Monetary Trends

July 2005

Is the Bond Market Irrational?

Recently, financial commentators and central bankers have labeled the failure of long-term rates to rise in the face of an upward trending federal funds rate a "conundrum." Because consumption decisions by households and investment decisions by firms depend on long-term interest rates, the ability to control these rates has been considered an important policymaking tool. The implicit assumption is that bond yields ought to react to changes in yields of short-term instruments. In fact, a common benchmark model holds that simple market forces should make long-term interest rates a weighted average of the short-term interest rates expected to prevail during the period covered by the bond.

I analyze data on 1- and 10-year bond yields and a notion of the short-term rate controlled by the Fed for the period January 1962–May 2005. I find a number of episodes in which long-term rates failed to adjust to changes in short-term rates. Events similar to those in 2004-05 occurred in 1975-78 and 1986-89. Therefore, although unusual, the recent behavior of long-term rates is far from unprecedented.

Scatter plots in the chart show the reaction of both short-term (left panel) and long-term (right panel) bond yields to changes in the Fed target: Each circle corresponds to a change in the Fed target, matched to a measure of the bond market within a period of five trading weeks. Regression lines capture the average reaction.

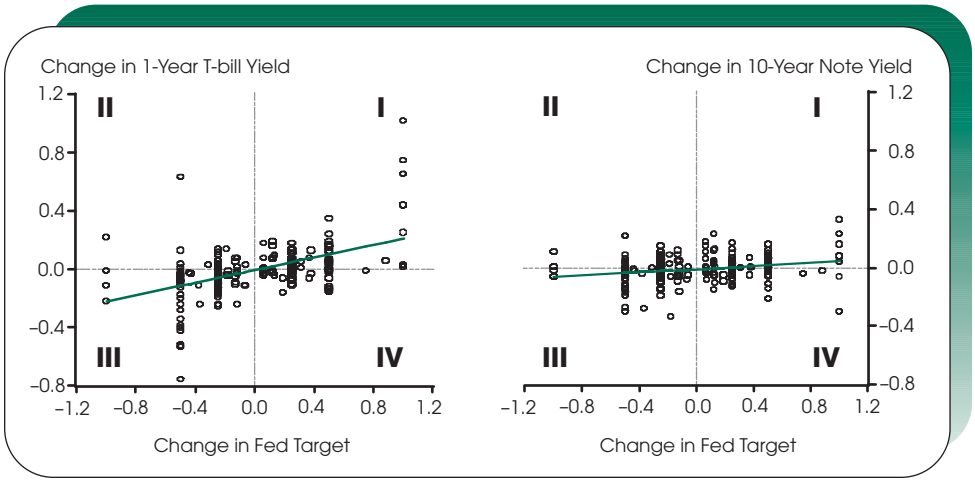
One would expect to find circles only in quadrants I and III: Changes in the short-term Fed operating target ought to cause changes of the same sign in bond yields. Moreover, since long-term bond yields should equal weighted averages of current and future short-term rates, such an effect should be stronger on money market instruments than on long-term bonds. The chart shows that short-term interest rates react more to changes in the Fed target than long-term rates do, but, unexpectedly, quadrants II and IV contain many observations. In particular, for more than a third of 204 target changes, the 10-year Treasury note yield moved in the opposite direction of the Fed target.

Should the recent failure of long-term interest rates to react to changes in short-term rates cast a shadow on the prospects of the U.S. economy? An analysis of the data is reassuring. Periods in which there is a concentrated lack of response do not precede any particular phase of the business cycle or specific trends in inflation. Per se, a lack of reaction in long-term yields does not imply an inverted term structure or an impending recession. Moreover, neither the level nor the volatility of interest rates correlates or reacts to periods in which bond markets fail to react.

Does this mean that U.S. bond markets are irrational? A simple extension of the benchmark model of the term structure of interest rates recognizes that investors are averse to risks. In this extended model, long-term rates are a weighted average of expected short-term rates plus a compensation for risk. A policy change may then raise current and future expected rates but, at the same time, reassure investors by implying smaller perceived inflation risks. In these situations the Fed target and long-term yields may move in opposite directions.

In fact, the data suggest that recent volatility in long-term bond markets has been low, between one-half and one-third of historical levels, exactly what one would expect in a framework in which anti-inflationary hikes of Fed target rates cause compensation for risk to be revised downward. Perhaps this is a virtuous mechanism in which trust in long-run price stability immediately translates into stable bond prices. The recent behavior of U.S. bond markets may rationally reflect markets' understanding and trust in the Fed's goal of long-run price stability.

—Massimo Guidolin



Views expressed do not necessarily reflect official positions of the Federal Reserve System.

Contents

Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.
2. Shaded areas indicate recessions, as determined by the National Bureau of Economic Research.
3. *Percent change at an annual rate* is the simple, not compounded, monthly percent change multiplied by 12. For example, using consecutive months, the percent change at an annual rate in x between month $t-1$ and the current month t is: $[(x_t/x_{t-1})-1]\times 1200$. Note that this differs from *National Economic Trends.* In that publication, monthly percent changes are compounded and expressed as annual growth rates.
4. The *percent change from year ago* refers to the percent change from the same period in the previous year. For example, the percent change from year ago in x between month $t-12$ and the current month t is: $[(x_t/x_{t-12})-1]\times 100$.

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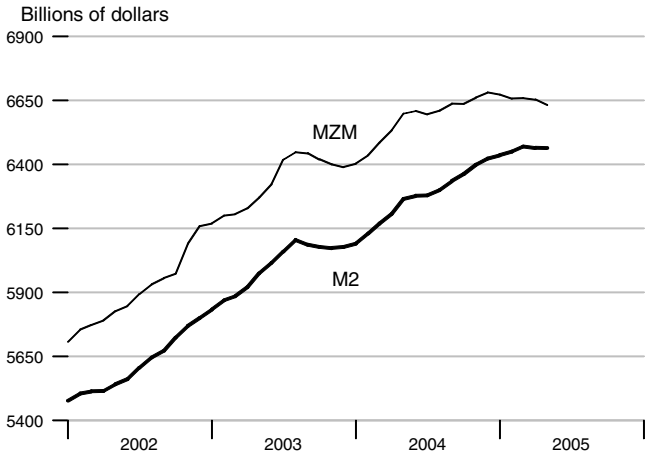
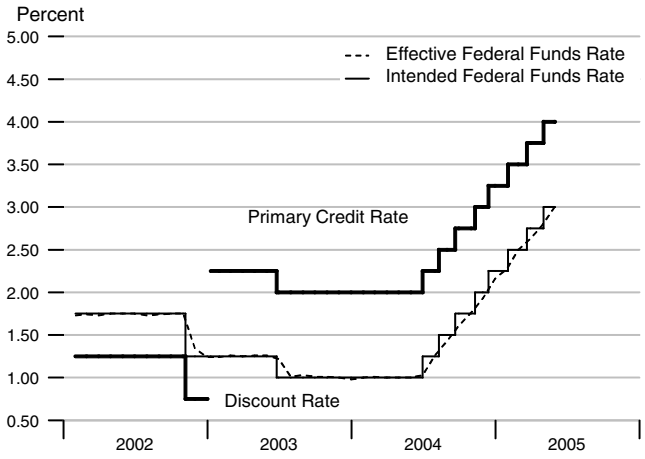
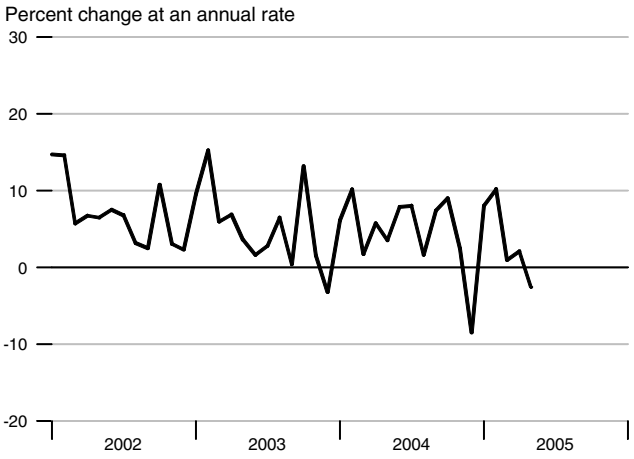
M2 and MZM



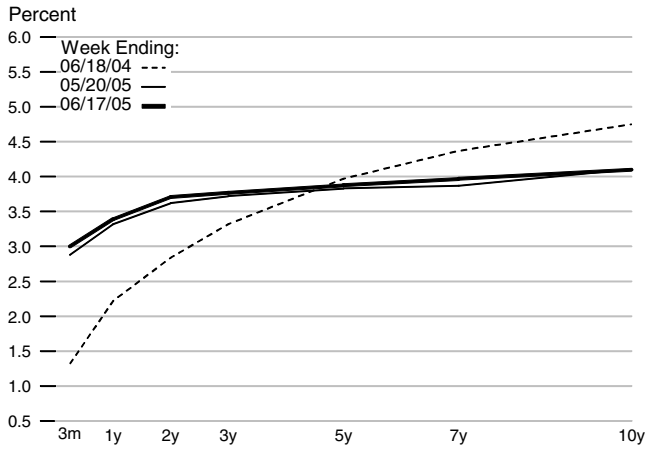
Reserve Market Rates



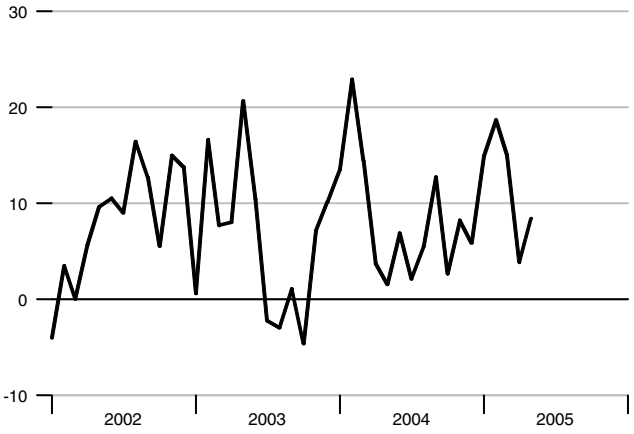
Adjusted Monetary Base



Treasury Yield Curve



Total Bank Credit

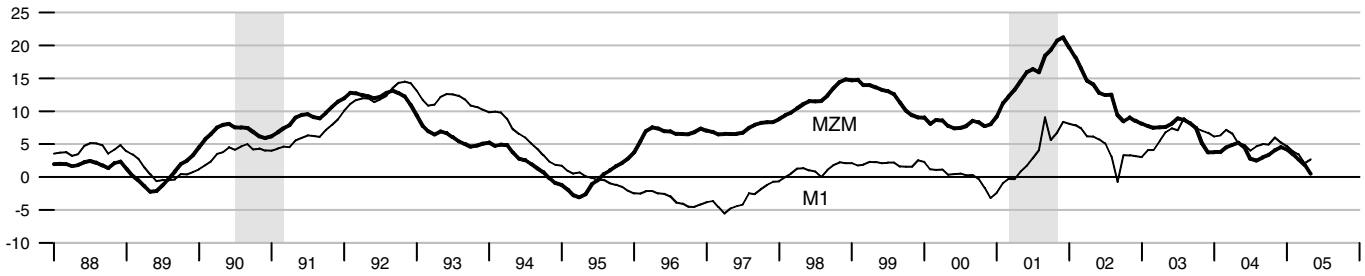


Interest Rates

	Mar 05	Apr 05	May 05
Federal Funds Rate	2.63	2.79	3.00
Prime Rate	5.58	5.75	5.98
Primary Credit Rate	3.58	3.75	3.98
Conventional Mortgage Rate	5.93	5.86	5.72
Treasury Yields:			
3-Month Constant Maturity	2.80	2.84	2.90
6-Month Constant Maturity	3.09	3.14	3.17
1-Year Constant Maturity	3.30	3.32	3.33
3-Year Constant Maturity	3.91	3.79	3.72
5-Year Constant Maturity	4.17	4.00	3.85
10-Year Constant Maturity	4.50	4.34	4.14

