MONETARY POLICY AND LONG-TERM INTEREST RATES: A SURVEY OF EMPIRICAL LITERATURE

M. A. AKHTAR*

This paper surveys recent empirical literature on effects of monetary policy on long-term interest rates. Most studies reviewed here suggest that tightening monetary policy results in higher long-term interest rates. But available evidence suffers from conceptual and empirical problems and fails to indicate the magnitude of short-run and long-run policy effects on long rates. Also, recent studies have not investigated the possibility of shifts in recent-year effects of monetary policy on long rates. Finally, the paper offers a policy perspective on limitations of existing evidence and suggests future research on monetary policy effects on long rates.

I. INTRODUCTION

In the first half of 1994, a moderate monetary policy tightening led to sharp increases in long-term interest rates. Contrary to popular press commentary, the rise in long rates in response to a restrictive monetary policy is not surprising. Financial innovations and structural changes over the last decade may have made long rates more sensitive to monetary policy than in the past. Yet, other recent monetary policy changes did not induce sharp changes in long rates. In 1992, for example, long rates' response to monetary policy changes was less than earlier experience would suggest. Differences in long rate movements associated with different monetary policy episodes may simply reflect developments in other financial and nonfinancial determinants of long rates.

A literature review should: (i) indicate whether long rates' recent response to monetary policy is in fact unusual, (ii) provide at least a rough sense of the magnitude and timing of the effect that a given monetary policy change will have over the short run versus the long run (important information since long rates play a central role in capital formation and economic activity), (iii) help assess the need for a fresh investigation of this subject.

This paper provides such a review. The review is not intended to be comprehensive, only to offer a broad overview of results. The main focus is on nominal interest rates, although the paper considers studies of both nominal and real interest rates.

II. OVERVIEW OF MONETARY POLICY EFFECTS ON LONG-TERM INTEREST RATES

In the short run, monetary policy tightening lowers bank reserves, deposits, and loans. At the same time, it pushes up the federal funds rate and other short-term interest rates. Higher short-term interest rates, working through substitution and

*Vice President, Federal Reserve Bank of New York. The views expressed do not necessarily reflect those of the Federal Reserve Bank of New York or of the Federal Reserve System. The author is grateful to two anonymous referees and to Howard Howe and John Wenninger for comments and suggestions, to Joshua Gleason and Richard Peach for model simulations reported in the Appendix, and to Eldon Dvorak for considerable help in editing and shortening the paper.

ABBREVIATIONS
DRI: Data Resources Inc.
ECM: Error correction model
MPS: MIT-Penn-SSRC
VAR: Vector Autoregressions

Contemporary Economic Policy
(ISSN 1074-3529)
Vol. XIII, July 1995

expectational effects, tend to increase long-term interest rates. These short-run or direct effects on long rates generally run in the same direction as those on short rates, but the magnitude is uncertain. For example, the expectations and liquidity preference theories of term structure point to a rise in long rates when short rates move up even though the two theories embody significantly different assumptions about the risk premium on long rates. One notable exception is the Fisher price expectations effect, which works to reduce long rates because a tighter monetary policy results in anticipations of lower future inflation. However, how quickly this effect actually materializes is an empirical issue.

Higher interest rates lead to a weaker economy, and the feedback effects from lower actual/expected output and inflation—together with the Fisher price expectations effect—tend to reverse at least a part of the original increase in long-term interest rates. The extent of the feedback and other effects depends on many factors, including the size of actual/perceived changes in output and inflation and the extent to which changes in policy are fully anticipated. Consequently, the net long-run or equilibrium effect of monetary policy actions on long-term interest rates is theoretically ambiguous and is a matter for empirical analysis. However, many economists believe that in the long run the feedback and the Fisher price expectations effects dominate the liquidity and other direct influences so that a tighter monetary policy eventually results in lower (not higher) interest rates (see Friedman, 1968; Cagan, 1972; Patinkin, 1992).

Empirical studies frequently focus on monetary policy's equilibrium effects on long-term interest rates without making a distinction between short-run and long-run effects. This equilibrium effect presumably refers to the medium run or the full business cycle period—a period long enough for most feedback effects of policy changes to work their way through the economy—rather than to the theoretical long run over which monetary policy generally is thought to be neutral. To avoid confusion, however, this paper follows the usual convention of using equilibrium and long-run notions interchangeably.

Note that a tightening of monetary policy affects both nominal and real long-term interest rates. The effects on real rates stem from cyclical developments in economic activity around the long-term trend and from shifts in the risk premium that compensates for uncertainty about future values of long-term instruments. If monetary policy is neutral in the long run, changes in the short-term stance of monetary policy—as distinct from changes in the policy rules—have no significant consequences for the long-run real rate of return on capital. The marginal productivity of capital is the main determinant of the real rate of return on capital, which in turn is the dominant component of real long rates, at least in the long run. (For a review of the issues on the long-run neutrality of monetary policy, see DeLong and Summers, 1988; Patinkin, 1992.)

III. A GENERAL FRAMEWORK FOR CONSIDERING EMPIRICAL EVIDENCE

A. *Identifying Monetary Policy Changes*

Examining the influence of monetary policy actions on long-term interest rates requires having a reliable measure of changes in monetary policy stance. Identifying policy changes involves two aspects: (i) choice of an appropriate policy indicator and (ii) measurement of changes in that indicator. Over the years, many variables have served as monetary policy indicators. Changes in the quantity of "money"—bank reserves, monetary base, M1 or M2—and changes in the federal funds rate or other short-term interest rates are the most common measures of monetary policy tightness or ease. Some economists have utilized bank credit and other credit measures. In recent years, many have argued that the spread between long-term and short-term interest rates (such as the funds rate) may be a useful indicator of monetary policy. They argue that long rates incorporate inflationary expectations but generally are insensitive to short-run policy developments.

Recent experience has been unfavorable to using M1, M2, and other broad money and credit aggregates as monetary policy indicators. Because of far-reaching changes in the financial system, defining and controlling "money" and predicting its relationship to the economy has become almost impossible. Even so, many economists continue to use M1 or M2 to gauge changes in monetary policy. Financial innovations seem to have had less significant consequences for interest rate indicators of monetary policy. Bernanke and Blinder (1992) and Brunner (1994), among others, present substantial evidence that shifts in the stance of monetary policy dominate short-run variations in the federal funds rate. Bernanke and Blinder (1992); and Laurent (1988) also suggest that the spread between the long bond rate and the federal funds rate is a useful monetary policy indicator. Many other economists eschew using both interest rates and monetary aggregates as policy indicators. Instead, they prefer to use bank reserves or the monetary base to gauge policy changes. For example, Strongin (1992) and Christiano and Eichenbaum (1991) offer evidence favoring the use of non-borrowed bank reserves to measure short-run monetary policy changes.

Theoretically, none of the available indicators is clearly superior for capturing changes in the short-run stance of monetary policy, although some indicators may be better suited than others for this purpose. In choosing an indicator for short-term policy changes, at least three considerations are important: (i) monetary authorities' ability to control the relevant policy indicator, (ii) strength and predictability of that indicators' influence on the economy, and (iii) extent to which factors other than monetary policy influence that indicator. A variable will prove to be a good policy indicator if the Federal Reserve can control it and if it has a strong and predictable influence on the economy while at the same time factors other than monetary policy do not significantly influence it. Unfortunately, variables with potentially strong and predictable effects on the economy also generally are endogenous to the economy—though in different degrees—and, therefore, are subject to only partial control by the Federal Reserve.

