Predictability and Effectiveness of Monetary Policy

Transparency in the conduct of monetary policy is generally considered to be a good thing. Many economists believe that the better market participants are able to predict monetary policy actions—specifically, changes in the target for the federal funds rate—the more effective monetary policy will be in influencing long-term interest rates.

There are two problems with this argument. The first stems from the expectations hypothesis (EH) itself, which asserts that the long-term rate is determined by the market's expectation of the short-term rate over the holding period of the long-term asset (plus a risk premium). The EH implies market participants are able to predict the future level of the short-term rate, which necessarily implies that they can predict changes in the short-term rate. It is not the ability to predict near-term policy actions, per se, that determines the magnitude of the response of long-term rates to policy actions, however. Rather, it is the ability to predict the longer-term course of policy that is important. The following simple example illustrates why this is true: Assume that the market fully and correctly anticipates that the Fed will lower the funds rate target by 50 basis points next week and raise it 50 basis points the following week. Despite the fact that these actions are perfectly predictable in this example, their effect on longer-term rates would be small. Indeed, the longer an asset's term, the smaller will be the effect.

If the future course of policy could be known with certainty, the predictability of policy actions would affect only the timing of the market response to policy actions, not the size of the response of long-term rates. To see why, consider two scenarios where the Fed permanently reduces the funds rate target by 50 basis points. In the first scenario, the market anticipates the Fed's action, so that long-term rates fall by 50 basis points in advance of the Fed's action.

In the second, the market does not anticipate the policy action; long-term rates fall by 50 basis points but only after the Fed reveals that it has reduced the funds rate target. In both cases the effect on long-term rates is the same. The only difference is the timing of the decline in long-term interest rates—either before the action or when the action is announced. In which case is monetary policy more effective? This is not an easy question to answer in general; however, policy is not *obviously* more effective in the case where the market is able to predict the timing of policy actions. Predicting the timing of policy actions is not the critical factor: The effect of policy actions on long-term rates is determined by the market's ability to predict how *long* this new policy will persist.

A second problem with the argument that predictability of policy actions increases the effectiveness of policy is that it depends on how monetary policymakers set their policy instrument. Some policymakers claim to set their instrument at the level consistent with achieving their policy objectives, given all the information they have at the time, including their forecasts for the economy. The instrument setting is changed only when policymakers receive new information that suggests that their policy objectives cannot be obtained with the instrument's current setting. If policy is made in this way, market participants need two pieces of information to predict the timing of policy actions. First, they must anticipate the new information that policymakers will receive. Hence, predicting policy actions requires that market participants predict future events better than policymakers can. This would seem to be a rather severe requirement.

Market participants also must be able to predict how policymakers will respond to the new information. This is extremely difficult, if for no other reason than the fact that information tends to come in packets, not pieces. Each day policymakers receive news about a number of economic variables. How they respond to any one piece of information depends, in part, on the other pieces of information in that packet and, perhaps, on information received in the packets of previous days.

—Daniel L. Thornton

Contents

Page

Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.

2. Except where otherwise noted, solid shading indicates recessions, as determined by the National Bureau of Economic Research. The NBER has not yet determined the end of the recession that began in March 2001; however, the hatched shading indicates this recession ended in November 2001, as determined by a statistical model for dating business cycle turning points developed by Marcelle Chauvet ("An Econometric Characterization of Business Cycle Dynamics with Factor Structure and Regime Switching," *International Economic Review*, November 1998, pp. 969-96) and discussed by Marcelle Chauvet and Jeremy Piger ("Identifying Business Cycle Turning Points in Real Time," Federal Reserve Bank of St. Louis *Review*, March/April 2003, pp. 47-62).

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: $[(x_t/x_{t-12})-1] \times 100$.

We welcome your comments addressed to:

M2 and MZM

Billions of dollars

Reserve Market Rates

Percent

- - - - Effective Federal Funds Rate
—— Intended Federal Funds Rate

Primary Credit Rate

Discount Rate

Adjusted Monetary Base

Percent change at an annual rate

Treasury Yield Curve

Percent

Week Ending:
06/14/02 - - - - -
05/16/03 ——
06/13/03 ——

3m 1y 2y 3y 5y 7y 10y

Total Bank Credit

Percent change at an annual rate
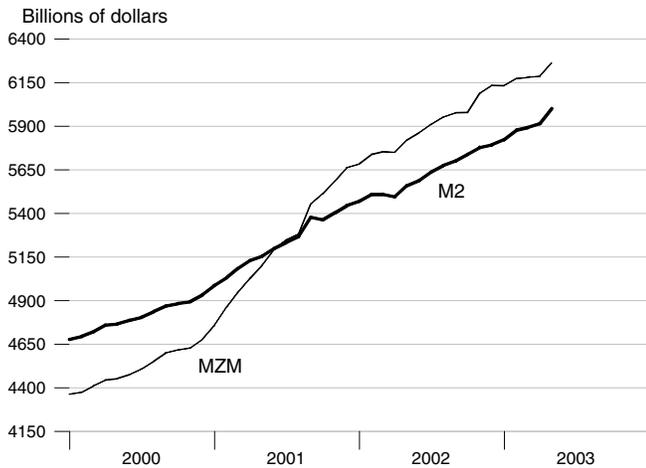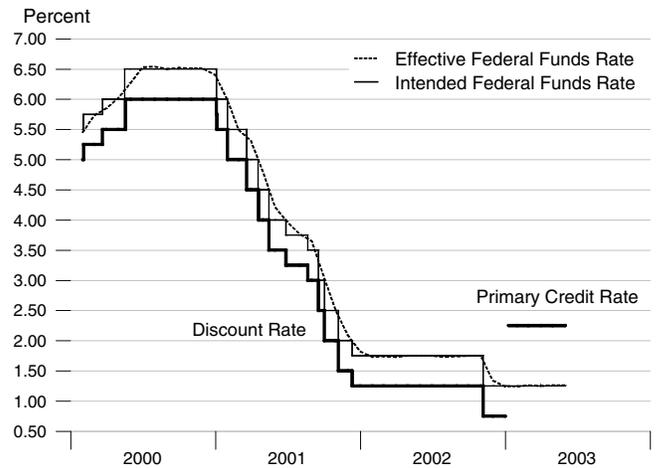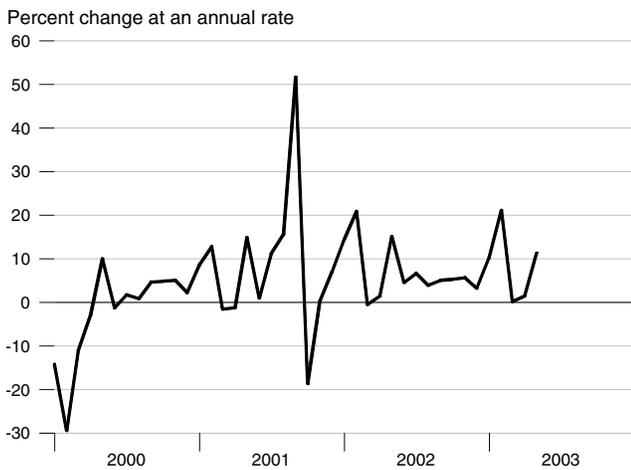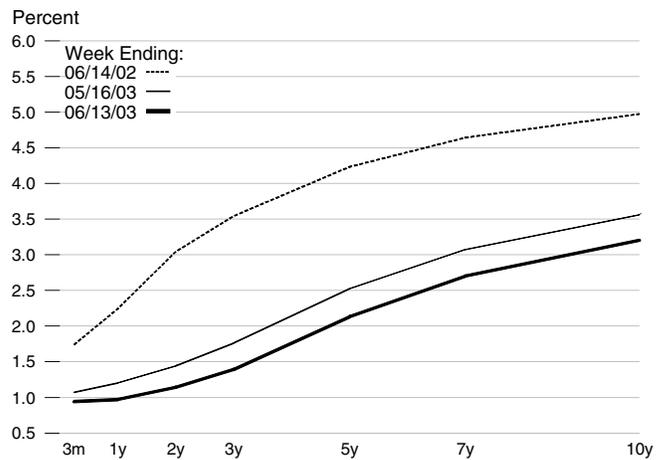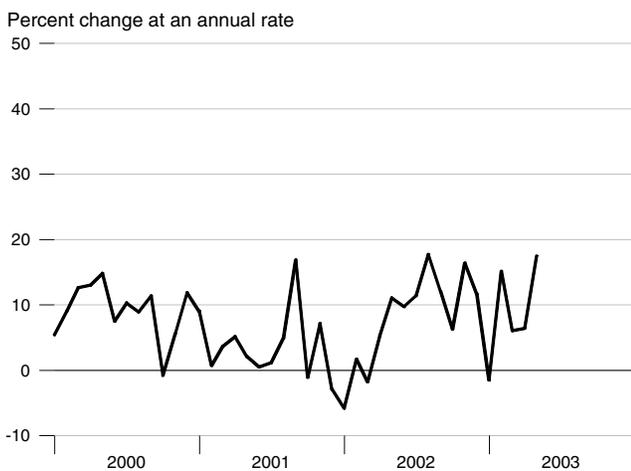
Interest Rates

	Mar 03	Apr 03	May 03
Federal Funds Rate	1.25	1.26	1.26
Prime Rate	4.25	4.25	4.25
Primary Credit Rate	2.25	2.25	2.25
Conventional Mortgage Rate	5.75	5.81	5.48
Treasury Yields:			
3-Month Constant Maturity	1.15	1.15	1.09
6-Month Constant Maturity	1.16	1.17	1.11
1-Year Constant Maturity	1.24	1.27	1.18
3-Year Constant Maturity	1.98	2.06	1.75
5-Year Constant Maturity	2.78	2.93	2.52
10-Year Constant Maturity	3.81	3.96	3.57

MZM and M1

Percent change from year ago

MZM

M1

M2
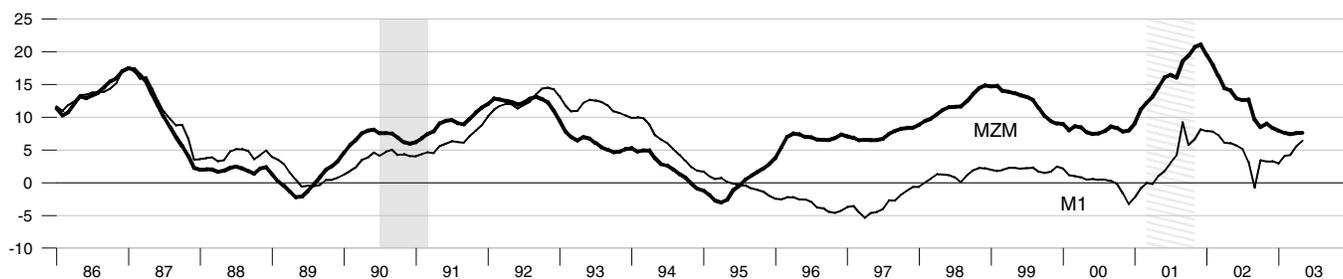
Percent change from year ago
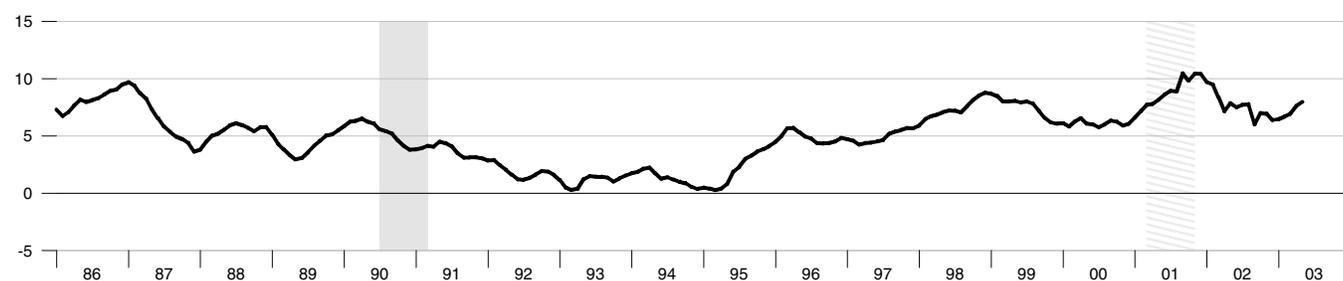
M3