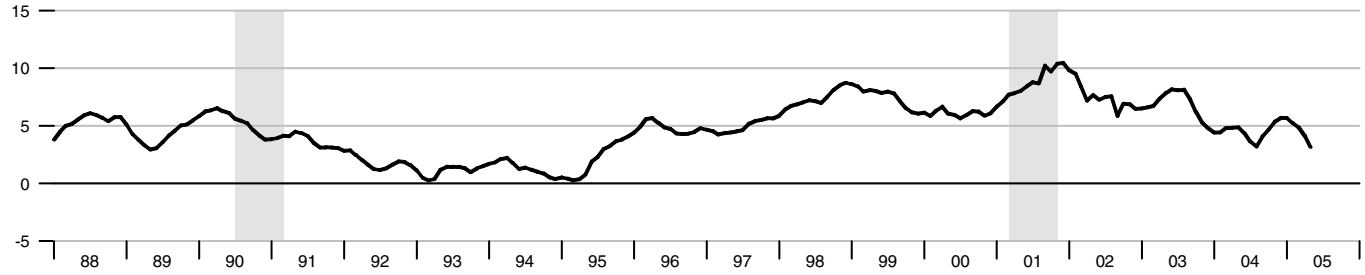
MZM and M1

Percent change from year ago



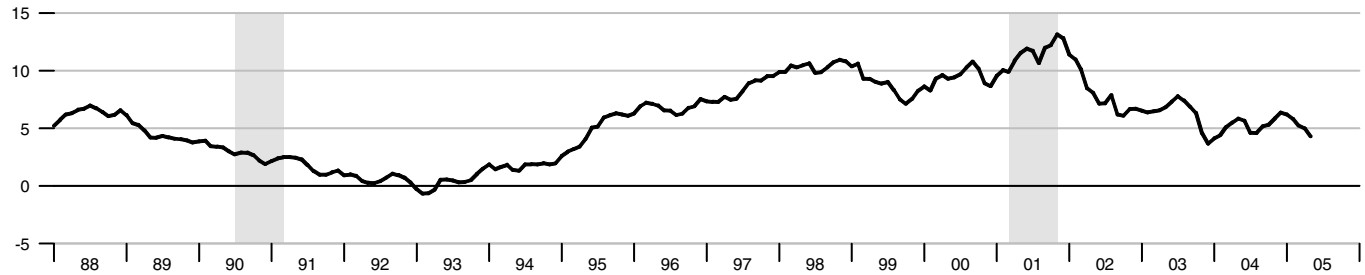
M2

Percent change from year ago



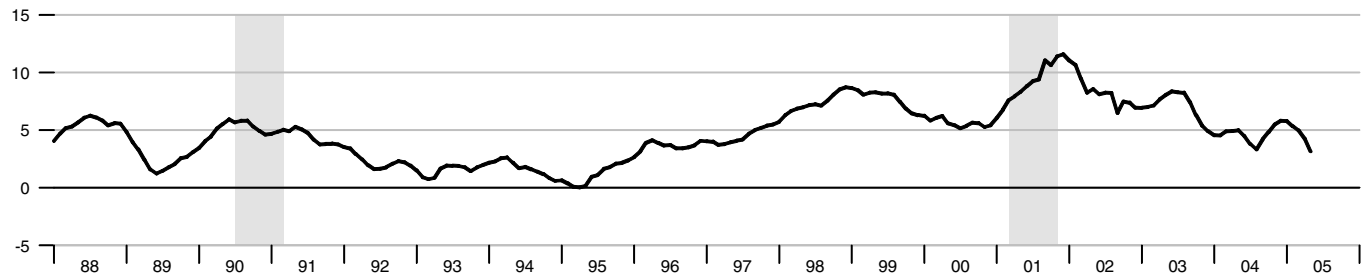
M3

Percent change from year ago



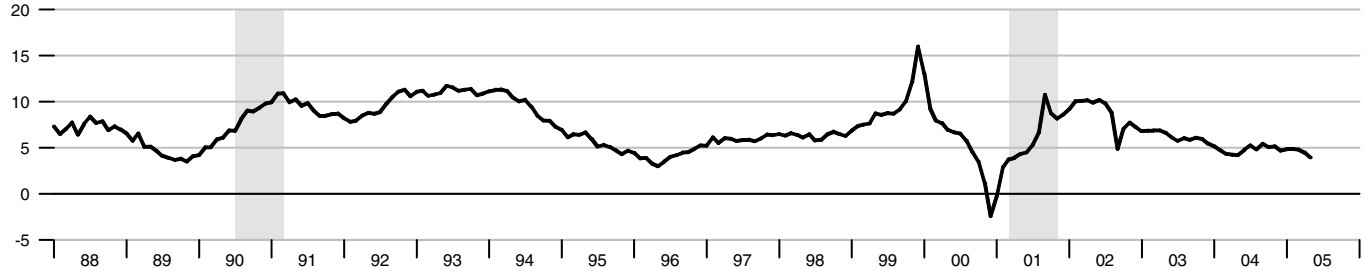
Monetary Services Index - M2

Percent change from year ago



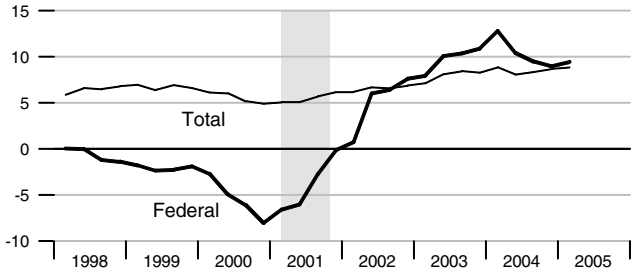
Adjusted Monetary Base

Percent change from year ago



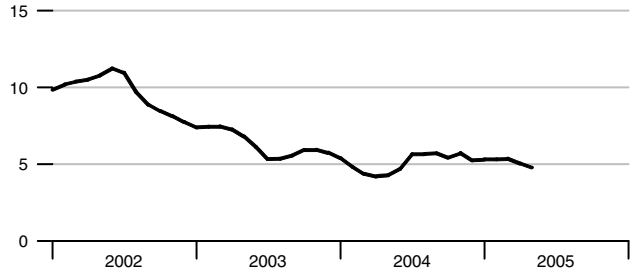
Domestic Nonfinancial Debt

Percent change from year ago



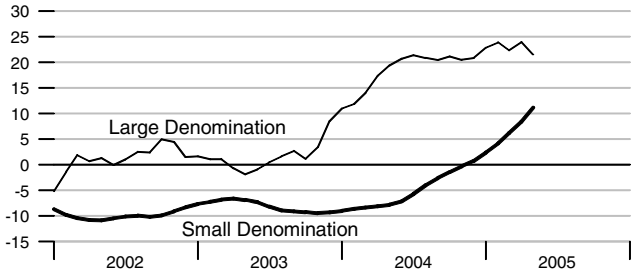
Currency Held by the Nonbank Public

Percent change from year ago



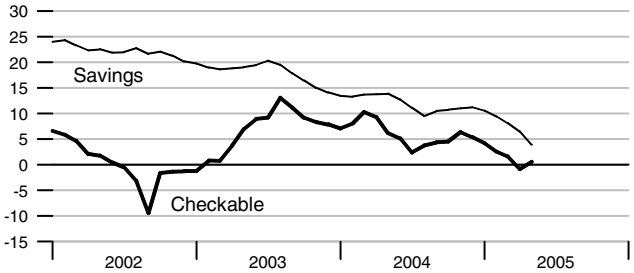
Time Deposits

Percent change from year ago



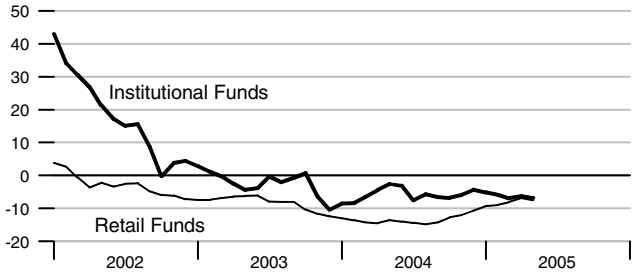
Checkable and Savings Deposits

Percent change from year ago



Money Market Mutual Fund Shares

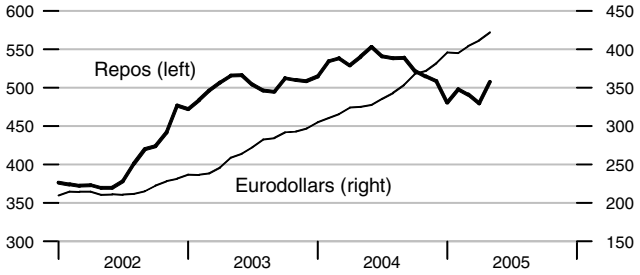
Percent change from year ago



Repurchase Agreements and Eurodollars

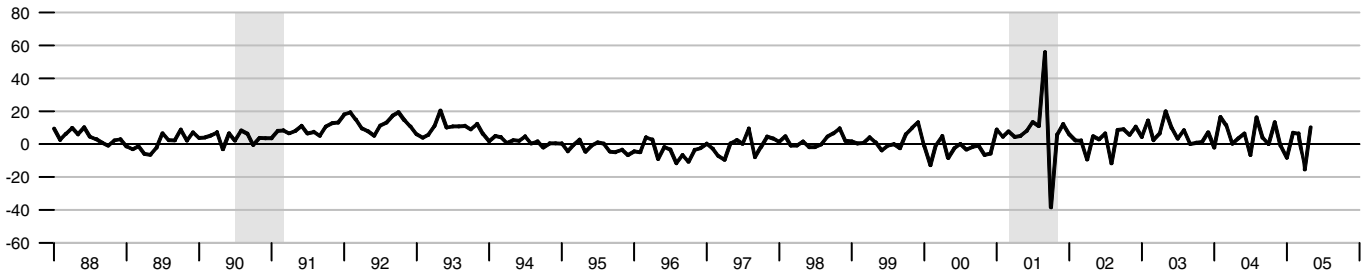
Billions of dollars

Billions of dollars