In principle, one can view short-term monetary policy changes or policy shocks as independent of changes in policy rules or in the policy regime. In practice, however, separating the two types of changes is difficult due to the endogenous nature of monetary policy indicators. For example, short-term policy changes may cause policy rule changes because the former may contain information about long-run goals or policy objectives, namely the economy's output and price paths. Also structural parameters are unlikely to remain fixed in the face of ongoing interaction of changes in policy and nonpolicy variables. The problem of separating short-run policy changes from policy rules is particularly serious for monetary aggregates, especially M1 and M2, because they have experienced major structural changes. At the same time, they have been used in setting the intermediate targeting strategy—i.e., the policy rules—as well. A further difficulty in investigating the effect of short-term policy changes over a relatively long period—say more than a few years—is that policy rules are likely to undergo shifts, which may influence the short-term policy indicators. For example, a shift in policy regime toward more effective operating procedures to control a short-term policy indicator may have significant consequences for that indicator's movements.

A useful proxy for monetary policy changes is difficult to construct because monetary policy actions normally do not account for all movements in variables used as policy indicators. Precisely how much of the movements and even which movements are due to policy actions is far from clear. No simple or common rule can provide a meaningful separation of policy and nonpolicy components because the linkages of various indicators to the economy and, in many cases, to policy itself are quite complex and differ significantly from one indicator to another. Also, a given change in a policy indicator may imply a different degree of monetary policy tightness or ease under different circumstances. For example, a 100 basis points increase in the federal funds rate implies less policy tightening in a high inflation environment than in a low inflation environment.

B. *Need for Structural Models*

Identifying policy changes and considering their effects on long-term interest rates requires a model of the economy's structure with an explicit account of the monetary policy process. Unrealistic theoretical models that disregard the main linkages between monetary policy actions and long-term interest rates are not useful for empirical investigation. Simple correlations between "money" and long-term interest rates, for example, offer little.

But recognizing the structural nature of monetary policy effects on interest rates does not yield a unique theoretical model. No professional consensus exists on how to specify the economy's structure and monetary policy's role in that structure. Competing theoretical models offer useful descriptions of the economy's structure, but theory, by itself, provides no guidance for choosing among the models. Theoretical differences frequently reflect differences in tastes or in ideology, and sometimes in perceptions of economic reality. Other considerations, including the models' abilities to deal with relevant policy issues, are necessary in choosing among competing theoretical models.

In principle, structural models require structural estimates. As Marschak (1953) demonstrates, one should choose the best policy on the basis of estimates of the structure and expected or intended changes in that structure. Knowledge of the structure is necessary because policy and nonpolicy factors involve changing structural parameters. Such knowledge would be unnecessary to estimate the effect of policy changes only if the structural parameters remained fixed over time, which is unlikely. Both policy and nonpolicy factors are bound to induce changes in the economy's structure in the long run, and perhaps even in the medium run. Lucas (1976) argues that one cannot expect the structural parameters to remain fixed in the face of policy rule changes because economic agents' behavior depends on the policies pursued. In other words, the coefficients of structural equations are not independent of changes in the exogenous policy variables.

If short-term monetary policy changes were exogenous and separable from policy rule changes, the Lucas critique would have little significance for this paper's main focus—effects of short-run monetary policy changes on long-term interest rates. However, short-term policy changes are difficult to isolate from policy rules. In principle, both the need for structural estimates and the Lucas critique appear relevant to empirical investigations of how policy changes affect long-term interest rates.

Getting around the Lucas critique is not easy, however. Proposed econometric solutions bring problems of their own and do not necessarily yield superior results. For example, redefining the exogeneity concept does not resolve the practical policy problem but only defines the problem away. Similarly, structural models with varying parameters involve great complications for estimation and require more data and information than are available to address many policy problems.

In any event, the Lucas critique's *practical* significance for changes in the structure may be overstated.[1] For example, if shifts in the structural parameters are small, they will not cause serious problems. In his study of different international monetary regimes, Taylor (1989) uncovers shifts in the structural parameters, but they are not large enough to generate much instability in conventional macroeconomic relationships. In the case at hand, short-term monetary policy changes most likely will not cause sudden and large shifts in the structural parameters, although those parameters may be unstable for other reasons. Moreover, use of appropriate dummy variables can handle at least partially some regime shifts, such as the October 1979 change in monetary policy operating procedures.

Structural estimates are necessary for dealing with unstable parameters and for identifying policy changes when policy indicators are at least partially endogenous. Therefore, the Lucas critique problem aside, structural estimates represent the best approach for examining monetary policy effects on long-term interest rates. But reduced form estimates of a structural model also may yield reasonable results if the structural parameters show only minor changes over time. It is important to note that the usefulness of both structural and reduced form estimates depends on how well the underlying model captures monetary policy's role and deals with issues of interest to policymakers.

The mere preference for structural estimates as opposed to reduced form estimates is insufficient for determining a model's usefulness since many different procedures are available for either type of model. Results from different estimation procedures under the same methodology can differ substantially, and some structural estimates may have as many problems as do some reduced form estimates. Moreover, in many cases, a careful investigator can compensate for deficiencies of reduced form estimates by utilizing sensitivity tests for changes in specification and in sample period.

IV. REVIEW OF EMPIRICAL RESULTS

Before reviewing evidence of monetary policy's influence on long rates, an overview of its role in determining *short rates* may be useful. Discussions of monetary policy frequently equate easier policy with lower short rates and tighter policy with higher short rates. The main reason is that the Federal Reserve and other central banks usually accord a major role to money market rates in implementing monetary policy. And a widely held view is that the Federal Reserve exercises substantial control over the federal funds rate. In fact, many economists believe that the Fed historically has engaged in smoothing or stabilizing interest rates (see, for example, Goodfriend, 1991; Poole, 1991).

In recent years, numerous studies have investigated monetary policy's influence on short rates. Most find that easier monetary policy—measured by narrow quantity-based variables such as nonborrowed bank reserves and monetary base or by changes in the federal funds rate—results in strong and persistent declines in short-term interest rates (see, for example, Leeper and Gordon, 1992; Christiano and Eichenbaum, 1991; Strongin, 1992). However, studies using M1 and M2 as measures of monetary policy shocks frequently

1. The Lucas critique qualitatively is very significant, however. It has played a major role in spawning the use of new econometric approaches to design and assess economic policies and has contributed significantly toward understanding conceptual difficulties of econometric policy evaluations. But many issues raised by the critique remain unresolved. For a review of the main issues stemming from the Lucas critique, see Savin and Whiteman (1992).

do not find the inverse relationship between money growth and short-term interest rates (see Reichenstein, 1987).

A. *Quantity-Based Measures of Monetary Policy*

Researchers have used two broad approaches to examine effects of quantity-based monetary policy measures on long-term interest rates: (i) reduced form correlations where changes in long rates are regressed on past changes in money stock and (ii) long rate models that use a broad range of fundamental determinants along with quantity-based policy variables. Recent studies focusing on the relationship between quantity-based policy variables and long rates have relied almost exclusively on M1, M2, or monetary base to identify policy changes. Bank reserves as a policy indicator have received no attention in these studies.

Cagan (1966, 1972) and Gibson (1970) estimate reduced form correlations that show an inverse short-run relationship between long-term interest rates and M1 or M2. In Gibson's regressions of the postwar period, the negative effect of money on long rates lasts less than three months for M1 and less than five months for M2. Most recent studies under this approach generally deal with short rates rather than with long rates. One exception is Cochrane's (1989) study, which examines the relationship between M1 and the 20-year Treasury bond yield during the 1979–1982 period. He uses spectral window filters to eliminate high-frequency noise and to detrend long-run (low frequency) movements and then regresses the filtered long rate data on the filtered M1 data. He finds a significant negative relationship between the two variables lasting for up to a year, with the greatest effect during the first three to six months.

