

UC Berkeley

Fisher Center Working Papers

Title

The Reaction of Reduced-Form Coefficients to Regime Changes: The Case of Interest Rates

Permalink

<https://escholarship.org/uc/item/4r76f5dq>

Authors

Peek, Joe
Wilcox, James A.

Publication Date

1985

Peer reviewed



Institute of
Business and
Economic Research

University of
California,
Berkeley

**CENTER FOR REAL ESTATE
AND URBAN ECONOMICS
WORKING PAPER SERIES**

REAL ESTATE WORKING PAPER NO. 85-97

THE REACTION OF REDUCED-FORM COEFFICIENTS
TO REGIME CHANGES: THE CASE OF INTEREST RATES

BY

JOE PEEK

JAMES A. WILCOX

These papers are preliminary
in nature; their purpose is
to stimulate discussion and
comment. Therefore, they
are not to be cited or quoted
in any publication without
the express permission of
the author.

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

**CENTER FOR REAL ESTATE AND URBAN ECONOMICS
UNIVERSITY OF CALIFORNIA, BERKELEY**

The Center was established in 1950 to examine in depth a series of major changes and issues involving urban land and real estate markets. The Center is supported by both private contributions from industry sources and by appropriations allocated from the Real Estate Education and Research Fund of the State of California.

**INSTITUTE OF BUSINESS AND ECONOMIC RESEARCH
J. W. Garbarino, Director**

The Institute of Business and Economic Research is a department of the University of California with offices on the Berkeley campus. It exists for the purpose of stimulating and facilitating research into problems of economics and of business with emphasis on problems of particular importance to California and the Pacific Coast, but not to the exclusion of problems of wider import.

The Reaction of Reduced-Form Coefficients to Regime Changes:

The Case of Interest Rates

Joe Peek
Boston College

and

James A. Wilcox
University of California, Berkeley
and National Bureau of Economic Research

Revised: January 1985

Working Paper No. 85-97

We would like to thank, without indicating the approval of, Christopher Baum, Robert McDonald, Richard A. Meese, Robert G. Murphy, Janet Yellen and seminar participants at the Federal Reserve Banks of Dallas and San Francisco, the 1984 NBER Summer Institute, and the University of California, Davis. Helen O'Keefe provided fast and accurate typing. Financial support was provided by the Center for Real Estate and Urban Economics and the Institute for Business and Economic Research at Berkeley.



The Reaction of Reduced-Form Coefficients to Regime Changes:
The Case of Interest Rates

Joe Peek

Boston College

and

James A. Wilcox

University of California, Berkeley

and National Bureau of Economic Research

Abstract

This study investigates whether the apparent intertemporal instability of a particular reduced-form equation (that for interest rates) can be explained by changing government policy parameters, or regimes, and otherwise stable structural parameters. We hypothesize that major fiscal, monetary, and regulatory policy parameter shifts have been important sources of that instability. Direct tests imply that reduced-form coefficients move by statistically significant and economically meaningful amounts in response to policy parameter change. Both in-sample and out-of-sample forecasts from the proposed model outperform those from the non-responsive parameter specification. Furthermore, our model is able to explain the unusually high real interest rates occurring in the early 1980s.



"Just as everybody talks about the weather, every economist talks about endogenous stabilization policy, but nobody ever does anything about it." (Goldfeld and Blinder (1972))

A. Introduction

For more than a decade, empirical studies have sought to determine whether nominal interest rates adjust such that real rates are unaffected by changes in the anticipated inflation rate (the Fisher neutrality hypothesis). An unsettling aspect of these studies is the volatility of the estimated interest rate response to anticipated inflation over various sample periods.¹ Estimates based on data for the 1950s provided low and insignificant values for the response.² As the sample period was extended, larger point estimates of the response were obtained, finally approaching unity. Carlson (1979), Cargill and Meyer (1980) and Levi and Makin (1979) produce estimated interest rate responses that decline, often dramatically, when the sample period is extended to include the first half of the 1970s. Peek and Wilcox (1983) find that the inclusion of income tax and aggregate supply shock effects reduces, but does not eliminate, the observed coefficient instability. This suggests other relevant factors remain.

The Lucas (1976) critique suggests that conventional reduced-form coefficients may vary over time due to the dependence of private sector expectational parameters on government policy parameters. Sims (1982) has recently countered that this objection should be regarded as no more than a "cautionary footnote" (p. 108) since policy rules "have not changed frequently or by large amounts" (p. 138). He argues that in fact there has been little drift in (final form) parameter estimates through time. Here we test directly whether changes

in policy parameters have produced changes in reduced-form parameters. We hypothesize that significant, quantifiable changes have occurred in the policy parameters that are especially relevant to the reduced form for interest rates. We incorporate these parameters in our model and investigate whether the apparent intertemporal instability of the reduced-form equation for interest rates can be explained by the changing values of government policy parameters through time and otherwise stable structural parameters. Clarida and Friedman (1983, 1984) have demonstrated that, relative to the predictions of either a structural or an astructural model, interest rates in the post-1979 period have been "too high." We use our resulting expanded model to address these recent, puzzling levels of interest rates.

We consider three major sources of change in the government's policy parameters:³

- 1) changes in fiscal policy parameters,
- 2) changes in monetary policy parameters, and
- 3) changes in financial regulatory policy parameters.

The first category is exemplified by changes in personal tax rates. Peek (1982) presents evidence that changing tax rates significantly affect interest rates and that incorporating their movements substantially reduces the instability of interest rate coefficients. Furthermore, Peek and Wilcox (1984) find that such tax effects are complete; that is, there is no evidence of the "fiscal illusion" suggested by Tanzi (1980). The second category of policy parameter change is typified by the October 1979 change in monetary policy (as well as by the 1951 Treasury Accord). Third, the creation of negotiable certificates of deposit (CDs) in the early 1960s and of six-month money-market certificates in the late 1970s and the elimination of interest rate ceilings on large CDs in the early

1970s exemplify the regulatory changes most directly relevant to financial markets. By reducing the degree of disintermediation when rates rise, these financial innovations may have reduced the impact of monetary restraint through credit availability and thus may have decreased the interest elasticity of private expenditures. To the extent each of these policies influence structural parameters, the reduced-form response of nominal interest rates to anticipated inflation (and to other factors) will vary with regime changes.

Below we present a simple macro model which highlights the link between policy parameters and reduced-form coefficients. Sections C and D describe the measurement and estimation methodology and present our empirical results. The final section concludes.

B. A Model of Interest Rates

This section presents a model of interest rates that embodies both fiscal and monetary policy parameters. Solution of the model produces reduced forms that highlight the link between policy parameter variation and movements in the reduced-form coefficients. The model consists of IS, LM, wage, aggregate supply, and monetary policy rule equations. These five relationships can be expressed in linearized form as

$$Y - Y^N = a_0 - a_1 r^* + a_2 \Delta Y_{-1} + a_3 (G - Y^N) - a_4 SS \quad (1)$$

$$M - P - Y^N = b_0 + b_1 (Y - Y^N) - b_2 i^* + b_3 SD \quad (2)$$

$$W = c_0 + P^e - c_1 SS \quad (3)$$

$$P = d_0 + W + d_1 (Y - Y^N) + d_2 SS, \quad (4)$$

$$M - P^e - Y^N = M_x + e_1 r \quad (5)$$

where the coefficients of all the variables are assumed to be positive and:

Y = the logarithm of actual real output,

y^N = the logarithm of natural real output,

ΔY_{-1} = the percentage change in real output lagged one period,

G = the logarithm of real government purchases,

M = the logarithm of the nominal money supply,

M_x = the logarithm of the non-interest-rate-reactive component
of the real money supply,

P = the logarithm of the actual price level,

p^e = the logarithm of the expected price level,

W = the logarithm of the nominal wage,

SS = the supply shock variable,

SD = the standard deviation of the after-tax nominal interest
rate,

r = the real interest rate,

r^* = the after-tax real interest rate,

i^* = the after-tax nominal interest rate.

The two after-tax interest rates are related to the nominal interest rate (i) by
(6) and (7):

$$i^* \equiv i(1 - t) \quad (6)$$

$$r^* \equiv i^* - p^e \quad (7)$$

where t is the marginal tax rate on interest income and p^e is the anticipated
inflation rate.

Real expenditures depend on the real after-tax interest rate, an investment

accelerator term, exogenous real government demand, and real shocks emanating from the supply side. Money demand is hypothesized to depend on output and on the after-tax nominal interest rate, which represents the opportunity cost of holding money when interest income is taxed. The third argument in the money demand function (SD) represents a measure of the capital-value risk associated with holding bonds as alternatives to money in wealth portfolios (see Slovin and Sushka (1983) for discussion and empirical evidence in favor of this hypothesis). The wage and price equations embody the natural rate hypothesis.

