Monetary Trends

April 2003

THE FEDERAL RESERVE BANK of ST. LOUIS

Symmetric Inflation Risk

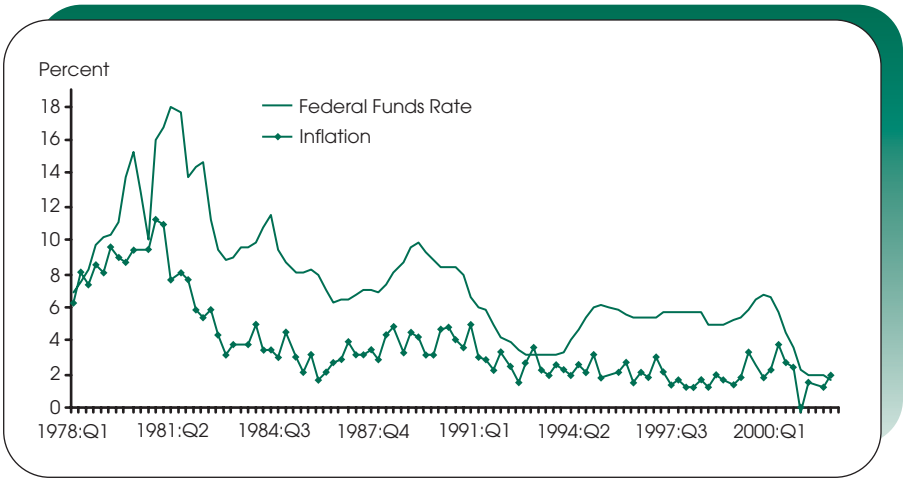
It is generally presumed that a reduction in the inflation rate, i.e., disinflation, is beneficial to the economy because high inflation raises the cost of holding money, increases the frequency of costly price changes, and lowers the value of nominal incomes. Disinflation can impose costs, however, and outright deflation—a sustained fall in the general price level—can be disastrous. A decrease in inflation causes real interest rates to rise, which can dissuade firms from committing to long-term investment spending and lead to lower output growth, which, in turn, can put further downward pressure on prices. Unanticipated disinflation is costly to bearers of long-term debt who, when borrowing, forecast higher inflation rates. These costs are incurred because disinflation increases the value of the dollars that borrowers must pay back relative to what borrowers had expected.

Policymakers all over the world have judged that the benefits of lower inflation outweigh the costs of a decline in the inflation rate when the rate is high. However, once price stability has been achieved—when the inflation rate is near zero—continued disinflation will result in deflation and impose significant costs on the economy. Recent experience in Japan (as well as historical experiences in the United States and elsewhere) illustrate the problems that can arise from sustained deflation. When inflation was low in Japan during the late 1970s and 1980s, output growth was smooth. The persistent deflation since the 1990s (Japan's average inflation rate between 1993 and 2002 was –0.2 percent) has been combined with slow growth and volatile fluctuations in output.

The figure shows the rise and fall in U.S. inflation and interest (federal funds) rates since 1978. Economic theory tells us that there is a one-to-one positive relationship between the inflation rate and the nominal interest rate. During the period 1978 through 1986, for example, the average inflation rate (measured by the GDP deflator) was 5.7 percent. Over that same period, the federal funds rate averaged 10.6 percent. Recently, however, the inflation rate and the federal funds rate have been considerably lower. Between 1995 and 2002, the average inflation rate was only 1.8 percent while the federal funds rate was 4.8 percent.

The current economic environment in the United States is one of low inflation and inconsistent output growth. To stimulate output growth, the FOMC has cut the federal funds rate to a historically low level. In the past, when inflation was high, such an expansionary monetary policy would have focused attention on the risk of an increase in inflation. Disinflation would not have been viewed as a potential problem. Yet, today's low inflation rate has some different implications for policy. With the inflation rate as low as it is now, the risk of sustained deflation cannot be discounted, especially because disinflation now would yield little offsetting benefit. In this environment of near price stability, inflation risks are symmetric—one must be wary not only of shocks that lead to inflation, but also of events that could create deflation.

—Abbigail J. Chiodo and Michael T. Owyang



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

Available on the web at research.stlouisfed.org

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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:

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Effective January 9, 2003, the Board of Governors of the Federal Reserve System established primary and secondary credit programs, which replace adjustment and extended credit programs. The primary credit rate is reported on pages 3, 9, and 17. For further information, please refer to <http://www.frbdiscountwindow.org/>.
Beginning this issue, the over-10-year government bond for Canada reported on page 15 is replaced with the 10-year government bond.

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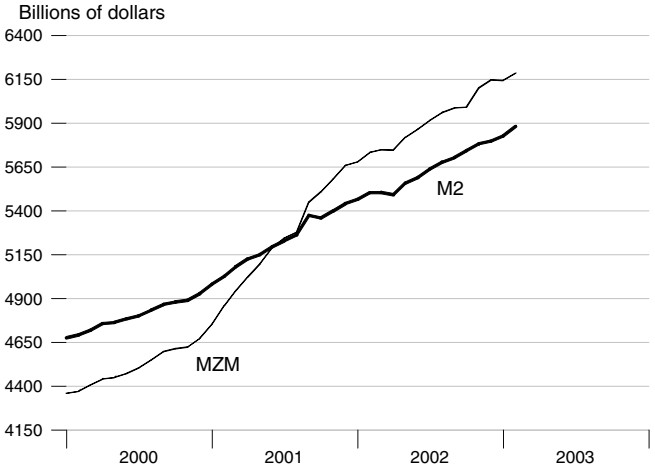
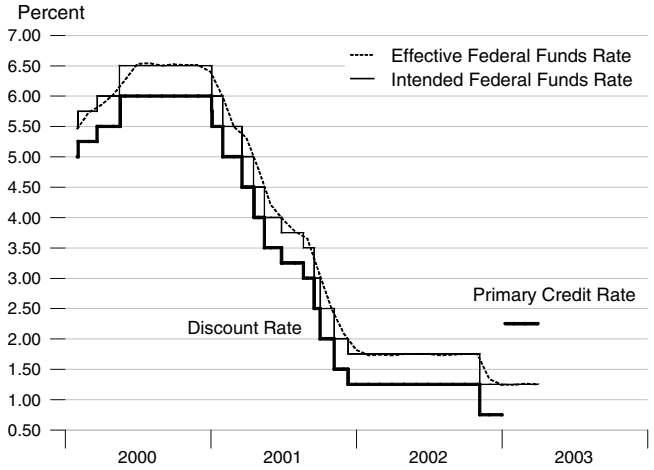
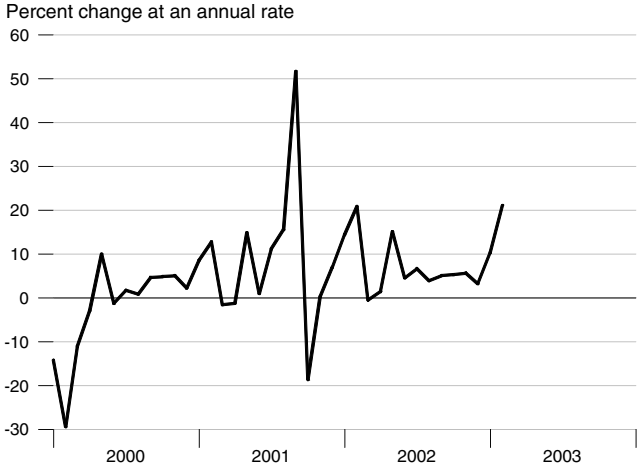
M2 and MZM



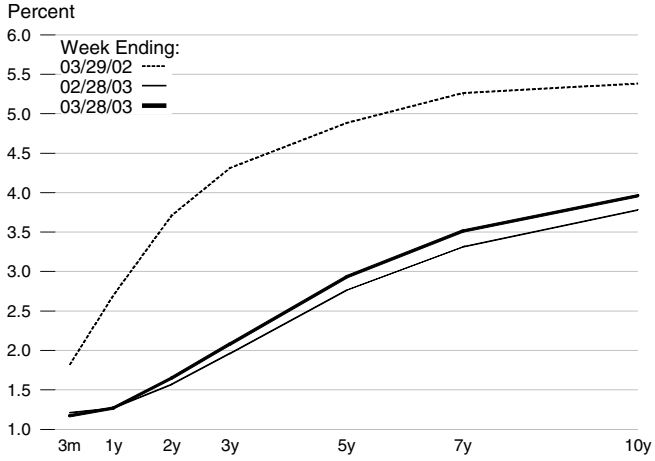
Reserve Market Rates



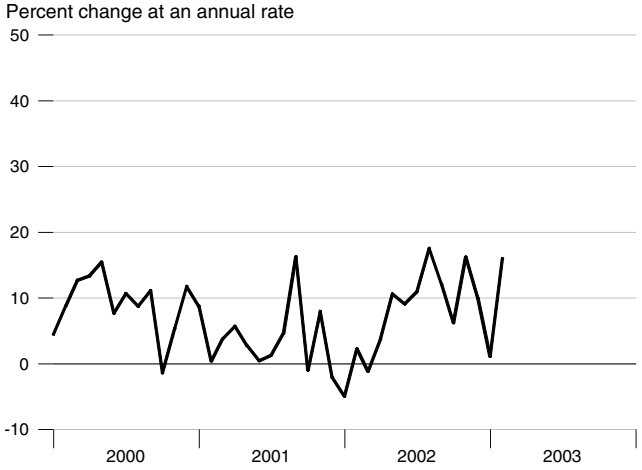
Adjusted Monetary Base



Treasury Yield Curve



Total Bank Credit



Interest Rates

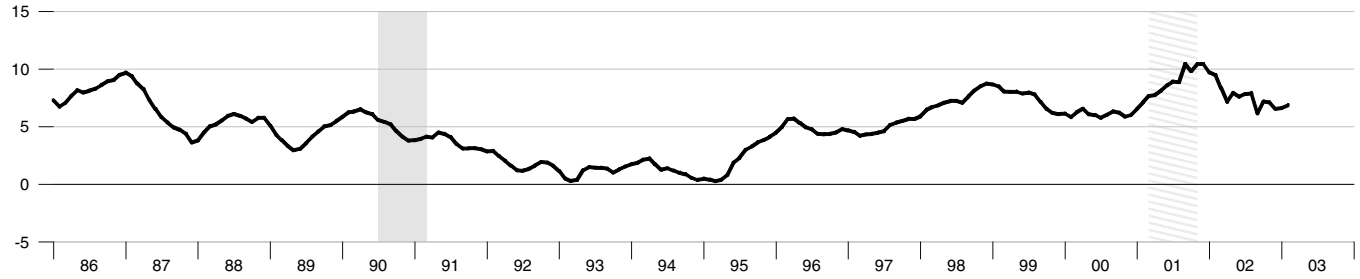
	Jan 03	Feb 03	Mar 03
Federal Funds Rate	1.24	1.26	1.25
Prime Rate	4.25	4.25	4.25
Primary Credit Rate		2.25	2.25
Conventional Mortgage Rate	5.92	5.84	5.75
Treasury Yields:			
3-Month Constant Maturity	1.19	1.19	1.15
6-Month Constant Maturity	1.22	1.20	1.16
1-Year Constant Maturity	1.36	1.30	1.24
3-Year Constant Maturity	2.18	2.05	1.98
5-Year Constant Maturity	3.05	2.90	2.78
10-Year Constant Maturity	4.05	3.90	3.81