Several recent studies also have used the Cagan-Gibson approach to investigate the response of long-term interest rates to *announcements* of money supply changes in the period immediately before and after the October 1979 change in monetary policy procedures. The literature reveals mixed results for the announcement effect on long rates. While several studies find that expected future monetary policy tightness leads to higher long rates (see, for instance, Cornell, 1983; Roley and Walsh, 1984), others fail to confirm this finding (see Hardouvelis, 1984; Judd, 1984).

The Cagan-Gibson method is inadequate for examining monetary policy's effect on long-term interest rates. The method fails to consider adequately the economy's structure and monetary policy's role in that structure, thereby ignoring important fundamental determinants of long rates. Results from this approach are difficult to interpret for a variety of reasons: (i) the approach fails to identify supply versus demand sources of money growth (i.e., money may not be exogenous); (ii) money may be correlated with missing variables; (iii) money growth and interest rates may not be stationery stochastic processes.

In contrast, estimation models that use quantity-based monetary policy variables along with other fundamental determinants to explain long rates provide a more realistic description of the role of monetary policy in the economy. Feldstein and Eckstein (1970), Sargent (1969), and Feldstein and Chamberlain (1973) are examples of early studies that use the fundamentals-based approach to examine long rate movements and include monetary aggregates among the explanatory variables. Table 1 summarizes these three studies and more recent studies that investigate the influence of M1, M2, or monetary base on long rates in the context of fundamentals-based models. With the exception of Friedman (1980), studies in this table estimate essentially reduced form equations of the underlying models.

TABLE 1

Determinants of Long-Term Interest Rates: The Role of Money

Study	Model Structure	Dependent Variable	Main Explanatory Variables[a]	Monetary Variables	Findings on Monetary Variables	Estimation Period, Data Frequency
Sargent (1969)[b]	A loanable funds model based on Wicksell's notion of the market vs. equilibrium rates.	Durand's ten year basic yield.	Real GNP, change in real GNP, commodity prices.	Percent change in real M1.	Significant; 10 percent increase in real M1 lowers nominal long rate by about 20 basis points.	1902–1940, annual data.
Feldstein–Eckstein (1970)	Integration of liquidity preference and price expectations effects.	Yield to maturity on seasoned Moody's Aaa corporate bonds.	Per capita real private GNP, expected inflation, real per capita privately owned Federal government debt, expected long rate.	Real per capita monetary base, change in real per capita monetary base.	Both variables are significant; 1 percent increase in real per capita monetary base reduces long rates by 6-8 basis point in equilibrium and much more in the first quarter.	1954–1969, quarterly data.
Feldstein-Chamberlain (1973)	A more generalized version of the Feldstein-Eckstein model relating yields on money, bonds, goods and equity claims.	Yield to maturity on newly issued Moody's Aaa corporate bonds.	Per capita real GNP, expected inflation, expected long rate, expected capital gains on equity shares.	Real per capita monetary base, a distributed lag on percent changes in real per capita monetary base, a proxy for Regulation Q.	All three variables are significant; 1 percent increase in real per capita monetary base lowers long rates by 6-7 basis points in equilibrium, and much more in the first quarter.	1954–1971, quarterly data.
Friedman (1980)[c]	An asset demand-supply framework, utilizes portfolio theoretic considerations.	Seasoned Aaa corporate bond yield.	A 10 equation model with a broad range of influences; substituted for the term structure equation of the MIT-Penn-SSRC (MPS) model.	Simulations with the modified (MPS) model use 2 percent annual rate faster growth of M1 than in the baseline.	Significant effect on long rates; simulations indicate a 46 basis points decline in long rates after 10 years.	1967-1969, quarterly data.
Mishkin (1981)	An efficient market-rational expectations model.	Unanticipated quarterly return on long term government bonds.	Unanticipated growth rates of industrial production and inflation.	Unanticipated growth rates of M1 or M2.	No evidence of any negative effect of unanticipated money growth on long rates.	1954-1976, quarterly data.
Mascaro-Meltzer (1983)	An extended IS/LM-rational expectations model.	10 year Treasury rate.	Expected income, expected price level, expected inflation, public debt, variability of unanticipated money growth, variability of unanticipated velocity growth.	Unanticipated monetary base lagged one period.	Significant; one percent increase in monetary base lowers long rates by 45-50 basis points.	1969–1979 and 1969–1981, quarterly data.

TABLE 1 continued

Determinants of Long-Term Interest Rates: The Role of Money

Study	Model Structure	Dependent Variable	Main Explanatory Variables[a]	Monetary Variables	Findings on Monetary Variables	Estimation Period, Data Frequency
Giorola (1984)[d,e]	A version of the Feldstein-Eckstein model.	Nominal Aaa corporate bond rate.	*ln* of per capita real private GNP, current and lagged percent changes in personal consumption expenditure deflator, *ln* of private held federal debt.	*ln* of per capita real monetary base.	Significant in the original regression but marginal after serial correlation correction.	1954–1983, quarterly data.
Evans (1985)[d]	An IS/LM-rational expectations framework.	Moody's Aaa bond rate.	Ratios of real Federal spending and real Federal deficit to trend real GNP.	Current and lagged ratio of real M2 to real GNP.	Not significant in most regressions.	October 1979 to December 1983, monthly data.
Evans (1987)[d]	A "Keynesian"-rational expectations model.	Moody's Aaa bond rate.	Unanticipated changes in ratios of real government spending and real Federal deficit to natural real GNP.	Unanticipated changes in the ratio of real M1 to natural real GNP.	No significant effects of M1 over 1956–1979 but significant over 1931–1979.	1956–1979 and 1931–1979, annual data.
Cebula (1988, 1992)[d]	An IS/LM type model with the addition of a loanable funds variable.	Nominal interest rate on Moody's Aaa corporate bonds.	Ratios of structural and cyclical deficits to trend GNP, ratio of Federal government purchases to trend GNP, expected inflation, *ex ante* real three month Treasury bill rate.	Net acquisition of credit market instruments by the Federal Reserve, average of the current and preceding quarters' values, expressed as a ratio to trend GNP.	No significant effect on long rates.	1955–1984, quarterly data.
Barth-Bradley (1989)	A rational expectations-equilibrium business cycle model.	Real return on a value weighted portfolio of all New York Stock Exchange stocks.	Unanticipated and anticipated growth rates of Federal debt, temporary and permanent real Federal spending.	Unanticipated and anticipated M1 growth.	Significant effect of current and lagged unanticipated M1 growth.	1948–1976, annual data.
Coorey (1991)	A structural model which relates asset returns on money, bonds and capital.	Real 10-year Treasury yield; real Aaa corporate bond yield.	Private wealth, Federal debt to GNP ratio, demographic variables, capital-labor ratio, fiscal balance.	Ratio of real M2 to real GNP.	Significant; 1 percentage point increase in the M2 variable lowers expost real long rates by 50-60 basis points, and forward looking real rates by 30-40 basis points.	1959–1990, quarterly data.

[a]Excluding monetary variables.
[b]Model appears to be inadequate for explaining post–1940 period.
[c]For a comparison of predictive ability and other statistical properties of this model with several single equation models, see Friedman and Roley (1980).
[d]Model designed to look at the effect of the Federal deficit on interest rates.
[e]As reported in Barth, Iden and Russek (1984-1985).