Percent change from year ago
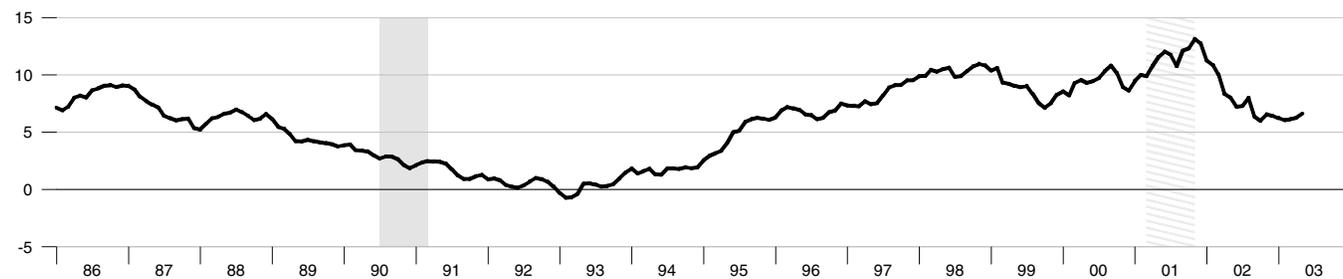
Monetary Services Index - M2

Percent change from year ago
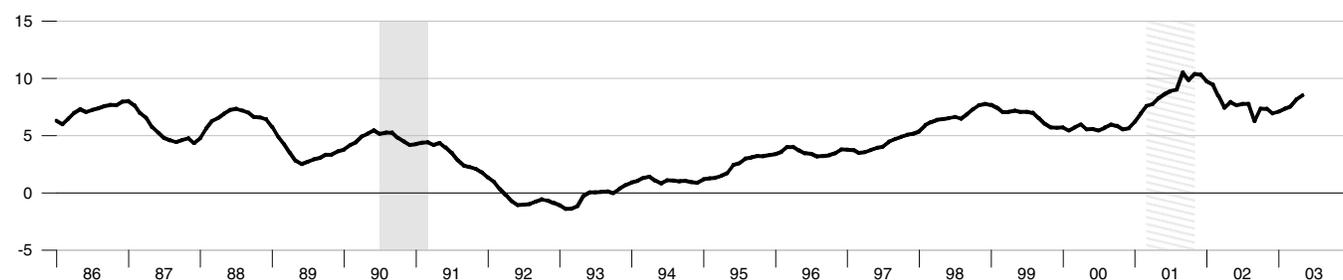
Adjusted Monetary Base

Percent change from year ago

Domestic Nonfinancial Debt

Percent change from year ago
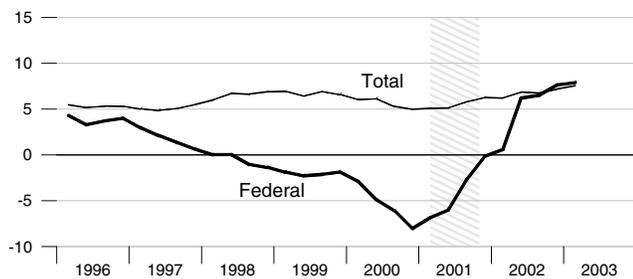
Currency Held by the Nonbank Public

Percent change from year ago
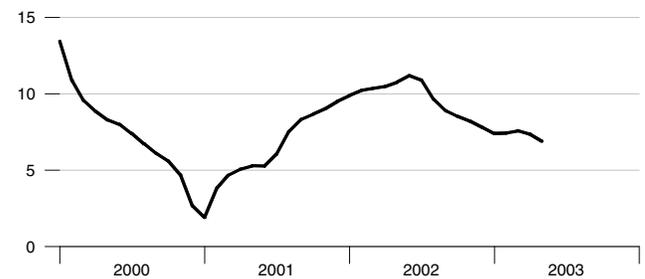
Time Deposits

Percent change from year ago
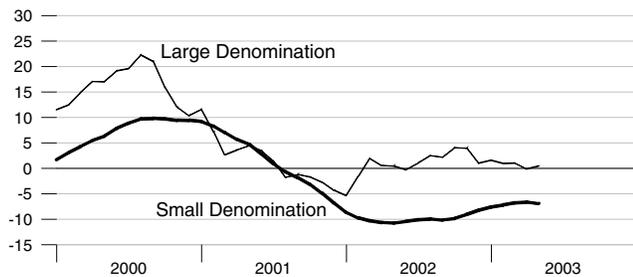
Checkable and Savings Deposits

Percent change from year ago
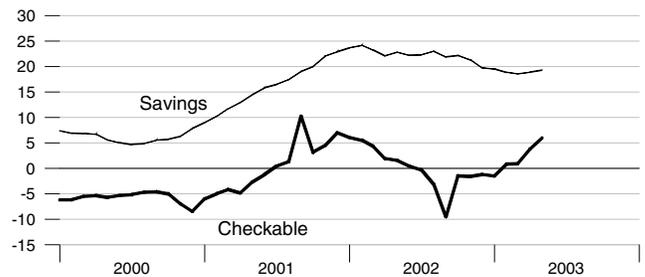
Money Market Mutual Fund Shares

Percent change from year ago
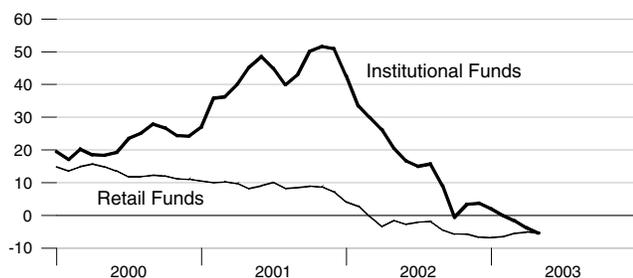
Repurchase Agreements and Eurodollars

Billions of dollars   Billions of dollars
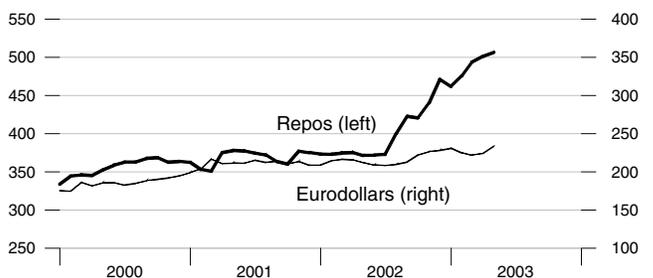
M1