MZM and M1

Percent change from year ago

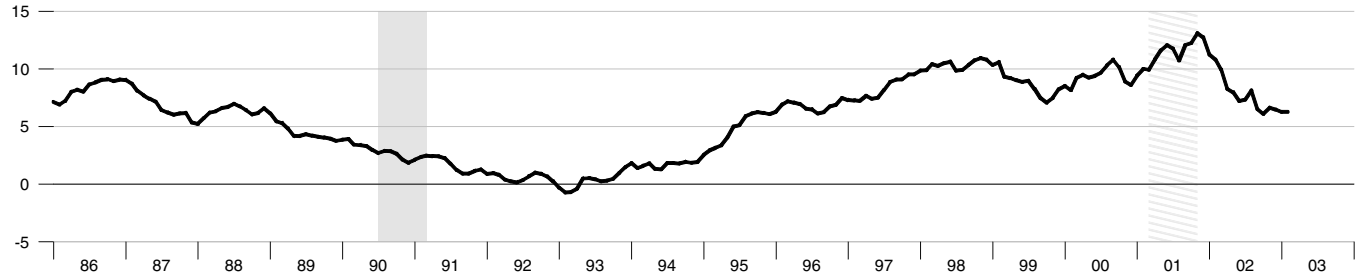
M2

Percent change from year ago



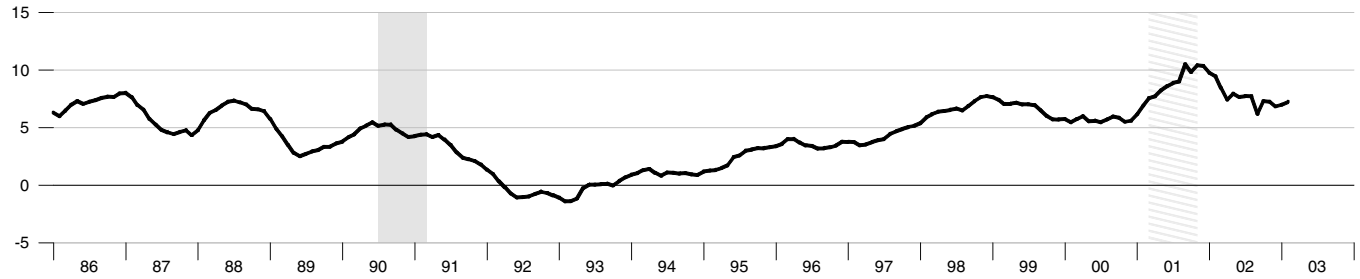
M3

Percent change from year ago



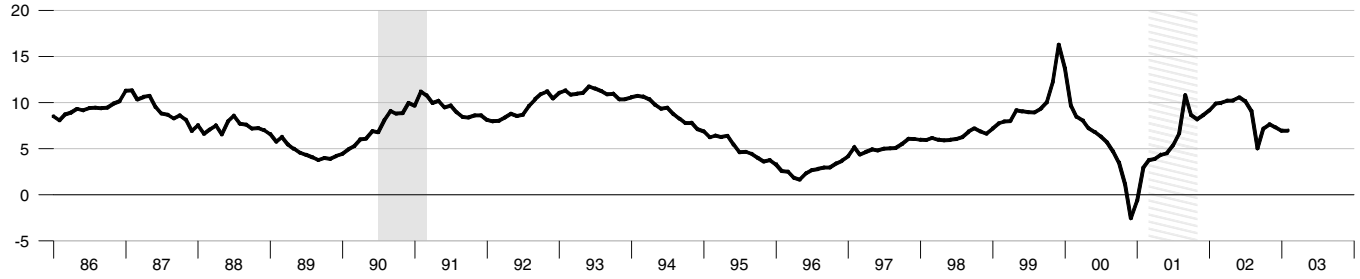
Monetary Services Index - M2

Percent change from year ago



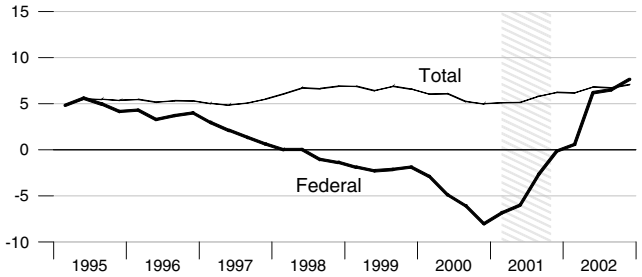
Adjusted Monetary Base

Percent change from year ago



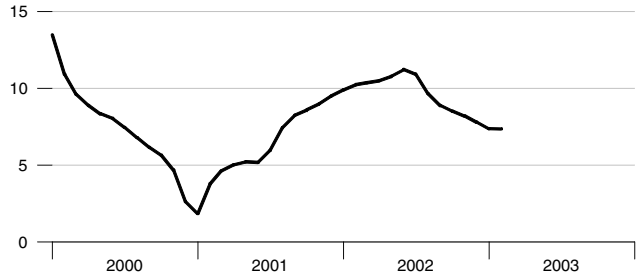
Domestic Nonfinancial Debt

Percent change from year ago



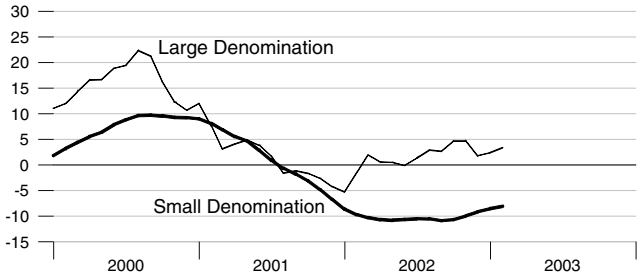
Currency Held by the Nonbank Public

Percent change from year ago



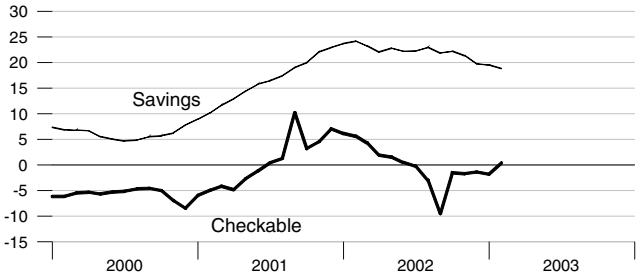
Time Deposits

Percent change from year ago



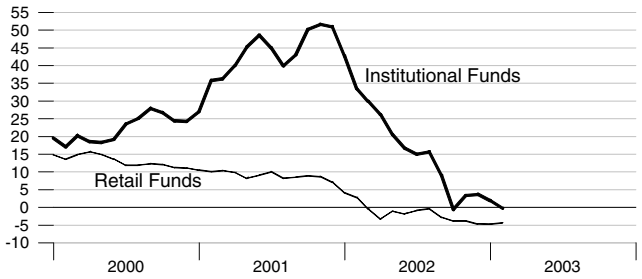
Checkable and Savings Deposits

Percent change from year ago



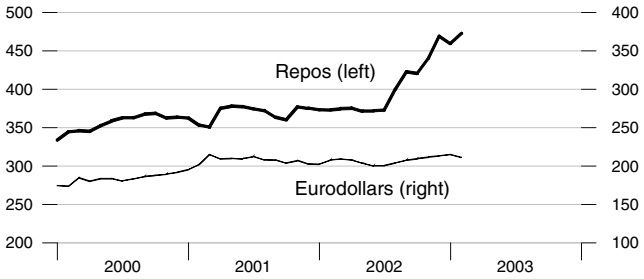
Money Market Mutual Fund Shares

Percent change from year ago



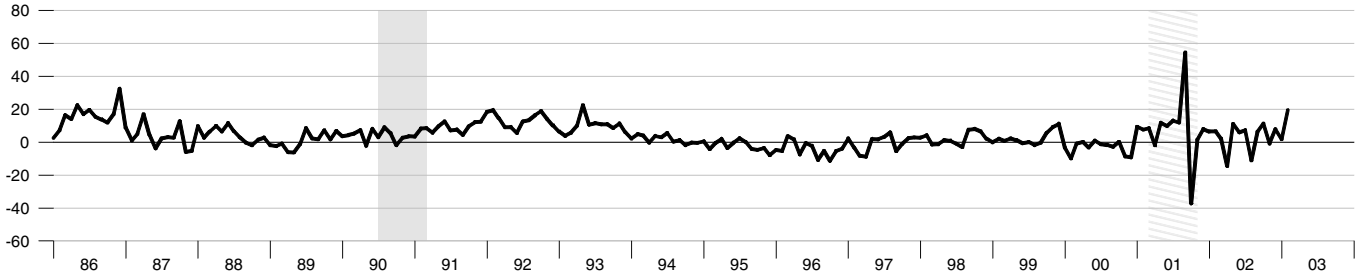
Repurchase Agements and Eurodollars