These models yield mixed results for the influence of money on long rates. Feldstein and Eckstein and other early studies find that, *ceteris paribus*, money (monetary base or M1) increases are significantly negatively correlated with long rates. Mishkin (1981) and Evans (1985, 1987), using a rational expectations framework, find no support for this proposition. Cebula (1988, 1992) reports regressions based on a hybrid IS/LM-loanable funds model in which changes in the monetary base are not significantly related to long rates. Other studies in table 1 do find a significant negative effect of changes in money on long rates. All recent studies in the table focus on eventual or equilibrium effects of monetary policy changes on long rates and provide no analysis of short-run effects.

Estimates based on rational expectations where only unanticipated money matters generally do not yield a significant inverse relationship between money and long rates. Mascaro and Meltzer (1983) and Barth and Bradley (1989) are exceptions. Both of these studies report significant effects of unanticipated monetary growth on long rates. However, the dependent variable in the Barth and Bradley study—the real return on a value weighted stock portfolio of the New York Stock Exchange—probably exhibits significantly different movements than do other more commonly used measures of real long rates.

In any event, results from studies using only unanticipated money growth as the policy variable suffer from significant limitations. However, a more important weakness of the studies in table 1 concerns the use of M1 and M2 to identify changes in monetary policy. Another shortcoming of these studies is that all except Coorey (1991) use pre-1983 data. Even Coorey's study focuses on the whole sample period and does not examine changes in the role of long-rate determinants over time. Thus, available studies using money as a policy variable tell little about monetary policy's influence on long rates in the more recent period compared with that of the earlier period.

B. *Interest Rate-Based Measures of Monetary Policy*

This section reviews three types of evidence: (i) recent evidence on the ability of the federal funds rate to explain long-term interest rate movements and the spread between long rates and the federal funds rate; (ii) results from recent studies that use the federal funds rate or another short-term rate as one of several determinants of long rates; (iii) tests of the rational expectations version of the expectations theory of term structure that regresses long rate changes on the spread between long and short rates.

This review makes only limited use of the extensive literature on the term structure of interest rates. Much of that literature offers no explanation of long rates in the context of a framework that explicitly considers monetary policy and fundamental determinants in the economy. However, the literature says a good deal about monetary policy's general influence on long rates and on the whole structure of rates. For example, if monetary policy can control some short rates (e.g., the funds rate or the discount rate) and has strong effects on other (market) short rates, the moving average relationship between long and short rates documented in term structure studies suggests that monetary policy also has considerable influence on long rates. (For details of the moving average relationship, see Campbell and Shiller, 1984, and references cited by them.) Note that the moving average relationship between long and short rates provides no explanation of long rate movements. It says nothing about the forces driving long rate movements or about the role of monetary policy in the evolution of those forces or even about the direction of causation between long and short rates.

Many recent studies argue that the federal funds rate is a good measure of monetary policy stance, but very few investigate the influence of the funds rate on long rates. Table 2 lists three recent studies that examine the relationship between the funds rate and long rates in a simple bivariate framework. (Table 3 lists other recent studies that use the funds rate in the context of more general models of long rates.) Two of the studies in table 2 are concerned with a very short time frame, one to 10 days, while the third one deals with a longer period. All three studies suggest that changes in the federal funds rate have significant effects on long rates.

The usefulness of the evidence in table 2 is dubious because studies exclusively based on bivariate relationships ignore other important fundamental influences on long-term interest rates. In general, results from these studies are difficult to interpret for reasons that similarly complicate interpreting the results from the Cagan-Gibson method. Interpretation difficulties are less serious for studies concerned with the immediate effect of the funds rate on long rates. However, evidence on the immediate effect of the funds rate is not particularly helpful in judging the significance of monetary policy influence on long-term interest rates and on the economy.

Table 3 lists recent empirical studies that use fundamental determinants along with the federal funds rate or some other short rate. If the Federal Reserve dominates movements of the federal funds rate and of other short-term rates, the effect of short rates on long rates reflects monetary policy influence on long rates.

The studies in table 3 use a wide array of theoretical models and empirical methodologies, but most estimate reduced form equations. All find significant effects of short rate changes on long rates. Most studies in the table attempt to quantify these effects and suggest that the long-run response of nominal long rates ranges from about 1/5 to about 2/3 of a percentage point for every one percentage point change in nominal short rates. The short-run response is considerably smaller and is available only in a few cases. One study specifying the real short rate as an independent variable finds that long rates reflect about 75 to 80 percent of the change in short rates.

Among the table 3 studies, only Estrella and Hardouvelis (1990), Blanchard (1984), and Shiller et al. (1983) explicitly look at whether the linkage between short rates and long rates has changed over time. Using pre-1983 data, the latter two studies conclude that the predictive power of the equation has deteriorated in the recent period and that the distributed lag on short rates has shortened over time. The Estrella and Hardouvelis study, which includes more recent data through 1989, finds considerable instability in the relationship between the funds rate and the long rate. Also, it finds the linkage somewhat stronger in the more recent period relative to the earlier period. However, all three studies involve simple extensions of the term structure equation and, therefore, cannot offer adequate analysis of long rate response to monetary policy.

Tests of the expectations theory of the term structure may contain useful information about the influence of monetary policy on long-term interest rates. However, that depends on whether the spread between long rates and the federal funds rate or other short rates is an appropriate indicator of monetary policy. The tests considered here use simple bivariate analysis, and the authors do not intend to deal with monetary policy's role in influencing long rates.

One implication of the (rational) expectations theory of the term structure is that the spread between long and short rates—the slope of the yield curve—should predict changes in long rates. Specifically, according to the expectations hypothesis, a rise in the current long rate relative to the

TABLE 2
The Federal Funds Rate and Long-Term Interest Rates

Study	Model Structure	Dependent Variable	Findings on the Funds Rate	Observation Period, Data Frequency
Cook-Hahn (1989)	A simple regression model that estimates the effect of changes in the funds rate target on market rates.	10-year Treasury bond rate, 20-year Treasury bond rate.	Significant; a one percentage point increase in the funds rate target induces, on the day of the target change, 13 and 10 basis points movements in the 10-year and 20-year bond rates, respectively.	September 1974-September 1979, daily data.
Radecki-Reinhart (1994)	Impressionistic data analysis.	10-year and 30-year Treasury bond rates.	A 25 basis point increase in the intended funds rate leads to about 3 basis points rise, on average through the first 10 days, in the 10-year rate and a somewhat smaller response of the 30-year rate.	1989–1993, daily data.
Cohen-Wenninger (1994)	A simple regression model.	Spread between the 10-year Treasury bond rate and the Federal funds rate.	The implied effect of the funds rate on the bond rate shows instability and a wide range over various subperiods, with the long-rate response generally higher in the more recent period. For the 1982–1993 period, a one percentage point movement of the funds rate induces about 65 basis points change in the bond rate.	1955–1993 and various subperiods, quarterly data.

current short rate should be followed by a subsequent rise in the next period's long rate. That is, if the yield curve is steeply sloped, the long rate should rise on average, and if the yield curve is negatively sloped or flat, the long rate should fall on average. This prediction stems from the rational expectations view that a rise in long rates relative to short rates is due to expectations of higher future short rates. And, as those expectations are realized, the rise in future short rates will lead to a positive correlation of changes in short rates with the earlier spreads.

Numerous studies test this rational expectations hypothesis by regressing changes in long rates on the long-short spread. If monetary policy actions dominate the long-short spread, as many economists believe, these regression results may reflect policy influence on long rates. However, the implied negative relationship between the spread and changes in both short and long rates is the exact opposite of what is suggested by the expectations hypothesis of the term structure.