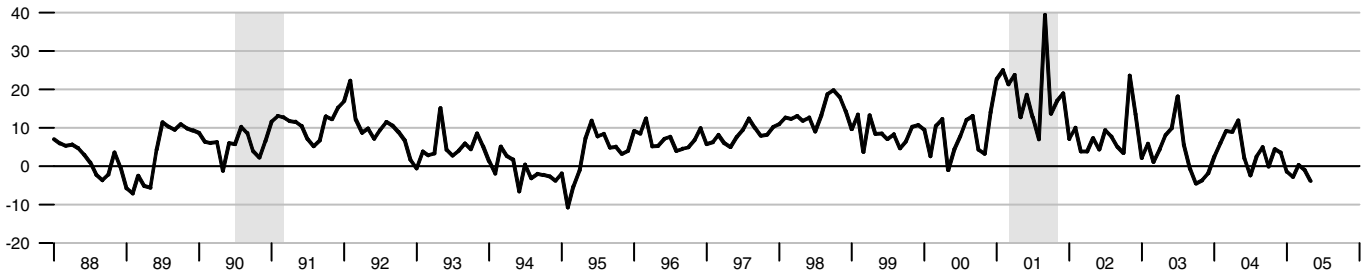
M1

Percent change at an annual rate



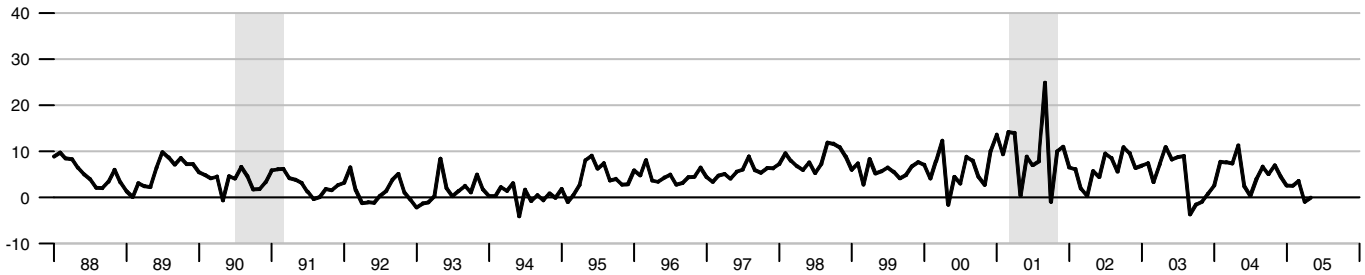
MZM

Percent change at an annual rate



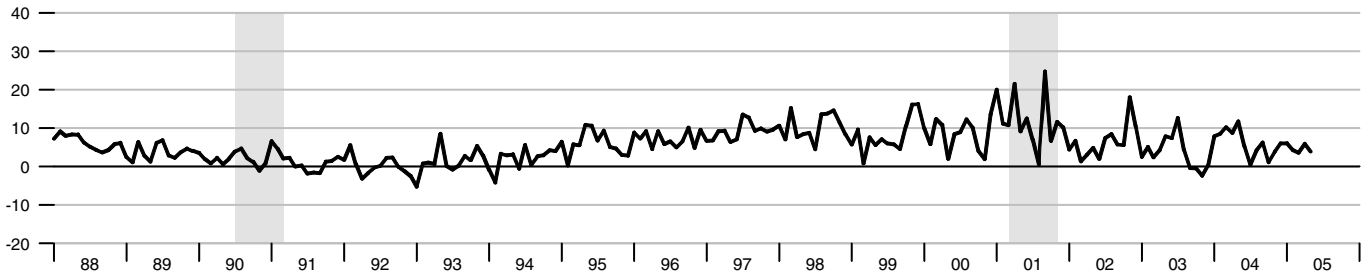
M2

Percent change at an annual rate



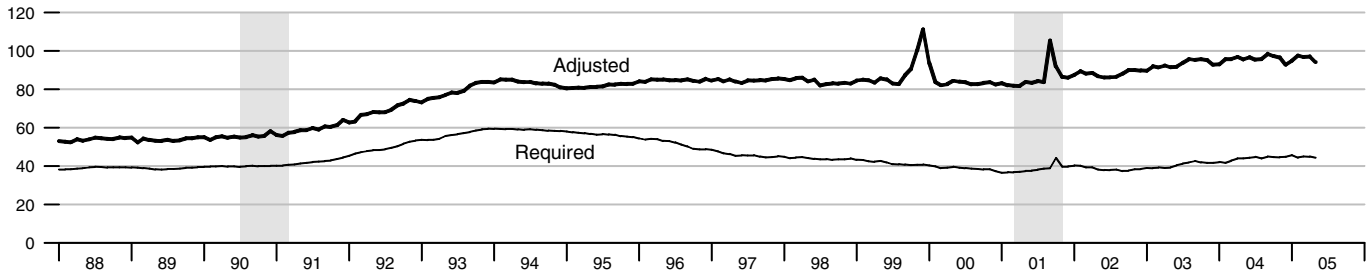
M3

Percent change at an annual rate



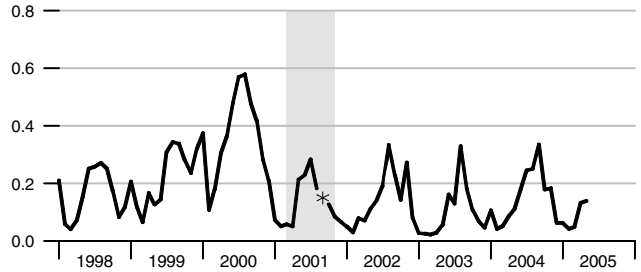
Adjusted and Required Reserves

Billions of dollars



Total Borrowings, nsa

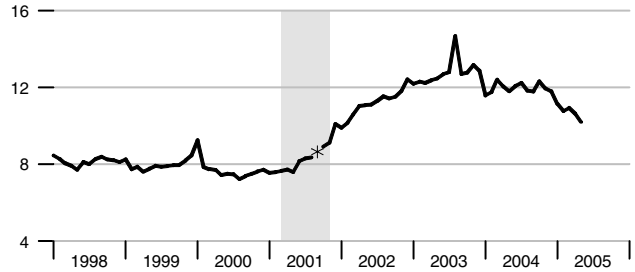
Billions of dollars



*Actual value for September 2001 is $3.4 billion.

Excess Reserves plus RCB Contracts

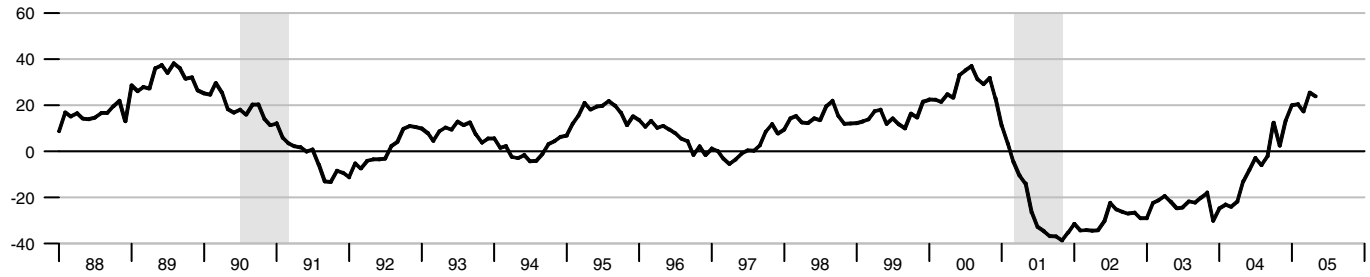
Billions of dollars



*Actual value for September 2001 is $26.43 billion.

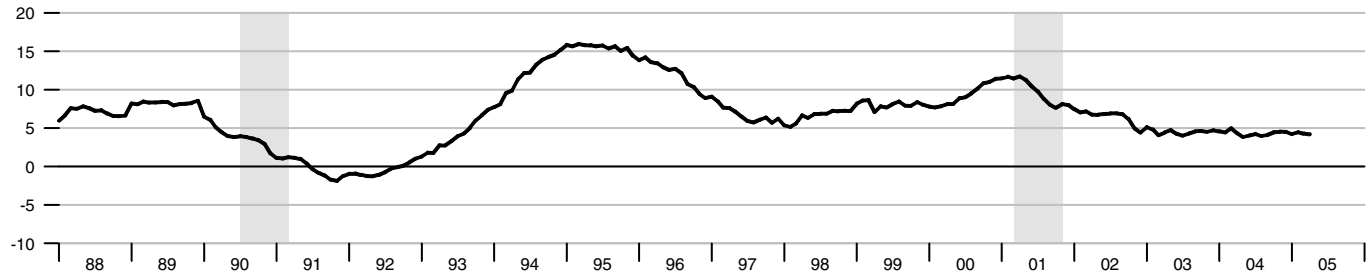
Nonfinancial Commercial Paper

Percent change from year ago

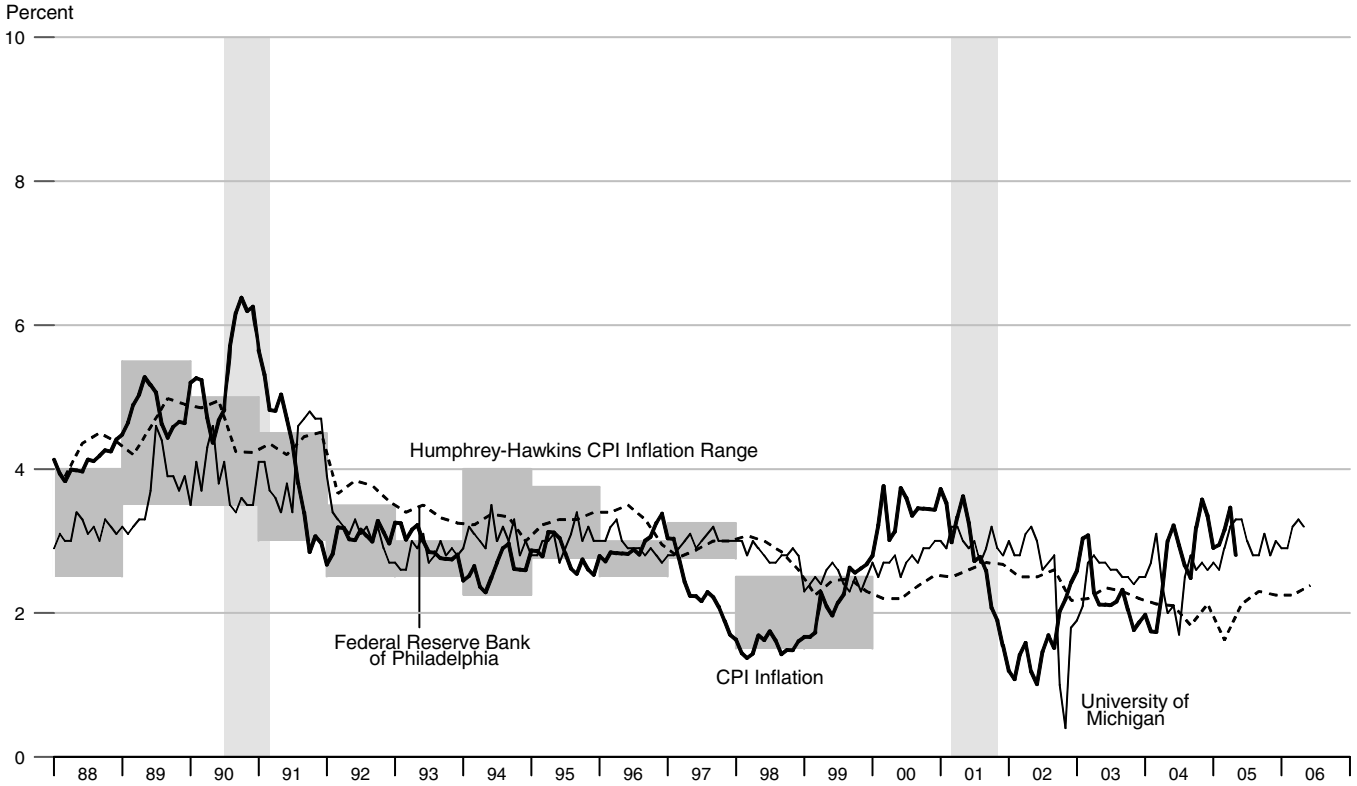


Consumer Credit

Percent change from year ago

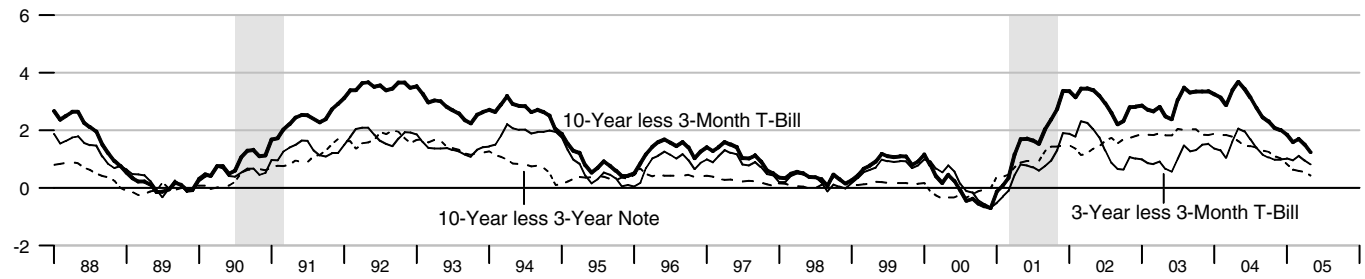


Inflation and Inflation Expectations

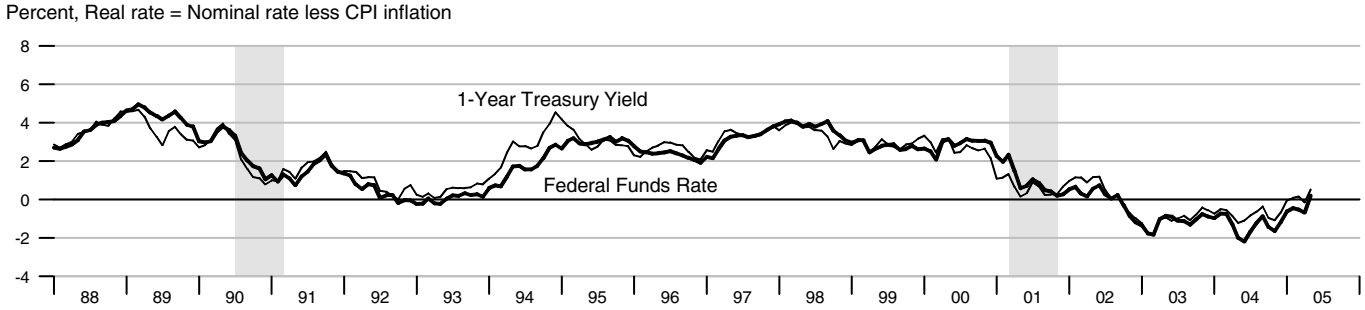


The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph. See notes on page 19.