Equation (5) posits a monetary authority (Fed) policy that allows the nominal money supply, adjusted for the expected price level and natural real output, to rise and fall with the real interest rate. "Even a casual look at post-accord Federal Reserve policy would confirm the view that, for better or worse, the System was pursuing the money market strategy..." (Lombra and Torto (1973)). Guttentag (1966) observes that "under the money market strategy, the principal open market target is the condition of the money market" by which "is meant the interest rate on short-term claims..." The Fed almost certainly has reacted to other factors as well, e.g., cyclical unemployment, inflation, international forces, and the preferences of individual policymakers. Shifts in the slope parameter e_1 in (5), however, can be viewed as capturing some of the major policy shifts of the postwar period. That parameter measures the extent to which the Fed stabilizes interest rates in practice, i.e., accommodates. This parameter can be thought of as a measure of the degree to which the nominal money supply (given P^e and Y^N) moves in response to fluctuations in the real interest rate. The reduced pegging of interest rates after the 1951 Treasury Accord, the increased emphasis on monetary aggregates in the 1970s, and the October 1979 shift to reserves targeting can each be represented by changes in

the policy parameter e_1 . Since each of these changes presumably involved moving toward a less procyclical monetary policy (and a steeper effective LM curve), each can be characterized as a reduction in e_1 .

Equations (1-7) can be combined to yield the reduced-form equation for the nominal interest rate:

$$i = \beta_0 + \beta_1 p^e + \beta_2 \Delta Y_{-1} + \beta_3 G' + \beta_4 M_x + \beta_5 SS + \beta_6 SD \quad (8)$$

(+)
(+)
(+)
(-)
(?)
(+)

where G' represents $(G - Y^N)$ and:

$$\beta_0 = \frac{a_0(b_1+d_1) + b_0 + c_0 + d_0}{D} \quad (9)$$

$$\beta_1 = \frac{a_1(b_1+d_1) + e_1}{D}, \quad (10)$$

$$\beta_2 = \frac{a_2(b_1+d_1)}{D}, \quad (11)$$

$$\beta_3 = \frac{a_3(b_1+d_1)}{D}, \quad (12)$$

$$\beta_4 = \frac{-1}{D}, \quad (13)$$

$$\beta_5 = \frac{(d_2-c_1) - a_4(b_1+d_1)}{D}, \quad (14)$$

$$\beta_6 = \frac{b_3}{D}, \quad \text{and} \quad (15)$$

$$D = (1-t)[a_1(b_1+d_1) + b_2] + e_1. \quad (16)$$

The sign of β_5 is indeterminate a priori. An adverse supply shock reduces investment and real wages and thus the interest rate, while at the same time

increasing input costs which, operating through the aggregate supply equation, raise the interest rate. The investment-real wage effect might be expected to dominate, suggesting a negative value for β_5 . The results presented in Peek and Wilcox (1983) and Wilcox (1983a, 1983b) support this interpretation.

The three policy parameters t , e_1 , and a_1 are of particular interest. To the extent that any of these parameters (or for that matter, any of the structural parameters) vary over time, the reduced-form coefficients will also change. Insofar as the structural parameter in question enters more than one reduced-form coefficient, the β 's will not vary independently. For example, the marginal tax rate (t) enters all of the reduced-form coefficients in the same way. An increase in the tax rate will raise not only the interest rate response to expected inflation, but also all of the other reduced-form coefficients. In fact, since changes in t alter the denominator of each β identically, the reduced-form coefficients will all have the same movement over time (up to a scale factor) due to changes in t . A decrease in the response of private expenditures to the real after-tax interest rate (a_1) will reduce the denominators of all eight β 's by the same amount. However, since a_1 also appears in the numerator of β_1 , the interest rate response to the expected inflation rate will be differentially affected; the decrease in a_1 will raise all of the other reduced-form coefficients, while the response to expected inflation will be reduced. Similarly, a decrease in e_1 will raise all of the β 's except β_1 through its effect on D . But, as with a_1 , e_1 also enters the numerator of β_1 . In this instance, however, the direction of the net effect of the change in e_1 on β_1 is ambiguous a priori.

C. Methodology

Equations (9)-(16) illustrate the relationship between policy parameters and

the reduced-form coefficients. Our hypothesis is that failure to allow for movements over time in these policy parameters has contributed to observed reduced-form estimate instability. We rectify this shortcoming by including values of the time series of the proxies for fiscal, monetary, and regulatory policy parameters. This allows us to test directly for the significance of policy changes in explaining reduced-form coefficient variability and to evaluate whether the remaining, deeper parameters are stable. Incorporating fiscal policy parameter movements requires a measure of the marginal tax rate of the marginal investor, t . If a tax-exempt institution is the marginal investor, the marginal tax rate is zero. If individuals are the marginal investors, the appropriate tax rate is the marginal personal income tax rate.⁴ The progressivity of the personal income tax rate makes measuring that rate problematic. As our measure of t , we use the average marginal tax rate on interest income constructed from data contained in annual editions of Statistics of Income, Individual Income Tax Returns (see Peek (1982)). The tax rate is calculated as a weighted average of the marginal personal income tax rate for each adjusted gross income class. The weight for each class is equal to its share of the total interest received by all income classes.⁵

A downward drift in the measured interest rate response to expected inflation as the sample period was extended into the 1970s has been noted by Carlson (1979), Cargill and Meyer (1980), and Levi and Makin (1979). This may be due to the continuing financial institution deregulation and consequent reduction in disintermediation. A number of regulatory changes reduced the potential for disintermediation throughout that period (e.g., the creation of negotiable certificates of deposit, increases in Regulation Q ceilings, the introduction of six-month money market certificates). Such changes might reduce the interest

response of private expenditures (a_1), thereby lowering the reduced-form coefficient on expected inflation (see equation (10)).⁶

We allow for changing regulatory policy (and financial innovation) with a measure of the effect of such changes rather than attempting to quantify the changes themselves. To do so, we take as our regulatory policy indicator, SHR, the share of commercial banks' and thrift institutions' liabilities that pay market-related interest rates. We assume that the interest response of expenditures is a function of SHR and DCC:

$$a_1 = f_0 + (f_1 + f_2/\text{SHR})\text{DCC}, \quad (17)$$

where DCC is a dummy variable that takes a value of unity when the three-month Treasury bill yield exceeds the regulation Q ceiling interest rate on savings deposits and is zero otherwise. Thus, DCC switches on when disintermediation is likely. The extent to which a_1 changes then depends upon the share of liabilities subject to disintermediation. We also allow the IS curve intercept (a_0) to move during these periods so as not to constrain the IS function to pivot about its horizontal intercept:

$$a_0 = f_3 + f_4\text{DCC}. \quad (18)$$

In this specification, $f_0(>0)$ represents the (absolute value of the) interest response of expenditures in the non-disintermediation periods. During the disintermediation periods, the value of a_1 may increase. Thus, we expect $(f_1 + f_2/\text{SHR})$ to be positive. Furthermore, we expect the increase in a_1 to be larger the smaller is the value of SHR ($f_2 > 0$). We also expect f_4 to be positive in (18).

Similarly, we seek a measure of the time series for the money supply policy parameter, e_1 . To do so, we rewrite (5) as:

$$M-P^e-Y^N = h_0 + h_1 AFB + h_2 GWM + h_3 PAV + h_4 RE + h_5 AFBRE + h_6 GWMRE + h_7 PAVRE \quad (19)$$

AFB, GWM, and PAV are dummy variables that are assigned a value of one during the terms of the sample's Fed Chairmen Burns, Miller, and Volcker, respectively. Fed Chairman Martin's regime is represented by the constant term, h_0 . The same variables with the suffix RE are those dummies multiplied by the expected real interest rate, $RE = i - p^e$. This specification allows e_1 , the reaction of the money supply to expected real interest rates, to vary across the regimes of the different Fed chairmen, but restricts it to be constant within regimes. The three intercept dummies are included to lessen the likelihood that variations in the overall stringency of monetary policy across regimes be mistakenly attributed to variations in the systematic-response coefficient, i.e., to avoid empirically confusing intercept and slope shifts in the money supply function. The (step function) time series for the money supply reaction coefficient can be read directly from (19). Since the three regime coefficients reflect effects relative to the Martin regime, the values for e_1 are h_4 , (h_4+h_5) , (h_4+h_6) , and (h_4+h_7) for 1952:06 - 1970:06, 1970:12 - 1978:06, 1978:12 - 1979:06, and 1979:12-1982:06, respectively.⁷ Similarly, h_0 , (h_0+h_1) , (h_0+h_2) , and (h_0+h_3) reflect the average relative degree of monetary stringency for the four Fed Chairman regimes. M_x is also based on (19). Movements in M_x , $M-P^e-Y^N$ minus the real-rate-reaction elements, consist of all movements in money other than those due to the Fed's reaction to the real interest rate.