Recent studies generally produce regression results for changes in the long rate with respect to the long-short spread that fail to support the expectations hypothesis of the term structure. Table 4 reports results from five such studies. The short rate included in the spread variable is the three-month Treasury bill rate in four of the five studies. As the table shows, the spread has a negative sign in all five cases and is statistically significant in all but one case. If the spread is a useful indicator of monetary policy, these results are consistent with the view that monetary policy exercises considerable influence on long rates.

C. *Summary of Empirical Results*

This review of empirical studies suggests that monetary policy changes have significant effects on long rates. Most of the studies indicate that monetary policy tightening results in higher long-term interest rates. All studies using changes in the funds rate or in other short rates to identify monetary policy developments find a significant long-rate response to policy. Results from studies using quantity-based variables—monetary base, M1, and M2—are mixed, but most also indicate significant effects of monetary policy on long rates.

Existing evidence is inadequate in several respects, however. First, the evidence fails to provide a meaningful sense of the magnitude of policy effects on long rates, with some studies actually suggesting that long rates are immune to monetary policy developments. Second, while several studies investigate monetary policy effects over both the short run and the long run, the focus of much empirical work is on the equilibrium effects. In particular, no significant evidence based on recent data is available on short-run versus long-run effects of policy changes on long rates. Finally, recent studies generally do not investigate the issue of possible shifts in monetary policy effects on long rates in recent years relative to those in the earlier period. In fact, few recent studies even use the post-1983/1984 data to examine the determination of long rates.

In contrast, simulation results from the DRI macroeconometric forecasting model of the U.S. economy (see the appendix) do yield quantitative estimates of monetary policy effects on long rates over the short run and long run. For example, an exogenous one percentage point rise in the federal funds rate leads to an increase in the 10-year Treasury bond rate of 39 basis points in the same quarter and of 77 basis points two years after the policy change. However, even these model simulations are unable to address the issue of possible shifts in monetary policy effects on long rates over time. In any event, simulation results from macroeconometric forecasting models are not entirely driven by historical evidence. They depend to a consider-

TABLE 3
Determinants of Long-term Interest Rates: The Role of Short Rates

Study	Model Structure	Dependent Variable	Main Explanatory Variables[a]	Monetary Variables	Findings on Monetary Variables	Estimation Period, Data Frequency
Dornbush-Fischer (1979)	A term structure plus model.	Rate on Treasury bonds of longer than 10-year maturity.	Ratio of potential GNP to actual GNP, the average inflation rate over previous 4 years, the lagged long rate.	3-month Treasury bill rate.	Significant; given other determinants, a 100 basis points increase in the bill rate increases the long rate by 13 basis points in the first quarter and 39 basis points eventually.	1955–1977, quarterly data.
Friedman (1980)[b]	An asset demand-supply framework utilizes portfolio theoretic considera-tions.	Seasoned Aaa corporate bond yield.	A 10 equation model with a broad range of influences; substituted for the term structure equation of the MPS model.	Simulations with the modified MPS model, use the 3-month Treasury bill rate as the exogenous variable.	A 100 basis points increase in the bill rate leads to about 33 basis points increase in the corporate bond rate after 10 quarters.	1967–1969, quarterly data.
Shiller-Campbell-Schoenholtz (1983)	A version of the Modigliani-Shiller equation.	20-year bond yield.	Current and 19 lagged changes in consumer price inflation; the lag distribution is 3rd degree polynomial with end-point constraint.	Current and 19 lags on the 3-month Treasury bill rate; the lag distribution is 3rd degree polynomial with endpoint constraint.	Significant; given the inflation rate, a 100 basis points rise in the bill rate increases the long rate by 26-34 basis points in the first quarter and by 53-62 basis points in total; the predictive performance of the equation deteriorated after 1979 and the distributed lag on short rates has shortened over time.	1955–1979, quarterly data.
Blanchard (1984)	The 1979 MPS version of the Modigliani-Shiller equation.	Yield on Aaa bond rate.	A 3rd degree 19 quarters polynomial distributed lag on the consumer price inflation rate, variability of the short rate, measured as an 8-quarter moving variance.	3-month rate on private commercial paper, current rate and a 3rd degree 19 quarters polynomial distributed lag on the commercial paper rate.	Significant; a 100 basis points rise in the short rate leads to long rate increase of 19 basis points in the current quarter and 64 basis points eventually; the equation estimates vary considerably for various subsample tests.	1954–1983, quarterly data.

TABLE 3 continued

Determinants of Long-term Interest Rates: The Role of Short Rates

Study	Model Structure	Dependent Variable	Main Explanatory Variables[a]	Monetary Variables	Findings on Monetary Variables	Estimation Period, Data Frequency
Hoelscher (1986)[c]	A long-term loanable funds model.	10-Year Treasury bond rate.	Change in per capita real GNP, real government budget deficits, the 12-month Livingston survey forecast of inflation expectations.	One-year Treasury rate minus the expected inflation.	Significant; about 75-80 percent of each percentage point rise in the real short rate is reflected in the long rate.	1953–1984, quarterly data.
Estrella-Hardouvelis (1990)	A vector autoregressive model designed to estimate the effect of unanticipated changes.	Unanticipated changes in the 10-year Treasury bond rate.	Anticipated changes in the funds rate, the 3-month bill rate and the 10-year bond rate.	Unanticipated changes in the Federal funds rates.	Significant; a one percentage point unanticipated rise in the funds rates increases the long rate by about 18 basis points over the entire sample period but the effect shows considerable instability, with the effect generally higher in the more recent period.	1955–1989 and several subperiods, monthly data.
Miller-Russek (1991)	Cointegration and error-correction models for Granger-causality.	Long-term Treasury bond rate.	The lagged values of the Federal deficit; some regressions also use real GNP.	The lagged value of the one-year constant maturity Treasury bill rate.	Results show that the short rate Granger-cause the long rate, and that both rates and the Federal deficit are cointegrated.	1946–1989 for annual data; 1947–1989 for quarterly data.
Howe-Pigott (1991–1992)	Model intended to explain Wicksell's "natural" or long-run equilibrium rate and fluctuations around that rate.	Changes in the real 10-year Treasury bond rate (expected inflation measures consumer price inflation of past-three years).	Current and lagged changes in the ratio of government deficit to GNP, three-month bill rate, lagged changes in the long rate.	Changes in the real Federal funds rate (nominal less the past three years' consumer price inflation rate).	Shifts in the current and lagged real Federal funds rate account for a significant fraction of the gap between the estimated equilibrium real rate and the actual real long rate.	1975–1990, quarterly data.
Bank for International Settlements (1994)	Vector autoregressions (VARs) and error correction models (ECMs).	Mortgage rate on conventional mortgages.	VARs include 10-year bond yields (along with the other two rates); ECMs include lagged level and two lagged changes in the mortgage rate and the lagged level and change in the 10-year bond rate.	Innovations in the Federal funds rate.	In the VARs, the variance decomposition attributes 29 percent of the mortgage rate change to innovations in the Federal funds rate over a 12-month horizon; in the ECMs, the long-run effect is significant but relatively small—17 basis points for every 100 basis points change in the funds rate.	1984–1993, quarterly data.

[a]Other than short rates.
[b]For a comparison of predictive ability and other statistical properties of this model with several single equation models, see Friedman and Roley (1980).
[c]Model designed to look at the effect of the Federal deficits.