Percent change at an annual rate
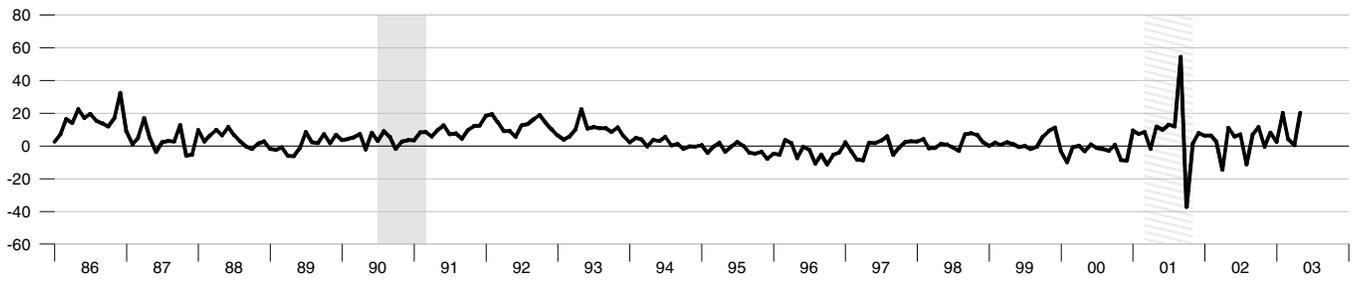
MZM

Percent change at an annual rate
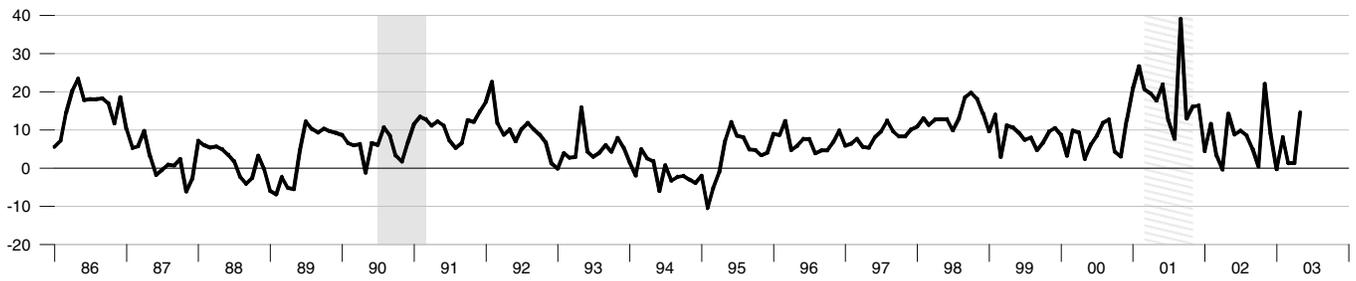
M2

Percent change at an annual rate

M3
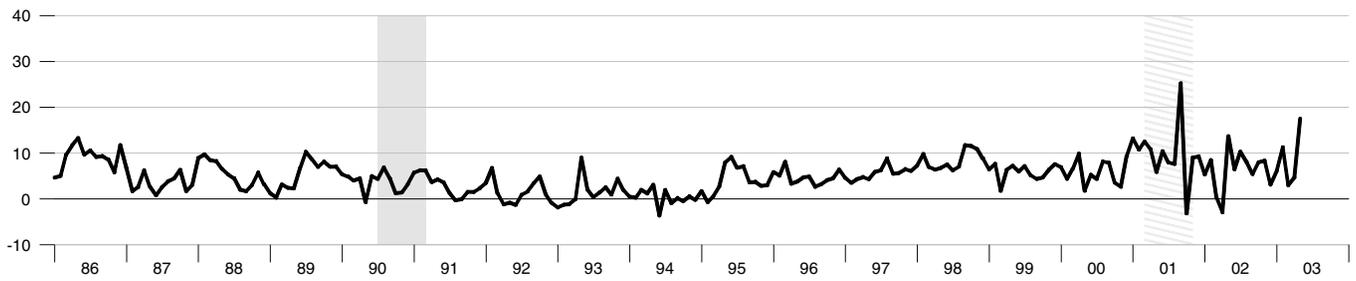
Percent change at an annual rate
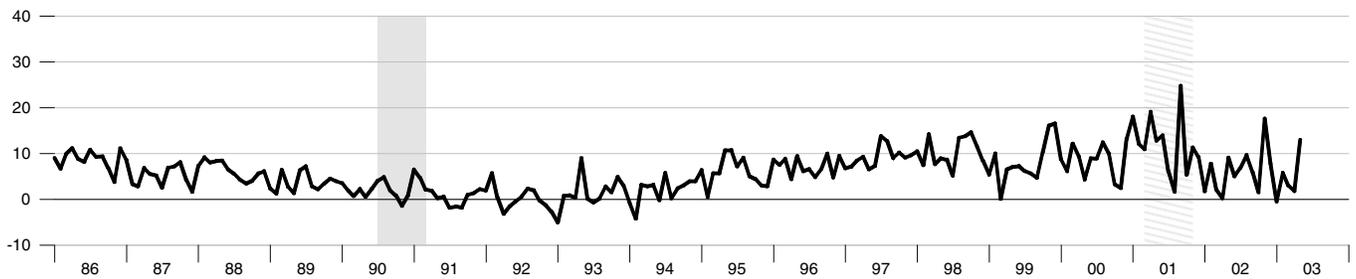
Adjusted and Required Reserves

Billions of dollars
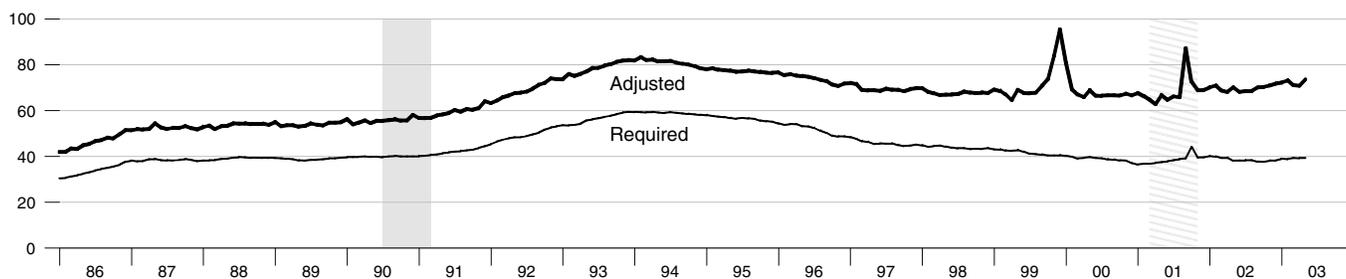
Total Borrowings, nsa

Billions of dollars
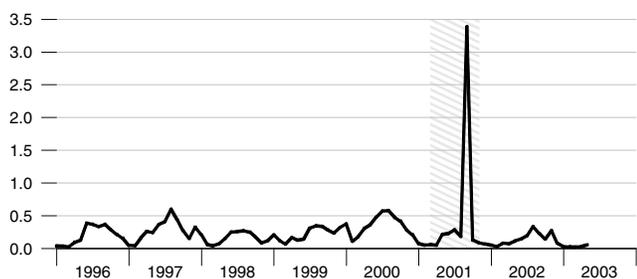
Excess Reserves plus RCB Contracts

Billions of dollars
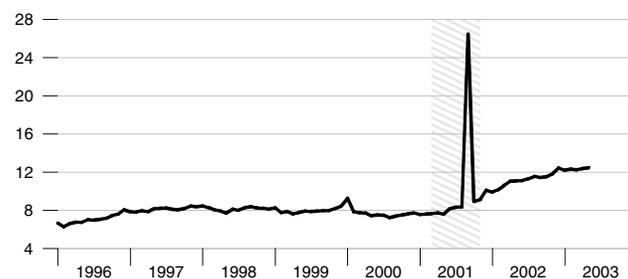
Nonfinancial Commercial Paper

Percent change from year ago
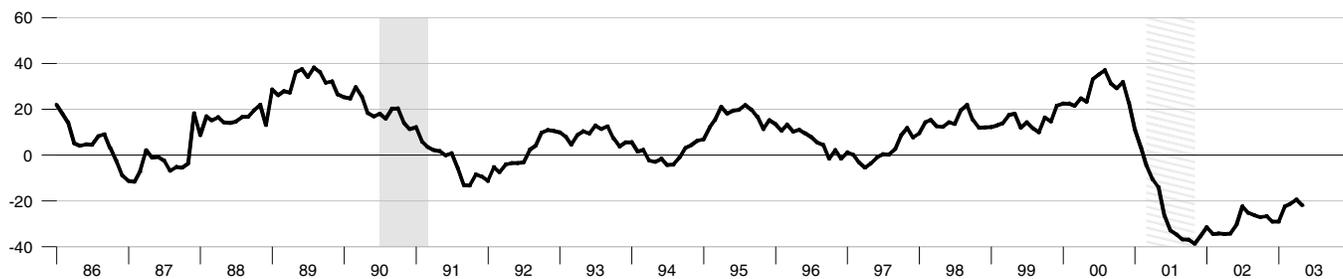
Consumer Credit

Percent change from year ago
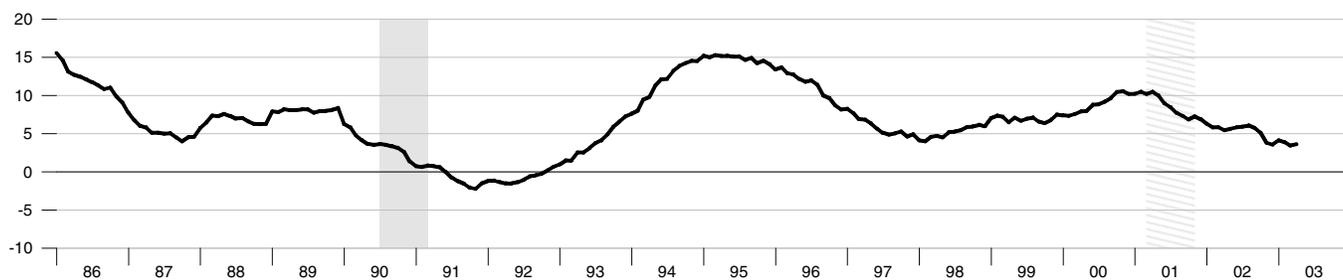
Inflation and Inflation Expectations

Percent

Federal Reserve Bank
of Philadelphia

Humphrey-Hawkins CPI Inflation Range

University of
Michigan

CPI Inflation

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.
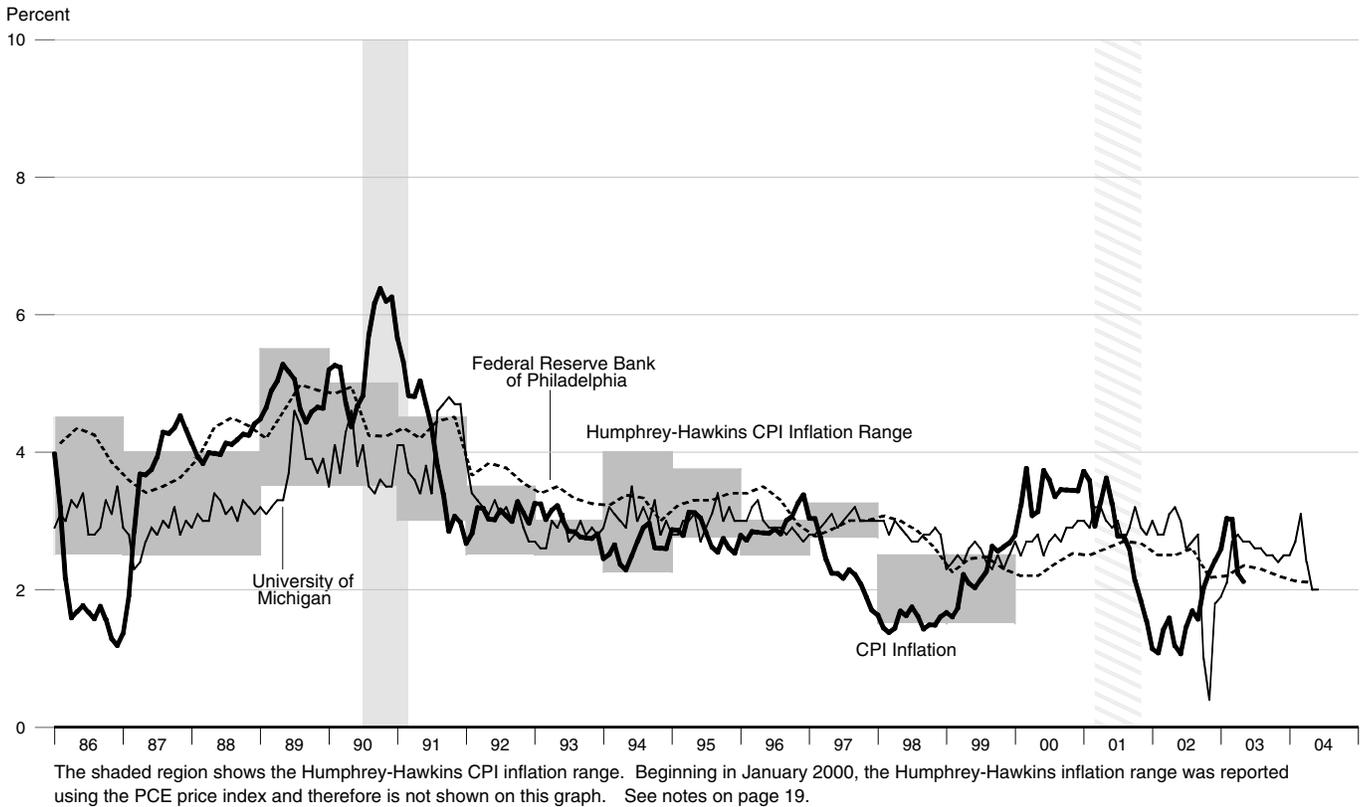
Treasury Security Yield Spreads
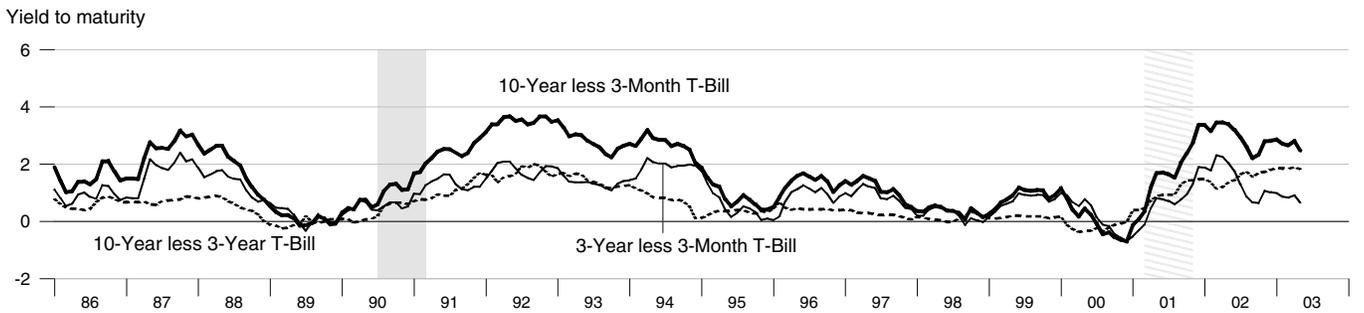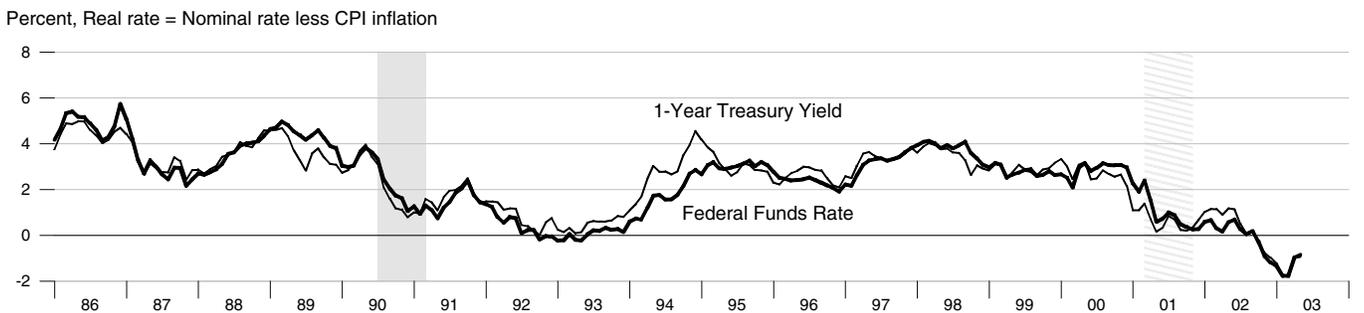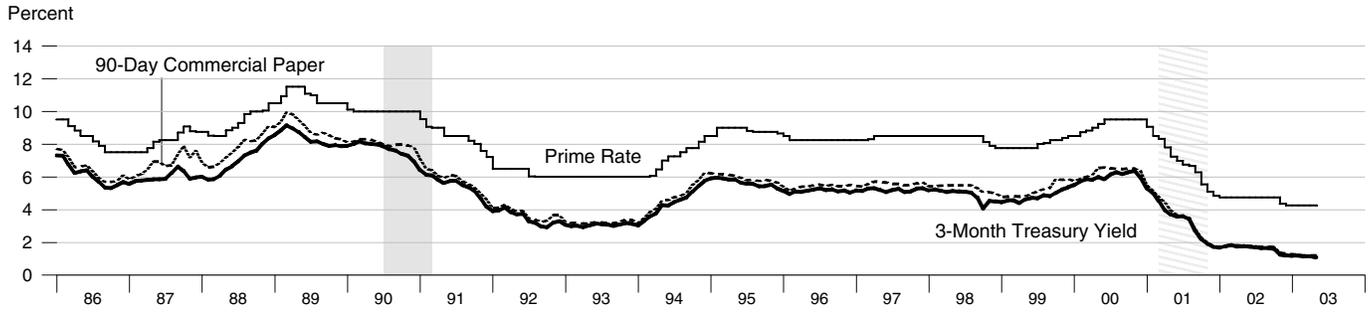
Yield to maturity

