June 2000

MonetaryTrends

THE FEDERAL RESERVE BANK of ST. LOUIS

e-cash

Innovations in electronic data processing continue to change the way we do business. For weekend getaways, we search the Internet for "dotcom" airfares and use our credit cards to purchase electronic tickets over the Internet. We do not have to worry about left-behind or lost tickets at the airport check-in. Yet, once we have left town, the electronic age seems to be light years away. Out of state, we find our debit cards rejected at the grocery store. Although we can use our credit card, we cannot get the much-needed "cash back" for small purchases such as the daily newspaper or a cup of coffee. ATMs are widely available for cash withdrawal, but charges of 75 cents or more for a transaction are common when the ATM is not operated by our home bank. Wouldn't it be convenient to have cash available anywhere, any time? Is there hope that the electronic age will make cash both generally accepted *and* generally available at zero marginal cost?

The smart card is an electronic-age candidate to answer our cash needs. Smart-card technology allows consumers to store value on their debit cards. In the Netherlands, approximately 11 million smart-card enabled debit cards were in circulation during 1998. Smart cards allow households to pay for small purchases virtually anywhere, making paper money and coins largely obsolete. Public phones not only accept smart cards as a form of payment; they also allow smart-card holders to add value to their cards by directly connecting to the holders' bank accounts. With the existence of inexpensive electronic devices called "homeloaders," households can transfer money over the phone line between cards and between a card and a bank account. In combination with a personal computer, the homeloader allows smart-card holders to wire cash over the Internet.

In the United States, MasterCard and Visa are trying to increase the usage of smart cards by further enhancing homeloader technology. A contactless card is being developed. This enables the card to be placed near a transceiver at the point of purchase instead of being inserted into a special slot. This electronic card technology is faster than the use of bills and coins. The card also is multifunctional. For example, one may purchase electronic tickets for a sports event on the Internet. At the gate, the card serves as an identity token (in lieu of a paper ticket). Also, commuters can use the card to purchase and store transit tickets.

Security concerns for online e-cash transactions are likely to be of little importance in the future. New encryption technology for Internet transaction sessions has been developed that is virtually unbreakable during the time a session lasts. A person is more likely to find credit card information in a trash bin than to break a session encryption code.

The smart card is a network technology. The more consumers use the technology, the lower the costs are for running the network. To exploit these network externalities, the smart card needs a critical mass of consumers. Smart-card technology will be successful if it is competitive, relative to other means of transactions, in terms of price and convenience. Fees on ATM withdrawals certainly work in favor of more widespread smart-card usage. In addition, as more consumers become comfortable with financial transactions over the Internet, the habit of using bills and coins will be easier to break.

—Frank A. Schmid

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

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Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.

2. Shaded areas indicate recessions, as dated by the National Bureau of Economic Research.

3. The *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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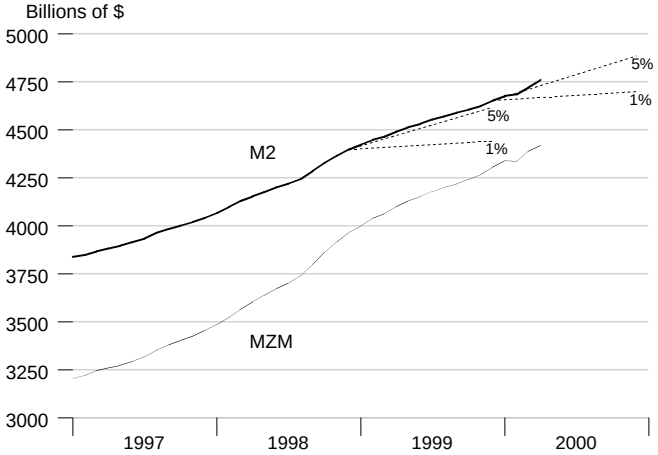
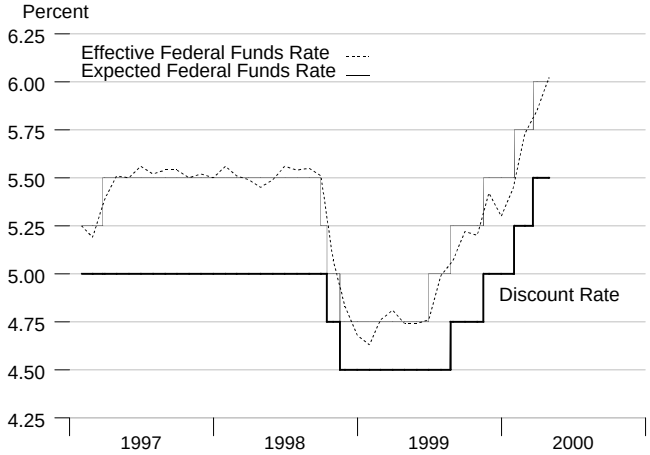
M2 and MZM