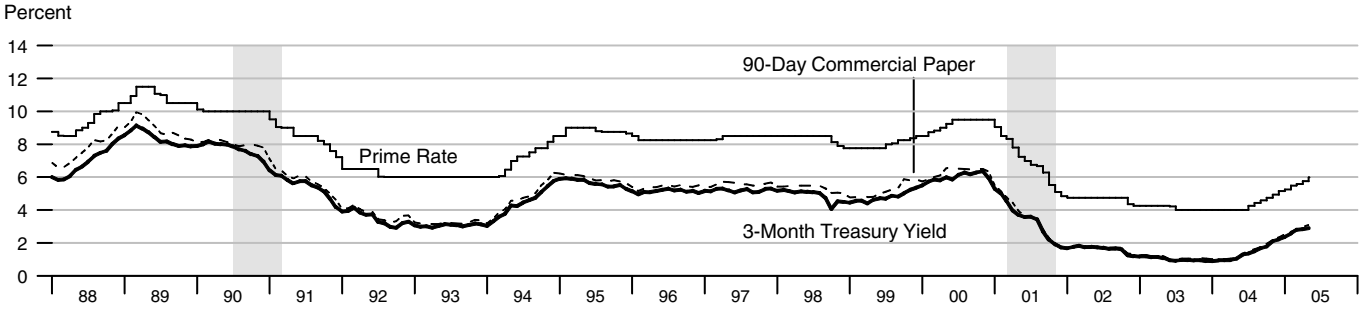
Treasury Security Yield Spreads



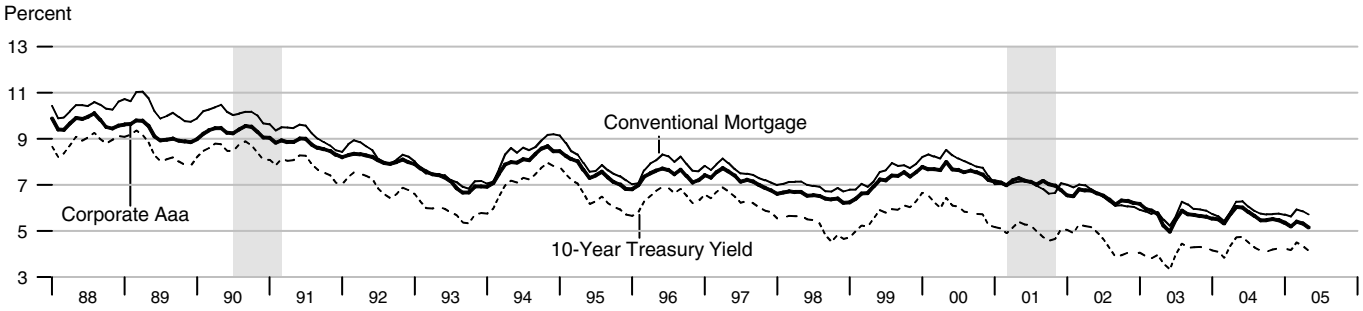
Real Interest Rates



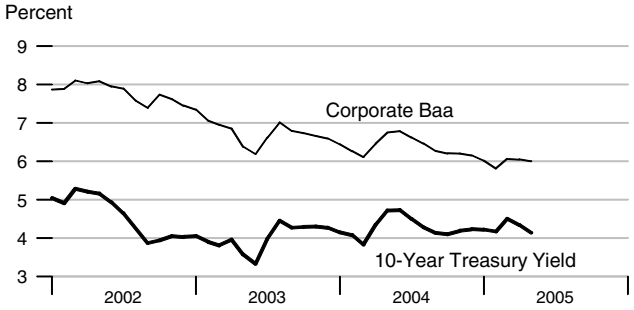
Short-Term Interest Rates



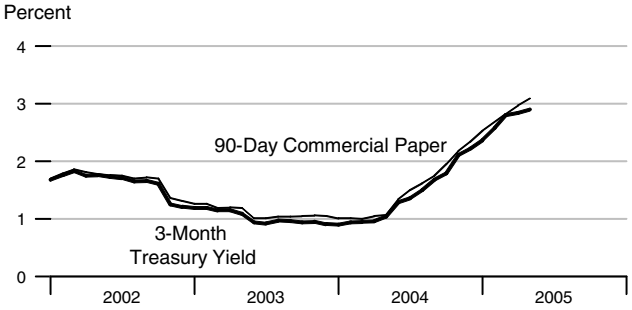
Long-Term Interest Rates



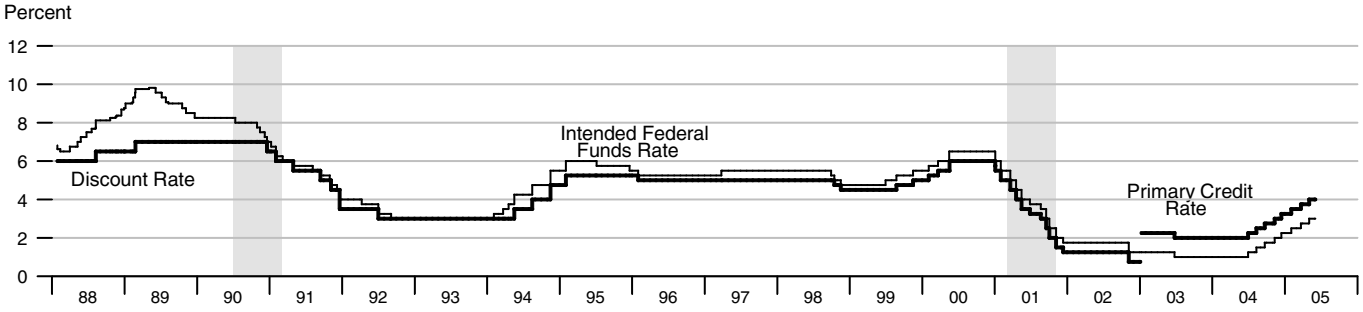
Long-Term Interest Rates



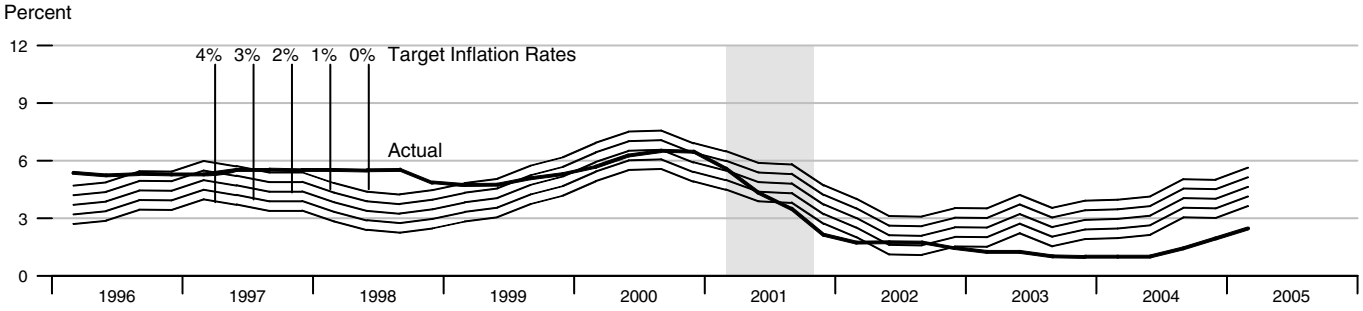
Short-Term Interest Rates



FOMC Intended Federal Funds Rate, Discount Rate, and Primary Credit Rate



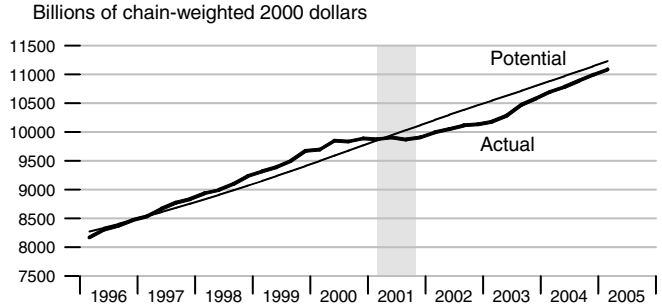
Federal Funds Rate and Inflation Targets



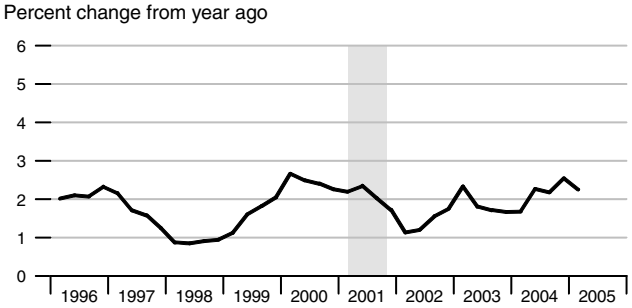
Calculated federal funds rate is based on Taylor's rule. See notes on page 19.

Components of Taylor's Rule

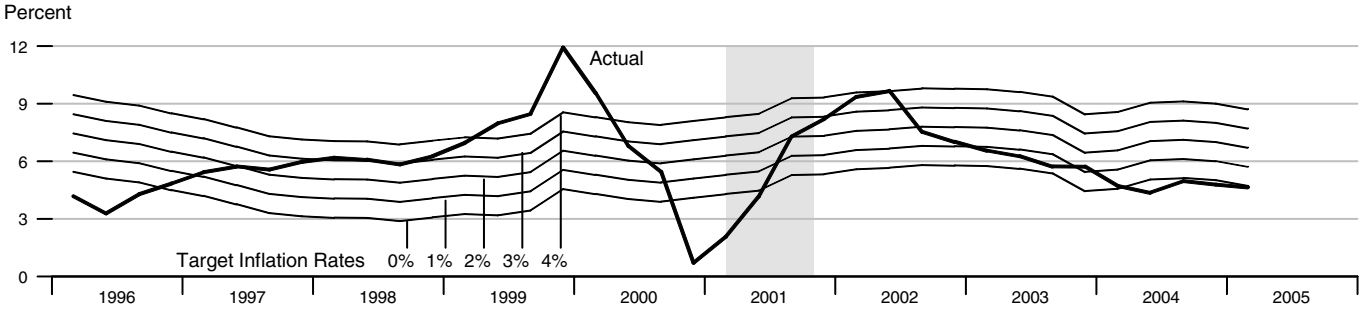
Actual and Potential Real GDP



PCE Inflation



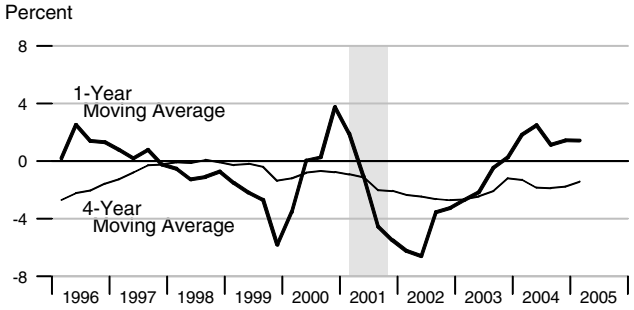
Monetary Base Growth* and Inflation Targets



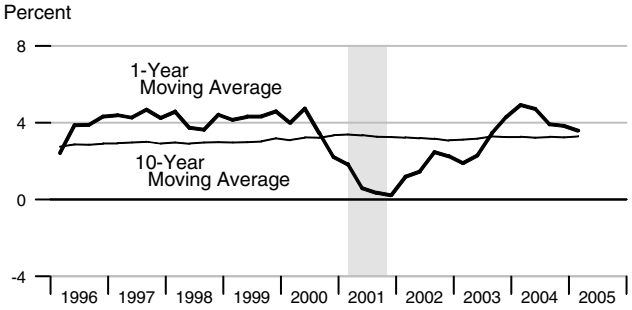
*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago. See notes on page 19.