TABLE 4

Regressions of Changes in Long Rate on Long-Short Rate Spread

Study	Dependent Variable	Coefficient of Spread	Short Rate in Spread	Estimation Period, Data Frequency
Shiller (1979)	Yield on recently offered AAA utility bonds.	−0.125*	4-6 month commercial paper rate.	1966–1977, quarterly, first week of the quarter
Summers-Mankiw (1984)	Yield on constant maturity 20-year Treasury bonds.	−0.086	3-month Treasury bill rate.	1963–1983, quarterly, first week of the quarter.
Mankiw (1986)	Yield on 10-year and over Treasury bonds.	−0.11*	3-month Treasury bill rate.	1961–1984, monthly averages.
Campbell-Shiller (1994)	Pure discount (zero coupon) yield on 10-year Treasury bonds (McCulloch's data).	−4.298*	3-month Treasury bill discount yield.	1952–1987, monthly, end of month.
Hardouvelis (1994)	Yield to maturity on 10-year Treasury bonds.	−2.901*	3-month Treasury bill discount yield.	1954–1992, monthly averages.

Notes: (1) Regressions equation is specified as $R_{t+1} - R_t = a + b(R_t - r_t) + u$, where R is the long rate, r is the short rate and u is an error term; (2) Numbers marked with an asterisk (*) are significant at the 95 percent or higher confidence levels.

able extent on judgmental "add" factors, on initial or baseline conditions, and on the need for consistency among various parts of the econometric description of the whole economy. Therefore, such simulations are not a close substitute for empirical studies of policy effects on long rates.

V. A POLICY PERSPECTIVE ON EMPIRICAL EVIDENCE

For policy, the usefulness of empirical results on long rates lies in providing some sense of the magnitude of short-run and eventual effects that policy changes have on long rates and how those effects may be changing over time. Yet, available evidence fails to offer a satisfactory account of these aspects.

The shortcomings of existing evidence stem from three main inter-related problems that plague the empirical studies on long rates: (i) the use of analytical and empirical models that differ widely from one another and that often are not well-suited for estimating monetary policy effects on long rates; (ii) the use of estimation methodologies that frequently aggravate the problems and/or differences of the underlying models; and (iii) the difficulties of identifying useful measures of monetary policy changes.

The empirical studies reviewed here utilize a wide variety of models to estimate monetary policy effects on long rates. Since the early 1980s, such models have included the Cagan-Gibson method, term structure models for interest rates, the

IS/LM model, Modigliani-Shiller equation, long-term loanable funds models, the Feldstein-Eckstein model, equilibrium business cycle models, rational expectations-based "Keynesian" models, the rational expectations-efficient markets model, and vector autoregression (VAR) models. These models differ significantly from one another, and most suffer from conceptual problems or harbor other serious shortcomings. This paper does not catalogue these models' conceptual problems, but it does indicate limitations of some models.

Empirical implementation frequently magnifies conceptual problems and differences in the models. Most empirical studies of long rates estimate reduced form equations even for models that seem to require structural estimates to measure monetary policy changes and their effects on long rates. In many cases, restrictive assumptions needed for reduced form estimation weaken the usefulness of results, at least from a policy perspective. In addition, sorting out more useful from less useful results often is quite difficult because the reduced form estimates, even when based on theoretically similar models, tend to differ significantly. They do so because of differences in estimation procedures and often because of differences in implementing the same procedure—for example, the use of different assumptions and conditioning information for the VAR procedure. Also, apart from the estimation procedure, differences in specifications of empirical proxies for the key right-hand side variables in otherwise similar regressions cause the results to differ among studies. Different ways of constructing movements of unanticipated money, for example, lead to differences in results reported by different investigators.

Consequently, developing a consensus view or even a rough sense of the estimated average policy effects on long rates presently is impossible. In fact, no significant common ground seems to exist among many studies because the underlying models disagree on both what is to be explained and how to explain it.

A major problem of recent evidence is that marked differences in empirical and theoretical models result in the lack of a common framework for identifying and measuring changes in monetary policy stance. Even if a particular quantity-based or interest rate-based variable is a good indicator of monetary policy stance, the extent to which actual movements of that variable are identified as a measure of policy shocks depends on the type of model used for estimating policy effects on long rates. The rational expectations and the VAR models consider only a portion of actual variations in a policy indicator relevant for measuring policy changes. Reduced form estimates of most traditional models, such as the IS/LM and the Feldstein-Eckstein models, generally treat all movements of that indicator as a measure of policy change.

The traditional approach is likely to overstate the extent of policy shocks because policy indicators respond to changes in the economy. This may be especially true for money stock measures of policy where money demand responds passively to changes in economic activity not generated by monetary policy developments. How to resolve this identification problem is not clear. None of the available approaches to measure monetary policy actions provides a satisfactory solution.

Economists sometimes attempt to resolve the identification problem by focusing on particular episodes when monetary policy variables "clearly" have moved for reasons unconnected to previous developments in the private sector. Following the classic work of Friedman and Schwartz (1963), Romer and Romer (1989) and, more recently, Boschen and Mills (1991, 1993) use this type of "narrative" approach based on the Federal Open Market Committee documents to identify actual or intended monetary policy changes in the postwar period. However, this narrative approach cannot resolve the identification problem since judgmental and retrospective search for policy changes invariably leads to multiple interpretations of the policy record.

The more technical Granger-causality tests also yield ambiguous implications for the identification problem. In a bivariate set up, such tests generally suggest that money Granger-causes income while income does not cause money, implying that most, if not all, variations in money represent policy changes. In multivariate time series models, however, this causality weakens greatly as interest rates and other variables frequently appear as more significant than money (see Sims, 1980, 1992).

In the VAR models, the identification problem is addressed in an a-theoretic fashion by using "innovations"—i.e., residuals of a policy indicator not accounted for by historical values of itself and of other variables in a multivariate system—as a measure of policy shocks. This procedure may capture unusual policy shocks but it clearly goes too far in excluding other more normal policy changes. Ordinary policy actions presumably are made endogenous and therefore are excluded from consideration as a measure of policy shocks. Put differently, it is not credible to argue that a monetary policy change is not genuine simply because it is not "unusual" relative to past values of policy indicators and of other arbitrarily chosen variables.

A conceptually different set of problems arises with the rational expectations approach, which partitions observed variations of a policy indicator into anticipated versus unanticipated movements and considers only the unanticipated portion as an appropriate measure of policy changes. While unanticipated movements may have more powerful effects on the economy than do anticipated movements, the latter need not be "neutral," at least in the short run. The evidence strongly suggests that anticipated monetary policy has significant effects on the economy (see, for example, Cechetti, 1986; Fischer, 1980; Mishkin, 1983). The weight of professional opinion today is that both anticipated and unanticipated monetary policy actions matter, at least in the short run (see Fischer, 1992; Patinkin, 1992). In these circumstances, unanticipated developments in an indicator are not likely to be adequate for identifying monetary policy actions and for measuring their effects on long rates.

VI. CONCLUSION: IMPLICATIONS FOR FUTURE RESEARCH

Further progress on the identification problem for policy changes may be possible, but a general consensus on its resolution appears unlikely. Nor is it very likely that a consensus model for estimating policy effects will emerge in the foreseeable future. Currently, there seems to be no way to measure monetary policy actions and their effects on long rates that would not be subject to serious objections. However, improving upon existing evidence on long-rate effects of monetary policy is possible.

First, future research on long-rate effects of monetary policy should be based on "realistic" descriptions of the economy with an explicit account of the monetary policy process. The empirical models need not be elaborate. In fact, they can be quite small but must consider monetary policy changes in the context of fundamental influences on long-term interest rates. With appropriate extensions and modernizations, several existing models—e.g., the Feldstein-Eckstein model, the IS/LM model, and long-term loanable funds models—might be adequate for the task.