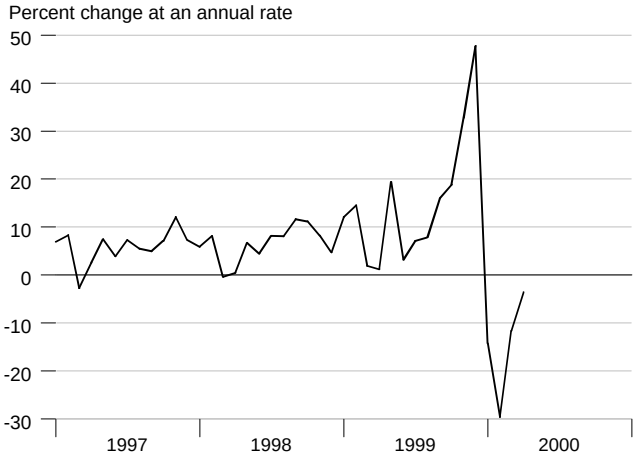


Dotted lines indicate the FOMC target ranges.

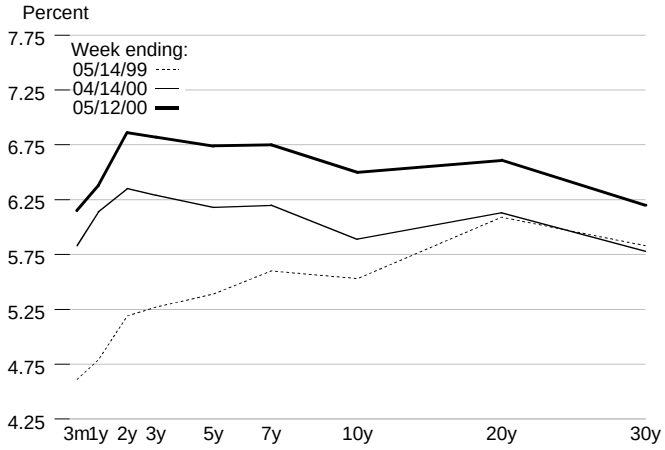
Reserve Market Rates



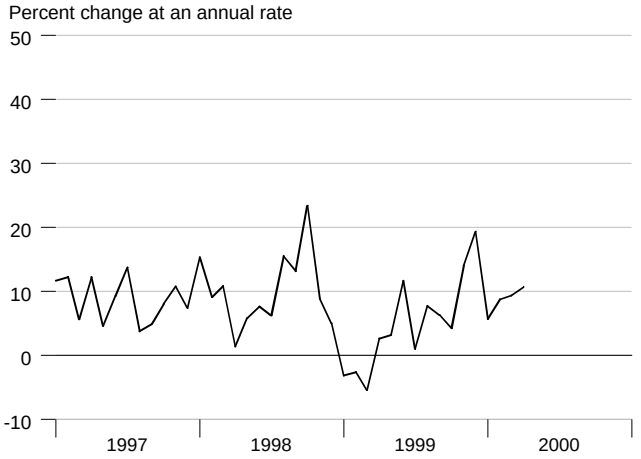
Adjusted Monetary Base



Treasury Yield Curve



Total Bank Credit

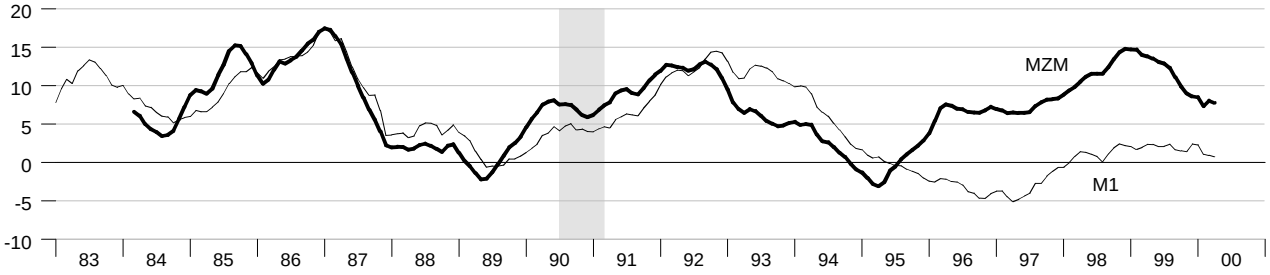


Interest Rates

	Feb 00	Mar 00	Apr 00
Federal Funds Rate	5.73	5.85	6.02
Discount Rate	5.24	5.34	5.50
Prime Rate	8.73	8.83	9.00
Conventional Mortgage Rate	8.33	8.24	8.15
Treasury Yields:			