Billions of dollars | Billions of dollars



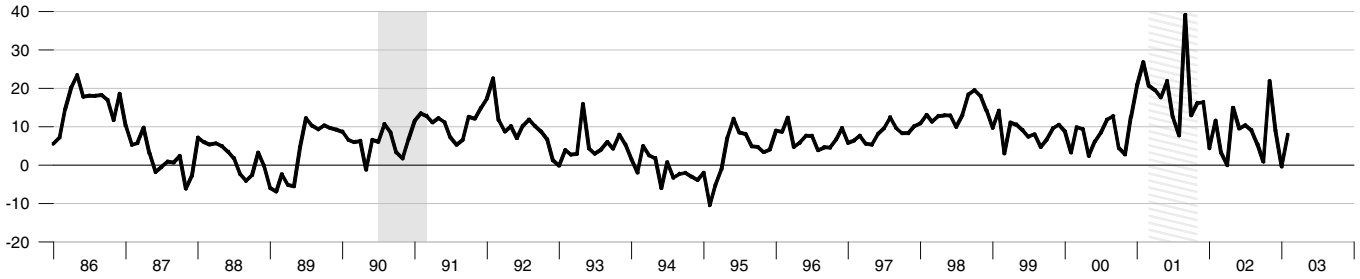
M1

Percent change at an annual rate



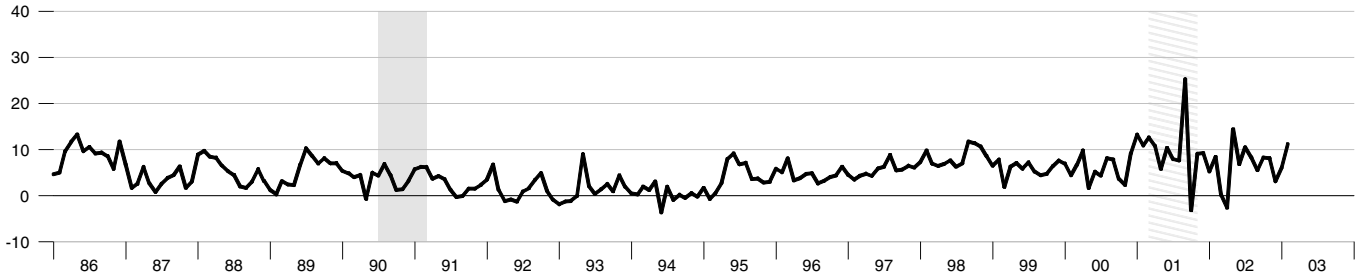
MZM

Percent change at an annual rate



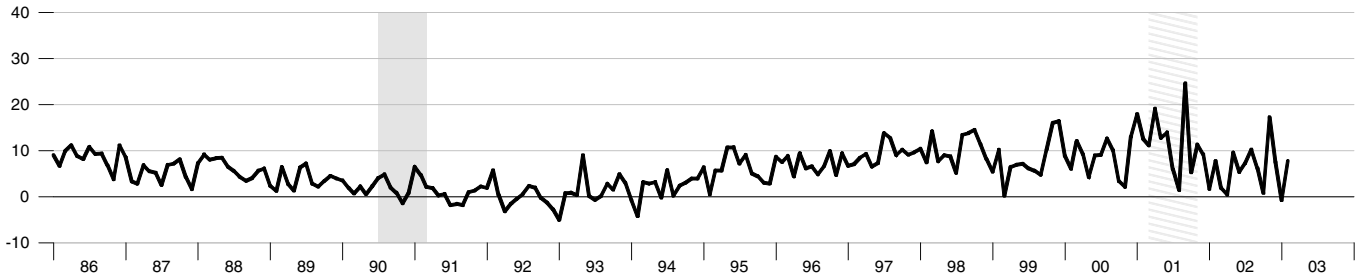
M2

Percent change at an annual rate



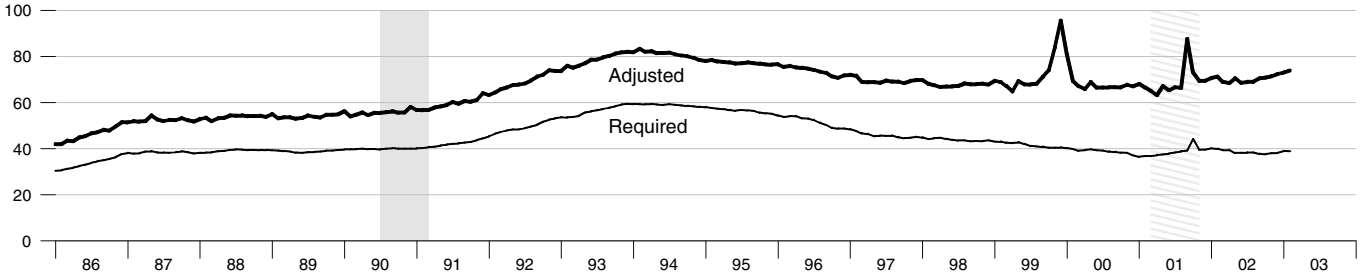
M3

Percent change at an annual rate



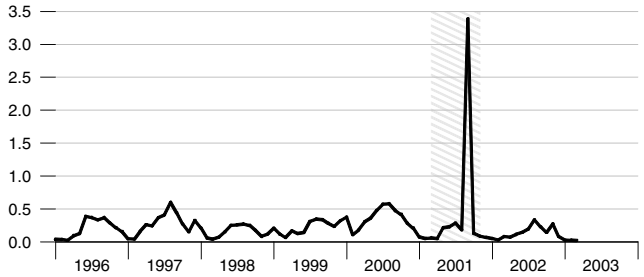
Adjusted and Required Reserves

Billions of dollars



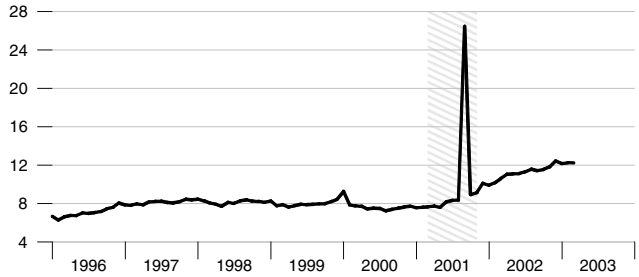
Total Borrowings, nsa

Billions of dollars



Excess Reserves plus RCB Contracts

Billions of dollars

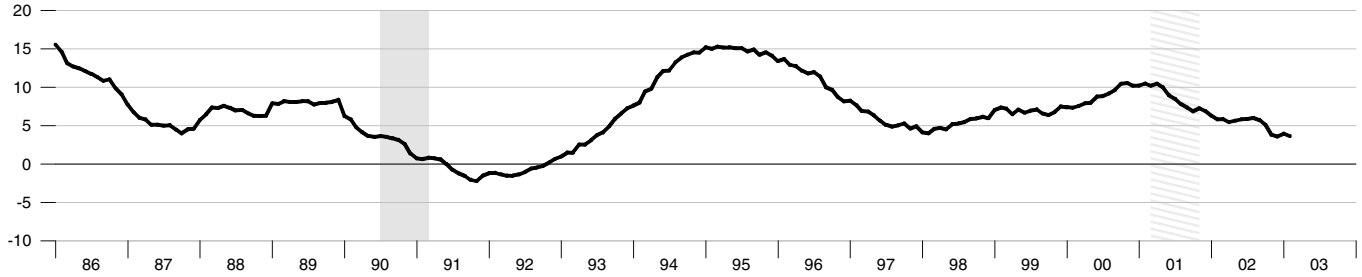


Nonfinancial Commercial Paper

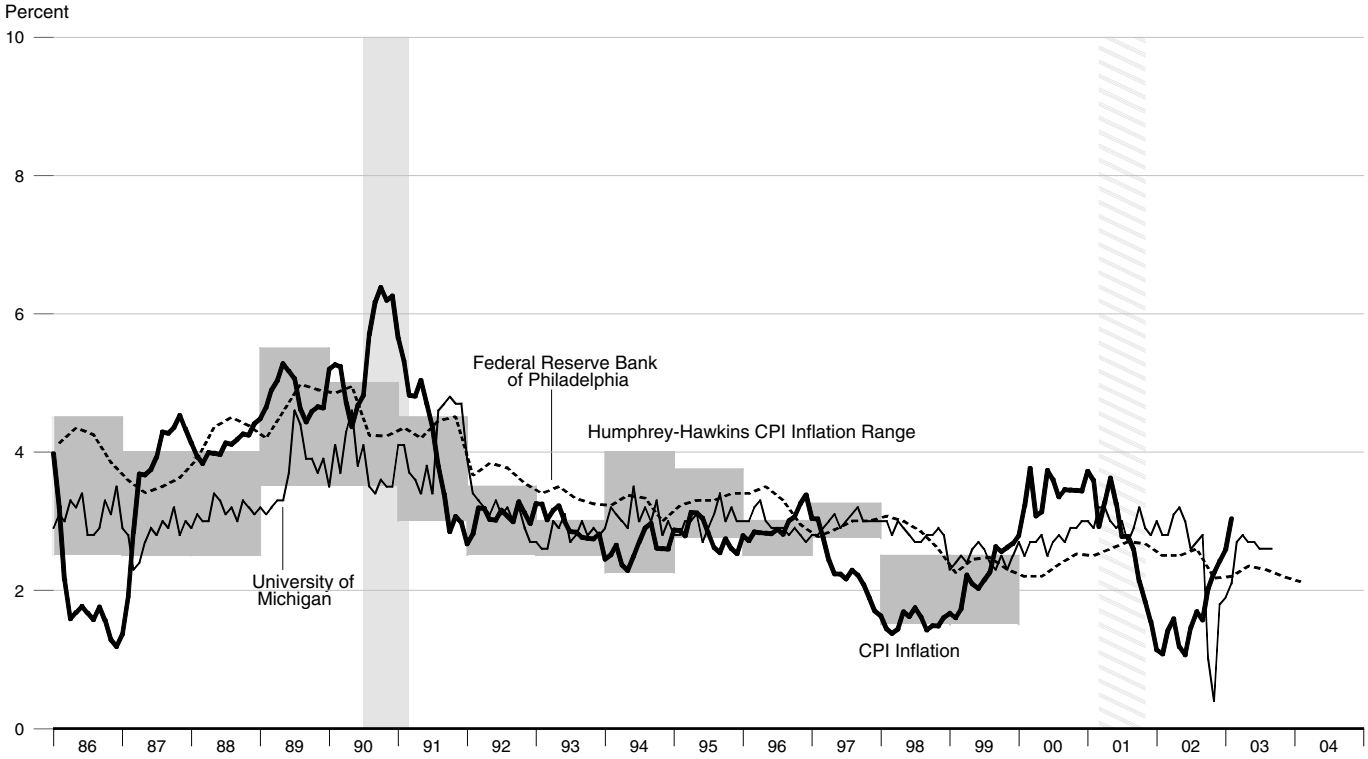
Percent change from year ago

Consumer Credit

Percent change from year ago

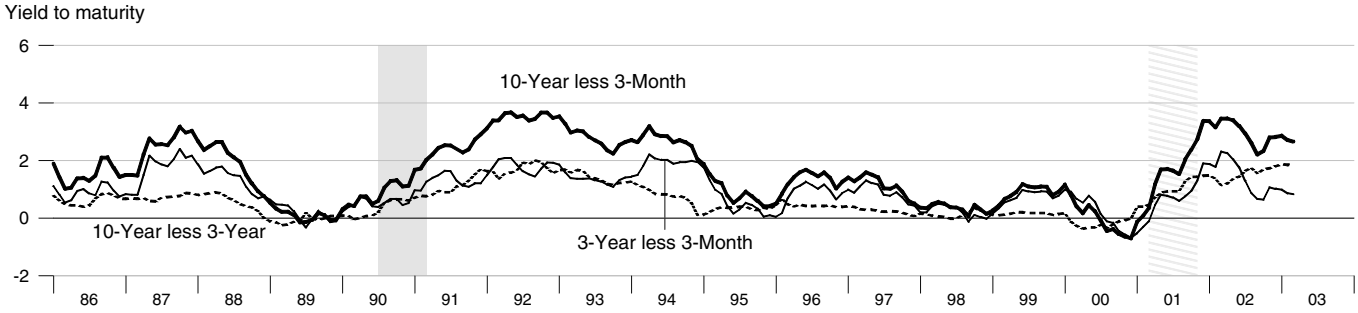


Inflation and Inflation Expectations

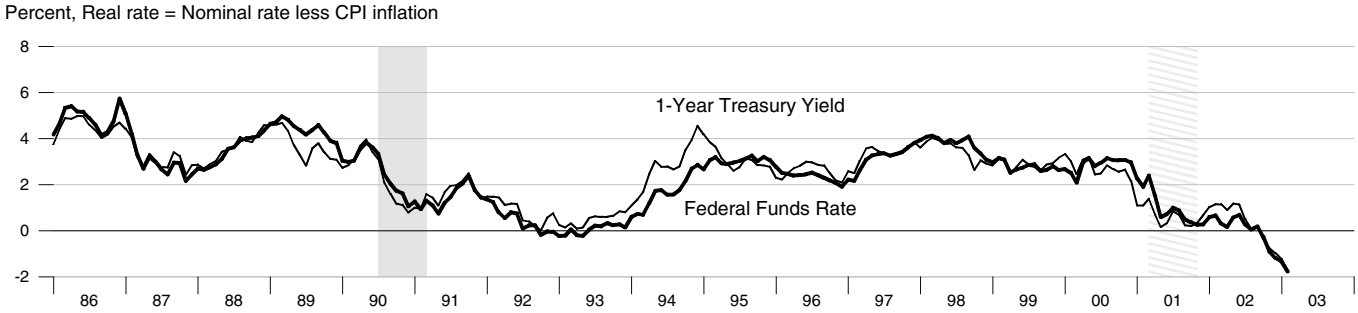


The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph. See notes on page 19.