D. Empirical Results

1. Estimates Based on Constant Policy Parameters

This section presents the results of estimating (8) subject to (9)-(18). When e_1 , f_1 , f_2 , and f_4 are taken to be zero through time, constant-coefficient,

ordinary least squares (OLS) suffices. These restrictions are equivalent to setting M_x to equal $(M-P^e-Y^N)$, e_1 equal to zero, and a_1 equal to a constant. As a result, (8) can be expressed as:

$$i = \beta_0 + \beta_1 P^e + \beta_2 \Delta Y_{-1} + \beta_3 G' + \beta_4 M' + \beta_5 SS + \beta_6 SD \quad (20)$$

where M' is $(M-P^e-Y^N)$,

$$\beta_1 = \frac{a_1(b_1 + d_1)}{D}, \text{ and} \quad (21)$$

$$D = (1-t)(a_1(b_1 + d_1) + b_2). \quad (22)$$

Tanzi (1980) suggests that individuals have suffered from "fiscal illusion" by failing to take complete account of tax rates. Peek (1982), using a 1960-1979 sample, can be interpreted as testing the hypothesis that individuals rather than tax-exempt institutions are the marginal investors in the six-month and one-year Treasury bill market. Alternatively, the null hypothesis could be that individuals are the marginal investors but ignore income tax considerations in making their financial decisions. Using the Davidson-MacKinnon (1981) non-nested model specification test, the non-tax adjusted model (equivalent to our equations (20)-(22) with $t = 0$) was rejected in favor of the tax-adjusted formulation (equations (20)-(22)) using an index of marginal personal income tax rates. Employing a more detailed model incorporating supply shock and foreign-held bond effects, Peek and Wilcox (1983) reconfirmed these results for the entire 1952-79 period for the one-year Treasury bill rate. We also showed how changes over time in the correlations between the anticipated inflation rate and the tax rate and supply shock variable contributed to previously measured inter-temporal instability in the estimated expected inflation coefficient. Further, Peek and Wilcox (1984) estimate a specification similar to (20)-(22) with $(1-t)$

replaced by $(1-\theta t)$, where θ reflects the degree of (lack of) fiscal illusion. Using nonlinear least squares, the estimate of θ closely approximates one, indicating no fiscal illusion. Therefore, we here restrict θ to unity, implying complete adjustment to changes in tax rate policies. From (22), it can be seen that $(1-t)$ can be factored out of the coefficient of each explanatory variable. Using our tax rate series, we can express (20) with constant reduced-form coefficients when we divide each of the right-hand-side variables (including the constant term) by $(1-t)$. Now, $1/(1-t)$ is included in the explanatory variables rather than in their coefficients. The implied reduced-form coefficients in (20) at any time are then the estimated constant coefficients divided by the value of $(1-t)$ for that period.

Table 1 presents the results of estimating (20). June and December averages of the secondary market yield (on a bond equivalent basis) on one-year U.S. Treasury bills are used as the dependent variable.⁸ p^e is the Livingston one-year expected inflation rate, recorded in June and December. This measure of expected inflation has the advantages of being truly ex ante and of embodying whatever sophistication agents actually use to form their expectations.⁹ The Lucas proposition is likely to apply to expectations generating mechanisms with particular force. The measure used here is the output of a presumably varying mechanism and therefore is not subject to that critique. The remaining variables are measured with second and fourth quarter data (except SD). M is the nominal money supply. p^e is the price level expected six months ahead from the Livingston survey data. Y^N , natural real output, is from the Council of Economic Advisors. $(M-p^e-Y^N)$ has been detrended by regressing it on a linear time trend and using the residual as M' . G' is the logarithm of the ratio of real government purchases to real natural output. ΔY_{-1} is the four-quarter

TABLE 1

OLS ESTIMATES OF EQUATION (20)
 dependent variable: nominal yield on 1 year Treasury bill
 semi-annual observations
 (absolute values of t-statistics in parentheses)

Sample Period	Constant	p^e	ΔY -1	G'	M'	SS	SD	D7982	R ²	DW	SEE
1.1952:06- 1979:06	12.5 (5.37)	0.734 (9.72)	7.56 (2.35)	3.17 (3.72)	-0.29 (0.10)	-3.08 (3.86)	0.39 (0.92)	---	.8867	1.31	0.813
2.1952:06- 1982:06	12.6 (3.97)	0.770 (8.07)	6.16 (1.37)	3.03 (2.65)	-9.10 (2.56)	-3.50 (3.01)	1.04 (2.03)	---	.8766	1.11	1.261
3.1952:06- 1982:06	8.2 (3.00)	0.575 (6.62)	4.53 (1.22)	1.55 (1.57)	-1.91 (0.53)	-2.32 (2.37)	0.44 (1.01)	4.84 (5.17)	.9185	1.25	1.035

growth rate of real GNP up to the preceding quarter. SS is the ratio of the import deflator to the GNP deflator, adjusted for exchange rate changes. SD is the 18-month moving standard deviation of the after-tax nominal interest rate, lagged one month. D7982 is a dummy variable that takes the value one starting with the December 1979 observation. The June 1980 observation has been omitted due to the presence of credit controls; otherwise, the full sample is 1952:06-1982:06.

The estimates in row 1 imply that rises in expected inflation and exogenous government purchases, faster real growth, and more volatile interest rates raise rates while higher real money balances and positive supply shocks each lower them. Both money and interest rate volatility have statistically insignificant effects. After 1979 interest rates were both surprisingly high and volatile. Row 2 shows that when the post-1979 period is added to the sample, the standard error of estimate rises by 55 percent and both money and interest rate variability now have significant effects. This appears to confirm the popular attribution of the high post-1979 interest rates to sharply increased interest rate volatility and tighter money. Including D7982 in row 3, however, reduces both estimated coefficients to insignificance. The coefficient of 4.84 on D7982 in row 3 indicates that the surprises were large and primarily on the upside. However, even allowing for this nonexplained upward shift leaves the standard error of the estimate much larger than before 1979.

With the exception of M', adding the post-1979 period seems to change the estimated coefficients relatively little. The sharp jump in the money coefficient reflects econometric attribution of the unusually high real interest rate in recent years to the unusually restrictive Volcker monetary policy. In fact, once we introduce D7982, the M' coefficient becomes positive and insigni-

ficant (row 3). While most of the coefficient estimates appear stable, when we do a formal stability test a different picture emerges. The hypothesis of stability for this specification over a mid-1979 sample split is soundly rejected (F-statistic = 10.88). This instability is also apparent when a time series of the expected inflation coefficient estimate is generated by rolling over a fourteen-year (n=28) sample using the specification in (20). Figure 1 plots the estimated time series for the interest rate response to expected inflation (β_1 in (20)) that includes the personal tax rate effect. It is constructed as the product of the (constant) estimated coefficient on $p^e/(1-t)$ and the average value of $1/(1-t)$ during each of the rolling 14 year subsamples. This series exhibits considerable movement. In particular, the sharp jump in the series after the 1952 and 1953 observations are eliminated and the early 1970s observations are added to the rolling sample, the downward drift as the sample leaves the 1950s and enters the 1970s, the rise as the sample moves into the second half of the 1970s, and the resumption of the decline as the 1980s observations are included, suggests that major movements are left to be explained.