Second, given that the models involved frequently are structural, researchers should not shy away from estimating appropriate simultaneous equations. Whether the estimates are structural or reduced form, future empirical work should place greater emphasis on sensitivity tests with alternative specifications to take account of the enormous uncertainties in theoretical and empirical models of monetary policy influence on long-term interest rates. For example, in the absence of a consensus on how to identify monetary policy changes, alternative measures of those changes may be particularly helpful in understanding policy effects on long rates.

Finally, future research on monetary policy and long rates aimed at addressing questions of significant interest to policymakers would help fill an important gap in the literature. In particular, more empirical work should be done on estimating the short-run versus long-run monetary policy effects on long-term interest rates, and how those effects may have changed over the last 10 to 15 years. Further analysis of data no doubt will contribute toward a better understanding of these and other issues concerning the role of monetary policy in the evolution of long rate movements.

APPENDIX

Macroeconometric Model Simulations

This appendix reports simulations of the effects that monetary policy changes have on long rates from the DRI macroeconometric model of the U.S. economy. The model uses term structure relations to describe linkages from short to long rates and can be simulated with either the federal funds rate or nonborrowed reserves as the exogenous policy variable. The model provides an elaborate set of equations that link the federal funds rate through yields on instruments of various maturity to long rates. The 10-year Treasury bond yield is the key long rate in the model. In addition to the term structure relations, the estimating equation for the 10-year rate contains the federal structural budget deficit, the ratio of short-term government debt to long-term government debt, and a personal consumption expenditure deflator as explanatory variables.

Two sets of simulations are reported here. One set uses a permanent one percentage point rise in the federal funds rate, relative to the baseline, as the exogenous policy variable. The other assumes a permanent 2 percent reduction in nonborrowed reserves, relative to the baseline, as the exogenous policy variable. Both types of simulations allow for significant feedback effects on the 10-year Treasury rate.

Table 1A indicates that changes in monetary policy have significant effects on long rates under both types of policy shocks. A one percentage point increase in the funds rate induces a rise in the 10-year Treasury yield of 39 basis points in the same quarter and of 65 basis points within the first three quarters. Thereafter, the Treasury yield continues to increase at a gradually diminishing rate. It is 77 basis points higher eight quarters after the policy change.

The response of the 10-year Treasury yield to changes in nonborrowed reserves as the exogenous policy shock also is substantial. A 2 percent permanent one-time reduction in nonborrowed reserves increases the Treasury rate by 84 basis points in the same quarter and by another 43 basis points in the following quarter. The rate increase slides back gradually after the first two quarters.

TABLE 1A
Effects of Monetary Policy on the Ten-Year Treasury Bond Yield in the DRI Macroeconometric Forecasting Model of the U.S. Economy
(Basis Points Deviations from Baseline)

Quarters After Policy Change	Simulation with the Federal Funds Rate[a]	Simulation with Nonborrowed Reserves[b]
Same Quarter	39	84
Two Quarters	65	115
Four Quarters	71	68
Eight Quarters	77	68

[a]Assumes a permanent one percentage point increase in the federal funds rate.
[b]Assumes a permanent one-time two percent reduction in nonborrowed reserves.

REFERENCES

Bank for International Settlements, "National Differences in Interest Rate Transmission: Introduction," in *National Differences in Interest Rate Transmission*, Basle, Switzerland, 1994, i–xxiv.

Barth, James R., and Michael D. Bradley, "Evidence on the Real Interest Rate Effects of Money, Debt and Government Spending," *Quarterly Review of Economics and Business*, Spring 1989, 49–57.

Barth, James R., George Iden, and Frank S. Russek, "Do Federal Deficits Really Matter?" *Contemporary Policy Issues*, Fall 1984, 79–95.

Bernanke, Ben S., and Alan S. Blinder, "The Federal Funds and the Channels of Monetary Transmission," *American Economic Review*, September 1992, 901–921.

Blanchard, Olivier J., "The Lucas Critique and the Volcker Deflation," *American Economic Review*, May 1984 (Papers and Proceedings), 211–215.

Boschen, John F., and Leonard O. Mills, "The Effects of Countercyclical Monetary Policy on Money and Interest Rates: An Evaluation of the Evidence from FOMC Documents," *Federal Reserve Bank of Philadelphia Working Paper* No. 91-20, Philadelphia, October 1991.

———, "The Relation Between Narrative and Money Market Indicators of Monetary Policy," *Economic Inquiry*, January 1995, 24–44.

Brunner, Allan D., "The Federal Funds Rate and the Implementation of Monetary Policy: Estimating the Federal Reserve's Reaction Function," *International Finance Discussion Papers*, No. 466, Federal Reserve Board, Washington, D.C., May 1994.

Cagan, Phillip, "Changes in the Cyclical Behavior of Interest Rates," *Review of Economics and Statistics*, August 1966, 219–250.

———, *The Channels of Monetary Effects on Interest Rates*, Columbia University Press, New York, 1972.

Campbell, John Y., and Robert J. Shiller, "A Simple Account of the Behavior of Long-Term Interest Rates," *American Economic Review*, May 1984 (Papers and Proceedings), 44–48.

———, "Yield Spreads and Interest Rate Movements: A Bird's Eye View," *Review of Economic Studies*, 1991, 495–514.

Cebula, Richard J., "Federal Government Budget Deficits and Interest Rates: A Brief Note," *Southern Economic Journal*, July 1988, 206–210.

———, "Federal Government Budget Deficits and Interest Rates: Reply," *Southern Economic Journal*, January 1992, 821–823.

Cecchetti, Stephen G., "Testing Short-Run Neutrality," *Journal of Monetary Economics*, May 1986, 409–423.

Christiano, Lawrence J., and Martin Eichenbaum, "Identification and the Liquidity Effect of a Monetary Policy Shock," *National Bureau of Economic Research Working Paper*, No. 3920, Cambridge, Mass., November 1991.

Cohen, Gerald D., and John Wenninger, "Changing Relationship Between the Spread and the Funds Rate," *Federal Reserve Bank of New York Working Paper* No. 9408, New York, May 1994.

Cochrane, John H., "The Return of the Liquidity Effect: A Study of the Short-Run Relation Between Money Growth and Interest Rates," *Journal of Business and Economic Statistics*, January 1989, 75–83.

Cook, Timothy, and Thomas Hahn, "The Effects of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal of Monetary Economics*, November 1989, 331–335.

Cornell, Bradford. "The Money Supply Announcements Puzzle: Review and Interpretation," *American Economic Review*, September 1983, 644–657.

Correy, Sharmini, "The Determinants of U.S. Real Interest Rates in the Long Run," *International Monetary Fund Working Papers*, No. 91/118, Washington, D.C., 4, 1991.

DeLong, J. Bradford, and Lawrence H. Summers, "How Does Macroeconomic Policy Affect Output?" *Brookings Papers on Economic Activity*, 2, 1988, 433–480.

Dornbush, Rudiger, and Stanley Fischer, *The Determinants and Effects of Changes in Interest Rates*, Association of Reserve City Bankers, Chicago, December 1979.

Estrella, Arturo, and Gikas Hardouvelis, "Possible Roles of the Yield Curve in Monetary Policy," in Federal Reserve Bank of New York, *Intermediate Targets and Indicators for Monetary Policy: A Critical Survey*, New York, 1990, 339–362.