10-Year less 3-Month T-Bill

10-Year less 3-Year T-Bill

3-Year less 3-Month T-Bill

Real Interest Rates

Percent, Real rate = Nominal rate less CPI inflation

1-Year Treasury Yield

Federal Funds Rate

Short-Term Interest Rates

Percent

Long-Term Interest Rates

Percent

Long-Term Interest Rates

Percent

Short-Term Interest Rates

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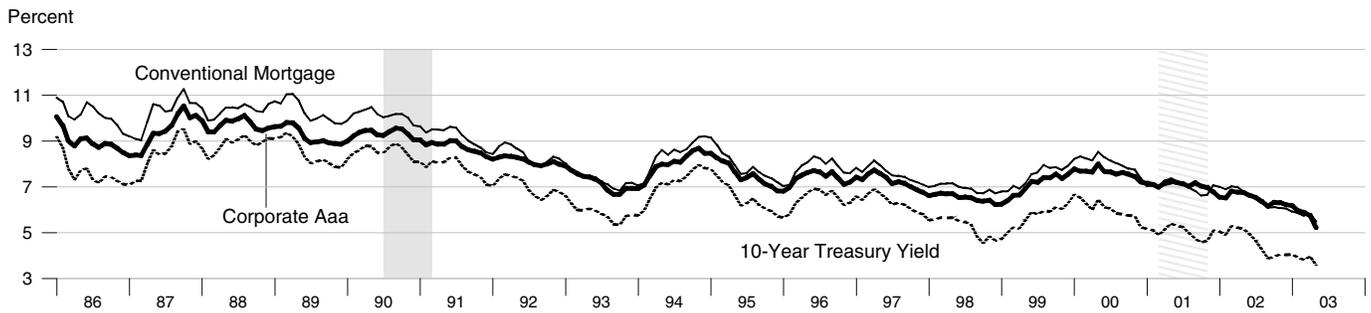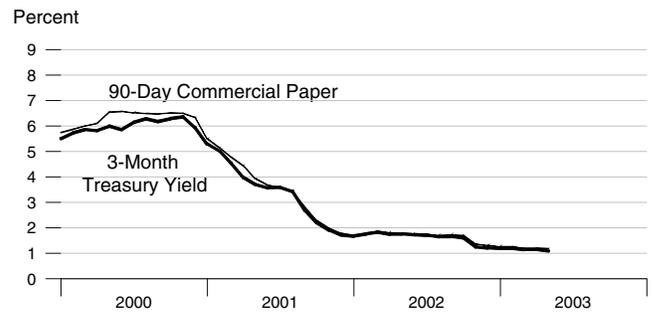
FOMC Intended Federal Funds Rate, Discount Rate, and Primary Credit Rate

Percent

Federal Funds Rate and Inflation Targets

Percent

4% 3% 2% 1% 0% Target Inflation Rates
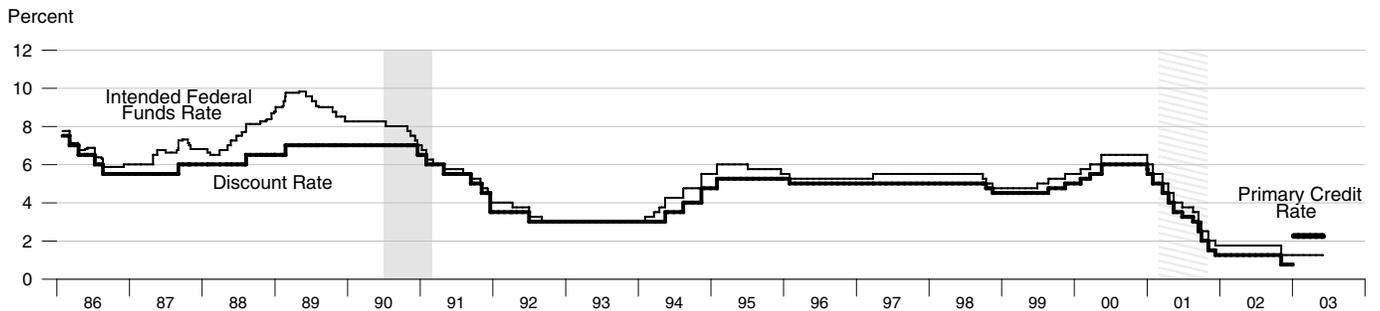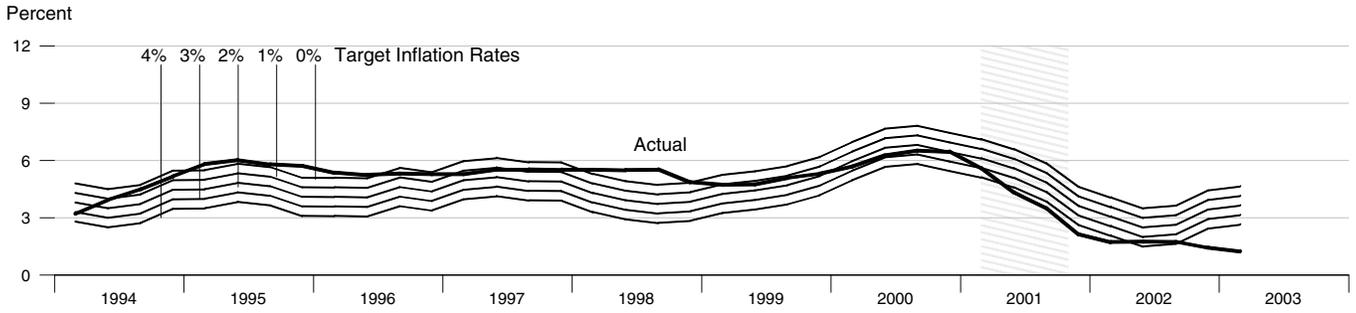
Actual

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

Billions of chain-weighted 1996 dollars

Actual

Potential
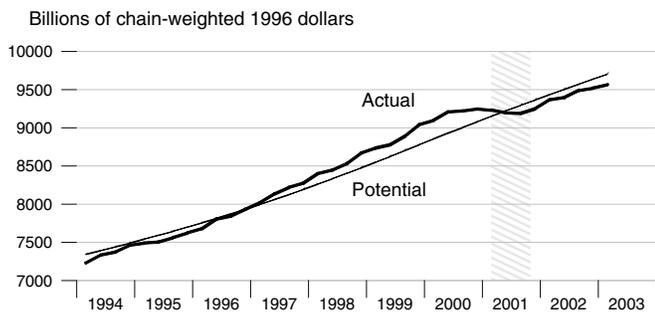
PCE Inflation and Projections

Percent change from year ago
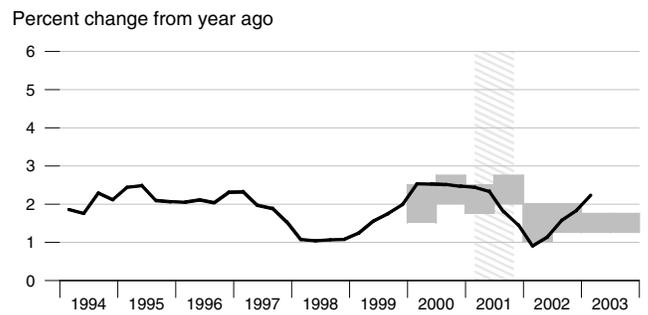
The shaded region shows the range of projections published in the Monetary Policy Report to Congress.