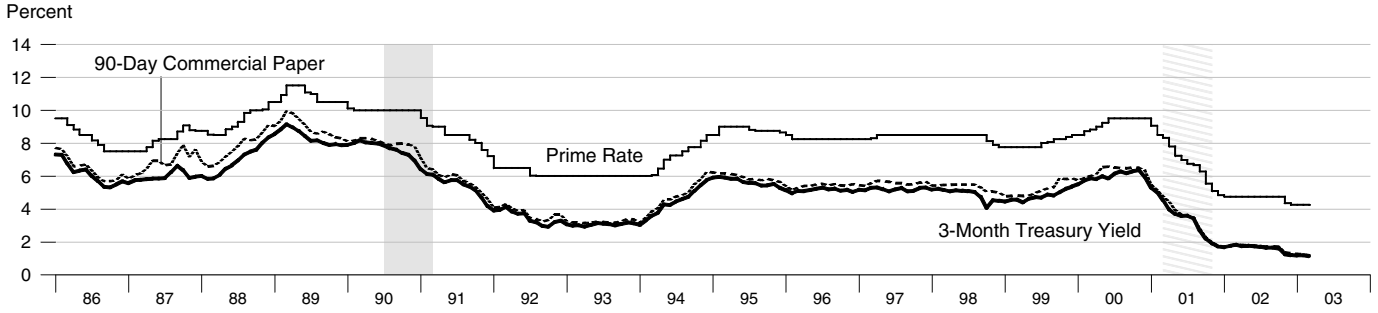
Treasury Security Yield Spreads



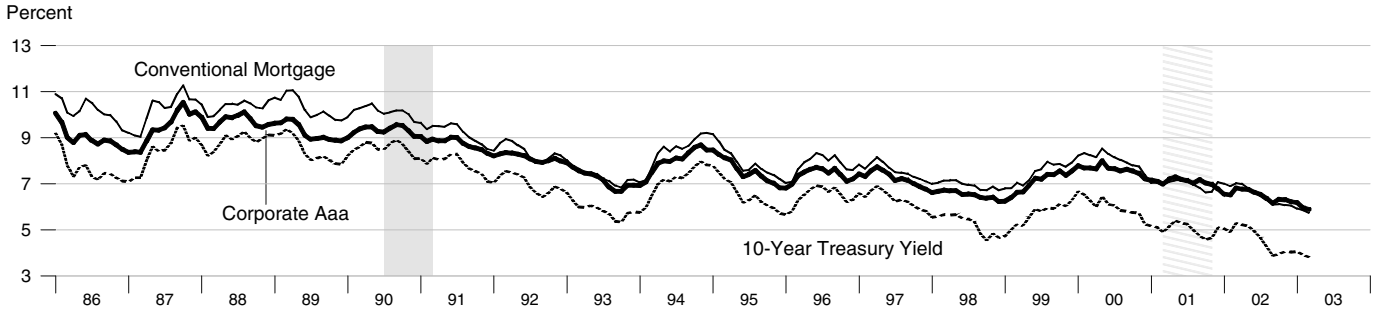
Real Interest Rates



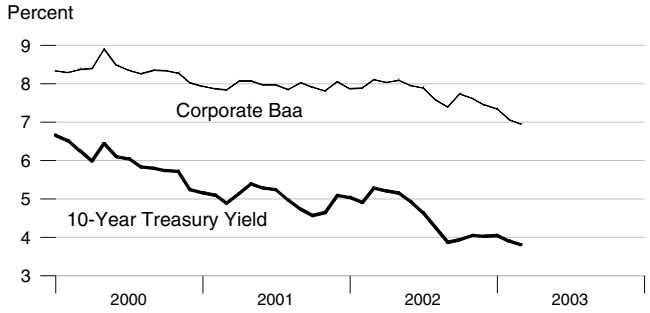
Short-Term Interest Rates



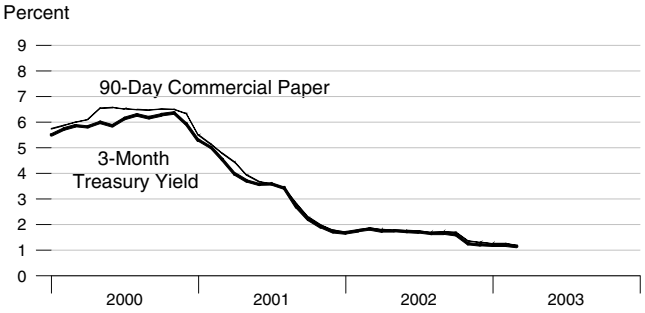
Long-Term Interest Rates



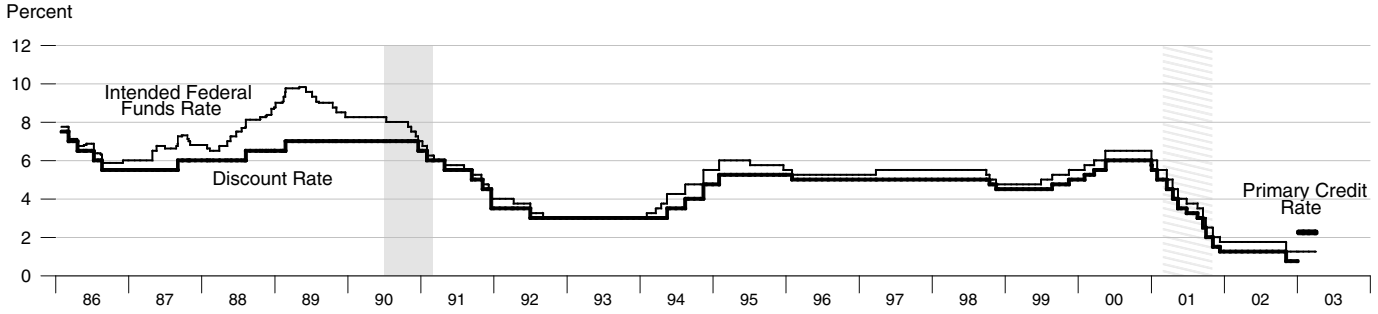
Long-Term Interest Rates



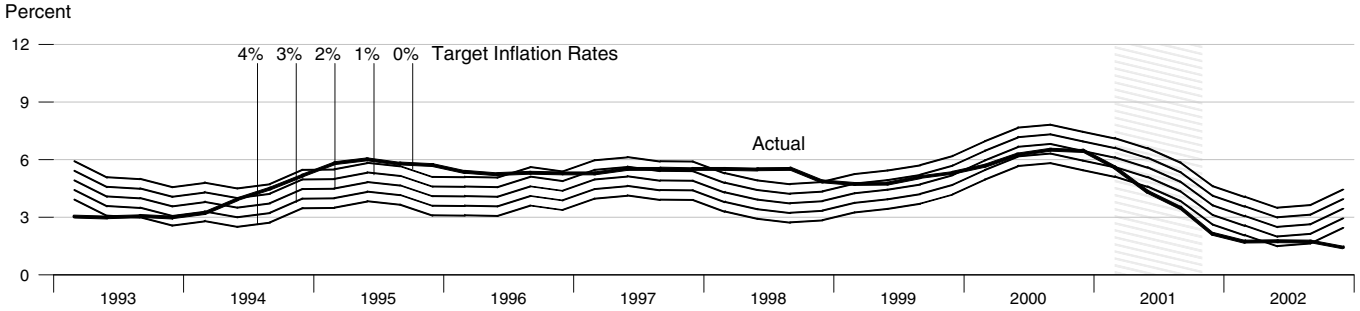
Short-Term Interest Rates



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



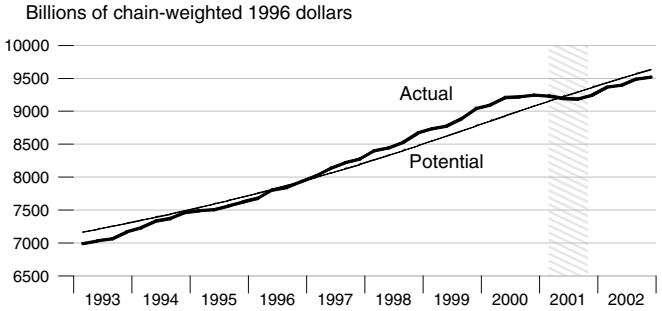
Federal Funds Rate and Inflation Targets



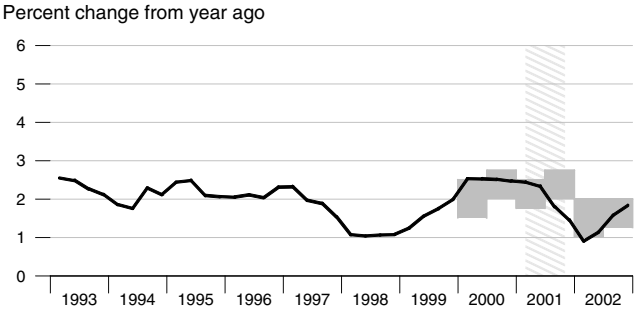
Calculated federal funds rate is based on Taylor's rule.

Components of Taylor's Rule

Actual and Potential Real GDP

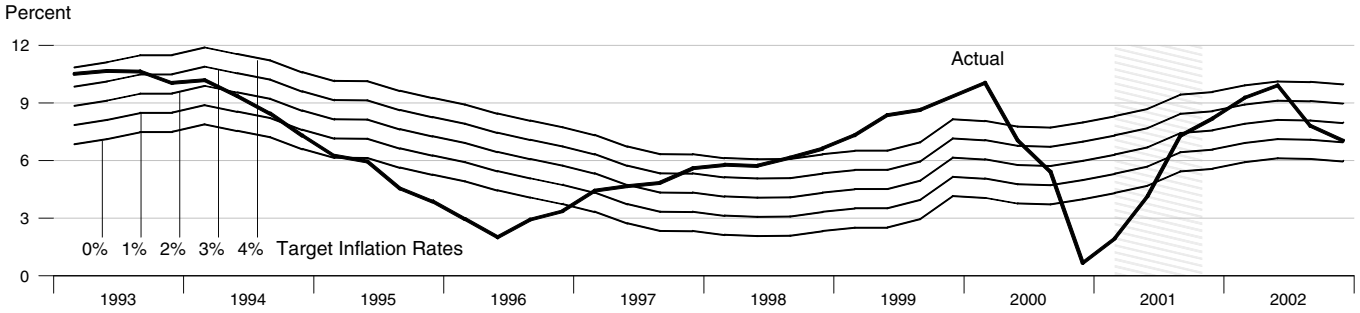


PCE Inflation and Projections



The shaded region shows the range of projections published in the Monetary Policy Report to Congress.

