, \quad \text{and} \quad \frac{W_p}{p W} = -1. \]

For these parameter values we get the third case. \( |I_p| \) equals \( \frac{M}{p^2} \) and the nominal interest rate is unaffected by changes in the anticipated inflation rate.\(^{19}\)

In general, the higher the proportion of wealth held in assets whose value is fixed in nominal terms and the higher the wealth elasticity of money demand, the more likely will be the outcomes in Cases (1) or (3) and the less likely the outcome in Case (2).

c. Portfolio Composition Effects of Changes in the Anticipated Inflation Rate

Thus far, it has been assumed that the anticipated inflation rate is not a direct determinant of portfolio composition \( L^{aw} = 0 \). The nominal rate of interest on the alternative asset is taken as a measure of the holding cost of money. This is the assumption made by Mundell, Karni, and Sargent. This section argues that the realization of this assumption depends crucially on the nature of the alternative asset to holding real balances. The effects of dropping the assumption that \( L^{aw} \) equals zero are examined. To simplify the analysis throughout this section we return to the assumption that wealth is not an argument in the demand for money function.\(^{17}\)

First, suppose that, as in the Modigliani model used by Mundell, the alternative to holding money is to hold equity shares. These shares have the property that the income stream they yield (dividends) is fixed in real terms, hence, the value of these equities, the discounted present value of these income streams, is unaffected by inflation (for a given nominal interest rate).\(^{12}\) In contrast, inflation reduces the real value of money balances. The expected real rates of return on money \( r_n \) and equity shares \( r_e \) can be written as follows:

\[ r_n = r - p \]

\[ r_e = r + \alpha - p \]

where \( p \) is the expected inflation in the price of equities. The cost of holding money measured by the expected real return on equities minus the expected real return on money would be,

\[ r_e - r_n = \alpha + p \]

Only where \( p \) was zero would that nominal rate of interest on equities accurately reflect the cost of holding money. The implicit assumption in the Mundell and Karni papers is that even though the stream of dividend payments is fixed in real terms and, hence, for a given nominal interest rate the price of equities rises proportionally with the commodity price level, this appreciation in equity prices is never anticipated.

Instead here it is assumed that,

\[ p_e = f(p) \]

\[ f(p) > 0 \]

the expected appreciation in equity prices is a positive function of the expected rate of commodity inflation. It follows that such expectations are not an argument in the demand for money function.\(^{18}\)

The assumption made by Mundell and Karni that \( p_e \) equals zero is in accord with a number of models which abstract from expected capital gains on equities. Where expected commodity price changes are included in the model and especially where actual price changes in equities do respond to actual price changes in commodities, however, it seems reasonable to allow for expected appreciation in equity prices. The assumption that such expected equity price appreciation is a positive function of expected commodity inflation and hence \( L^{aw} \) is less than zero is in accord with either an adaptive expectations theory of expectations formation or with a theory of "rational" formation of expectations.\(^{19}\)
Figure 1—Effects of a Change in the Anticipated Rate of Inflation

For the case where $L_m < 0$, an increase in the anticipated rate of inflation has two effects on the demand for money. These are shown graphically in Figure 1, where the nominal rate of interest on equities is measured on the vertical axis and real income is measured on the horizontal axis. For the moment it is assumed that the price level is fixed and there are no wealth effects. The IS curve traces out points of equilibrium in the goods market (equation 7). The LM curve shows points of equilibrium in the money market (equation 8).

Initially equilibrium exists at $(y_m, 0)$ with $p^* = 0$. Now assume that $p^*$ increases to some positive value $p$. There are two effects in the model. Any nominal rate of interest corresponds to a lower real rate and higher level of investment; the IS curve shifts to the right (IS'). By itself this causes a rise in the nominal rate of interest and a fall in the demand for real balances for equilibrium at any income level. Additionally the increase in $p^*$ will increase the expected return on equities relative to money ($r - r_e$) causing a shift from holding money to holding equities; the LM curve shifts downward to the right (LM'). Equilibrium is restored at $(y_d, A)$. The shift in the LM curve has been neglected in previous models. This shift out of money into equities lessens the upward pressure on the interest rate caused by an increase in the anticipated inflation rate and, therefore, will, in general, increase the likelihood that the real rate will fall. Before analyzing this relationship further, the case where the alternative to holding money is to hold bonds is considered.