3-month constant maturity	5.73	5.86	5.82
6-month constant maturity	6.00	6.11	6.07
1-year constant maturity	6.22	6.22	6.15
3-year constant maturity	6.65	6.53	6.36
5-year constant maturity	6.68	6.50	6.26
10-year constant maturity	6.52	6.26	5.99
30-year constant maturity	6.23	6.05	5.85

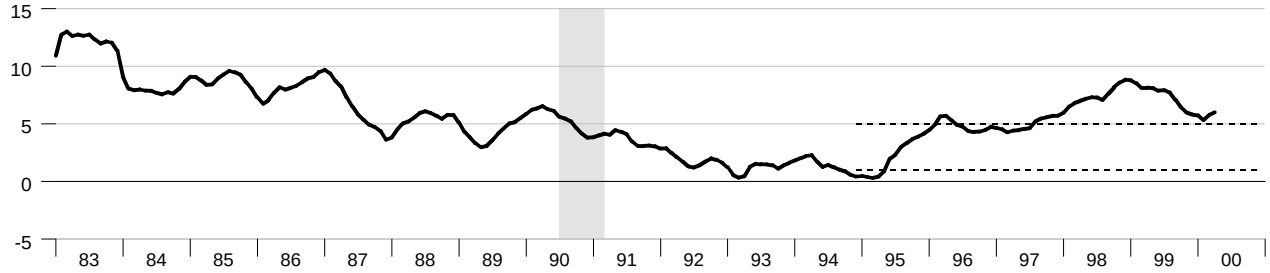
MZM and M1

Percent change from year ago



M2

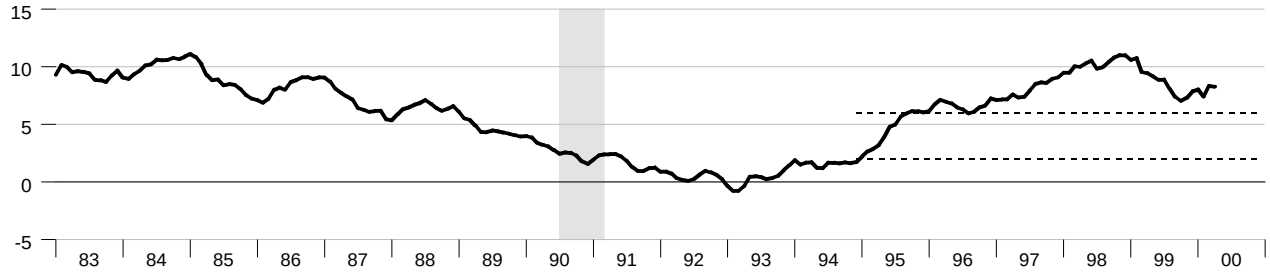
Percent change from year ago



Dotted lines indicate the FOMC target ranges.