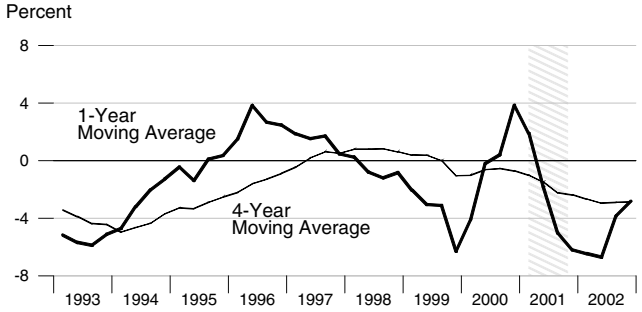
Monetary Base Growth* and Inflation Targets



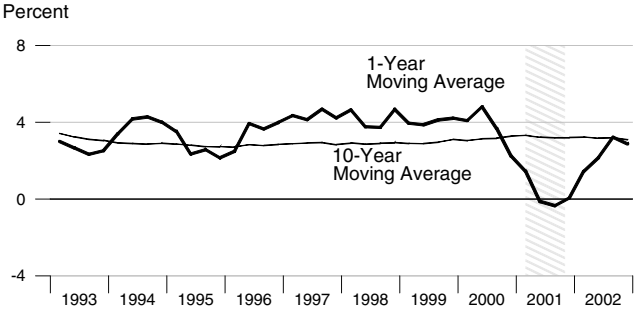
*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago.

Components of McCallum's Rule

Monetary Base Velocity Growth

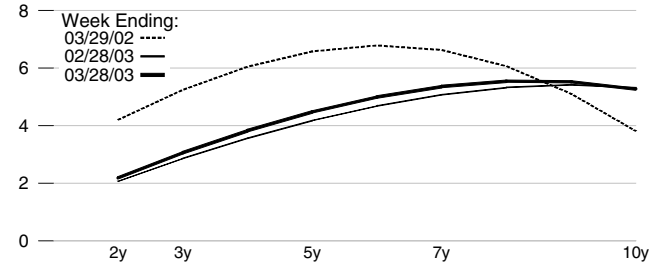


Real Output Growth



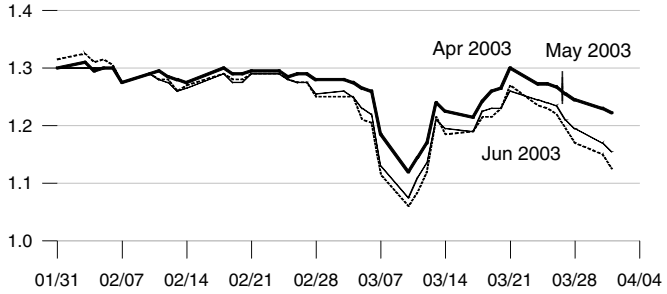
Implied One-Year Forward Rates

Percent



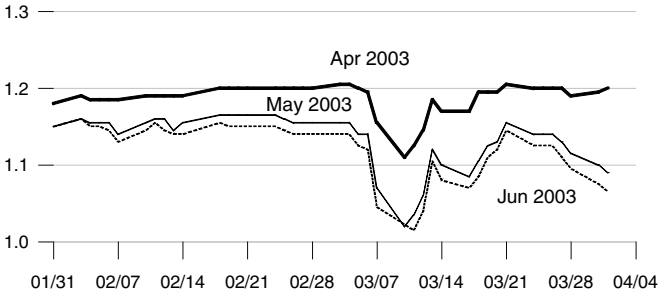
Rates on 3-Month Eurodollar Futures

Percent, daily data



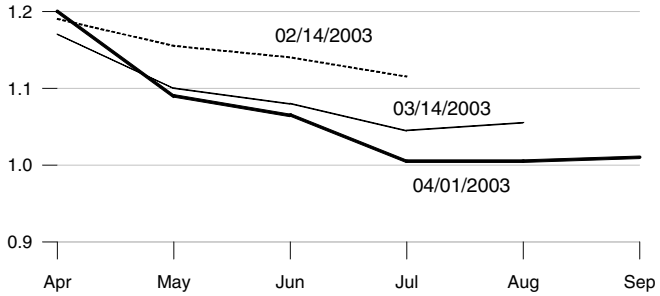
Rates on Selected Fed Funds Futures Contracts

Percent, daily data



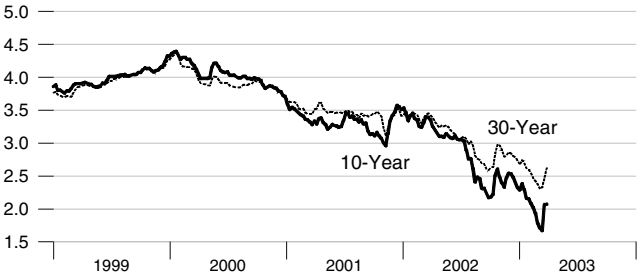
Implied Yields on Fed Funds Futures

Percent



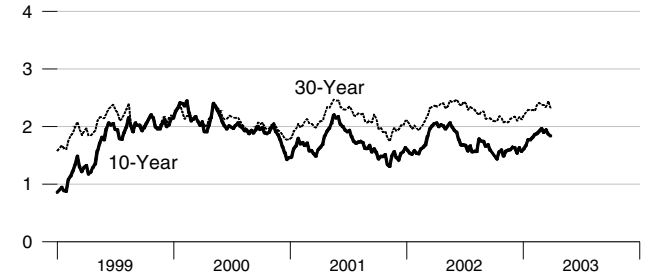
Inflation-Protected Treasury Yields

Percent, weekly data



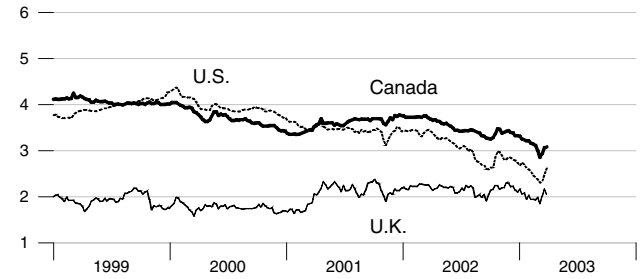
Inflation-Protected Treasury Yield Spreads