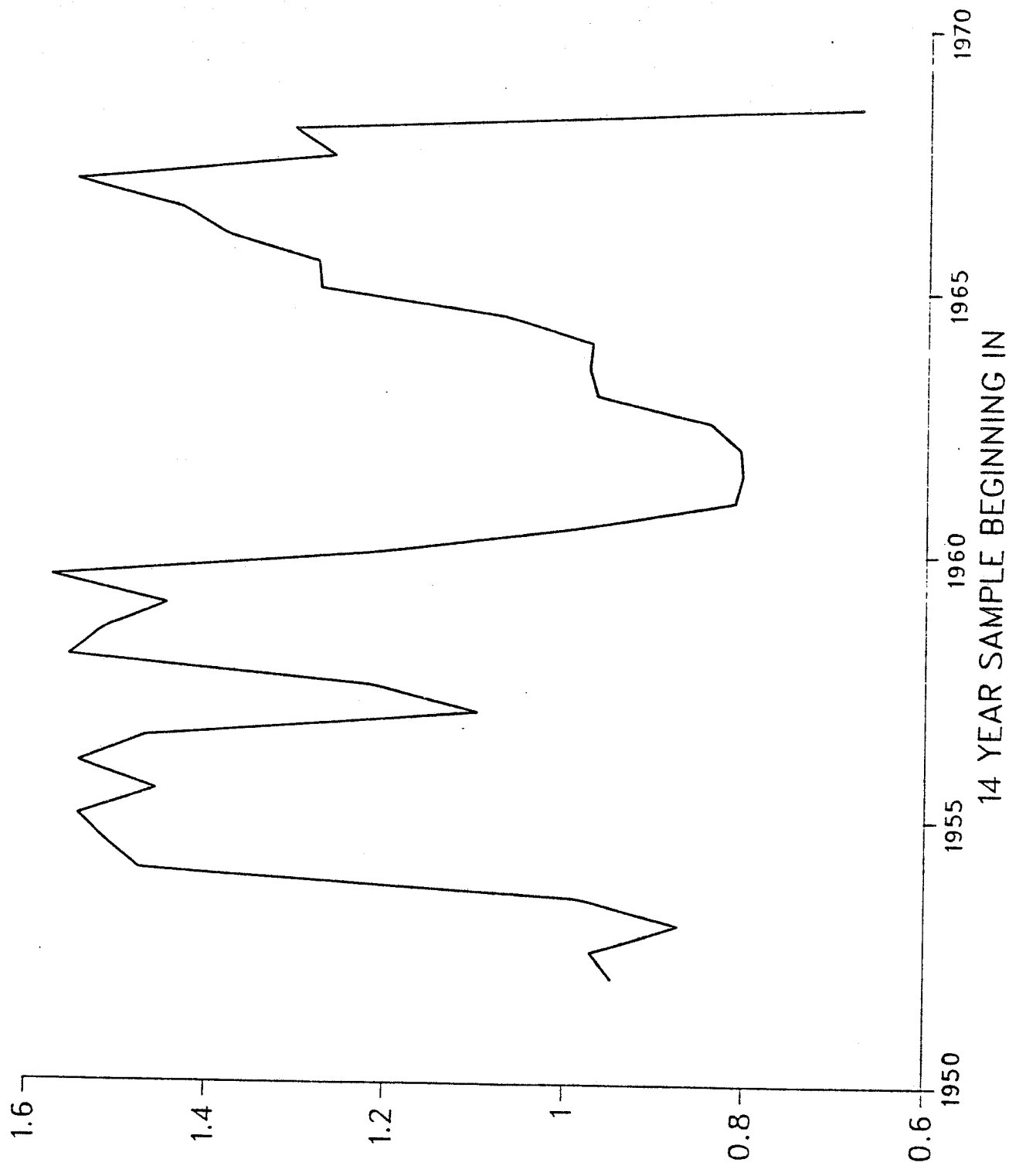
2. Estimates based on Changing Policy Parameters

To estimate (8), allowing for variations in monetary and regulatory policy as well as tax policy changes, we substitute (17) and (18) for a_1 and a_0 . Nonlinear least squares can be used to estimate equation (8) while imposing the coefficient restrictions described in (9)-(16). Incorporating (17)-(18) and the definition of e_1 implicit in (19), we can rewrite (8) as:

$$i = \frac{\alpha_0}{D} + \frac{N}{D} p^e + \frac{\alpha_2}{D} \Delta Y_{-1} + \frac{\alpha_3}{D} G' + \frac{\alpha_4}{D} M_x + \frac{\alpha_5}{D} SS + \frac{\alpha_6}{D} SD + \frac{\alpha_7}{D} DCC, \quad (23)$$

$$\text{where } N = \gamma_0 + \gamma_1 DCC + \gamma_2 DCC/SHR + \gamma_3 (h_4 + h_5 AFB + h_6 GWM + h_7 PAV) \quad (24)$$

FIGURE 1
Anticipated Inflation Coefficient from Rolling Regressions



$$\text{and } D = (1-t)(\gamma_4 + \gamma_1 \text{DCC} + \gamma_2 \text{DCC}/\text{SHR}) + \gamma_3(h_4 + h_5 \text{AFB} + h_6 \text{GWM} + h_7 \text{PAV}). \quad (25)$$

Because of the form of (23), we can estimate the α 's and γ 's only up to a scale factor. To obtain a unique set of estimates of the α 's and γ 's, we arbitrarily fix one of the coefficients (or, alternatively, divide the numerators and denominators of all of the β 's by one of the parameters).¹⁰ Since we are most interested in the coefficients of the explanatory variables, we have chosen to use the constant term, α_0 , as the scale factor. This produces point estimates of the ratios of the α 's and γ 's to α_0 .¹¹ While we cannot perform marginal significance tests for the α 's and γ 's with the resulting point estimates and coefficient standard errors, the summary statistics for the equation itself as well as the estimated time series of the β 's are uniquely determined; that is, they are invariant with respect to the scale factor used. A chi-square test statistic can be used to perform likelihood ratio tests of the restriction that each of the relevant coefficients (the α 's and γ 's) is zero. This produces the desired measures of marginal significance.

We jointly estimate the system composed of (19) and (23), with N and D defined as in (24) and (25), using maximum likelihood which allows for cross-equation error correlation to ensure consistency. Our model predicts that γ_0 , γ_2 , γ_3 , and γ_4 are all positive. While the sign of γ_1 may be positive or negative, $(\gamma_1 + \gamma_2/\text{SHR})$ should be positive. We anticipate positive values for α_2 , α_3 , α_6 and α_7 , and negative values for α_4 and α_5 . The estimates for the 1952:06-1982:06 sample, again omitting the 1980:06 credit controls period, are:¹²

$$\begin{aligned} M' = & -0.122 + 0.0857\text{AFB} + 0.0412\text{GWM} - 0.131\text{PAV} + 0.0472\text{RE} + 0.0175\text{AFBRE} \\ & (6.44) \quad (4.17) \quad (0.96) \quad (3.31) \quad (1.58) \quad (2.02) \\ & -0.0226\text{GWMRE} - 0.0228\text{PAVRE} \\ & (1.35) \quad (2.82) \end{aligned} \quad (26)$$

$$R^2 = .369 \quad \text{SEE} = 0.0418 \quad \text{DW} = 1.03$$

$$i = (1 + Np^e + 0.232\Delta Y_{-1} + 0.167G' - 1.82M_x - 0.367SS - 0.0685SD + 0.0696DCC)/D, \\ (1.02) \quad (2.10) \quad (5.80) \quad (5.41) \quad (2.45) \quad (2.24) \quad (27)$$

$$R^2 = .987 \quad \text{SEE} = 0.385 \quad \text{DW} = 1.59$$

where N , M_x , and D are:

$$N = 0.103 - 0.0733DCC + 0.000586DCC/SHR + 1.10 (0.0472 + 0.0175AFB - 0.0226GWM \\ (1.82) \quad (3.19) \quad (2.69) \quad (2.16)(1.58) \quad (2.02) \quad (1.35) \\ - 0.0228PAV) \quad (28) \\ (2.82)$$

$$M_x = M' - 0.0472RE - 0.0175AFBRE + 0.0226GWMRE + 0.0228PAVRE \quad (29) \\ (1.58) \quad (2.02) \quad (1.35) \quad (2.82)$$

$$D = (1-t)(0.135 - 0.0733DCC + 0.000586DCC/SHR) + 1.10 (0.0472 + 0.0175AFB \\ (4.04) \quad (3.19) \quad (2.69) \quad (2.16)(1.58) \quad (2.02) \\ - 0.0226GWM - 0.0228PAV) \quad (30) \\ (1.35) \quad (2.82)$$

The numbers in parentheses below the coefficient estimates can be interpreted approximately as t-statistics. They are calculated as the square root of the chi-square test statistic used to perform the likelihood ratio tests of the restriction that each of the relevant coefficients was zero.¹³ It should be emphasized that we estimated a two equation (not a five equation) system composed of (26) and (27). To simplify the presentation of (27), we chose to substitute the symbols N , M_x and D for the more complicated expressions appearing in (28)-(30). It can be seen from (28) and (30) that there were a number of within-equation coefficient restrictions imposed in (27). Furthermore, as can be seen from a comparison of (26) and (28)-(30), there are also across-equation restrictions imposed on the coefficients determining the time series for the interest rate reaction by the Fed (e_1).

With the exception of the SD coefficient, the general pattern of signs and significance of the coefficients in (27) mirrors the OLS results of Table 1. We now obtain a negative response of interest rates to interest rate volatility. To the extent that the higher degree of volatility occurs in long-term interest rates as well, a negative response of our short-term interest rate (we use a one-year maturity) would be consistent with a flight of funds from long-term securities to relatively less risky (in terms of capital-value risk) short-term instruments. That is, the term structure curve would steepen. There would be an unambiguous rise in long-term rates, while very short-term rates would certainly rise by less and might even fall if there were a sufficient increase in the demand for very short-term maturities. Our results are consistent with this latter case.

Another interesting feature of (27) compared to our Table 1 results is the increased significance of the money coefficient. While the M' coefficient is significant in row 2, it switches sign and becomes insignificant in row 3. In previous studies (both ours and those of others), there similarly has been a tendency for the money variable to be insignificant and, at times, to have a positive coefficient. This could be attributed to offsetting liquidity and real balance effects. However, while real balance effects sometimes play an important role in theoretical debates, there is little evidence of their empirical importance and it is unlikely that they are the source of positive estimated money effects on interest rates.