Monetary Base Growth* and Inflation Targets

Percent

Actual

Target Inflation Rates   0% 1% 2% 3% 4%
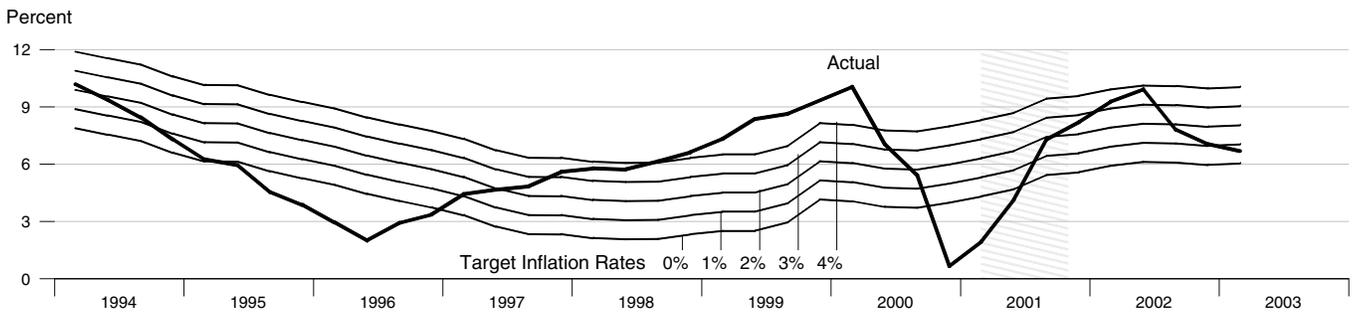
*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago. See notes on page 19.

Components of McCallum's Rule

Monetary Base Velocity Growth
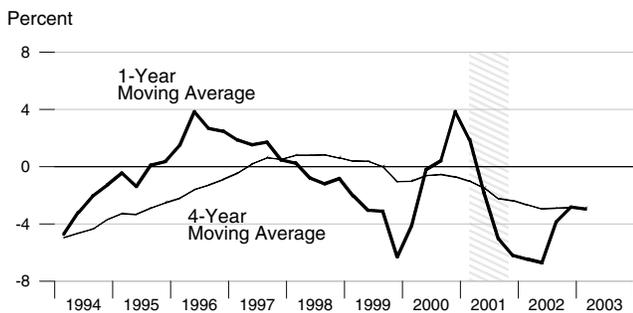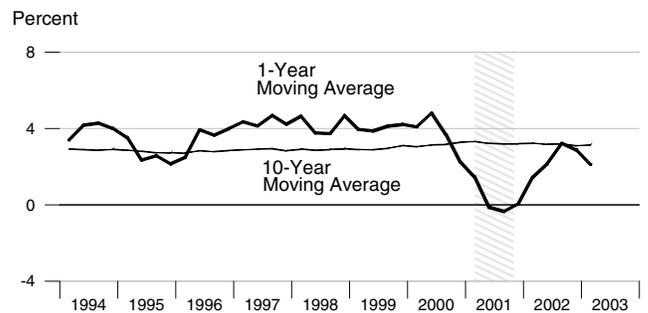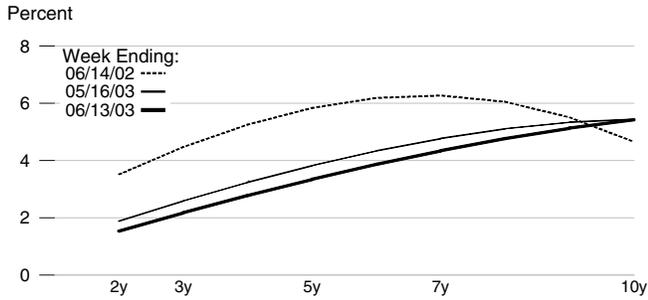
Percent

1-Year
Moving Average

4-Year
Moving Average

Real Output Growth

Percent

1-Year
Moving Average

10-Year
Moving Average

Implied One-Year Forward Rates

Percent

Week Ending:
06/14/02 ------
05/16/03 ——
06/13/03 ▬▬

Rates on 3-Month Eurodollar Futures

Percent, daily data

Jul 2003

Jun 2003

Aug 2003

Rates on Selected Federal Funds Futures Contracts

Percent, daily data

Jun 2003

Jul 2003

Aug 2003

Rates on Federal Funds Futures on Selected Dates

Percent

04/11/2003

05/16/2003

06/13/2003

Contract Month

Inflation-Indexed Treasury Bonds

Percent, weekly data

30-Year

10-Year

Inflation-Indexed Treasury Yield Spreads

Percent, weekly data

30-Year

10-Year

Inflation-Indexed 30-Year Government Bonds

Percent, weekly data

U.S.

Canada

U.K.

Inflation-Indexed 10-Year Government Bonds

Percent, weekly data

U.S.

U.K.
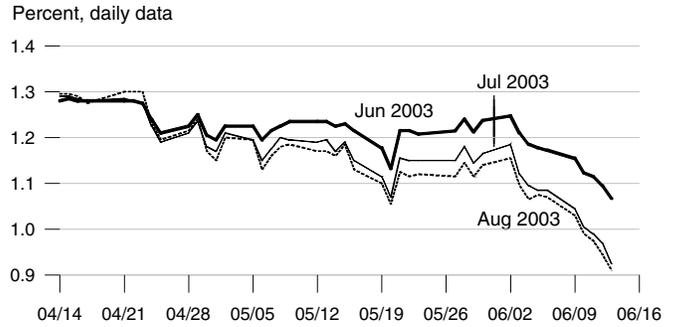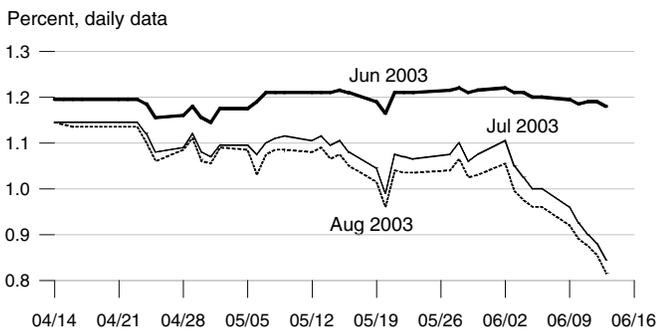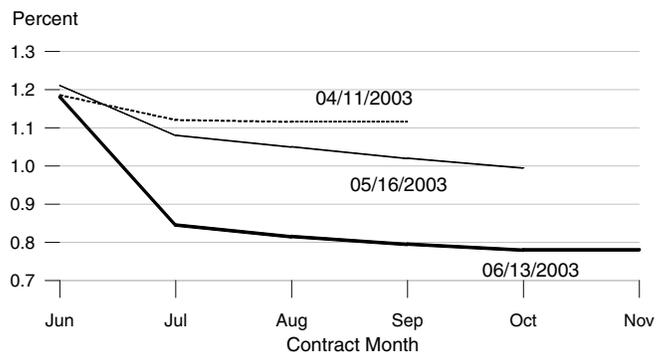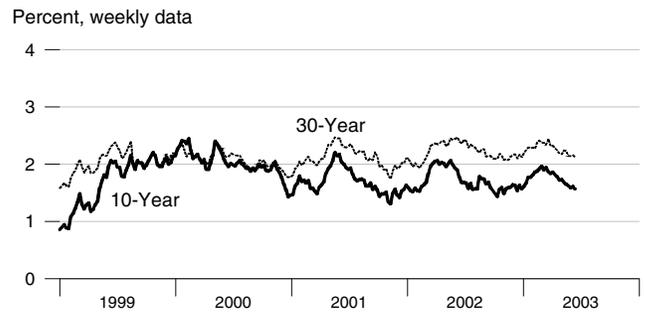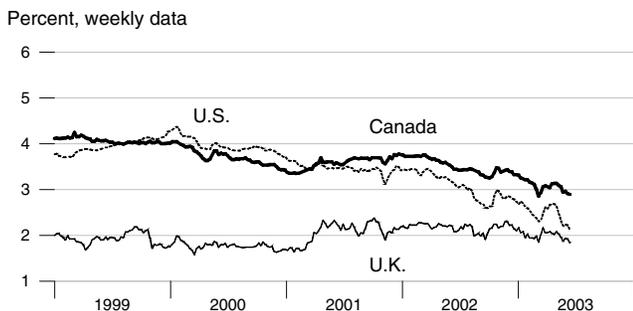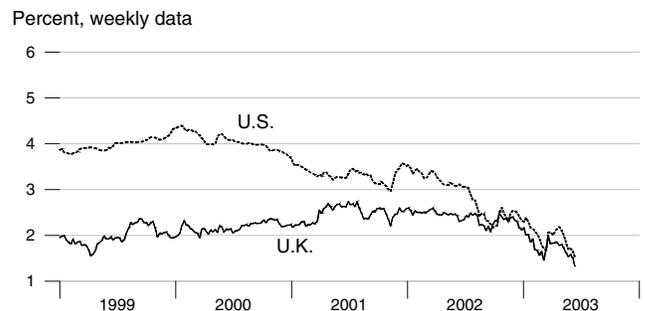
Velocity

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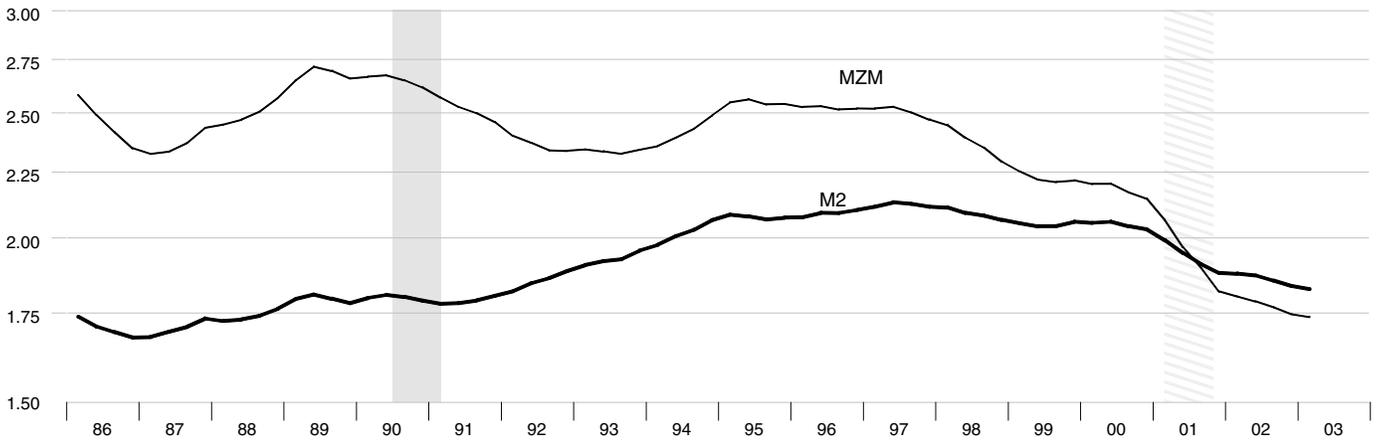
Interest Rates