Percent, weekly data



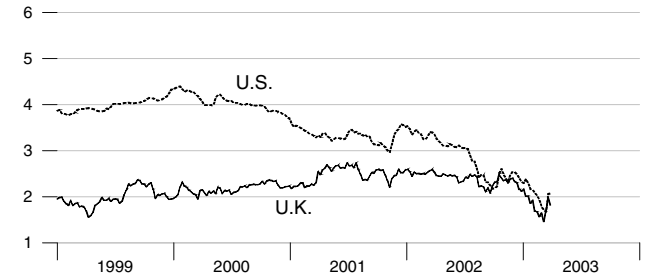
Inflation-Indexed 30-Year Bonds

Percent, weekly data

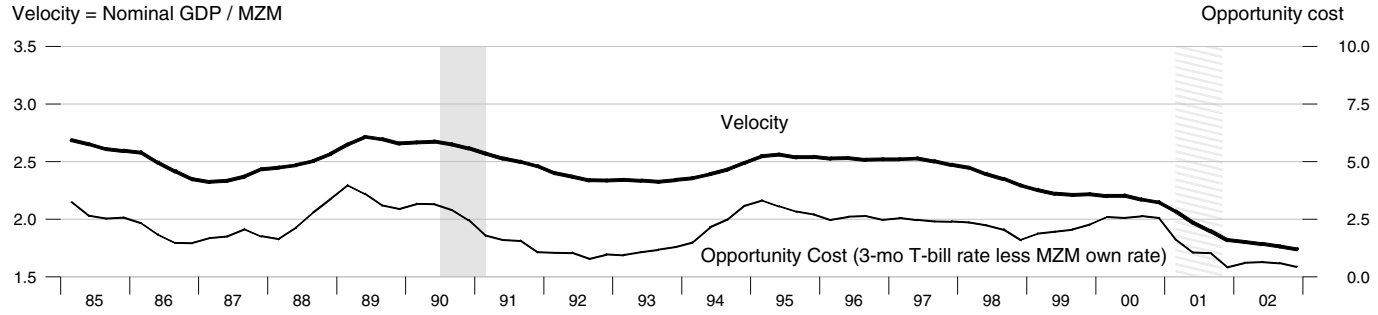


Inflation-Indexed 10-Year Bonds

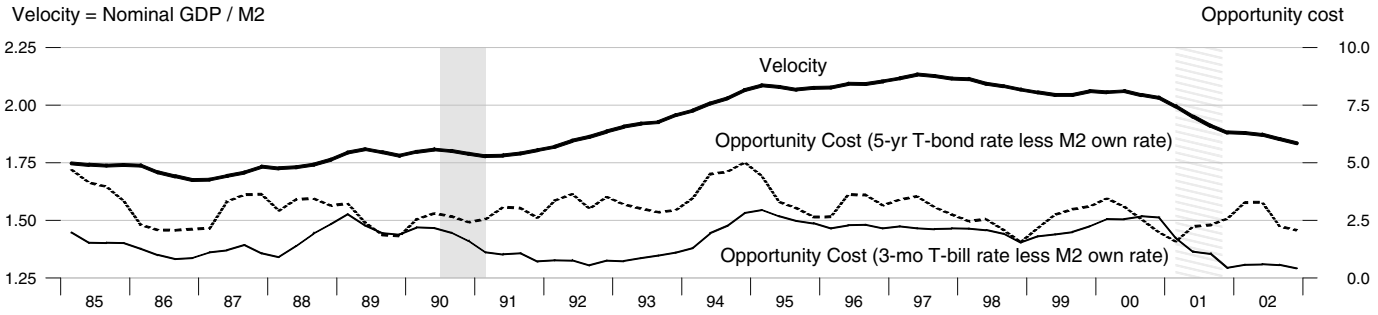
Percent, weekly data



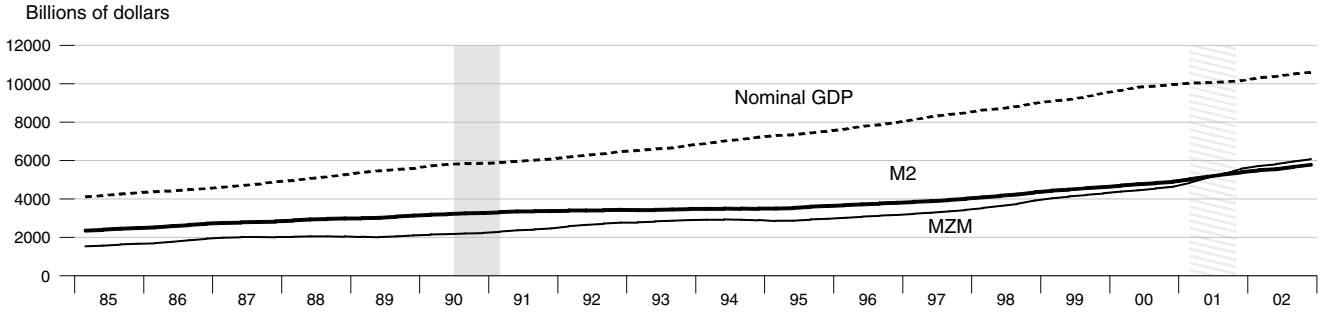
MZM Velocity and Opportunity Cost



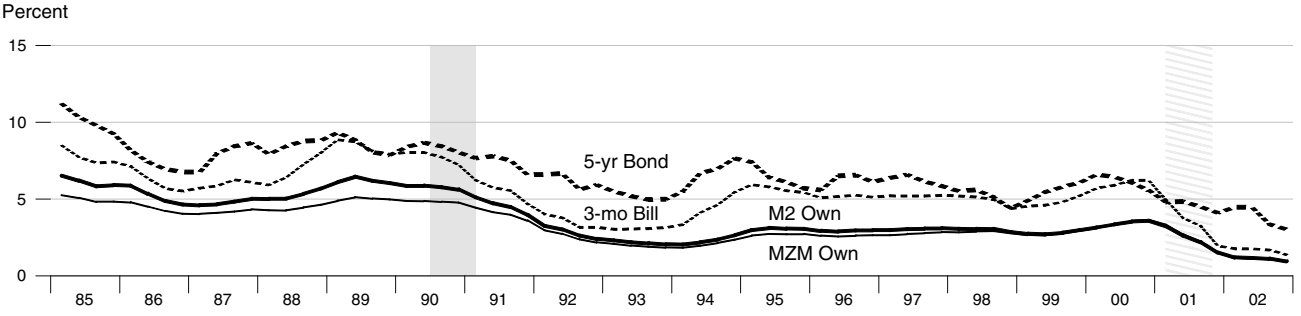
M2 Velocity and Opportunity Cost



M2, MZM, and Nominal GDP

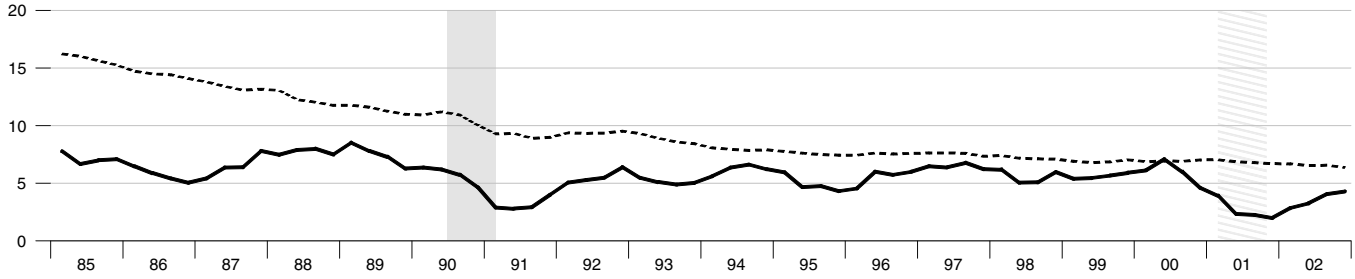


Interest Rates



Gross Domestic Product

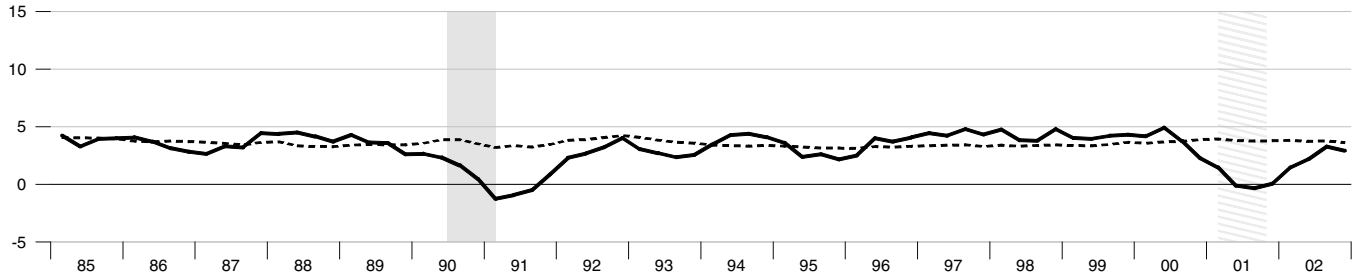
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