Components of McCallum's Rule

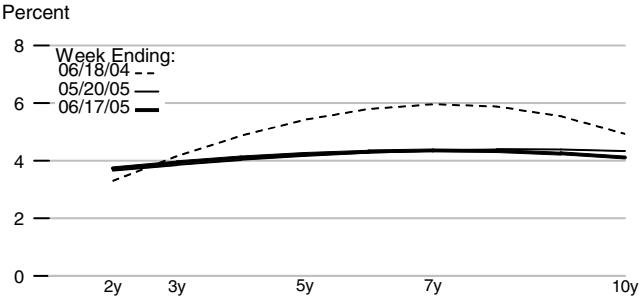
Monetary Base Velocity Growth



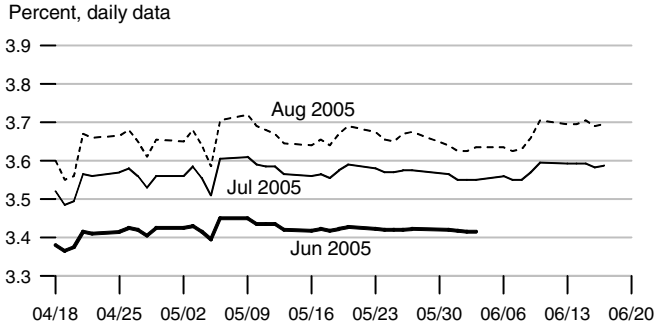
Real Output Growth



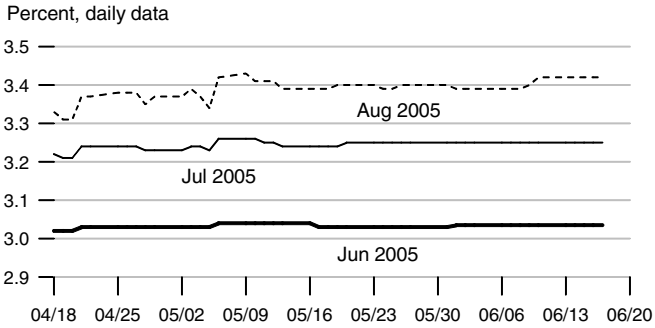
Implied One-Year Forward Rates



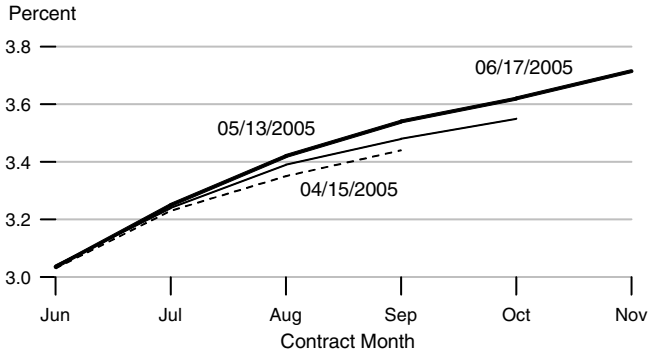
Rates on 3-Month Eurodollar Futures



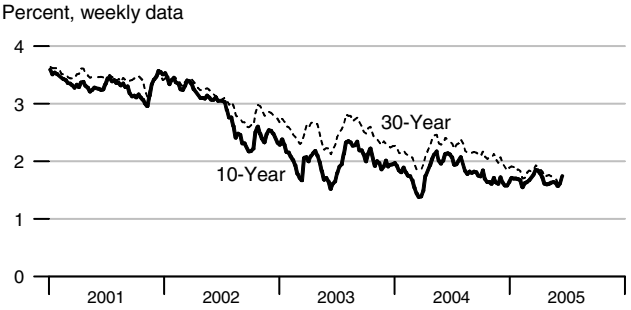
Rates on Selected Federal Funds Futures Contracts



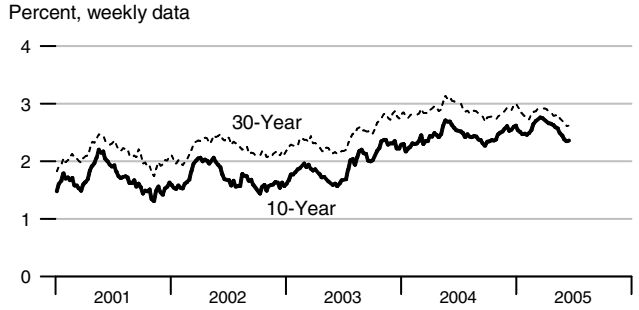
Rates on Federal Funds Futures on Selected Dates



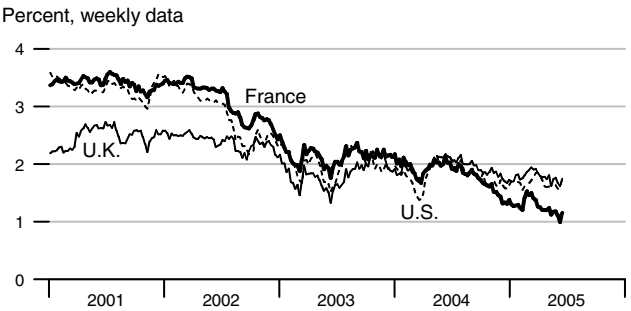
Inflation-Indexed Treasury Securities



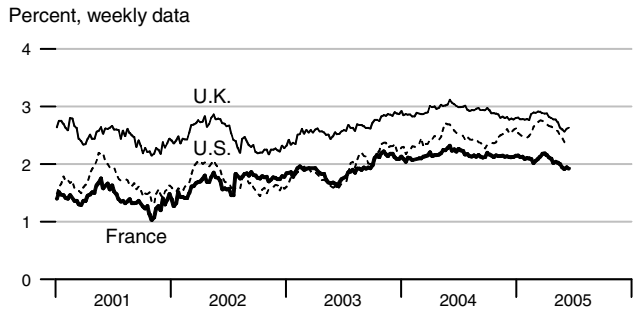
Inflation-Indexed Treasury Yield Spreads



Inflation-Indexed 10-Year Government Notes

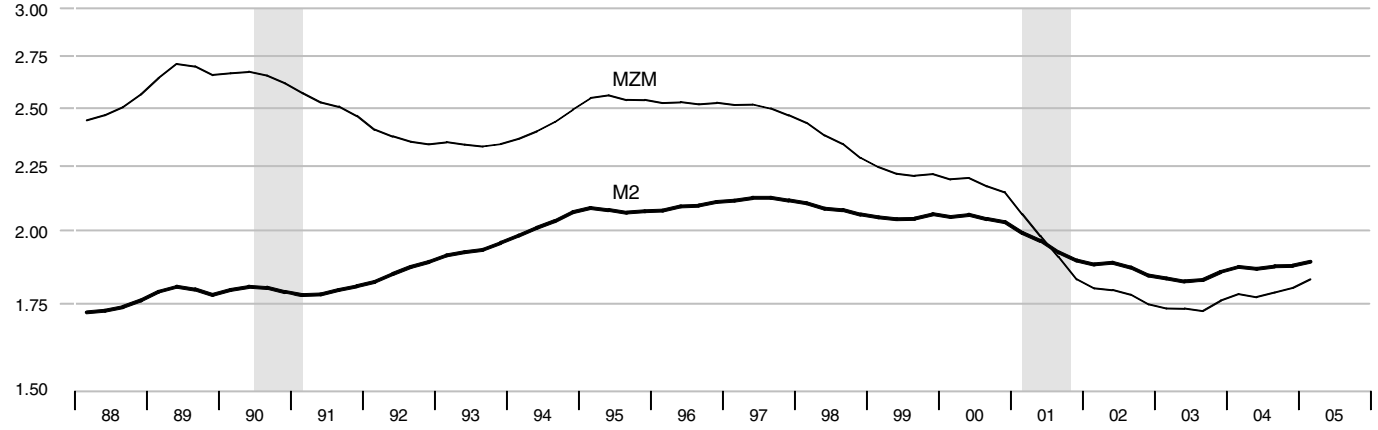


Inflation-Indexed 10-Year Government Yield Spreads



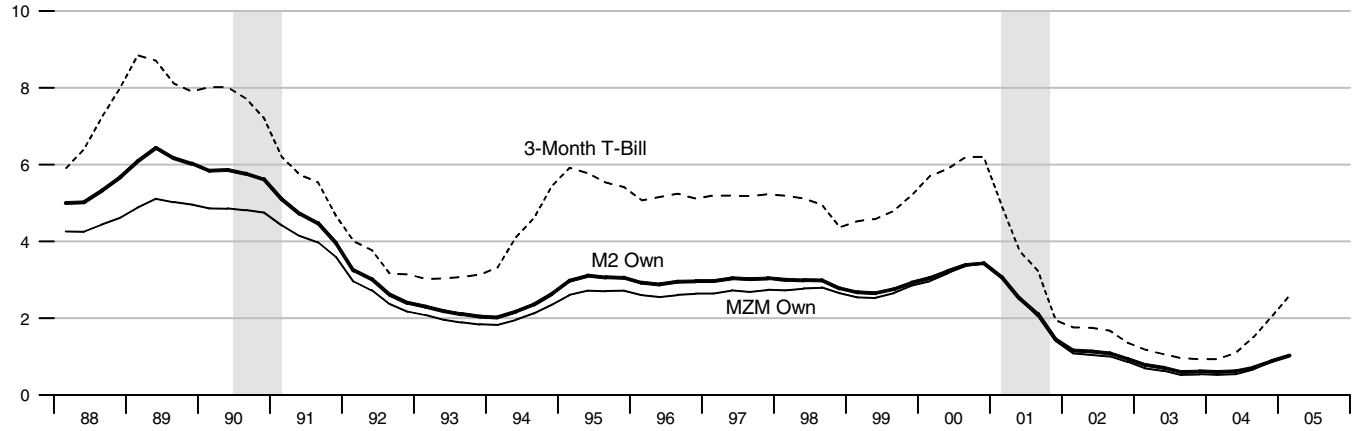
Velocity

Nominal GDP/MZM, Nominal GDP/M2 (Ratio Scale)



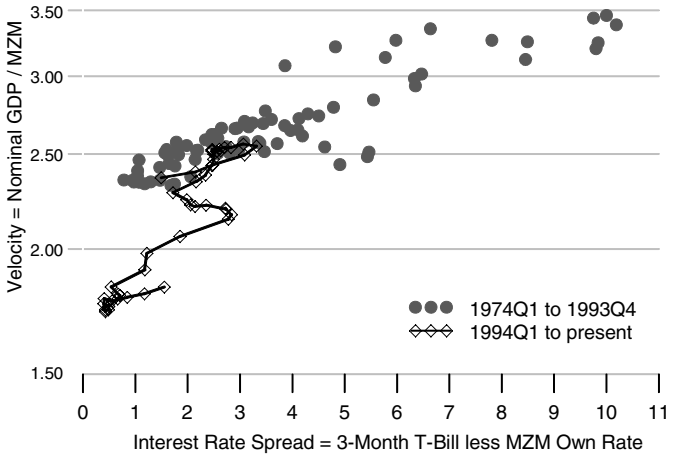
Interest Rates

Percent



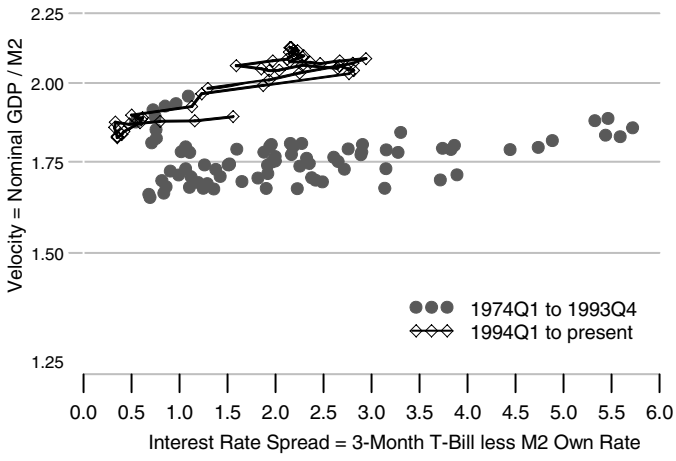
MZM Velocity and Interest Rate Spread

Ratio Scale



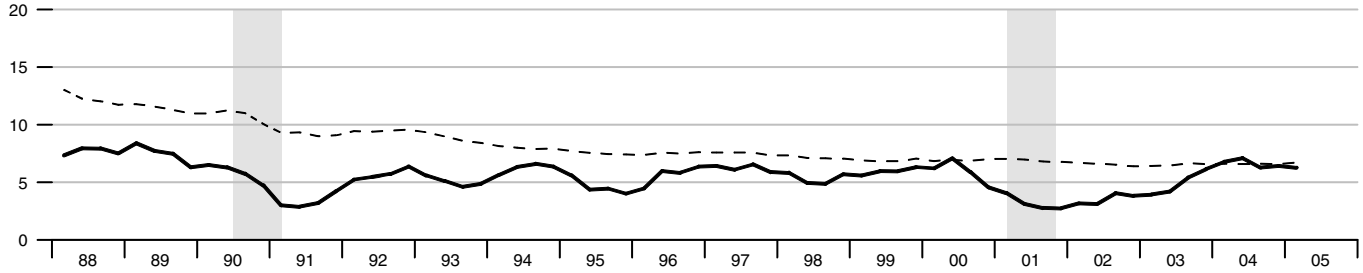
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