If bonds are the alternative asset, for example conduits paying a fixed nominal income stream of $8$ dollars per year, the expected real return on bonds will be,

$$r_e = i - p^*$$

where $i$ is the nominal rate of interest on bonds and $r_e$ is the expected real return on bonds. The difference in the expected real rates of return on bonds and money will be,

$$r_m - r_e = i.$$

Changes in the anticipated rate of return do not alter the relative returns on money and bonds since the value of both is fixed in nominal terms (for a given $i$). Sargent’s study

4There is a possible source of confusion here. Since by definition $i$, the "real rate of interest" is equal to $i - p^*$, we can substitute $i - p^*$ for $i$ in the money demand function in which case $L_m$ would be negative since a rise in $p^*$ implies a rise in $i$. Equivalently one can plot $r$ on the vertical axis in Figure 1, and the effect of an increase in $p^*$ can be shown as a rightward shift in the LM curve. The effect of an increase in anticipated inflation on money demand discussed in the text is a shift from money into equities for a given value of the nominal interest rate. While this effect has been neglected in models such as those used by Modigliani and Kimball, such an effect is implicit in the empirical work of Coenen (1960) and other studies of the effects of anticipated inflation on money demand. Such an effect is also recognized by Friedman (1956).

and in the empirical work on the relationship between price expectations and nominal interest rates, the bond rate of interest is taken as the return on the alternative asset, hence, the assumption that $L_m$ equals zero is justified. Only where equities or some other asset whose expected price is related to the commodity price level is the alternative to holding money balances would we expect $L_m$ to be negative.

If $L_m$ is negative, real income is allowed to vary and the level of real wealth, and the price level are held constant, the money demand function takes the form given by (4) with,

$$L = L(y, p^*, W), \quad L_m > 0,$$

$$L_m < 0.$$

total differentiation of (7), (8) with respect to $p^*$ results in the following relation for $dk/dp^*$,

$$\frac{dk}{dp^*} = \frac{1}{\delta} \left( \frac{L_y}{L_w} - \frac{L_y}{L_m} \right) = \frac{1}{\delta} \frac{L_y}{L_m}.$$

A comparison with (7) above, where it was assumed that $L_m$ was zero, shows the presence of the additional first term in (16) which has a negative sign. This term represents the downward pressure on the nominal interest rate due to the shift out of money into equities caused by the increase in the expected rate of appreciation in equity prices. Neglect of this influence will lead to an overestimation of the increase in the nominal interest rate which follows a rise in the anticipated inflation rate.

For one of the special cases considered above, however, such an overstatement does not occur. This is the case where $y = g$, $P$ is allowed to adjust, and wealth effects are not considered. This case is illustrated in Figure 2.

2 As in Figure 1, the initial equilibrium point $(y_m, 0)$ corresponds to $p^*$ equal to zero and we consider the effect of a rise in $p^*$ to some positive value $p$. Initially the IS curve shifts up to IS' and the LM curve shifts downward to LM'. The LM curve, however, must shift leftward to LM" in order to restore equilibriu

3The case where both bonds and equities are substitutes for real balances but where these two assets are treated as an aggregate to form a two asset model is considered in the conclusion to this paper.

4It remains as defined above.

Figure 2—Anticipated Inflation and the Nominal Interest Rate ($y = g$)
with respect to $p^*$ and solve for $dv/dp^*$ as given in (22), (23).

$$\frac{dv}{dp^*} = \frac{\sigma \lambda + a_t M}{\frac{M}{p^*}}$$ (22)

$$\frac{dP}{dp^*} = \frac{\sigma \lambda + a_t M}{\frac{M}{p^*}}$$ (23)

Since the denominator in both expressions is negative, $\sigma \lambda + a_t M$ is positive and $\frac{M}{p^*}$ is negative, $dv/dp^*$ will be smaller than for the case where $\frac{M}{p^*}$ equals zero while $dv/dp^*$ will be larger. In fact, it is the larger rise in $P$ which leads to the smaller rise in the nominal interest rate when the anticipated inflation rate rose since there will be a larger wealth effect on saving. Therefore, in the case analyzed by Mundell, taking account of the shift from money to equities results in a larger fall (rise) in the real interest rate for a given rise (fall) in the anticipated rate of inflation than when this portfolio effect is neglected.

The major point of this section has been to demonstrate that when the alternative to holding money is holding equities and when the expected appreciation in the price of equities is a positive function of the expected rate of appreciation in the price of commodities, a rise in the anticipated rate of inflation will cause a shift out of money into equities for a given nominal rate of interest. Failure to take this effect into account will, in general, lead to an overstatement of the rise in the nominal interest rate caused by an increase in the anticipated inflation rate and an understatement of the resulting fall in the real interest rate. Consequently the expansionary effect of a rise in the anticipated inflation rate on the price level and/or real income will be understated.