Evans, Paul, "Do Large Deficits Produce High Interest Rates?" *American Economic Review*, March 1985, 68–87.

———, "Interest Rates and Expected Future Budget Deficits in the United States," *Journal of Political Economy*, February 1987, 34–58.

Feldstein, Martin, and Otto Eckstein, "The Fundamental Determinants of the Interest Rate," *Review of Economics and Statistics*, November 1990, 363–375.

Feldstein, Martin, and Gary Chamberlain, "Multimarket Expectations and the Rate of Interest," *Journal of Money, Credit and Banking*, November 1973, 873–902.

Fischer, Stanley, "On Activist Monetary Policy with Rational Expectations," in Stanley Fischer, ed., *Rational Expectations and Economic Policy*, University of Chicago Press, Chicago, 1980, 211–247.

———, "New Classical Macroeconomics," in P. Newman, M. Milgate, and J. Eatwell, eds., *The New Palgrave Dictionary of Money and Finance*, Vol. 3, Macmillan Press, London, 1992, 24–28.

Friedman, Benjamin M., "The Determination of Long-Term Interest Rates: Implications for Fiscal and Monetary Policies," *Journal of Money, Credit and Banking*, May 1980, 331–352.

Friedman, Benjamin M., and V. Vance Roley, "Models of Long-Term Interest Rate Determination," *The Journal of Portfolio Management*, Spring 1980, 35–45.

Friedman, Milton, "The Role of Monetary Policy," *American Economic Review*, March 1968, 1–17.

Friedman, Milton, and Anna J. Schwartz, *A Monetary History of the United States, 1867-1960*, Princeton University Press, Princeton, N.J., 1963.

Gibson, William E., "Interest Rates and Monetary Policy," *Journal of Political Economy*, May/June 1970, 431–455.

Goodfriend, Marvin, "Interest Rates and the Conduct of Monetary Policy," in A. H. Meltzer, and C.I. Plosser, eds., *Carnegie-Rochester Conference Series on Public Policy* 34, North-Holland, Amsterdam and New York, Spring 1991, 7–30.

Hoelscher, Gregory, "New Evidence on Deficits and Interest Rates," *Journal of Money, Credit and Banking*, February 1986, 1–7.

Hardouvelis, Gikas A., "Market Perceptions of Federal Reserve Policy and the Weekly Monetary Announcements," *Journal of Monetary Economics*, September 1984, 225–240.

———, "The Term Structure Spread and Future Changes in Long and Short Rates in the G-7 Countries: Is There a Puzzle," *Journal of Monetary Economics*, April 1994, 255–283.

Howe, Howard, and Charles Pigott, "Determinants of Long-Term Interest Rates: An Empirical Study of Several Industrial Countries," *Federal Reserve Bank of New York Quarterly Review*, Winter 1991–1992, 12–28.

Judd, John P., "Money Supply Announcements, Forward Interest Rates and Budget Deficits," *Federal Reserve Bank of San Francisco Economic Review*, Fall 1984, 36–46.

Laurent, Robert D., "An Interest Rate-Based Indicator of Monetary Policy," *Federal Reserve Bank of Chicago Economic Perspectives*, January/February 1988, 3–14.

Leeper, Eric M., and David B. Gordon, "In Search of the Liquidity Effect," *Journal of Monetary Economics*, June 1992, 341–369.

Lucas, Robert E., Jr., "Econometric Policy Evaluation: A Critique," in K. Brunner, and A. H. Meltzer, eds., *The Phillips Curve and Labor Markets*, North-Holland, Amsterdam and New York, 1976, 19–46.

Mankiw, N. Gregory, "The Term Structure of Interest Rates Revisited," *Brookings Papers on Economic Activity*, 1, 1986, 61–96.

Mankiw, N. Gregory, and Lawrence H. Summers, "Do Long-Term Interest Rates Overreact to Short-Term Interest Rates?" *Brookings Papers on Economic Activity*, 1, 1984, 223–242.

Marschak, Jacob, "Economic Measurement for Policy and Prediction," in William C. Hood, and T. C. Koopman, eds., *Studies in Econometric Method*, John Wiley & Sons, New York, 1953, 1–26.

Mascaro, Angelo, and Allan H. Meltzer, "Long- and Short-Term Interest Rates in a Risky World," *Journal of Monetary Economics*, November 1983, 485–518.

Miller, Stephen M., and Frank S. Russek, "The Temporal Causality Between Deficits and Interest Rates," *Contemporary Policy Issues*, July 1991, 12–23.

Mishkin, Frederic S., "Monetary Policy and Long-Term Interest Rates: An Efficient Markets Approach," *Journal of Monetary Economics*, January 1981, 29–55.

———, *A Rational Expectations Approach to Macroeconometrics*, University of Chicago Press, Chicago, 1983.

Modigliani, Franco, and Robert J. Shiller, "Inflation, Rational Expectations and the Term Structure of Interest Rates," *Economica*, February 1973, 12–43.

Patinkin, Don, "Neutrality of Money," in P. Newman, M. Milgate, and J. Eatwell, eds., *The New Palgrave Dictionary of Money and Finance*, Vol. 3, Macmillan Press, 1992, London, 16–22.

Poole, William, "Interest Rates and the Conduct of Monetary Policy: A Comment," in A. H. Meltzer and C. I. Plosser, eds., *Carnegie-Rochester Conference Series on Public Policy* 34, North-Holland, Spring 1991, Amsterdam and New York, 31–39.

Radecki, Lawrence J., and Vincent Reinhart, "The Financial Linkages in the Transmission of Monetary Policy in the United States," in Bank for International Settlements, *National Differences in Interest Rates Transmission*, Basle, Switzerland, 1994, 291–337.

Richenstein, William, "The Impact of Money on Short-Term Interest Rates," *Economic Inquiry*, January 1987, 67–82.

Roley, V. Vance, and Carl E. Walsh, "Unanticipated Money and Interest Rates," *American Economic Review*, May 1984 (Papers and Proceedings), 49–54.

Romer, Christina, and David Romer, "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz," in O. Blanchard and S. Fischer, eds., *NBER Macroeconomic Annual*, MIT Press, Cambridge, Mass., 1989, 121–170.

Sargent, Thomas J., "Commodity Price Expectations and the Interest Rate," *Quarterly Journal of Economics*, February 1969, 127–140.

Savin, N. E., and Charles H. Whiteman, "Lucas Critique" in P. Newman, M. Milgate, and John Eatwell, eds., *The New Palgrave Dictionary of Money and Finance*, Vol. 2, Macmillan Press, London, 1992, 618–622.

Shiller, Robert J., "The Volatility of Long-Term Interest Rates and Expectations Models of the Term Structure," *Journal of Political Economy*, December 1979, 1,190–1,219.

Shiller, Robert J., John Y. Campbell, and Kermit L. Schoenholtz, "Forward Rates and Future Policy: Interpreting the Term Structure of Interest Rates," *Brookings Papers on Economic Activity*, 1, 1983, 173–217.

Sims, Christopher A., "Comparisons of Interwar and Postwar Business Cycles: Monetarism Reconsidered," *American Economic Review*, June 1980, 250–257.

________, "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy," *European Economic Review*, June 1992, 975–1,011.

Strongin, Steven, "The Identification of Monetary Policy Disturbances: Explaining the Liquidity Puzzle," *Federal Reserve Bank of Chicago Working Paper Series*, 92–27, Chicago, November 1992.

Taylor, John B., "Monetary Policy and the Stability of Macroeconomic Relationships," *Journal of Applied Econometrics*, Supplement 1989, S161–S178.