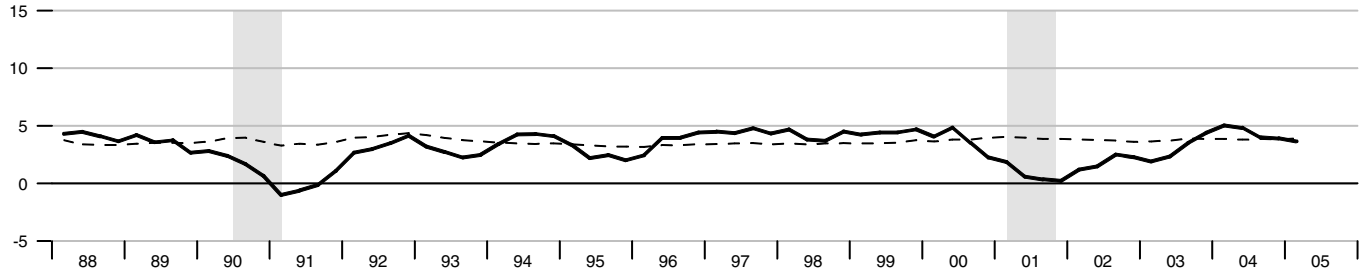
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

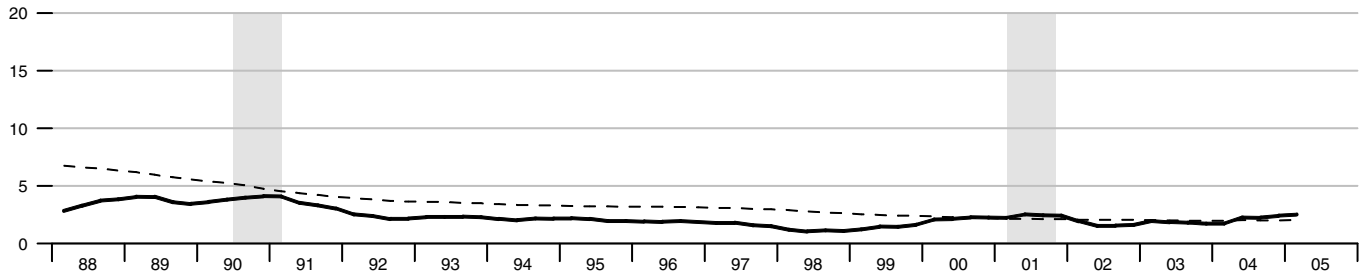
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

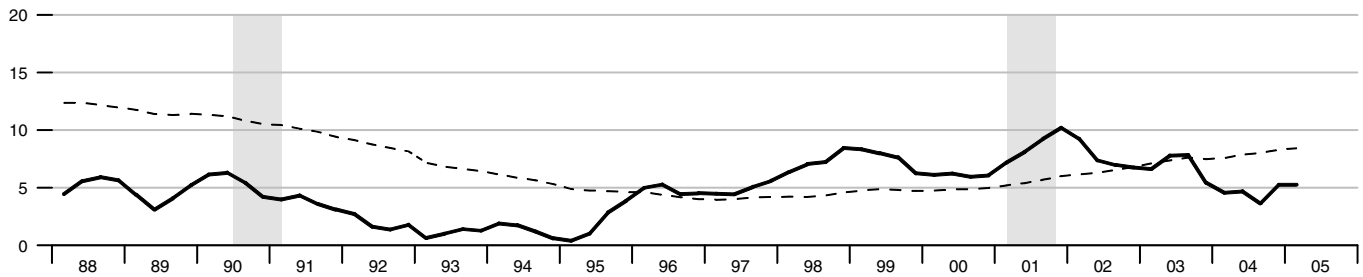
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

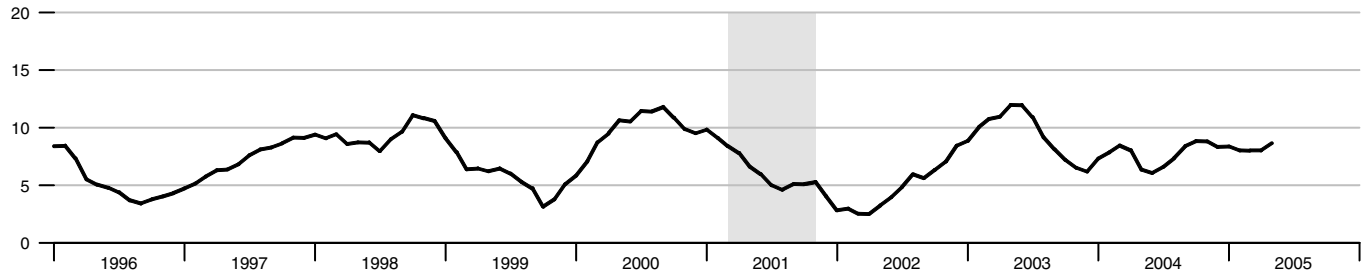
Percent change from year ago



Dashed lines indicate 10-year moving averages.

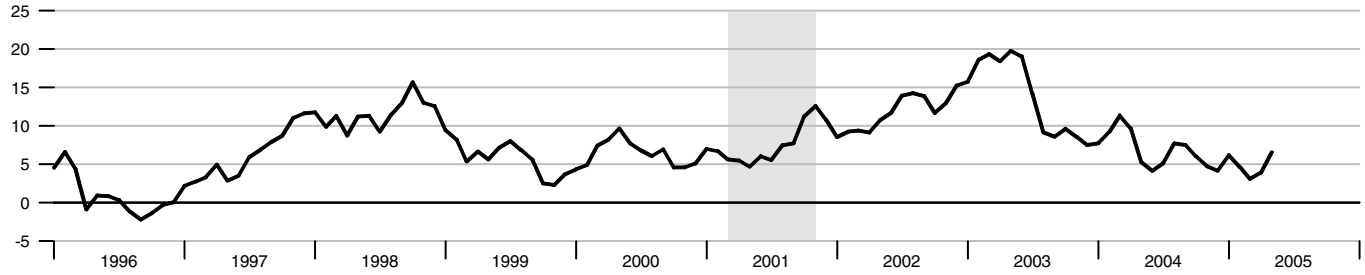
Bank Credit

Percent change from year ago



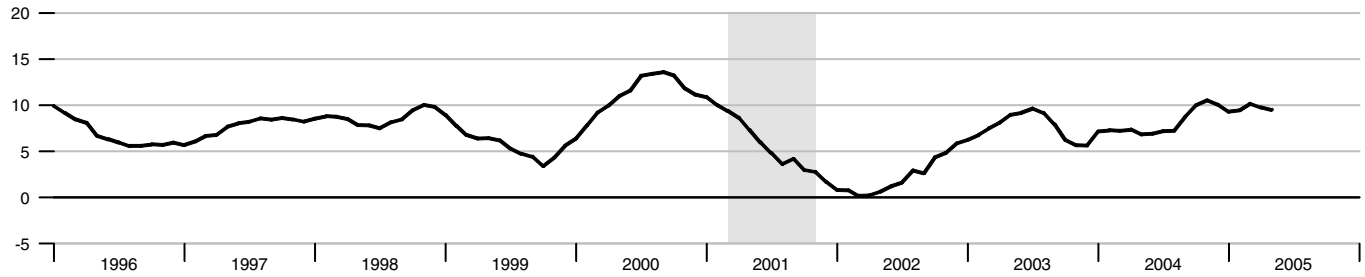
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



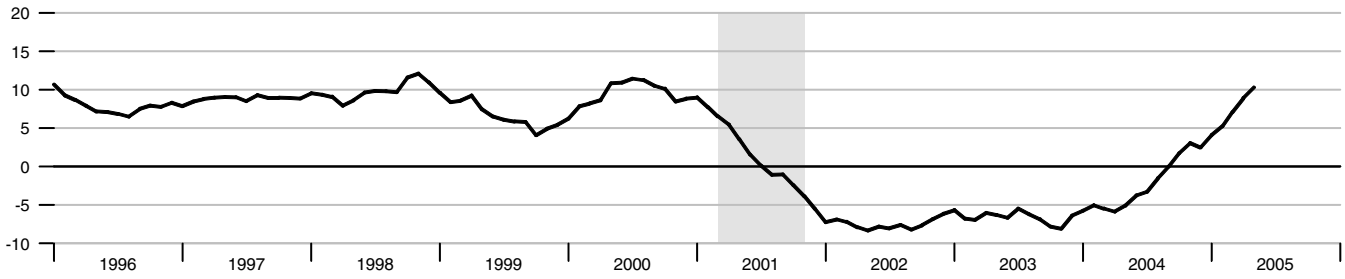
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

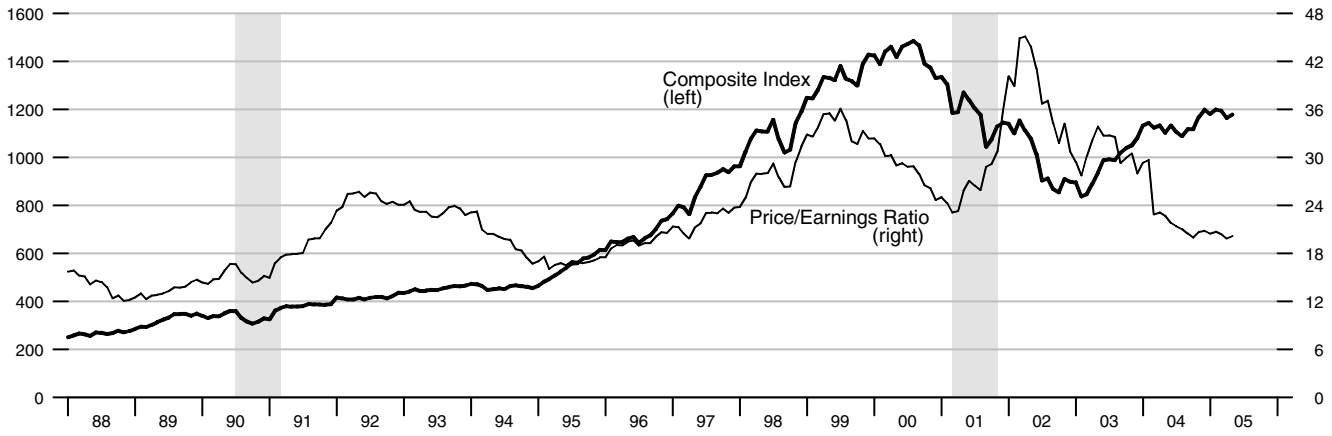


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



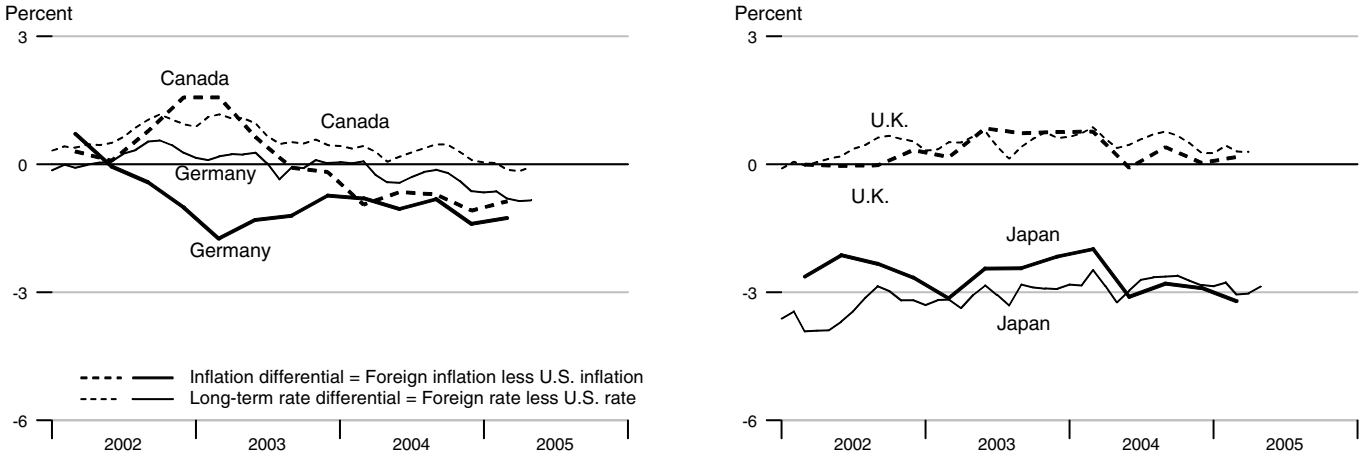
Standard & Poor's 500



Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2004Q2	2004Q3	2004Q4	2005Q1	Feb05	Mar05	Apr05	May05
United States	2.84	2.69	3.37	3.00	4.17	4.50	4.34	4.14
Canada	2.18	1.99	2.29	2.13	4.20	4.37	4.18	4.08
France	2.38	2.28	2.08	1.70	3.60	3.75	3.54	.
Germany	1.79	1.88	1.98	1.74	3.54	3.70	3.48	3.30
Italy	2.33	2.23	1.98	1.92	3.68	3.84	3.65	3.55
Japan	-0.27	-0.10	0.48	-0.20	1.40	1.45	1.32	1.27
United Kingdom	2.75	3.09	3.41	3.17	4.61	4.80	4.63	.