M3

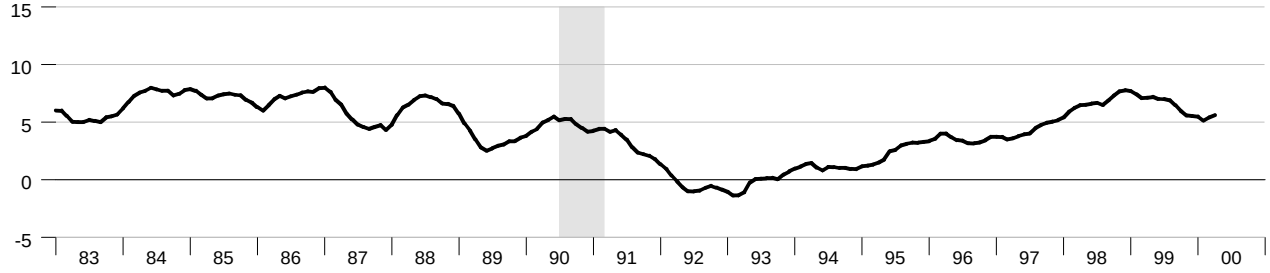
Percent change from year ago



Dotted lines indicate the FOMC target ranges.

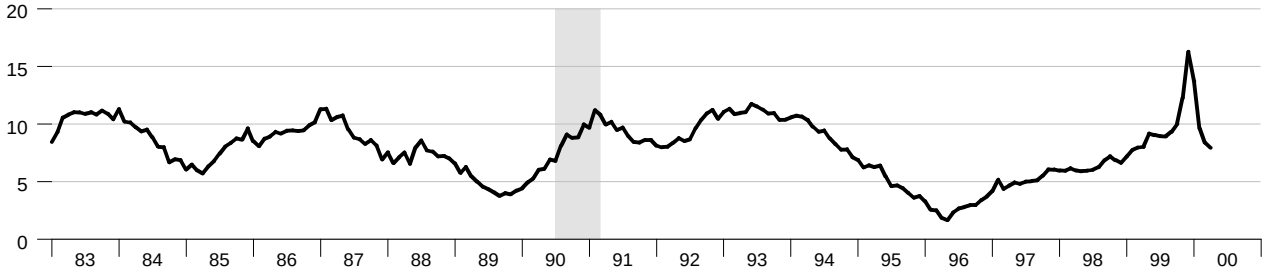
Monetary Services Index - M2

Percent change from year ago



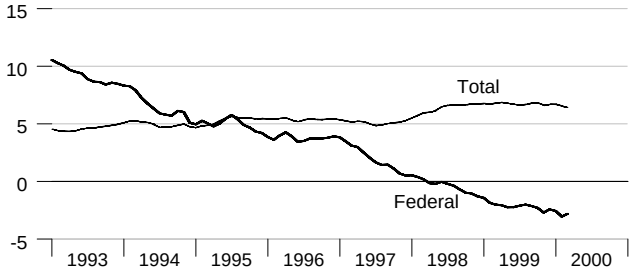
Adjusted Monetary Base

Percent change from year ago



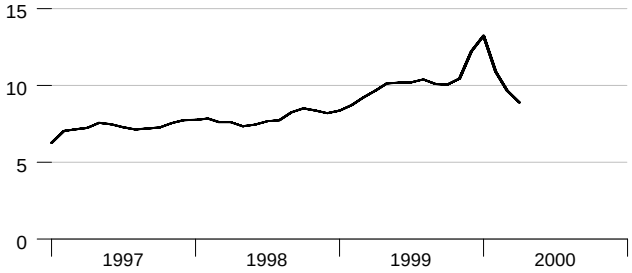
Domestic Nonfinancial Debt

Percent change from year ago



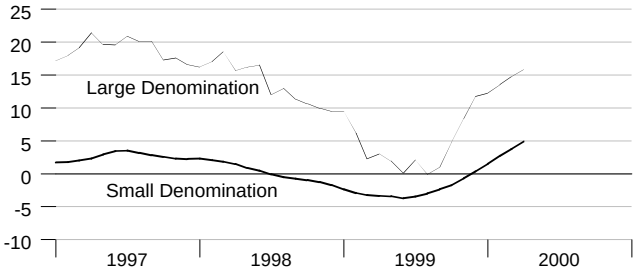
Currency Held by the Nonbank Public