A more likely explanation is the presence of an endogenous component in M' arising from the Federal Reserve's attempts to mitigate movements in interest rates. If the Fed were to increase the money supply in response to (or in anticipation of) an increase in the interest rate, this feedback effect would tend

to camouflage the true relationship between exogenous money and interest rates. Such bias is analogous to the errors that arise from ignoring the operation of monetary policy reaction functions when estimating the effect of changes of money on income (see Goldfeld and Blinder (1972)). Equation (27) purges M' of its endogenous component. Our two equation system estimates the Federal Reserve feedback component in total money and eliminates it from M' to form our exogenous money measure, M_x . This exogenized measure of money has an unambiguous, strong negative impact on interest rates, the absence of which has perplexed many previous investigators.¹⁴

The coefficients of particular concern here are those associated with the regulatory and monetary policy parameters. All of the γ 's have the appropriate sign. The estimates of the two key coefficients, γ_2 and γ_3 , are both positive and statistically significant, indicating that the reduced-form coefficients do in fact respond to regime changes. As e_1 falls, i.e., as monetary policy becomes less accommodative of real rate shocks, D falls. The response of interest rates to changes in the explanatory variables (except possibly for p^e) then rises, as the economy is effectively operating with a steeper LM curve. As SHR rises, i.e., as the share of liabilities which are unregulated rises, D falls, increasing all of the reduced-form coefficients except that on p^e . Due to the effect of SHR on the numerator of β_1 , the increase in SHR (reduction in a_1) will lower the reduced-form expected inflation coefficient. As fewer liabilities are regulated, market interest rate increases induce less disintermediation and less credit rationing. Less expenditure is deterred by given interest rate increases, generating an effectively steeper IS curve, as hypothesized. The only problem with our estimates is that the quantity $(\gamma_1 + \gamma_2/SHR)$ is not positive for all values of SHR in our sample. The point estimates of γ_1 and γ_2 are

such that this term becomes negative in the last half of the sample as SHR continues to increase.

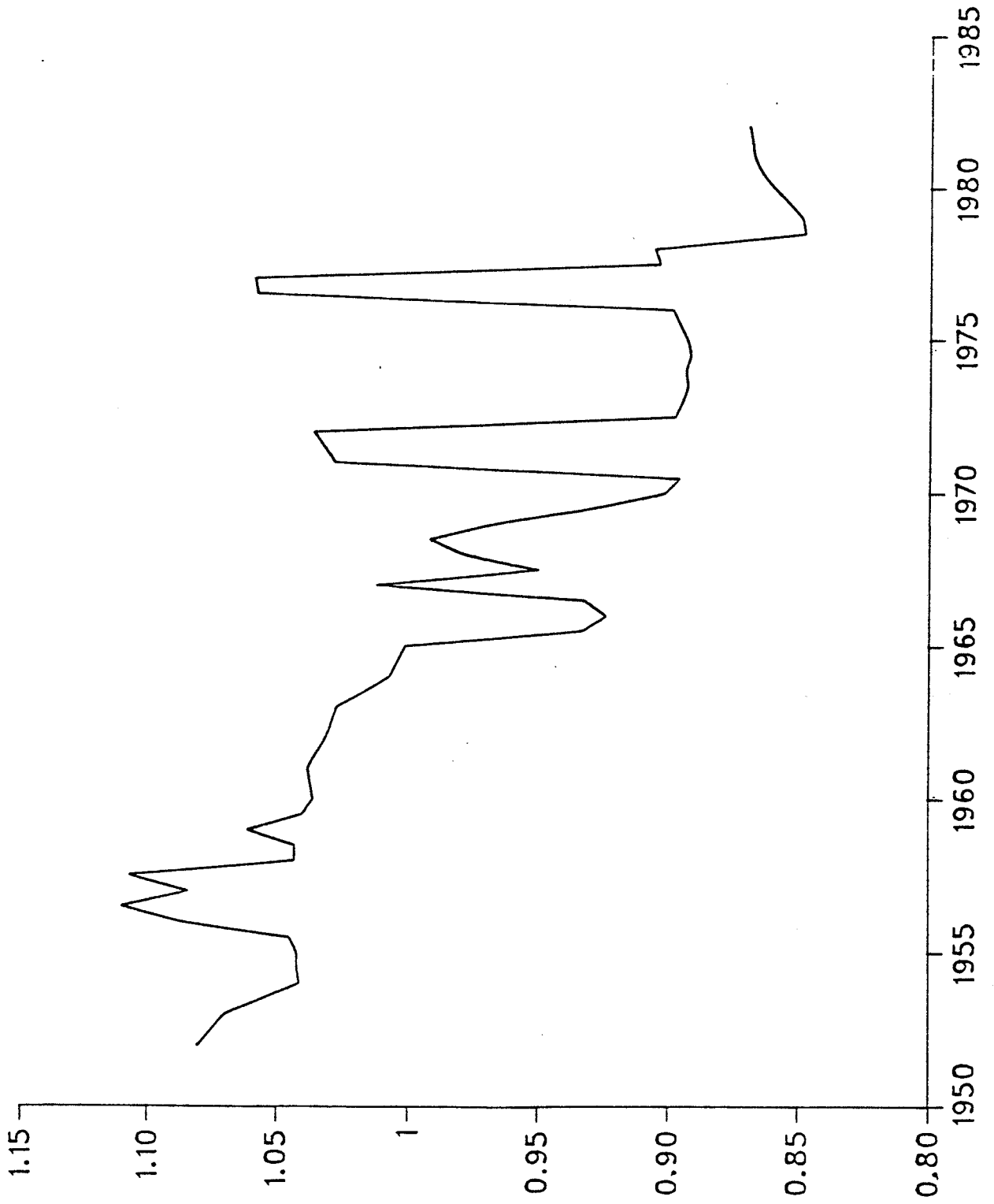
From (26) we can compute the estimated time series for the Fed response to interest rates, e_1 . The estimated values for e_1 (a step function) are 0.0472, 0.0647, 0.0246, and 0.0244 for the Martin, Burns, Miller, and Volcker regimes, respectively. This suggests that the Miller and Volcker regimes accommodated real rate shocks least while the Burns years saw the most accommodation. The William McChesney Martin regime appears to have been in between. We have written (26) in such a way that we can easily compare the relative degree of accommodation across regimes using the Martin years as a benchmark. The statistically significant coefficients on AFBRE and PAVRE indicate that Burns was significantly more accommodative and Volcker significantly less accommodative than Martin. While the point estimate of the coefficient on GWMRE is of the same magnitude as that on PAVRE, it is not statistically significant. When the system was re-estimated with a constant degree of accommodation over the entire sample period ($h_5 = h_6 = h_7 = 0$), we could easily reject the restriction (chi-square statistic = 14.6; critical value for the 1 percent level = 11.3). Similarly, our estimates of the average tightness of the four Fed chairman regimes imply that monetary policy was easiest during the Burns years, tighter than Burns but easier than Martin in the Miller regime, and tightest under Volcker. Again, we find that the Burns and Volcker regimes differed significantly from the benchmark Martin regime. We conclude that Burns was both the most accommodative and the least restrictive (on average) of the four regimes, while Volcker was the least accommodative and the most restrictive. Considering point estimates alone, the primary difference between the Miller and Volcker regimes appears to be in the relative tightness of monetary policy rather than in the

degree of accommodation. However, both of the variables representing the differential response of the Miller regime were statistically insignificant.

Including D7982 as an additional explanatory variable in the interest rate equation (not shown) permits us to test whether the reduced-form coefficient movement that we ascribe to policy shifts remains when a dummy variable for the later part of the sample is included. The coefficient estimate of -0.737 (t -statistic = -1.45 ; pseudo t -statistic = 0.51) indicates that our model does not seriously underestimate the interest rate during the 1979-82 period as is the case with the linear specification in Table 1. Allowing for policy parameter change reduces the estimated coefficient on D7982 from nearly five hundred basis points (4.84 with a t -statistic of 5.17) to insignificance. Consequently, it appears that our results not only confirm an important role for changing policy parameters, but also resolves a major puzzle associated with the systematic underprediction of interest rates in the early 1980s (Clarida and Friedman, (1983, 1984)).