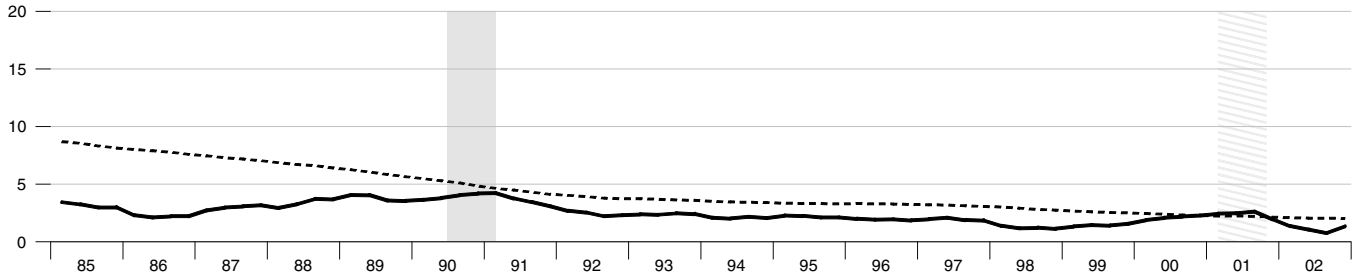
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

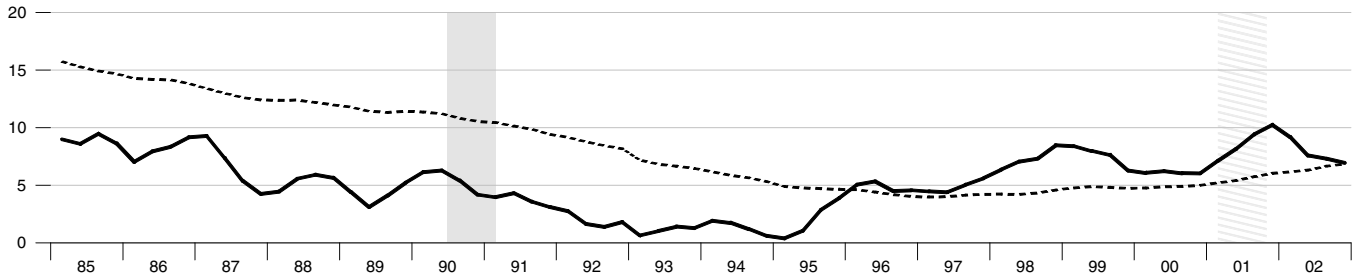
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

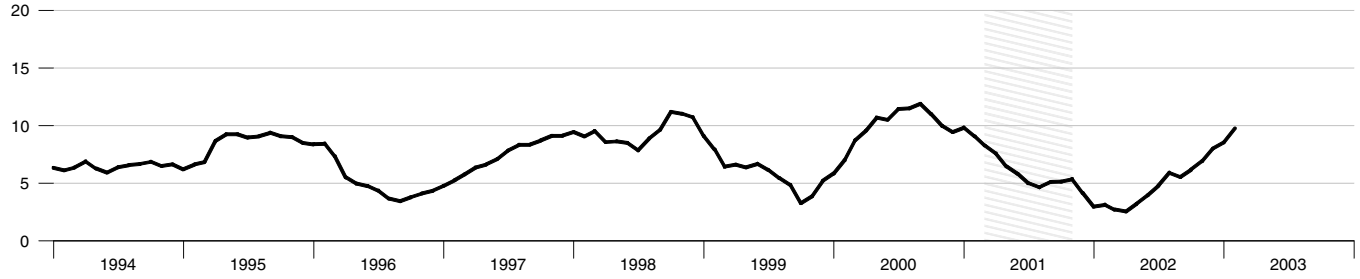
Percent change from year ago



Dashed lines indicate 10-year moving averages.

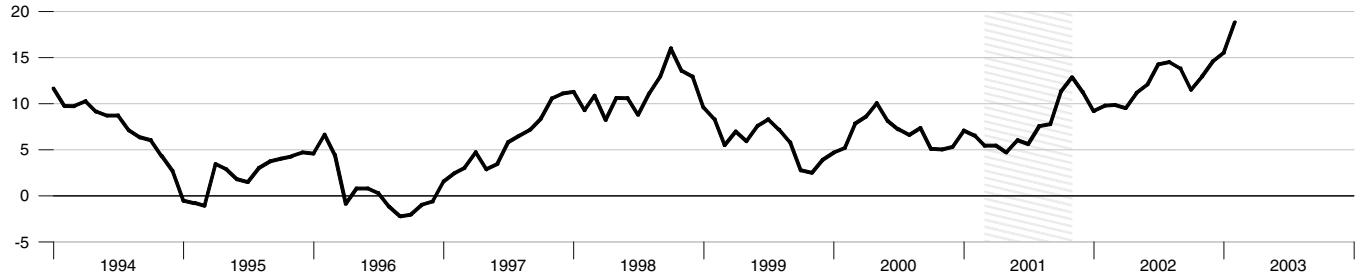
Bank Credit

Percent change from year ago



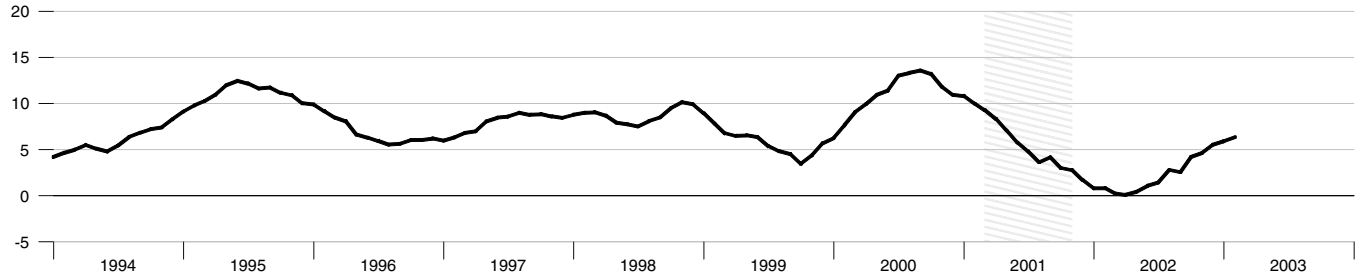
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



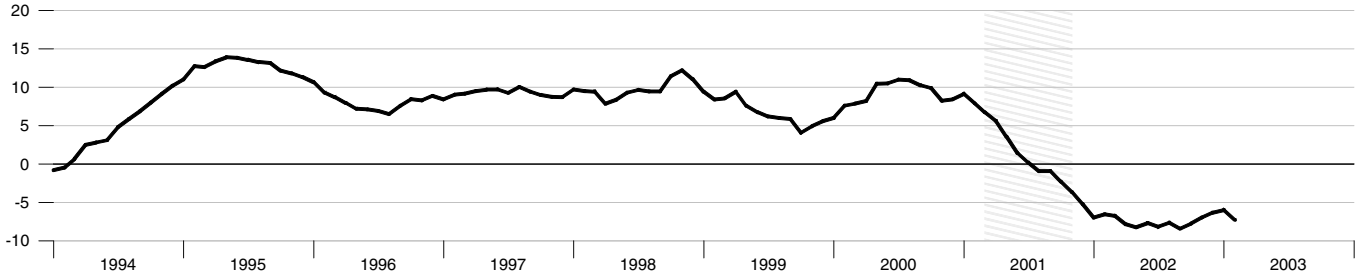
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