Percent
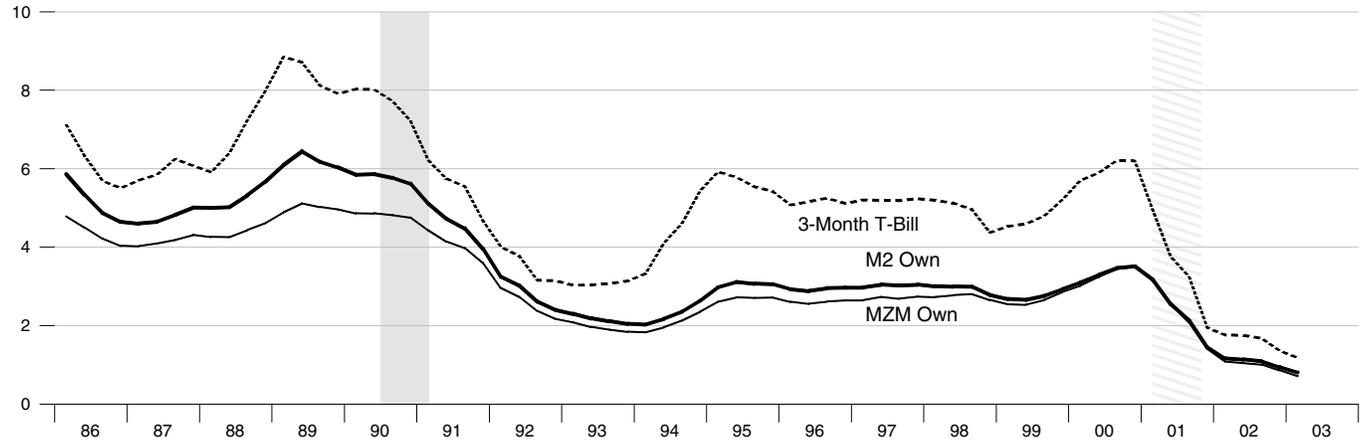
MZM Velocity and Interest Rate Spread
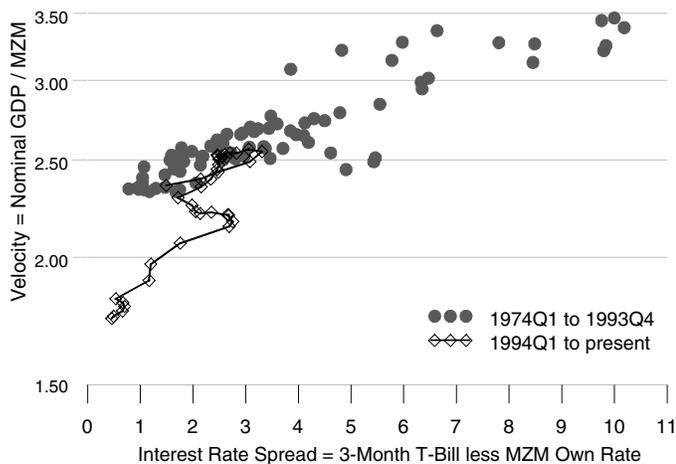
Ratio Scale

●●● 1974Q1 to 1993Q4
◇◇◇ 1994Q1 to present

Interest Rate Spread = 3-Month T-Bill less MZM Own Rate

M2 Velocity and Interest Rate Spread

Ratio Scale

●●● 1974Q1 to 1993Q4
◇◇◇ 1994Q1 to present

Interest Rate Spread = 3-Month T-Bill less M2 Own Rate
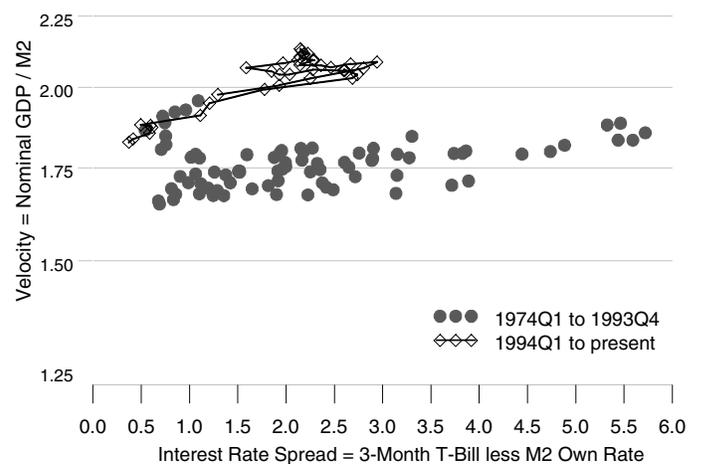
Gross Domestic Product

Percent change from year ago
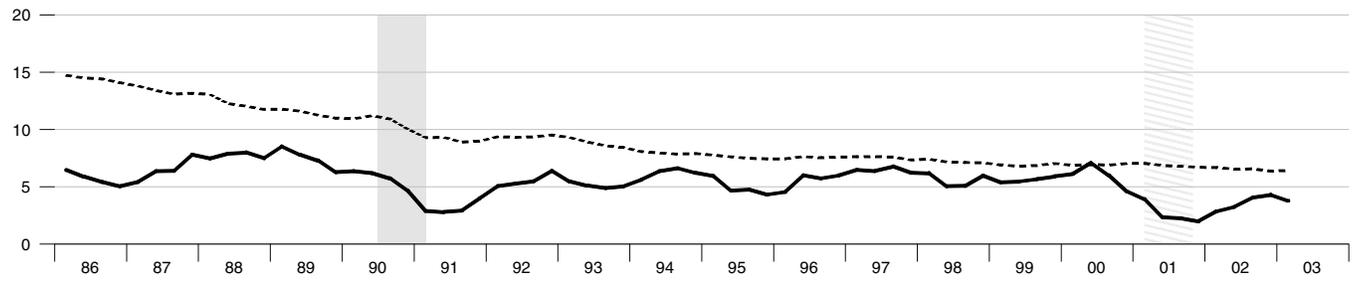
Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

Percent change from year ago
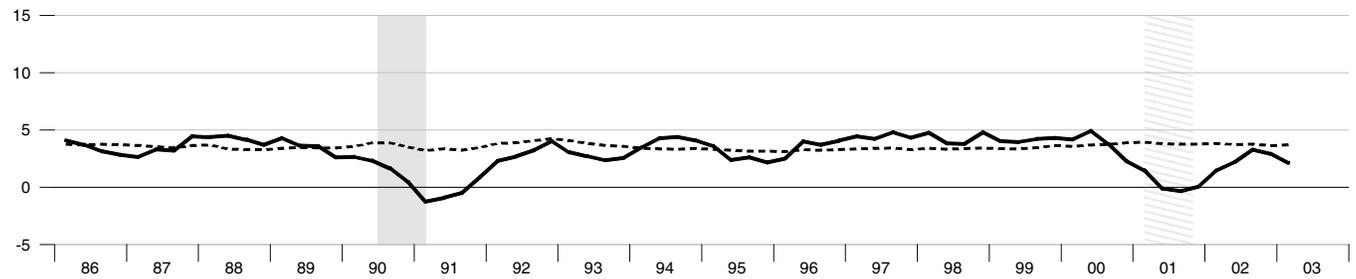
Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

Percent change from year ago
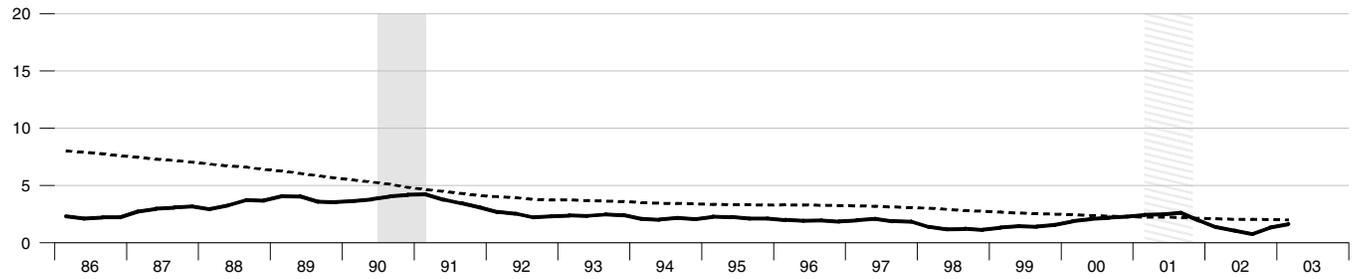
Dashed lines indicate 10-year moving averages.

M2

Percent change from year ago
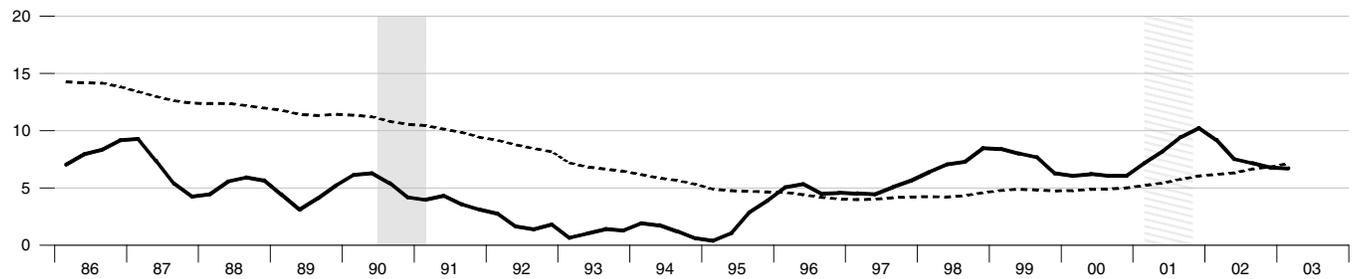
Dashed lines indicate 10-year moving averages.