Inflation and Long-Term Interest Rate Differentials



		Money Stock				Bank	Adjusted		
		M1	MZM	M2	M3	Credit	Monetary Base	Reserves	MSI M2
2000		1103.678	4509.104	4798.787	6861.381	5025.393	607.106	84.115	248.612
2001		1136.048	5221.274	5216.056	7643.691	5345.104	641.167	86.177	271.226
2002		1190.960	5891.854	5610.431	8257.008	5597.006	697.072	88.136	293.929
2003		1266.713	6326.600	5998.072	8784.036	6120.053	740.762	93.143	314.887
2004		1336.551	6574.067	6269.810	9242.243	6594.173	776.518	95.866	329.528
2003	1	1230.394	6192.207	5862.515	8619.603	5955.574	726.828	91.083	307.691
	2	1260.790	6274.126	5970.168	8729.417	6135.753	738.281	91.944	313.354
	3	1284.077	6436.738	6083.271	8896.684	6186.127	744.144	94.974	319.368
	4	1291.592	6403.327	6076.334	8890.443	6202.757	753.796	94.570	319.132
2004	1	1311.109	6441.546	6129.853	9012.424	6426.459	761.243	94.840	322.045
	2	1330.781	6580.405	6249.754	9224.186	6556.864	770.962	96.406	328.376
	3	1342.895	6614.558	6305.048	9322.538	6639.984	782.591	96.596	331.417
	4	1361.420	6659.758	6394.584	9409.826	6753.386	791.277	95.623	336.273
2005	1	1363.907	6663.184	6452.271	9530.766	6975.469	798.060	96.437	339.308
2003	May	1264.244	6270.911	5974.450	8730.472	6152.630	738.676	91.574	313.546
	Jun	1274.499	6322.589	6015.406	8784.139	6206.056	739.676	91.828	315.732
	Jul	1278.056	6418.338	6059.272	8876.499	6194.455	741.389	93.811	318.098
	Aug	1287.035	6447.869	6104.635	8908.458	6179.243	745.394	95.778	320.457
	Sep	1287.140	6444.008	6085.905	8905.094	6184.684	745.648	95.332	319.550
	Oct	1288.045	6419.677	6077.991	8901.526	6160.933	753.833	95.699	319.162
	Nov	1289.524	6400.171	6073.458	8883.805	6197.456	754.786	95.220	318.988
	Dec	1297.207	6390.134	6077.554	8885.997	6249.881	752.769	92.790	319.247
2004	Jan	1295.024	6403.612	6090.685	8944.154	6320.179	756.606	93.026	320.076
	Feb	1312.792	6435.942	6129.952	9008.232	6440.760	763.012	95.738	322.041
	Mar	1325.512	6485.083	6168.921	9084.886	6518.437	764.112	95.755	324.018
	Apr	1325.842	6533.516	6206.832	9151.104	6538.667	767.768	96.901	326.084
	May	1329.698	6598.345	6265.083	9240.540	6547.217	770.029	95.588	329.196
	Jun	1336.804	6609.355	6277.346	9280.914	6584.707	775.088	96.729	329.849
	Jul	1329.473	6596.194	6279.309	9284.816	6596.436	780.276	95.493	330.158
	Aug	1347.436	6610.076	6300.455	9317.271	6626.663	781.339	95.823	331.121
	Sep	1351.776	6637.405	6335.381	9365.526	6696.854	786.158	98.472	332.973
	Oct	1351.840	6636.869	6362.017	9374.255	6711.771	792.055	97.354	334.524
	Nov	1366.797	6661.337	6398.793	9404.022	6757.636	793.690	96.636	336.501
	Dec	1365.623	6681.067	6422.942	9451.200	6790.752	788.085	92.880	337.794
2005	Jan	1356.276	6672.991	6436.690	9498.840	6875.052	793.357	94.888	338.589
	Feb	1364.052	6657.450	6450.467	9532.460	6982.012	800.094	97.595	339.192
	Mar	1371.393	6659.110	6469.656	9560.997	7069.342	800.730	96.827	340.142
	Apr	1353.869	6653.549	6464.521	9607.936	7092.149	802.130	97.132	339.960
	May	1365.314	6632.361	6464.182	9639.179	7141.695	800.432	94.259	339.598

*All values are given in billions of dollars.

		Federal Funds	Primary Credit Rate	Prime Rate	3-mo CDs	Treasury Yields 3-mo	3-yr	10-yr	Corporate Aaa Bonds	S & L Aaa Bonds	Conventional Mortgage
2000		6.24		9.23	6.46	6.00	6.22	6.03	7.62	5.58	8.06
2001		3.89		6.92	3.69	3.47	4.08	5.02	7.08	5.01	6.97
2002		1.67		4.68	1.73	1.63	3.10	4.61	6.49	4.87	6.54
2003		1.13	2.11	4.12	1.15	1.03	2.11	4.02	5.67	4.52	5.82
2004		1.35	2.34	4.34	1.56	1.40	2.78	4.27	5.63	4.50	5.84
2003	1	1.25	2.25	4.25	1.26	1.18	2.07	3.92	6.00	4.60	5.83
	2	1.25	2.23	4.24	1.17	1.06	1.77	3.62	5.31	4.28	5.51
	3	1.02	2.00	4.00	1.07	0.95	2.20	4.23	5.70	4.68	6.01
	4	1.00	2.00	4.00	1.10	0.93	2.38	4.29	5.66	4.52	5.92
2004	1	1.00	2.00	4.00	1.05	0.93	2.17	4.02	5.45	4.26	5.61
	2	1.01	2.00	4.00	1.25	1.10	2.98	4.60	5.93	4.82	6.13
	3	1.43	2.42	4.42	1.70	1.51	2.92	4.30	5.64	4.54	5.89
	4	1.95	2.94	4.94	2.25	2.04	3.05	4.17	5.48	4.39	5.73
2005	1	2.47	3.44	5.44	2.78	2.58	3.61	4.30	5.32	4.23	5.76
2003	May	1.26	2.25	4.25	1.22	1.09	1.75	3.57	5.22	4.16	5.48
	Jun	1.22	2.20	4.22	1.04	0.94	1.51	3.33	4.97	4.07	5.23
	Jul	1.01	2.00	4.00	1.05	0.92	1.93	3.98	5.49	4.59	5.63
	Aug	1.03	2.00	4.00	1.08	0.97	2.44	4.45	5.88	4.82	6.26
	Sep	1.01	2.00	4.00	1.08	0.96	2.23	4.27	5.72	4.63	6.15
	Oct	1.01	2.00	4.00	1.10	0.94	2.26	4.29	5.70	4.64	5.95
	Nov	1.00	2.00	4.00	1.11	0.95	2.45	4.30	5.65	4.50	5.93
	Dec	0.98	2.00	4.00	1.10	0.91	2.44	4.27	5.62	4.41	5.88
2004	Jan	1.00	2.00	4.00	1.06	0.90	2.27	4.15	5.54	4.42	5.74
	Feb	1.01	2.00	4.00	1.05	0.94	2.25	4.08	5.50	4.26	5.64
	Mar	1.00	2.00	4.00	1.05	0.95	2.00	3.83	5.33	4.11	5.45
	Apr	1.00	2.00	4.00	1.08	0.96	2.57	4.35	5.73	4.69	5.83
	May	1.00	2.00	4.00	1.20	1.04	3.10	4.72	6.04	4.93	6.27
	Jun	1.03	2.01	4.01	1.46	1.29	3.26	4.73	6.01	4.85	6.29
	Jul	1.26	2.25	4.25	1.57	1.36	3.05	4.50	5.82	4.71	6.06
	Aug	1.43	2.43	4.43	1.68	1.50	2.88	4.28	5.65	4.52	5.87
	Sep	1.61	2.58	4.58	1.86	1.68	2.83	4.13	5.46	4.40	5.75
	Oct	1.76	2.75	4.75	2.04	1.79	2.85	4.10	5.47	4.38	5.72
	Nov	1.93	2.93	4.93	2.26	2.11	3.09	4.19	5.52	4.45	5.73
	Dec	2.16	3.15	5.15	2.45	2.22	3.21	4.23	5.47	4.35	5.75
2005	Jan	2.28	3.25	5.25	2.61	2.37	3.39	4.22	5.36	4.24	5.71
	Feb	2.50	3.49	5.49	2.77	2.58	3.54	4.17	5.20	4.16	5.63
	Mar	2.63	3.58	5.58	2.97	2.80	3.91	4.50	5.40	4.29	5.93
	Apr	2.79	3.75	5.75	3.09	2.84	3.79	4.34	5.33	4.18	5.86
	May	3.00	3.98	5.98	3.22	2.90	3.72	4.14	5.15	4.20	5.72

*All values are given as a percent at an annual rate.

		M1	MZM	M2	M3
Percent change at an annual rate					
	2000	0.20	8.12	6.09	9.43
	2001	2.93	15.79	8.70	11.40
	2002	4.83	12.84	7.56	8.02
	2003	6.36	7.38	6.91	6.38
	2004	5.51	3.91	4.53	5.22
2003	1	7.97	7.77	6.84	6.59
	2	9.88	5.29	7.35	5.10
	3	7.39	10.37	7.58	7.66
	4	2.34	-2.08	-0.46	-0.28
2004	1	6.04	2.39	3.52	5.49
	2	6.00	8.62	7.82	9.40
	3	3.64	2.08	3.54	4.26
	4	5.52	2.73	5.68	3.75
2005	1	0.73	0.21	3.61	5.14
2003	May	19.89	8.10	10.90	7.86
	Jun	9.73	9.89	8.23	7.38
	Jul	3.35	18.17	8.75	12.62
	Aug	8.43	5.52	8.98	4.32
	Sep	0.10	-0.72	-3.68	-0.45
	Oct	0.84	-4.53	-1.56	-0.48
	Nov	1.38	-3.65	-0.89	-2.39
	Dec	7.15	-1.88	0.81	0.30
2004	Jan	-2.02	2.53	2.59	7.85
	Feb	16.46	6.06	7.74	8.60
	Mar	11.63	9.16	7.63	10.21
	Apr	0.30	8.96	7.37	8.75
	May	3.49	11.91	11.26	11.73
	Jun	6.41	2.00	2.35	5.24
	Jul	-6.58	-2.39	0.38	0.50
	Aug	16.21	2.53	4.04	4.19
	Sep	3.87	4.96	6.65	6.21
	Oct	0.06	-0.10	5.05	1.12
	Nov	13.28	4.42	6.94	3.81
	Dec	-1.03	3.55	4.53	6.02
2005	Jan	-8.21	-1.45	2.57	6.05
	Feb	6.88	-2.79	2.57	4.25
	Mar	6.46	0.30	3.57	3.59
	Apr	-15.33	-1.00	-0.95	5.89
	May	10.14	-3.82	-0.06	3.90

Definitions

M1: The sum of currency held outside the vaults of depository institutions, Federal Reserve Banks, and the U.S. Treasury; travelers checks; and demand and other checkable deposits issued by financial institutions (except demand deposits due to the Treasury and depository institutions), minus cash items in process of collection and Federal Reserve float.

MZM (money, zero maturity): M2 minus small-denomination time deposits, plus institutional money market mutual funds (that is, those included in M3 but excluded from M2). The label MZM was coined by William Poole (1991); the aggregate itself was proposed earlier by Motley (1988).

M2: M1 plus savings deposits (including money market deposit accounts) and small-denomination (under $100,000) time deposits issued by financial institutions; and shares in retail money market mutual funds (funds with initial investments under $50,000), net of retirement accounts.

M3: M2 plus large-denomination ($100,000 or more) time deposits; repurchase agreements issued by depository institutions; Eurodollar deposits, specifically, dollar-denominated deposits due to nonbank U.S. addresses held at foreign offices of U.S. banks worldwide and all banking offices in Canada and the United Kingdom; and institutional money market mutual funds (funds with initial investments of $50,000 or more).

Bank Credit: All loans, leases, and securities held by commercial banks.