Figure 2 plots the estimated time series values for β_1 , the reduced-form coefficient for expected inflation implied by (28) and (30). (Note that Figure 2 is not plotted on the same scale as Figure 1.) The implied coefficient exhibits a slight downward drift until the mid-1960s, due to a small decline in the effective tax rate series. Tax schedule reductions in 1954 and 1964-65 and a slight cyclical response to economic slack in the late 1950s and early 1960s combine to reduce effective tax rates. After 1965, strong nominal income growth lifted the effective tax rate and, hence, β_1 . The large fall-off in β_1 in 1978 is associated with the dramatic decline in e_1 attributed to the Miller regime (and continued in the Volcker regime). The upward spikes in β_1 in 1956-57 and 1959-60 reflect the disintermediation effects. During potential disinter-

FIGURE 2
The Implied Expected Inflation Coefficient
(1952:06 - 1982:06, semiannually)



mediation periods (when DCC takes on a nonzero value), the interest sensitivity of expenditures (a_1) and β_1 rise. The magnitude of these increases is related to the share of financial institutions' liabilities that pay market-related interest rates (SHR). As SHR increased over time, the size of the spikes diminished and, after the mid-1960s, became negative. Since DCC takes on a value of unity for most of the post 1965 period, the few instances where DCC is zero appear as upward spikes in β_1 . This is somewhat puzzling. Following the removal of interest rate ceilings on large CDs in the early 1970s, one might expect disintermediation to cease to be a factor. It could be that the value of a_1 during the normal periods in the first half of the sample has been overstated and the estimated negative impact of DCC and SHR in the second half of the sample (which includes almost every observation) is an attempt to correct the overstatement of a_1 .

Table 2 lists the actual values of interest rates and the values predicted in- and out-of-sample using variations of the linear (constant policy parameters) and nonlinear (variable policy parameters) specifications. The 1980:06 credit control observation is omitted. The summary measures in Table 2 show that, out-of-sample or in, the nonlinear equations outperform those from Table 1 over the most recent period. The relative improvement appears to be approximately the same for either in- or out-of-sample forecasts. In the in-sample case, the mean error is virtually eliminated, the mean absolute error is reduced by $(1.81-0.55=)$ 126 basis points (70 percent), and the root-mean-squared error (RMSE) is reduced by nearly 80 percent. Even compared to the dummy variable case, the reductions in the mean absolute error and the RMSE are each approximately 70 percent.

Because an estimate of h_7 (the relative degree of accommodation during the

TABLE 2

A Comparison of Nominal Interest Rate Predictions from the
Constant and the Variable Policy Parameter Models

<u>Date</u>	<u>Actual</u> (1)	<u>In-Sample</u>			<u>Out-of-Sample</u>		
		<u>Linear</u> (2)	<u>Linear with D7982</u> (3)	<u>Non- linear</u> (4)	<u>Linear</u> (5)	<u>Non- linear $h_5=h_6=h_7=0$</u> (6)	<u>Non- linear $h_7=h_6$</u> (7)
1979:12	12.26	13.26	15.15	12.76	11.29	12.11	12.15
1980:12	15.25	15.68	15.97	15.49	12.25	14.36	14.47
1981:06	15.23	13.42	14.21	14.26	10.00	13.46	13.65
1981:12	13.08	13.22	13.65	13.75	9.55	12.52	12.70
1982:06	14.38	8.71	11.22	14.02	6.29	11.95	12.21
<hr/> MEAN ERROR		1.18	---	-0.02	4.16	1.16	1.00
MEAN ABSOLUTE ERROR		1.81	1.67	0.55	4.16	1.16	1.00
ROOT-MEAN- SQUARED ERROR		2.71	2.01	0.60	4.80	1.42	1.26

Volcker regime) is required, we could not perform the usual out-of-sample predictions for the nonlinear specifications. Thus, we considered two alternatives. First (column 6), we estimated the nonlinear model through mid-1979 assuming a constant degree of accommodation ($=h_4$) across all three Fed Chairman regimes ($h_5 = h_6 = 0$). We then computed the post-sample predictions assuming that the Fed continued to pursue the same accommodation policy ($h_7 = 0$). In the second experiment (column 7), we allowed differences in the degree of accommodation among the Martin, Burns, and Miller regimes. The out-of-sample predictions were based on the assumption that Volcker would continue the accommodation policy pursued by Miller (the estimated h_6 value was $-.00372$). When we compare the summary measures appearing at the bottom of Table 2, we see that the nonlinear specifications again substantially outperform the linear specification. Both the mean errors and the RMSE's are reduced by over 70 percent. It appears that allowing for some degree of accommodation (even constant) and financial innovation is the major source of the improvement. Allowance for different degrees of accommodation across regimes produces only a slight further improvement.

E. Concluding Remarks

There is considerable intertemporal instability in previous interest rate equation estimates. We hypothesize that major fiscal, monetary, and regulatory policy parameter shifts have been important sources of that instability. We embed estimates of the time series values of these policy parameters in our model and estimate the deeper, more stable, underlying parameters. The estimates generate reduced-form coefficients that move by sizeable amounts in response to policy parameter change. Statistical tests imply that allowing for varying policy parameters provides a significantly better explanation of interest rates.

Our model explains not only statistically significant movement of the reduced-form coefficients, but economically meaningful changes as well. Both in-sample and out-of-sample forecasts from the proposed model outperform the more traditional specification. Furthermore, our model that accounts for policy changes is able to explain the heretofore puzzling high real interest rates in the early 1980s.

FOOTNOTES

1. See, for example, Cargill (1976), Wachtel (1977), Carlson (1979)).
2. See, for example, Cargill and Meyer (1974)).
3. This agenda ignores technological changes such as improvements in information processing and data transmission. Though the "deep" parameters of taste and technology may vary over time, their shifts are less readily quantified and are outside the range of this study.
4. Peek and Wilcox (1985) present evidence that the effective marginal investors in the Treasury bill market are households rather than corporations or tax-exempt institutions.
5. This tax series serves as an index of the marginal tax rate of the marginal individual, moving with that rate but perhaps not measuring its level exactly.
6. Bernstein (1983) and Gordon (1984) discuss this effect.
7. In October 1982, Fed Chairman Volcker announced a temporary abandoning of the monetary aggregate targets, apparently in favor of more focus on interest rates. We interpret this as a regime switch and end our sample in 1982:06.
8. Before December 1959, when one-year Treasury bills were introduced, the interest rate measure is based on the yield on Treasury bills with 9 to 12 month maturities.
9. In Peek and Wilcox (1984), we found that substituting an expected inflation measure based on prior interest rates did not affect our qualitative findings.

10. If the model is taken literally, $\alpha_4 = -1$ from (13). If we impose this restriction on the model, the α 's and γ 's can be identified. However, this simplified model ignores other considerations that would cause α_4 to deviate from minus one (e.g., the existence of a real balance effect). Because we do not believe that such a simplified model can be taken this literally and because we desire a measure of the marginal significance for the M_x coefficient, we have chosen not to impose the constraint that $\alpha_4 = -1$.
11. The resulting t-statistics will be for these ratios, not for the α 's and γ 's themselves. Both the point estimates and their associated t-statistics will depend upon which of the parameters is chosen as the scale factor. If, for example, we chose to scale by α_5 instead, we would obtain estimates of (and t-statistics for) a different set of coefficients (for example, α_3/α_5 instead of α_3/α_0). Because of this problem, we will not be able to obtain the relevant statistics for significance tests of the α 's and γ 's from the estimated standard errors of the coefficient estimates (i.e., the estimates of α_3/α_0 , γ_1/α_0 , etc.).
12. We have omitted the foreign bond variable that appeared in some of our earlier studies investigating the pre-1980 period. This variable was included to isolate the financial effects arising from supply shocks (in particular the OPEC shocks). These effects were presumed to be unrelated to real interest rate differentials across countries. However, once we include the post-1979 period, it is quite likely that the movements in this variable will be dominated by endogenous capital flows due to the recent relatively high U.S. real interest rates. When we include the foreign bond variable in our interest rate equation estimated through June 1982, its estimated coef-

ficient did, in fact, become positive (and statistically significant). This suggests that, at least for recent periods, reverse causation is likely to confound our estimates of the response of interest rates to foreign holdings of U.S. bonds.

13. The sample size is 60. The square root of the critical values for the chi-square distribution and (the absolute value of) the critical values for the t distribution converge as the sample size grows. These likelihood ratio tests reject (at the 5 percent level) the insignificance of the individual coefficients in (26)-(30) when the calculated chi-square test statistics exceed 3.84 or, equivalently, when the statistics in parentheses in (26)-(30) exceed 1.96. Since the h_i 's are identified in (19) and (23), we could have reported their t-statistics. However, we chose to report the pseudo-t-statistics to keep all of the marginal significance tests on the same footing.

14. This difference does not stem from attributing most of the movement of M' to its endogenous component. Regressions of M_x and the endogenous component, $M' - M_x$, on total money, M' , produce coefficients of 0.85 and 0.15, respectively. Thus, changes in M' are estimated to typically be 85 percent exogenous and only 15 percent endogenous.