Bank Credit

Percent change from year ago
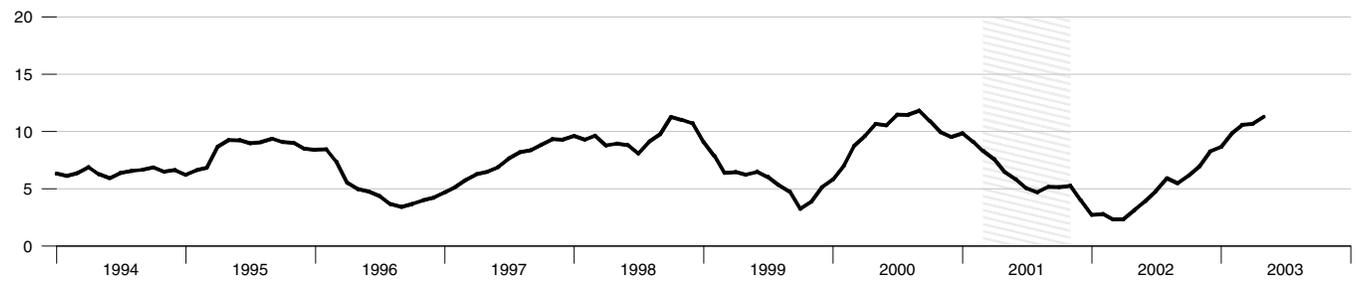
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago
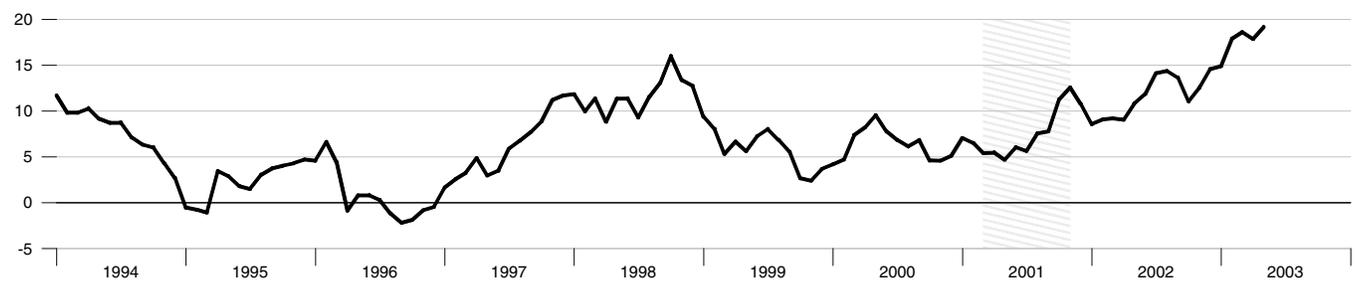
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago
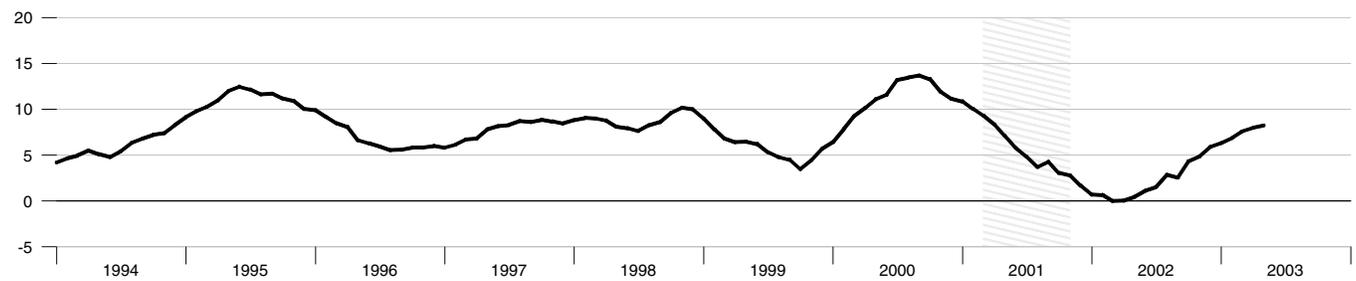
Commercial and Industrial Loans at Commercial Banks

Percent change from year ago
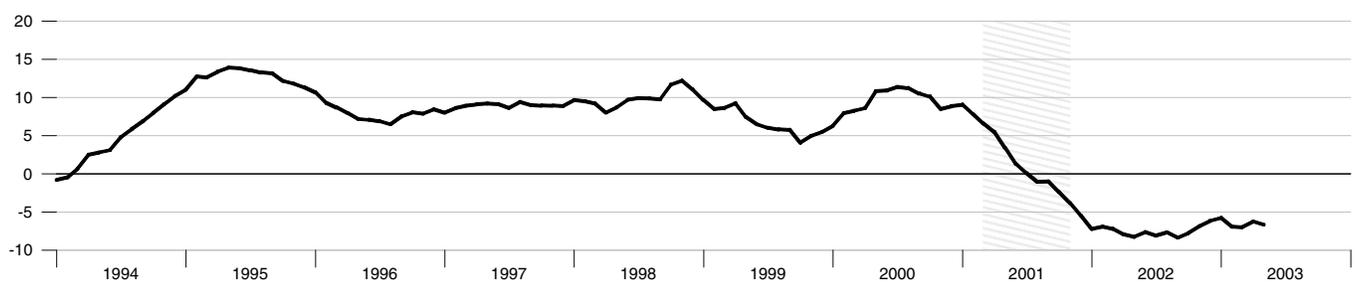
Standard & Poor's 500
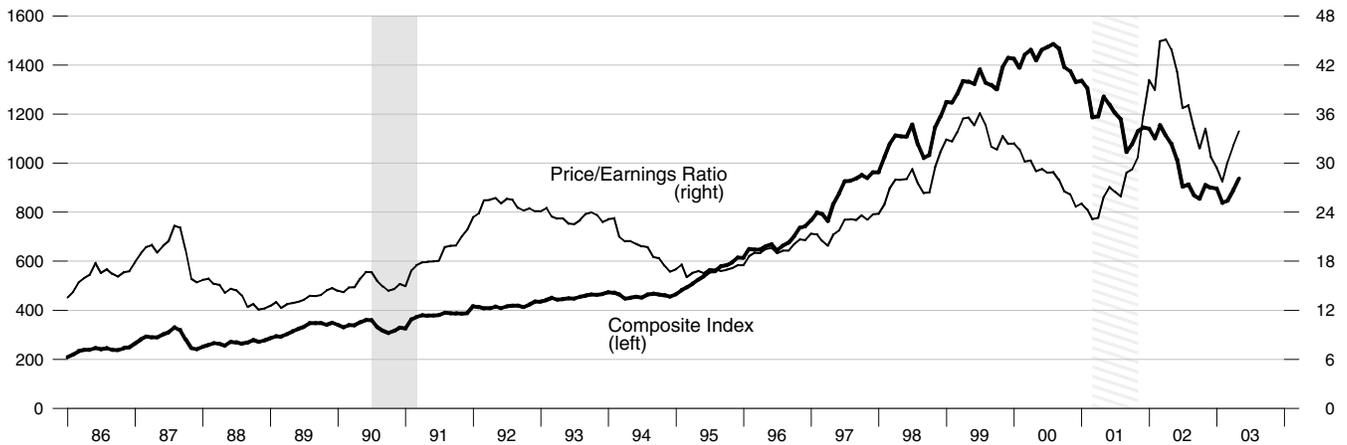
Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2002Q2	2002Q3	2002Q4	2003Q1	Feb03	Mar03	Apr03	May03
United States	1.24	1.58	2.25	2.87	3.90	3.81	3.96	3.57
Canada	1.33	2.33	3.79	4.47	4.93	5.13	4.90	4.50
France	1.63	1.75	2.14	2.38	4.33	4.55	4.49	.
Germany	1.20	1.14	1.20	1.17	3.95	4.00	4.15	3.82
Italy	2.27	2.41	2.77	2.72	4.16	4.18	4.31	.
Japan	-0.90	-0.87	-0.40	-0.23	0.72	0.64	0.59	0.50
United Kingdom	1.23	1.53	2.56	3.07	4.25	4.33	4.47	.

Inflation and Long-Term Interest Rate Differentials

Inflation differential = Foreign inflation less U.S. inflation
Long-term rate differential = Foreign rate less U.S. rate
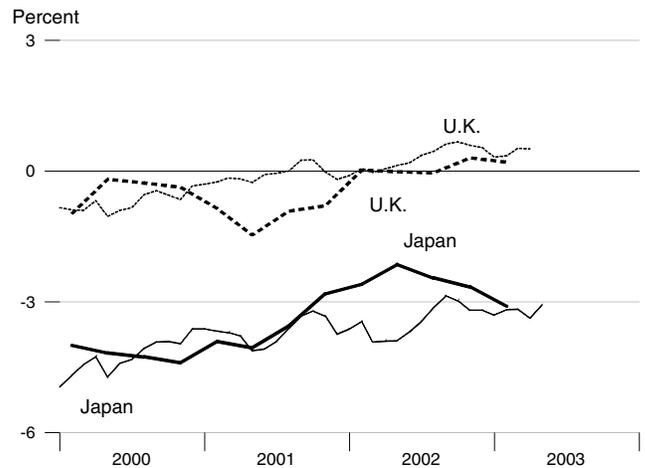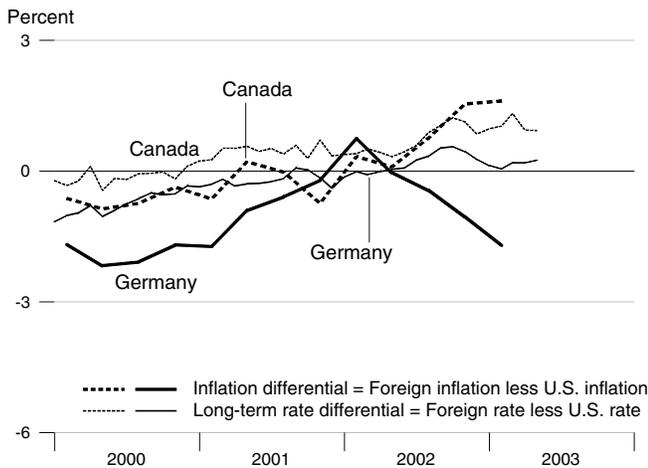
		Money Stock			Bank	Adjusted		
	M1	MZM	M2	M3	Credit	Monetary Base	Reserves	MSI M2
1998	1079.870	3709.460	4207.773	5749.669	4333.248	508.942	67.733	241.552
1999	1101.495	4170.041	4525.775	6252.402	4587.556	557.865	72.085	257.900
2000	1103.401	4507.616	4801.194	6841.028	5037.235	590.821	68.219	272.523
2001	1136.611	5218.970	5221.875	7620.986	5355.780	623.786	68.547	296.257
2002	1190.847	5886.690	5619.974	8228.836	5601.691	678.864	69.696	319.404
2001 1	1100.135	4855.412	5032.809	7275.901	5282.584	604.847	66.211	285.330
2	1116.115	5107.226	5160.071	7542.994	5323.924	610.937	64.799	292.817
3	1162.814	5327.136	5291.533	7725.814	5373.430	633.768	73.050	300.507
4	1167.377	5586.105	5403.087	7939.235	5443.181	645.591	70.129	306.373
2002 1	1184.001	5724.252	5494.745	8055.291	5421.276	663.330	69.963	311.597
2	1182.289	5810.577	5546.983	8135.540	5490.827	674.123	68.821	315.273
3	1191.288	5945.472	5669.515	8282.584	5663.883	684.782	69.004	322.303
4	1205.809	6066.458	5768.654	8441.928	5830.777	693.222	70.997	328.443
2003 1	1228.487	6161.437	5862.781	8549.966	5947.253	709.675	72.173	334.407
2001 May	1116.660	5100.917	5153.569	7540.286	5326.230	613.257	66.712	292.570
Jun	1125.834	5193.835	5198.157	7627.837	5328.540	613.757	64.744	295.000
Jul	1138.001	5247.612	5232.558	7666.166	5333.730	619.437	66.152	297.030
Aug	1149.222	5281.126	5265.733	7676.583	5355.717	627.452	65.870	299.260
Sep	1201.220	5452.671	5376.309	7834.693	5430.844	654.416	87.128	305.230
Oct	1163.909	5511.502	5362.212	7869.722	5426.103	644.247	72.545	304.240
Nov	1165.335	5585.291	5402.608	7943.632	5458.293	644.414	68.875	306.400
Dec	1172.887	5661.523	5444.441	8004.351	5445.147	648.113	68.968	308.480
2002 Jan	1179.038	5682.552	5468.550	8016.074	5418.916	655.865	70.181	310.000
Feb	1185.241	5737.216	5507.042	8067.957	5426.384	667.212	70.933	312.220
Mar	1187.723	5752.988	5508.642	8081.843	5418.528	666.914	68.774	312.570
Apr	1173.259	5751.100	5495.272	8083.512	5442.539	667.693	68.186	312.490
May	1183.978	5819.026	5557.797	8144.517	5492.631	676.063	70.143	315.750
Jun	1189.630	5861.606	5587.880	8178.592	5537.310	678.612	68.134	317.580
Jul	1196.528	5909.241	5635.710	8225.118	5590.026	682.347	68.443	320.080
Aug	1185.273	5951.275	5673.597	8290.939	5672.347	684.566	68.511	322.490
Sep	1192.062	5975.901	5699.238	8331.694	5729.275	687.433	70.059	324.340
Oct	1203.423	5978.262	5737.062	8342.288	5759.430	690.455	70.309	326.580
Nov	1202.943	6087.805	5776.906	8464.423	5837.995	693.678	70.963	328.870
Dec	1211.060	6133.307	5791.995	8519.073	5894.905	695.533	71.720	329.880
2003 Jan	1213.559	6131.844	5821.433	8515.742	5887.752	701.451	72.242	331.970
Feb	1233.845	6172.833	5876.072	8556.412	5961.938	713.738	73.137	335.140
Mar	1238.058	6179.635	5890.837	8577.744	5992.070	713.836	71.139	336.110
Apr	1238.520	6186.464	5913.944	8590.559	6024.291	714.713	70.862	337.950
May	1259.326	6261.315	6000.140	8683.309	6111.884	721.412	73.548	342.580