**4. Conclusion**

Using a modified version of the IS-LM curve model this study has analyzed the effect of anticipated inflation on the real rate of interest under a variety of assumptions about the structure of the model. The response of the real rate of interest to changes in the anticipated inflation rate was shown to depend on a number of factors including, the interest elasticity of the demand for money, whether income was fixed at a full employment level, the presence and nature of wealth effects in both the consumption function and money demand function, and the direct effect on desired portfolio composition of a change in the anticipated inflation rate.

The last of these influences, the direct effect on desired portfolio composition of a change in the anticipated inflation rate, was operative only when the alternative to holding money was to hold equities the value of which varied positively with the commodity price level. This finding has important implications for the proper construction and interpretation of empirical tests of the relationship between interest rates and anticipated inflation. These implications are discussed in the remainder of this section.

The use of two asset models of the Metzler or IS-LM curve variety to analyze multi-asset economies involves the implicit assumption that long term bonds and equities may be dealt with as a aggregate. This aggregation depends on the assumption that these assets are perfect substitutes and their nominal rate of return can be measured by one nominal interest rate. As Leijonhufvud (1968) and Tobin (1961) have made clear, the aggregation of bonds and equities is appropriate when considering the effects of interest rate risk within a fixed price model. Both bond and equities are long term assets and their value is similarly affected by interest rate changes. Their value is not similarly affected by changes in the price level as they are not good substitutes as regards risk of price changes. When studying the effects anticipated inflation on nominal interest rate it is clearly the risk of price changes that matters and the aggregation of bonds and equities is invalid. The nominal interest rates on both assets will be affected quite differently by changes in the anticipated inflation rate. Consider an economy with three assets: money, bonds, and equities. A rise in the anticipated rate of inflation will stimulate investment and increase income. The rise in interest rates increases the transactions demand for money for given nominal returns on equities and bonds. This shift out of equities and bonds into money pushes up nominal interest rates on both assets. The rise in the anticipated rate of appreciation in equity prices will raise the expected real rate of return on equities and, for given income level, cause a shift from both money and bonds into equities. The second effect has a downward impact on the nominal interest rate on equities and an upward impact on the nominal interest rate on bonds. To find the net effect on both nominal interest rates would require analysis within a three asset model. Empirical studies of the relationship between nominal bond interest rates and expected inflation rates can provide information only about the effect of anticipated inflation on the real holding returns on bonds. The effect of changes on the anticipated inflation rate on the real cost of capital, the interest rate variable which belongs in the investment function and the variable which determines whether changes in anticipated inflation have expansionary effects or not, depends on the movement in the nominal return on equities as well. Empirical tests based on improperly aggregated two asset models may well give misleading results about the response of the real rate of interest to changes in the anticipated inflation rate.

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A Note on the Behavior of Eurobond Interest Rates

PHILIP H. SIEGEL

I. Introduction

Recently, a number of studies have been published dealing with the eurobond market. Most of these studies have limited their interest to a discussion of the institutional aspects; while others have treated the analysis of the market in a non-empirical fashion. It is the purpose of this paper to make some contribution to the understanding of this market by considering one part of this market using regression analysis.

II. Scope and Methodology of the Study

This study will focus its attention upon analyzing the behavior of interest rates and financial variables dealing with U.S. corporate securities which have been denominated or marketed in U.S. dollars. The types of securities considered are of a straight debt nature issued by well-known U.S. multinational corporations. The following form was used to explain the behavior of eurobond rates:

\[ Reb = R(UK) - ER_{30} - Ra \]

in which

- \( Reb \) = Eurobond interest rates on U.S.
- \( R(UK) \) = United Kingdom central bank rate
- \( ER_{30} \) = Eurodollar deposit rate (30 days)
- \( Ra \) = U.S. Corporate Aaa Bond rate (U.S. market)

The use of the United Kingdom central bank rate was to get a reasonable proxy of the cost of borrowing in the overseas market. Although there are certain limitations, the U.S. multinational corporation financial manager must weigh alternative sources and costs of borrowing. The United Kingdom central bank rate does indicate the costs of borrowing in an important European financial market. The use of the eurodollar thirty day deposit rate has a twofold rationale. First of all, short-term borrowing in the eurodollar is a financial alternative to eurobond financing. In addition, when eurobonds are floated, the initial deposit creation is in the form of eurodollars. Therefore, the eurodollar rate would appear to have a significant impact on eurobonds in that they have both a complement and substitute relationship with eurobonds. Independent studies have shown that the substitute characteristic is much more important than the complement relationship. B. Gennis’ work also lends support to the relative importance of the substitute relationship between the eurodollar thirty day deposit rate and eurobonds.