Domestic Nonfinancial Debt: Total credit market liabilities of the U.S. Treasury, federally sponsored agencies, state and local governments, households, and nonfinancial firms. End-of-period basis.

Adjusted Monetary Base: The sum of currency in circulation outside Federal Reserve Banks and the U.S. Treasury, deposits of depository financial institutions at Federal Reserve Banks, and an adjustment for the effects of changes in statutory reserve requirements on the quantity of base money held by depositories. This series is a spliced chain index; see Anderson and Rasche (1996a,b, 2001, 2003).

Adjusted Reserves: The sum of vault cash and Federal Reserve Bank deposits held by depository institutions and an adjustment for the effects of changes in statutory reserve requirements on the quantity of base money held by depositories. This spliced chain index is numerically larger than the Board of Governors' measure, which excludes vault cash not used to satisfy statutory reserve requirements and Federal Reserve Bank deposits used to satisfy required clearing balance contracts; see Anderson and Rasche (1996a, 2001, 2003).

Monetary Services Index: An index that measures the flow of monetary services received by households and firms from their holdings of liquid assets; see Anderson, Jones, and Nesmith (1997). Indexes are shown for the assets included in M2, with additional data at research.stlouisfed.org/msi/index.html.

Note: M1, M2, M3, Bank Credit, and Domestic Nonfinancial Debt are constructed and published by the Board of Governors of the Federal Reserve System. For details, see *Statistical Supplement to the Federal Reserve Bulletin*, tables 1.21 and 1.26. MZM, Adjusted Monetary Base, Adjusted Reserves, and Monetary Services Index are constructed and published by the Research Division of the Federal Reserve Bank of St. Louis.

Notes

Page 3: Readers are cautioned that, since early 1994, the level and growth of M1 have been depressed by retail sweep programs that reclassify transactions deposits (demand deposits and other checkable deposits) as savings deposits overnight, thereby reducing banks' required reserves; see Anderson and Rasche (2001) and research.stlouisfed.org/aggreg/swdata.html. **Primary Credit Rate**, **Discount Rate,** and **Intended Federal Funds Rate** shown in the chart **Reserve Market Rates** are plotted as of the date of the change, while the **Effective Federal Funds Rate** is plotted as of the end of the month. Interest rates in the table are monthly averages from the Board of Governors H.15 Statistical Release. The **Treasury Yield Curve** shows constant maturity yields calculated by the U.S. Treasury for securities with 3 months and 1, 2, 3, 5, 7, and 10 years to maturity. Daily data and descriptions are available at research.stlouisfed.org/fred2/. See also *Statistical Supplement to the Federal Reserve Bulletin*, table 1.35. The 30-year constant maturity series was discontinued by the Treasury as of February 18, 2002.

Page 5: **Checkable Deposits** is the sum of demand and other checkable deposits. **Savings Deposits** is the sum of money market deposit accounts and passbook and statement savings. **Time Deposits** have a minimum initial maturity of 7 days. **Large Time Deposits** are deposits of $100,000 or more. **Retail** and **Institutional Money Market Mutual Funds** are as included in M2 and the non-M2 component of M3, respectively.

Page 7: **Excess Reserves plus RCB (Required Clearing Balance) Contracts** equals the amount of deposits at Federal Reserve Banks held by depository institutions but not applied to satisfy statutory reserve requirements. (This measure excludes the vault cash held by depository institutions that is not applied to satisfy statutory reserve requirements.) **Consumer Credit** includes most short- and intermediate-term credit extended to individuals. See *Statistical Supplement to the Federal Reserve Bulletin*, table 1.55.

Page 8: **Inflation Expectations** measures include the quarterly Federal Reserve Bank of Philadelphia *Survey of Professional Forecasters*, the monthly University of Michigan Survey Research Center's *Surveys of Consumers*, and the annual Federal Open Market Committee (FOMC) range as reported to the Congress in the February testimony that accompanies the Monetary Policy Report to the Congress. Beginning February 2000, the FOMC began using the personal consumption expenditures (PCE) price index to report its inflation range; the FOMC then switched to the PCE chain-type price index excluding food and energy prices ("core") beginning July 2004. Accordingly, neither are shown on this graph. **CPI Inflation** is the percentage change from a year ago in the consumer price index for all urban consumers. **Real Interest Rates** are ex post measures, equal to nominal rates minus CPI inflation.

Page 9: **FOMC Intended Federal Funds Rate** is the level (or midpoint of the range, if applicable) of the federal funds rate that the staff of the FOMC expected to be consistent with the desired degree of pressure on bank reserve positions. In recent years, the FOMC has set an explicit target for the federal funds rate.

Page 10: **Federal Funds Rate and Inflation Targets** shows the observed federal funds rate, quarterly, and the level of the funds rate implied by applying Taylor's (1993) equation

$$f_t^* = 2.5 + \pi_{t-1} + (\pi_{t-1} - \pi^*)/2 + 100 \times (y_{t-1} - y_{t-1}^P)/2$$

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where f_t^* is the implied federal funds rate, π_{t-1} is the previous period's inflation rate (PCE) measured on a year-over-year basis, y_{t-1} is the log of the previous period's level of real gross domestic product (GDP), and y_{t-1}^P is the log of an estimate of the previous period's level of potential output. **Potential Real GDP** is as estimated by the Congressional Budget Office.

Monetary Base Growth and Inflation Targets shows the quarterly growth of the adjusted monetary base (modified to include an estimate of the effect of sweep programs) implied by applying McCallum's (1988, 1993) equation

$$\Delta MB_t^* = \pi^* + (\text{10-year moving average growth of real GDP}) - (\text{4-year moving average of base velocity growth})$$

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where ΔMB_t^* is the implied growth rate of the adjusted monetary base. The 10-year moving average growth of real GDP for a quarter t is calculated as the average quarterly growth during the previous 40 quarters, at an annual rate, by the formula $((y_t - y_{t-40})/40) \times 400$, where y_t is the log of real GDP. The 4-year moving average of base velocity growth is calculated similarly. To adjust the monetary base for the effect of retail-deposit sweep programs, we add to the monetary base an amount equal to 10 percent of the total amount swept, as estimated by the Federal Reserve Board staff. These estimates are imprecise, at best. Sweep program data are found at research.stlouisfed.org/aggreg/swdata.html.

Page 11: **Implied One-Year Forward Rates** are calculated by this Bank from Treasury constant maturity yields. Yields to maturity, $R(m)$, for securities with $m = 1,\ldots,$ 10 years to maturity are obtained by linear interpolation between

reported yields. These yields are smoothed by fitting the regression suggested by Nelson and Siegel (1987),

$$R(m) = a_0 + (a_1 + a_2)(1 - e^{-m/50})/(m/50) - a_2 \times e^{-m/50},$$

and forward rates are calculated from these smoothed yields using equation (a) in table 13.1 of Shiller (1990),

$$f(m) = [D(m)R(m) - D(m-1)] / [D(m) - D(m-1)],$$

where duration is approximated as $D(m) = (1 - e^{-R(m) \times m})/R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). **Rates on 3-Month Eurodollar Futures** and **Rates on Selected Federal Funds Futures Contracts** trace through time the yield on three specific contracts. **Rates on Federal Funds Futures on Selected Dates** displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. **Inflation-Indexed Treasury Securities** are yields on the most recently issued inflation-indexed securities of 10- and 30-year original maturities. **Inflation-Indexed 10-Year Government Notes** shows the yield of an inflation-indexed note that is scheduled to mature in approximately (but not greater than) 10 years. The current French note has a maturity date of 7/25/2013, the current U.K. note has a maturity date of 8/16/2013, and the current U.S. note has a maturity date of 1/15/2015. **Inflation-Indexed Treasury Yield Spreads** and **Inflation-Indexed 10-Year Government Yield Spreads** equal the difference between the yields on the most recently issued inflation-indexed securities and the unadjusted security yields of similar maturity.

Page 12: **Velocity** (for MZM and M2) equals the ratio of GDP, measured in current dollars, to the level of the monetary aggregate. **MZM** and **M2 Own Rates** are weighted averages of the rates received by households and firms on the assets included in the aggregates. Prior to 1982, the 3-month T-bill rates are secondary market yields. From 1982 forward, rates are 3-month constant maturity yields.

Page 13: **Real Gross Domestic Product** is GDP as measured in chained 2000 dollars. The **Gross Domestic Product Price Index** is the implicit price deflator for GDP, which is defined by the Bureau of Economic Analysis, U.S. Department of Commerce, as the ratio of GDP measured in current dollars to GDP measured in chained 2000 dollars.

Page 14: **Investment Securities** are all securities held by commercial banks in both investment and trading accounts.

Page 15: **Inflation Rate Differentials** are the differences between the foreign consumer price inflation rates and year-over-year changes in the U.S. all-items Consumer Price Index.

Page 17: **Treasury Yields** are Treasury constant maturities as reported in the Board of Governors of the Federal Reserve System's H.15 release.

Sources

Agence France Trésor: French note yields.

Bank of Canada: Canadian note yields.

Bank of England: U.K. note yields.

Board of Governors of the Federal Reserve System: Monetary aggregates and components: H.6 release. Bank credit and components: H.8 release. Consumer credit: G.19 release. Required reserves, excess reserves, clearing balance contracts, and discount window borrowing: H.4.1 and H.3 releases. Interest rates: H.15 release. Nonfinancial commercial paper: Board of Governors website. Nonfinancial debt: Z.1 release. M2 own rate.

Bureau of Economic Analysis: GDP.

Bureau of Labor Statistics: CPI.

Chicago Board of Trade: Federal funds futures contract.

Chicago Mercantile Exchange: Eurodollar futures.

Congressional Budget Office: Potential real GDP.

Federal Reserve Bank of Philadelphia: Survey of Professional Forecasters inflation expectations.

Federal Reserve Bank of St. Louis: Adjusted monetary base and adjusted reserves, monetary services index, MZM own rate, one-year forward rates.

Organization for Economic Cooperation and Development: International interest and inflation rates.

Standard & Poor's: Stock price-earnings ratio, stock price composite index.

University of Michigan Survey Research Center: Median expected price change.

U.S. Department of the Treasury: U.S. security yields.

References

Anderson, Richard G. and Robert H. Rasche (1996a). "A Revised Measure of the St. Louis Adjusted Monetary Base," Federal Reserve Bank of St. Louis *Review*, March/April, *78*(2), pp. 3-13.*

____ and ____(1996b). "Measuring the Adjusted Monetary Base in an Era of Financial Change," Federal Reserve Bank of St. Louis *Review*, November/December, *78*(6), pp. 3-37.*

____ and ____(2001). "Retail Sweep Programs and Bank Reserves, 1994-1999," Federal Reserve Bank of St. Louis *Review*, January/February, *83*(1), pp. 51-72.*

____ and ____ , with Jeffrey Loesel (2003). "A Reconstruction of the Federal Reserve Bank of St. Louis Adjusted Monetary Base and Reserves," Federal Reserve Bank of St. Louis *Review*, September/October, *85*(5), pp. 39-70.*

____ , Barry E. Jones and Travis D. Nesmith (1997). "Special Report: The Monetary Services Indexes Project of the Federal Reserve Bank of St. Louis," Federal Reserve Bank of St. Louis *Review*, January/February, *79*(1), pp. 31-82.*

McCallum, Bennett T. (1988). "Robustness Properties of a Monetary Policy Rule," *Carnegie-Rochester Conference Series on Public Policy*, vol. 29, pp. 173-204.

____(1993). "Specification and Analysis of a Monetary Policy Rule for Japan," Bank of Japan *Monetary and Economic Studies*, November, pp. 1-45.

Motley, Brian (1988). "Should M2 Be Redefined?" Federal Reserve Bank of San Francisco *Economic Review*, Winter, pp. 33-51.

Nelson, Charles R. and Andrew F. Siegel (1987). "Parsimonious Modeling of Yield Curves," *Journal of Business*, October, pp. 473-89.

Poole, William (1991). Statement before the Subcommittee on Domestic Monetary Policy of the Committee on Banking, Finance and Urban Affairs, U.S. House of Representatives, November 6, 1991. Government Printing Office, Serial No. 102-82.

Sharpe, William F. (1997). *Macro-Investment Analysis*, on-line textbook available at www.stanford.edu/~wfsharpe/mia/mia.htm.

Shiller, Robert (1990). "The Term Structure of Interest Rates," *Handbook of Monetary Economics*, vol. 1, B. Friedman and F. Hahn, eds., pp. 627-722.

Taylor, John B. (1993). "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, vol. 39, pp. 195-214.

Note: *Available on the Internet at research.stlouisfed.org/publications/review/.