*All values are given in billions of dollars.

		Federal Funds	Discount Rate	Primary Credit Rate	Prime Rate	3-mo CDs	Treasury Yields			Corporate Aaa Bonds	S & L Aaa Bonds	Conventional Mortgage
							3-mo	3-yr	10-yr			
1998		5.35	4.92		8.35	5.47	4.91	5.14	5.26	6.53	4.93	6.94
1999		4.97	4.62		7.99	5.33	4.78	5.49	5.64	7.04	5.28	7.43
2000		6.24	5.73		9.23	6.46	6.00	6.22	6.03	7.62	5.58	8.06
2001		3.89	3.41		6.92	3.69	3.47	4.08	5.02	7.08	4.99	6.97
2002		1.67	1.17		4.68	1.73	1.63	3.10	4.61	6.49	4.87	6.54
2001	1	5.59	5.11		8.62	5.26	4.95	4.64	5.05	7.08	5.03	7.01
	2	4.33	3.83		7.34	4.10	3.75	4.43	5.27	7.22	5.11	7.13
	3	3.50	3.06		6.57	3.34	3.24	3.93	4.98	7.11	4.87	6.97
	4	2.13	1.64		5.16	2.06	1.94	3.33	4.77	6.92	4.97	6.78
2002	1	1.73	1.25		4.75	1.82	1.76	3.75	5.08	6.62	5.02	6.97
	2	1.75	1.25		4.75	1.83	1.75	3.77	5.10	6.71	5.01	6.81
	3	1.74	1.25		4.75	1.76	1.67	2.62	4.26	6.35	4.72	6.29
	4	1.44	0.94		4.45	1.49	1.36	2.27	4.01	6.28	4.71	6.08
2003	1	1.25		2.25	4.25	1.26	1.18	2.07	3.92	6.00	4.60	5.83
2001	May	4.21	3.73		7.24	4.02	3.70	4.51	5.39	7.29	5.15	7.15
	Jun	3.97	3.47		6.98	3.74	3.57	4.35	5.28	7.18	5.03	7.16
	Jul	3.77	3.25		6.75	3.66	3.59	4.31	5.24	7.13	4.79	7.13
	Aug	3.65	3.16		6.67	3.48	3.44	4.04	4.97	7.02	4.89	6.95
	Sep	3.07	2.77		6.28	2.87	2.69	3.45	4.73	7.17	4.93	6.82
	Oct	2.49	2.02		5.53	2.31	2.20	3.14	4.57	7.03	4.89	6.62
	Nov	2.09	1.58		5.10	2.03	1.91	3.22	4.65	6.97	4.85	6.66
	Dec	1.82	1.33		4.84	1.83	1.72	3.62	5.09	6.77	5.18	7.07
2002	Jan	1.73	1.25		4.75	1.74	1.68	3.56	5.04	6.55	5.05	7.00
	Feb	1.74	1.25		4.75	1.82	1.76	3.55	4.91	6.51	4.93	6.89
	Mar	1.73	1.25		4.75	1.91	1.83	4.14	5.28	6.81	5.09	7.01
	Apr	1.75	1.25		4.75	1.87	1.75	4.01	5.21	6.76	5.09	6.99
	May	1.75	1.25		4.75	1.82	1.76	3.80	5.16	6.75	5.03	6.81
	Jun	1.75	1.25		4.75	1.81	1.73	3.49	4.93	6.63	4.92	6.65
	Jul	1.73	1.25		4.75	1.79	1.71	3.01	4.65	6.53	4.81	6.49
	Aug	1.74	1.25		4.75	1.73	1.65	2.52	4.26	6.37	4.78	6.29
	Sep	1.75	1.25		4.75	1.76	1.66	2.32	3.87	6.15	4.58	6.09
	Oct	1.75	1.25		4.75	1.73	1.61	2.25	3.94	6.32	4.66	6.11
	Nov	1.34	0.83		4.35	1.39	1.25	2.32	4.05	6.31	4.77	6.07
	Dec	1.24	0.75		4.25	1.34	1.21	2.23	4.03	6.21	4.70	6.05
2003	Jan	1.24			4.25	1.29	1.19	2.18	4.05	6.17	4.72	5.92
	Feb	1.26		2.25	4.25	1.27	1.19	2.05	3.90	5.95	4.57	5.84
	Mar	1.25		2.25	4.25	1.23	1.15	1.98	3.81	5.89	4.51	5.75
	Apr	1.26		2.25	4.25	1.24	1.15	2.06	3.96	5.74	4.60	5.81
	May	1.26		2.25	4.25	1.22	1.09	1.75	3.57	5.22	4.16	5.48

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

		M1	MZM	M2	M3
Percent change at an annual rate					
	1998	0.99	11.67	7.29	10.36
	1999	2.00	12.42	7.56	8.74
	2000	0.17	8.10	6.09	9.41
	2001	3.01	15.78	8.76	11.40
	2002	4.77	12.79	7.62	7.98
2001	1	2.71	18.61	10.65	13.24
	2	5.81	20.75	10.11	14.68
	3	16.74	17.22	10.19	9.69
	4	1.57	19.45	8.43	11.05
2002	1	5.70	9.89	6.79	5.85
	2	-0.58	6.03	3.80	3.98
	3	3.04	9.29	8.84	7.23
	4	4.88	8.14	6.99	7.70
2003	1	7.52	6.26	6.53	5.12

		M1	MZM	M2	M3
2001	May	11.73	17.66	5.87	12.78
	Jun	9.86	21.86	10.38	13.93
	Jul	12.97	12.42	7.94	6.03
	Aug	11.83	7.66	7.61	1.63
	Sep	54.30	38.98	25.20	24.72
	Oct	-37.27	12.95	-3.15	5.37
	Nov	1.47	16.07	9.04	11.27
	Dec	7.78	16.38	9.29	9.17
2002	Jan	6.29	4.46	5.31	1.76
	Feb	6.31	11.54	8.45	7.77
	Mar	2.51	3.30	0.35	2.07
	Apr	-14.61	-0.39	-2.91	0.25
	May	10.96	14.17	13.65	9.06
	Jun	5.73	8.78	6.50	5.02
	Jul	6.96	9.75	10.27	6.83
	Aug	-11.29	8.54	8.07	9.60
	Sep	6.87	4.97	5.42	5.90
	Oct	11.44	0.47	7.96	1.53
	Nov	-0.48	21.99	8.33	17.57
	Dec	8.10	8.97	3.13	7.75
2003	Jan	2.48	-0.29	6.10	-0.47
	Feb	20.06	8.02	11.26	5.73
	Mar	4.10	1.32	3.02	2.99
	Apr	0.45	1.33	4.71	1.79
	May	20.16	14.52	17.49	12.96

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: M2 minus small-denomination time deposits, plus institutional money market mutual funds. The label MZM was coined by William Poole (1991) for this aggregate, proposed earlier by Motley (1988).

M2: M1 plus savings deposits (including money market deposit accounts) and small-denomination (less than $100,000) time deposits issued by financial institutions; and shares in retail money market mutual funds (funds with initial investments of less than $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, 1996b, 2001).

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 series, a 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).

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; additional data are available 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 *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: **MZM**, or "Money, Zero Maturity," includes the zero maturity, or immediately available, components of M3. MZM equals M2 minus small-denomination time deposits, plus institutional money market mutual funds (that is, the money market mutual funds included in M3 but excluded from M2). 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 Department 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/ fred/data/wkly.html. See also *Federal Reserve Bulletin*, table 1.35. The 30-year constant maturity series was discontinued by the Treasury Department 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 *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 Humphrey-Hawkins Act testimony each year. Beginning February 2000, the FOMC began using the personal consumption expenditures (PCE) price index to report its inflation range and therefore is not 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 $((y_t - y_{t-40})/40) \times 4 \times 100$, where y_t is the log of real GDP. The four-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 available 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 $m = 1,..., 10$ 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 Bonds** are yields on the most recently issued inflation-indexed securities of 10- and 30-year original maturities. **Inflation-Indexed Treasury Yield Spreads** equal, for 10- and 30-year maturities, the difference between the yields on the most recently issued inflation-indexed securities and the unadjusted bond yields of similar maturity. **Inflation-Indexed 30-Year Government Bonds** shows the yield of an inflation-indexed bond that is scheduled to mature in approximately (but not greater than) 30 years. The current bond for Canada has a maturity date of 12/01/2031, the current U.K. bond has a maturity date of 7/22/2030, and the current U.S. bond has a maturity date of 4/15/2032. **Inflation-Indexed 10-Year Government Bonds** shows the yield of an inflation-indexed bond that is scheduled to mature in approximately (but not greater than) 10 years. The current U.K. bond has a maturity date of 8/23/2011 and the current U.S. bond has a maturity date of 7/15/2012.

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 1996 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 1996 dollars.

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

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

Bank of Canada
   Canadian inflation-linked bond yields.

Bank of England
   U.K. inflation-linked bond 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. inflation-indexed 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, pp. 51-72.

____ , 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: Articles from this Bank's *Review* are available on the Internet at research.stlouisfed.org/publications/review/.