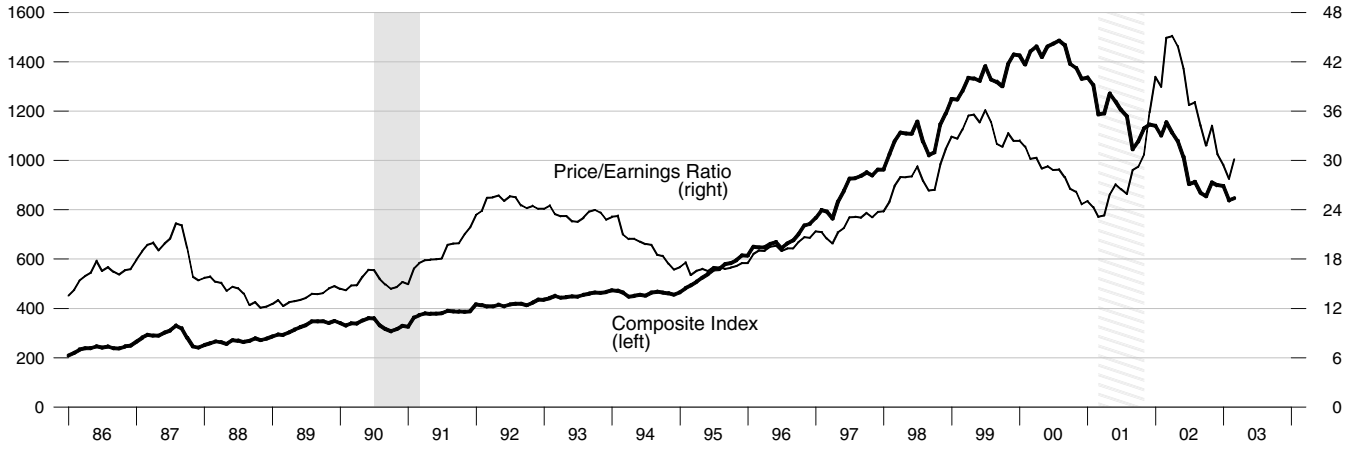


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



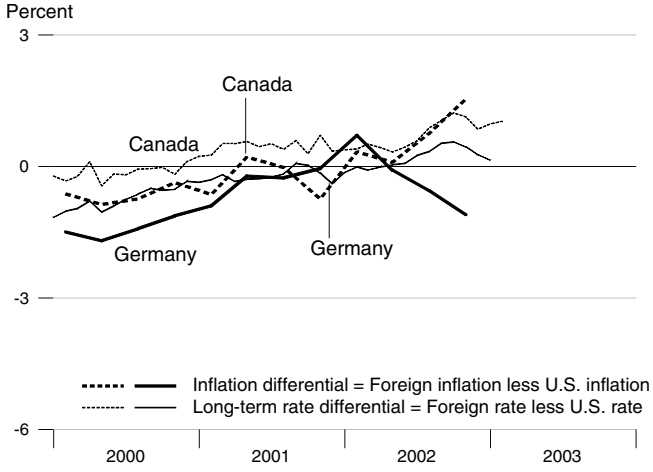
Standard & Poor's 500

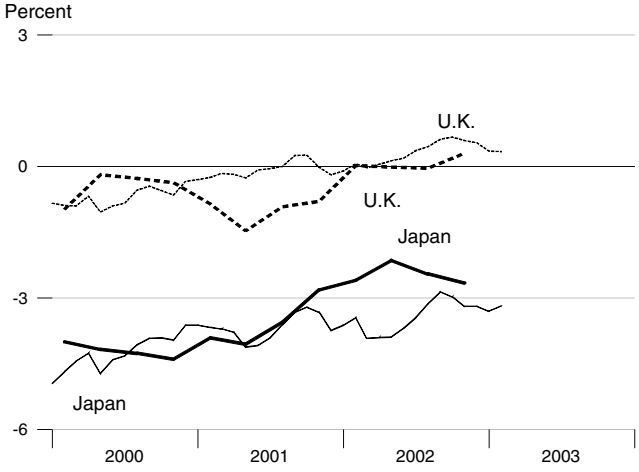


Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2002Q1	2002Q2	2002Q3	2002Q4	Nov02	Dec02	Jan03	Feb03
United States	1.19	1.24	1.58	2.25	4.05	4.03	4.05	3.90
Canada	1.53	1.33	2.33	3.79	5.18	4.88	5.02	4.93
France	2.13	1.63	1.75	2.14	4.80	4.79	4.41	.
Germany	1.90	1.16	1.03	1.16	4.50	4.30	4.20	.
Italy	2.41	2.27	2.41	2.77	4.74	4.55	4.38	4.16
Japan	-1.40	-0.90	-0.87	-0.40	0.86	0.84	0.75	0.72
United Kingdom	1.21	1.23	1.53	2.56	4.64	4.57	4.40	4.24

Inflation and Long-Term Interest Rate Differentials





		Money Stock				Bank	Adjusted		
		M1	MZM	M2	M3	Credit	Monetary Base	Reserves	MSI M2
	1998	1080.016	3707.676	4206.459	5747.521	4329.574	508.942	67.808	241.499
	1999	1101.888	4167.305	4523.633	6247.852	4587.385	557.865	72.360	257.790
	2000	1104.045	4504.688	4798.744	6833.892	5037.362	590.821	68.319	272.405
	2001	1137.041	5214.991	5218.119	7612.608	5355.677	623.788	68.983	296.067
	2002	1191.270	5890.641	5620.533	8221.630	5605.942	678.865	70.129	319.092
2000	1	1112.342	4378.730	4695.096	6620.521	4840.796	593.102	72.390	266.827
	2	1107.089	4454.369	4767.891	6759.688	4994.223	586.045	67.097	270.523
	3	1103.528	4549.478	4833.332	6919.848	5122.030	589.054	66.636	274.383
	4	1093.220	4636.174	4898.659	7035.513	5192.397	595.084	67.151	277.887
2001	1	1100.484	4851.627	5028.958	7268.379	5278.871	604.848	66.577	285.133
	2	1116.478	5103.197	5156.375	7536.713	5324.492	610.939	65.235	292.627
	3	1163.269	5323.070	5287.777	7716.943	5373.888	633.771	73.522	300.320
	4	1167.931	5582.071	5399.365	7928.397	5445.456	645.595	70.596	306.187
2002	1	1184.655	5719.453	5490.160	8042.997	5433.838	663.335	70.297	311.380
	2	1182.773	5810.250	5545.957	8125.848	5496.788	674.121	69.186	315.070
	3	1192.034	5953.922	5672.605	8281.559	5664.692	684.786	69.477	321.947
	4	1205.617	6078.941	5773.409	8436.116	5828.451	693.218	71.557	327.970
2001	Feb	1100.190	4859.076	5026.436	7270.863	5273.957	607.234	66.556	285.080
	Mar	1107.965	4942.648	5079.257	7338.179	5290.534	606.425	65.080	288.020
	Apr	1106.282	5023.156	5125.029	7454.869	5315.579	605.800	63.239	290.700
	May	1117.017	5096.859	5149.815	7533.990	5327.891	613.259	67.119	292.380
	Jun	1126.135	5189.575	5194.282	7621.280	5330.005	613.759	65.346	294.800
	Jul	1138.346	5243.358	5228.639	7658.681	5335.933	619.440	66.654	296.830
	Aug	1149.702	5277.079	5262.000	7667.624	5356.597	627.455	66.379	299.080
	Sep	1201.758	5448.773	5372.691	7824.525	5429.135	654.419	87.534	305.050
	Oct	1164.475	5507.546	5358.520	7858.911	5424.747	644.250	72.956	304.050
	Nov	1165.870	5581.293	5398.998	7932.763	5460.547	644.417	69.378	306.220
	Dec	1173.448	5657.374	5440.578	7993.516	5451.074	648.117	69.455	308.290
2002	Jan	1179.706	5678.119	5464.352	8004.683	5428.754	655.869	70.666	309.800
	Feb	1186.123	5732.647	5502.677	8055.961	5438.910	667.217	71.245	312.010
	Mar	1188.136	5747.592	5503.450	8068.348	5433.850	666.918	68.980	312.330
	Apr	1173.682	5747.376	5491.487	8071.127	5450.783	667.691	68.480	312.260
	May	1184.393	5818.670	5557.324	8135.053	5498.929	676.061	70.546	315.590
	Jun	1190.244	5864.703	5589.059	8171.365	5540.653	678.610	68.531	317.360
	Jul	1197.355	5915.212	5637.886	8220.872	5591.186	682.348	68.943	319.780
	Aug	1186.281	5959.922	5676.862	8290.654	5672.801	684.570	69.021	322.140
	Sep	1192.466	5986.631	5703.066	8333.152	5730.089	687.439	70.468	323.920
	Oct	1203.597	5991.130	5742.396	8338.911	5760.052	690.454	70.817	326.180
	Nov	1202.745	6100.134	5781.348	8458.319	5838.081	693.675	71.461	328.380
	Dec	1210.508	6145.559	5796.484	8511.118	5887.220	695.526	72.392	329.350
2003	Jan	1212.270	6143.727	5825.756	8505.993	5892.962	701.483	72.947	331.400
	Feb	1231.737	6183.840	5880.070	8560.602	5969.680	713.775	73.997	334.540

*All values are given in billions of dollars.

		Federal Funds	Discount Rate	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
	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		5.83
2001	Mar	5.31	4.81		8.32	4.89	4.54	4.43	4.89	6.98	5.00	6.95
	Apr	4.80	4.28		7.80	4.53	3.97	4.42	5.14	7.20	5.14	7.08
	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		5.75

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

		M1	MZM	M2	M3
Percent change at an annual rate					
	1998	1.00	11.67	7.30	10.35
	1999	2.03	12.40	7.54	8.71
	2000	0.20	8.10	6.08	9.38
	2001	2.99	15.77	8.74	11.39
	2002	4.77	12.96	7.71	8.00
2000	1	0.03	8.16	6.48	11.11
	2	-1.89	6.91	6.20	8.41
	3	-1.29	8.54	5.49	9.48
	4	-3.74	7.62	5.41	6.69
2001	1	2.66	18.59	10.64	13.24
	2	5.81	20.74	10.13	14.77
	3	16.76	17.23	10.19	9.57
	4	1.60	19.46	8.44	10.96
2002	1	5.73	9.84	6.73	5.78
	2	-0.64	6.35	4.07	4.12
	3	3.13	9.89	9.13	7.66
	4	4.56	8.40	7.11	7.47
2001	Feb	7.56	26.74	10.90	12.47
	Mar	8.48	20.64	12.61	11.11
	Apr	-1.82	19.55	10.81	19.08
	May	11.64	17.61	5.80	12.74
	Jun	9.80	21.83	10.36	13.90
	Jul	13.01	12.44	7.94	5.89
	Aug	11.97	7.72	7.66	1.40
	Sep	54.33	39.04	25.24	24.56
	Oct	-37.23	12.94	-3.17	5.27
	Nov	1.44	16.07	9.06	11.28
	Dec	7.80	16.36	9.24	9.19
2002	Jan	6.40	4.40	5.24	1.68
	Feb	6.53	11.52	8.42	7.69
	Mar	2.04	3.13	0.17	1.85
	Apr	-14.60	-0.05	-2.61	0.41
	May	10.95	14.89	14.39	9.50
	Jun	5.93	9.49	6.85	5.36
	Jul	7.17	10.33	10.48	7.27
	Aug	-11.10	9.07	8.30	10.19
	Sep	6.26	5.38	5.54	6.15
	Oct	11.20	0.90	8.28	0.83
	Nov	-0.85	21.83	8.14	17.18
	Dec	7.75	8.94	3.14	7.49
2003	Jan	1.75	-0.36	6.06	-0.72
	Feb	19.27	7.83	11.19	7.70

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,b).

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) and research.stlouisfed.org/aggreg/newbase.html.

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. For analytical purposes, MZM largely replaces M1. The **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 $m = 1,\ldots, 10$ 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 Fed Funds Futures Contracts** each trace through time the yield on three specific contracts. **Implied Yields on Fed Funds Futures** displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. **Inflation-Protected Treasury Yields** are yields on the most recently issued inflation-protected securities of 10- and 30-year original maturities. **Inflation-Protected Treasury Yield Spreads** equal, for 10- and 30-year maturities, the difference between the yields on the most recently issued inflation-protected securities and the unadjusted bond yields of similar maturity. **Inflation-Indexed 30-Year 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 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. Two alternative opportunity costs are shown, one relative to the 3-month Treasury constant maturity yield, the other to the 5-year constant maturity yield.

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 & Poors Inc.
Stock price-earnings ratio, stock price composite index.

University of Michigan Survey Research Center
Median expected price change.

U.S. Department of the Treasury
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Note: Articles from this Bank's *Review* are available on the Internet at research.stlouisfed.org/publications/review/.