REFERENCES

- Edward Bernstein. In "Comments and Discussion." Brookings Papers on Economic Activity (1983:2), 579-85.
- Thomas Cargill. "Anticipated Price Changes and Nominal Interest Rates in the 1950s." Review of Economics and Statistics 58 (August 1976), 364-367.
- _____, and Robert A. Meyer. "Interest Rates and Prices Since 1950." International Economic Review 15 (June 1974), 458-71.
- _____. "The Term Structure of Inflationary Expectations and Market Efficiency." Journal of Finance 35 (March 1980), 57-70.
- John A. Carlson. "Expected Inflation and Interest Rates." Economic Inquiry 17 (October 1979), 597-608.
- Richard A. Clarida and Benjamin M. Friedman. "The Behavior of U.S. Short-Term Interest Rates Since October, 1979." The Journal of Finance 39 (July 1984), 671-82.
- _____. "Why Have Short-Term Interest Rates Been So High?" Brookings Papers on Economic Activity (1983:2), 553-78.
- Russell Davidson and James G. MacKinnon. "Several Tests for Model Specification in the Presence of Alternative Hypotheses." Econometrica 49 (May 1981), 781-93.
- Stephen M. Goldfeld and Alan S. Blinder. "Some Implications of Endogenous Stabilization Policy." Brookings Papers on Economic Activity (1972:3), 585-640.
- Robert J. Gordon. Macroeconomics. Boston, MA: Little, Brown & Company, 1984.

- Jack Guttentag. "The Strategy of Open Market Operations." Quarterly Journal of Economics 81 (February 1966), 1-30.
- Maurice D. Levi and John H. Makin. "Fisher, Phillips, Friedman and the Measured Impact of Inflation on Interest." Journal of Finance 34 (March 1979), 35-52.
- Raymond E. Lombra and Raymond G. Torto. "Federal Reserve 'Defensive' Behavior and the Reverse Causation Argument." Southern Economic Journal 40 (July 1973), 47-55.
- Robert E. Lucas, Jr. "Econometric Policy Evaluation: A Critique." In Karl Brunner and Allan H. Meltzer, eds., The Phillips Curve and Labor Markets, Carnegie-Rochester Conference Series on Public Policy, Vol. 1. Amsterdam: North-Holland, 1976, 19-46.
- Joe Peek. "Interest Rates, Income Taxes, and Anticipated Inflation." American Economic Review 72 (December 1982), 980-91.
- _____ and James A. Wilcox. "The Degree of Fiscal Illusion in Interest Rates: Some Direct Estimates." American Economic Review 74 (December 1984), 1061-1066.
- _____. "The Postwar Stability of the Fisher Effect." Journal of Finance 38 (September 1983), 1111-24.
- _____. "Taxable and Tax-Exempt Interest Rates: The Role of Personal and Corporate Tax Rates." N.B.E.R. Working Paper #1544, January 1985.
- Christopher Sims. "Policy Analysis with Econometric Models." Brookings Papers on Economic Activity (1982:1), 107-152.
- Myron B. Slovin and Marie Elizabeth Sushka. "Money, Interest Rates, and Risk." Journal of Monetary Economics 12 (September 1983), 475-82.

Vito Tanzi. "Inflationary Expectations, Economic Activity, Taxes, and Interest Rates." American Economic Review 70 (March 1980), 12-21.

Paul Wachtel. "Survey Measures of Expected Inflation and Their Potential Usefulness." In Joel Popkin (ed.), Analysis of Inflation: 1965-1974. Cambridge, Mass: Ballinger Publishing Co., 1977, 361-95.

James A. Wilcox. "The Effects of Inflation Uncertainty and Supply Shocks on Real Interest Rates." Economics Letters 12 (1983a), 163-67.

_____. "Why Real Interest Rates Were So Low in the 1970s." American Economic Review 73 (March 1983b), 44-53.

U.S. Internal Revenue Service. Statistics of Income, Individual Income Tax Returns. Washington, D.C.: U.S. Government Printing Office, 1947-79.

**CENTER FOR REAL ESTATE AND URBAN ECONOMICS
WORKING PAPER SERIES PUBLICATION LIST**

Institute of Business and Economic Research
156 Barrows Hall, University of California
Berkeley, California 94720

The following working papers in this series are available at the charges indicated plus applicable tax, which partially covers the cost of reproduction and postage. Papers may be ordered from the address listed above. Checks should be made payable to the Regents of the University of California. Prices subject to change without notice.

-----Working Papers-----

79-1	Kenneth T. Rosen and David E. Bloom. "A Micro-Economic Model of Federal Home Loan Mortgage Corporation Activity." April 1979.	5.00
80-2	Kenneth T. Rosen and Mitchel Resnick. "The Size Distribution of Cities: An Examination of the Pareto Law and Primacy." July 1979.	5.00
80-3	Jennifer R. Wolch. "Residential Location of the Service-Dependent Poor." August 1979.	5.00
80-4	Stuart Gabriel, Lawrence Katz, and Jennifer Wolch. "Local Land-Use Regulation and Proposition 13: Some Findings from a Recent Survey." November 1979.	5.00
80-5	David Dale-Johnson. "Hedonic Prices and Price Indexes in Housing Markets: The Existing Empirical Evidence and Proposed Extensions." December 1979.	5.00
80-6	Susan Giles Levy. "Consumer Response to High Housing Prices: The Case of Palo Alto, California." January 1980.	5.00
80-7	Dwight Jaffee and Kenneth Rosen. "The Changing Liability Structure of Savings and Loan Associations." February 1980.	5.00
80-8	Dwight Jaffee and Kenneth Rosen. "The Use of Mortgage Passthrough Securities." March 1980.	5.00
80-9	Stuart Gabriel. "Local Government Land Use: Allocation in the Wake of a Property Tax Limitation." May 1980.	5.00
80-10	Kenneth Rosen. "The Affordability of Housing in 1980 and Beyond." June 1980.	5.00

- 80-11 Kenneth Rosen. "The Impact of Proposition 13 on House Prices in Northern California: An Initial Test of the Interjurisdictional Capitalization Hypothesis." May 1980. 5.00
- 80-12 Kenneth Rosen. "The Federal National Mortgage Association, Residential Construction, and Mortgage Lending." August 1980. 5.00
- 80-13 Lawrence Katz and Kenneth Rosen. "The Effects of Land-Use Controls on Housing Prices." August 1980. 5.00
- 80-14 Kenneth Rosen. "The Demand for Housing Units in the 1980s." September 1980. 5.00
- 80-15 Konrad Stahl. "A Note on the Microeconomics of Migration." October 1980. 5.00
- 80-16 John T. Rowntree and Earl R. Rolph. "Efficient Community Management." August 1980. 5.00
- 80-17 John M. Quigley. "Nonlinear Budget Constraints and Consumer Demand: An Application to Public Programs for Residential Housing." September 1980. 5.00
- 80-18 Stuart A. Gabriel and Jennifer R. Wolch. "Local Land-Use Regulation and Urban Housing Values." November 1980. 5.00
- 80-19 F. E. Balderston. "The Structural Option for the Savings and Loan Industry." November 1980. 5.00
- 80-20 Kristin Nelson. "San Francisco Office Space Inventory." November 1980. 5.00
- 80-21 Konrad Stahl. "Oligopolistic Location Under Imperfect Consumer Information." December 1980. 5.00
- 80-22 Konrad Stahl. "Externalities and Housing Unit Maintenance." December 1980. 5.00
- 81-23 Dwight M. Jaffee and Kenneth T. Rosen. "The Demand for Housing and Mortgage Credit: The Mortgage Credit Gap Problem." March 1981. 5.00
- 81-24 David E. Dowall and John Landis. "Land-Use Controls and Housing Costs: An Examination of San Francisco Bay Area Communities." March 1981. 5.00
- 81-25 Jean C. Hurley and Constance B. Moore. "A Study of Rate of Return on Mortgage Passthrough Securities." March 1981. 5.00

81-26	Kenneth T. Rosen. "The Role of Pension Funds in Housing Finance." April 1981.	5.00
81-27	John M. Quigley. "Residential Construction and Public Policy: A Progress Report." April 1981.	5.00
81-28	Kenneth T. Rosen. "The Role of the Federal and 'Quasi-Federal' Agencies in the Restructured Housing Finance System." June 1981.	5.00
81-29	Diane Dehaan Haber and Joy Hashiba Sekimura. "Innovations in Residential Financing: An Analysis of the Shared Appreciation Mortgage and a Comparison of Existing Alternative Mortgage Instruments." June 1981.	5.00
81-30	Diane Dehaan Haber and Joy Hashiba Sekimura. "Alternative Mortgages--Consumer Information Pamphlet." June 1981.	5.00
81-31	Jean C. Hurley. "A Model for Pricing Passthrough Securities Backed by Alternative Mortgage Instruments." June 1981.	5.00
81-32	Kenneth T. Rosen. "The Affordability of Housing in California." September 1981.	5.00
81-33	Kenneth T. Rosen and Lawrence Katz. "Money Market Mutual Funds: An Experiment in Ad Hoc Deregulation." September 1981.	5.00
81-34	Kenneth T. Rosen. "New Mortgage Instruments: A Solution to the Borrower's and Lender's Problem." September 1981.	5.00
81-35	Konrad Stahl. "Toward a Rehabilitation of Industrial, and Retail Location Theory." October 1981.	5.00
81-36	Fred Balderston. "S & L Mortgage Portfolios: Estimating the Discount from Book Value." October 1981.	5.00
81-37	Kenneth T. Rosen. "A Comparison of European Housing Finance Systems." October 1981.	5.00
81-38	Fred Balderston. "Regression Tests of the Relationship Between Book Net Worth and Revised Net Worth of S&L's." October 1981.	5.00
81-39	Lawrence Smith. "Rent Controls in Ontario: Roofs or Ceilings?" November 1981.	5.00
81-40	Alan Cerf. "Investment in Commercial Real Estate Including Rehabilitation: Impact of the Tax Recovery Act of 1981." November 1981.	5.00

81-41	Frederick E. Balderston. "The Savings and Loan Mortgage Portfolio Discount and the Effective Maturity on Mortgage Loans." December 1981.	5.00
82-42	John M. Quigley. "Estimates of a More General Model of Consumer Choice in the Housing Market." January 1982.	5.00
82-43	Martin Gellen. "A House in Every Garage: The Economics of Secondary Units." March 1982.	5.00
82-44	John D. Landis. "California Housing Profiles: 1980." March 1982.	5.00
82-45	Paul F. Wendt. "Perspectives on Real Estate Investment." February 1982.	5.00
82-46	Kenneth T. Rosen and Lawrence B. Smith. "The 'Used House Market.'" May 1982.	5.00
82-47	Kenneth T. Rosen. "Deposit Deregulation and Risk Management in an Era of Transition." May 1982.	5.00
82-48	Steven W. Kohlhagen. "The Benefits of Offshore Borrowings for the S&L Industry." May 1982.	5.00
82-49	Lawrence B. Smith. "The Crisis in Rental Housing: A Canadian Perspective." June 1982.	5.00
82-50	Anil Markandya. "Headship Rates and the Household Formation Process in Great Britain." June 1982.	5.00
82-51	Anil Markandya. "Rents, Prices, and Expectations in the Land Market." June 1982.	5.00
82-52	Kenneth T. Rosen. "Creative Financing and House Prices: A Study of Capitalization Effects." August 1982.	5.00
82-53	Kenneth T. Rosen and Lawrence B. Smith. "The Price Adjustment Process for Rental Housing and the Natural Vacancy Rate." September 1982.	5.00
82-54	Frederick E. Balderston. "Analysis of the Viability of S&L Firms." September 1982.	5.00
82-55	Lawrence B. Smith, Kenneth T. Rosen, Anil Markandya, and Pierre-Antoine Ullmo. "The Demand for Housing, Household Headship Rates, and Household Formation: An International Analysis." October 1982.	5.00
82-56	Sherman Maisel and Kenneth T. Rosen. "The Macroeconomics of Money Market Mutual Funds." December 1982.	5.00

- 82-57 Frederick E. Balderston. "Time-Path Viability of S&L Firms-- Part One: Firms Characterized by Accounting Data Only, With and Without Savings Growth." December 1982. 5.00
- 83-58 Alan R. Cerf. "Homeownership: Tax Incentives and National Policy." March 1983. 5.00
- 83-59 Hilary R. Sheehan. "Intermetropolitan Trends in Administrative Employment." May 1983. 5.00
- 83-60 Harvey S. Rosen, Kenneth T. Rosen, and Douglas Holtz-Eakin. "Housing Tenure, Uncertainty and Taxation." April 1983. 5.00
- 83-61 Kenneth T. Rosen and Lawrence B. Smith. "Recent Developments in the Economics of Housing." June 1983. 5.00
- 83-62 Ronnie Starbow. "Survey on the Use of Alternative Mortgage Instruments." June 1983. 5.00
- 83-63 Fung-Shine Pan. "On the Ginnie Mae: A Survey." June 1983. 5.00
- 83-64 Stuart Gabriel and Ilan Maoz. "Cyclical Fluctuations in the Israel Housing Market." June 1983 5.00
- 83-65 Dan Durning and John M. Quigley. "On the Distributional Implications of Mortgage Revenue Bonds and Creative Finance." October 1983. 5.00
- 83-66 Marian F. Wolfe. "Investment Performance of Existing Rental Housing in Selected San Francisco Bay Area Communities." October 1983. 5.00
- 83-67 Marian F. Wolfe. "Economic Behavior and Attitudes of Rental Property Owners." October 1983. 5.00
- 83-68 Alan R. Cerf. "Ownership or Rental Revisited: 1983." October 1983. 5.00
- 83-69 Frederick E. Balderston. "Time-Path Viability of S&L Firms-- Part II: Firms Characterized by Accounting Data and by Individual Portfolio Composition, With and Without Savings Growth." October 1983. 5.00
- 83-70 Frederick E. Balderston. "An Analysis of S&L Mergers, 1980-1982." November 1983. 5.00
- 83-71 Frederick E. Balderston. "New Entry Into the S&L Industry, 1980-82 and Beyond." November 1983. 5.00
- 83-72 Pierre Antoine Ullmo. "The Demand for Housing, Household Headship Rates, and Household Formation in France." December 1983. 5.00

84-73	Jonathan S. Leonard. "The Interaction of Residential Segregation and Employment Discrimination." January 1984.	5.00
84-74	Sherman Maisel. "The Secondary Mortgage Market and Proper Risk Sharing." January 1984.	5.00
84-75	Cynthia Kroll. "Employment Growth and Office Space Along the 680 Corridor: Booming Supply and Potential demand in a Suburban Area." February 1984.	10.00
84-76	Peter Berck and Kenneth T. Rosen. "Hedging with a Housing Start Futures Contract." March 1984.	5.00
84-77	John M. Quigley. "Residential Energy Standards and the Housing Market: A Regional Analysis." February 1984.	5.00
84-78	John M. Quigley. "Consumer Choice of Dwelling, Neighborhood and Public Services." April 1984.	5.00
84-79	John M. Quigley. "Citizen Turnout and Self-Interested Voting: Inferring Preferences from Secret Ballots." April 1984.	5.00
84-80	Charles Marston and Michael Wiseman. "Financing Local Government in San Francisco." April 1984.	5.00
84-81	Kenneth T. Rosen. "Toward a Model of the Office Building Sector." April 1984.	5.00
84-82	Daniel Kaufmann and John M. Quigley. "The Consumption Benefits of Investment in Urban Infrastructure: The Evaluation of Sites and Services Programs in Underdeveloped Countries." April 1984.	5.00
84-83	Lawrence Katz and Kenneth T. Rosen. "The Interjurisdictional Effects of Land-Use Controls on Housing Prices." July 1984.	5.00
84-84	Konrad Stahl and Raymond Struyk. "U.S. and German Housing Markets and Policies: A Comparative Economics Analysis." October 1984.	5.00
84-85	Alan R. Cerf. "Tax Shields for Low Income Housing and Alternative Real Estate Investments Compared: Before E.R.T.A. and After D.R.A." October 1984.	5.00
84-86	John Quigley. "The Evaluation of Complex Urban Policies: Simulating the Willingness to Pay for the Benefits of Subsidy Programs." October 1984.	5.00
84-87	Robert Wiberg. "The Demise of the REIT's and the Future of Syndications." May 1984.	5.00

- 84-88 James B. Kau and Donald Keenan. "Taxes, Points and Rationality in the Mortgage Market." May 1984. 5.00
- 84-89 James F. Epperson, James B. Kau, Donald C. Keenan, and Walter J. Muller, III. "Pricing Default Risk in Mortgages." October 1984. 5.00
- 84-90 James B. Kau and G. Stacy Sirmans. "Interest Rates, Inflation, and Specification Bias in Housing Models." October 1984. 5.00
- 84-91 Carolyn Sherwood-Call. "Theoretical Evidence on the Economic Effects of San Francisco's Payroll Tax." October 1984. 5.00
- 85-92 Jerome Rothenberg. "New Construction vs. Rehabilitation: The Tradeoff in Meeting America's Housing Needs." April 1985. 5.00
- 85-93 Roger Craine. "Maturity Intermediation and Interest Rate Risk: Hedging Strategies for S&Ls." March 1985. 5.00
- 85-94 Kenneth T. Rosen and Ruth Shragowitz. "The Proposed Growth Limit on Commercial Construction for San Francisco." May 1985. 5.00
- 85-95 Cynthia Kroll and Eileen Marrinan. "California Retail Sales: Growth Patterns and Locational Tendencies." May 1985. 5.00
- 85-96 Cynthia Kroll and Eileen Marrinan. "Siting Retail Space in the 1980s: A California Perspective." May 1985. 5.00
- 85-97 Joe Peek and James A. Wilcox. "The Reaction of Reduced-Form Coefficients to Regime Changes: The Case of Interest Rates." 5.00