Percent change from year ago



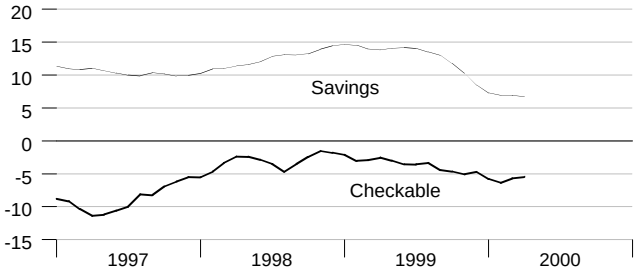
Time Deposits

Percent change from year ago



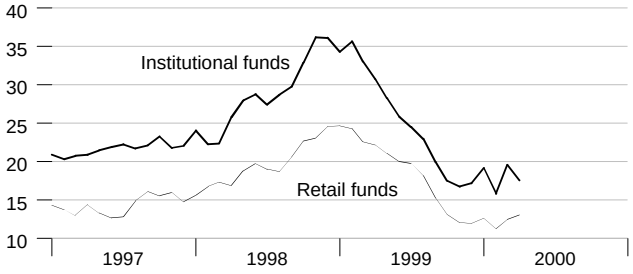
Checkable and Savings Deposits

Percent change from year ago



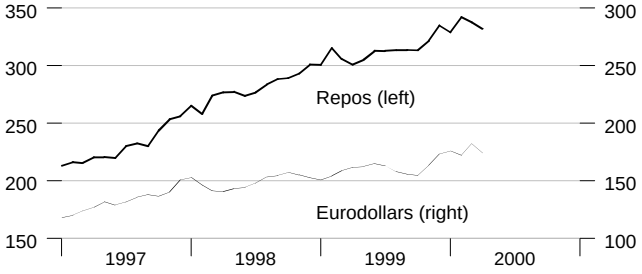
Money Market Mutual Fund Shares

Percent change from year ago



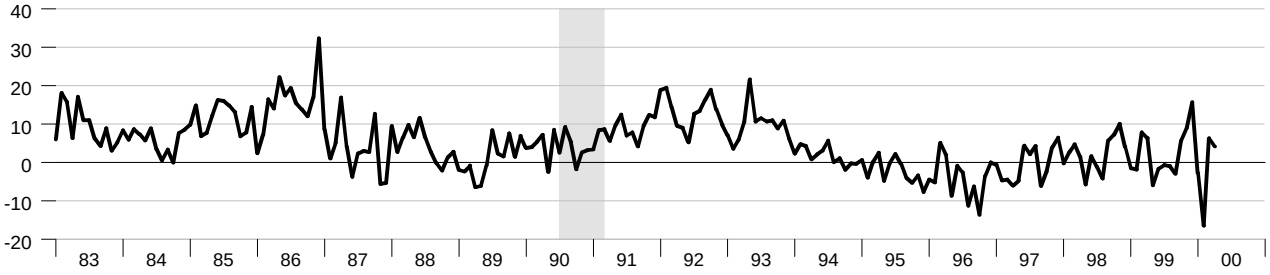
Repurchase Agreements and Eurodollars

Billions of dollars Billions of dollars



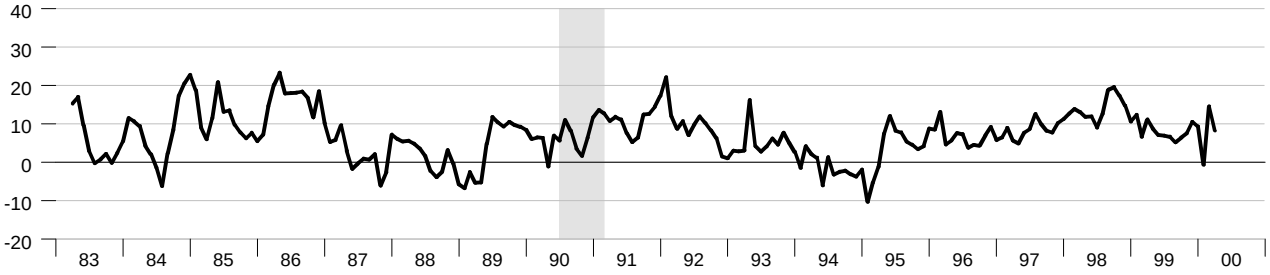
M1

Percent change at an annual rate



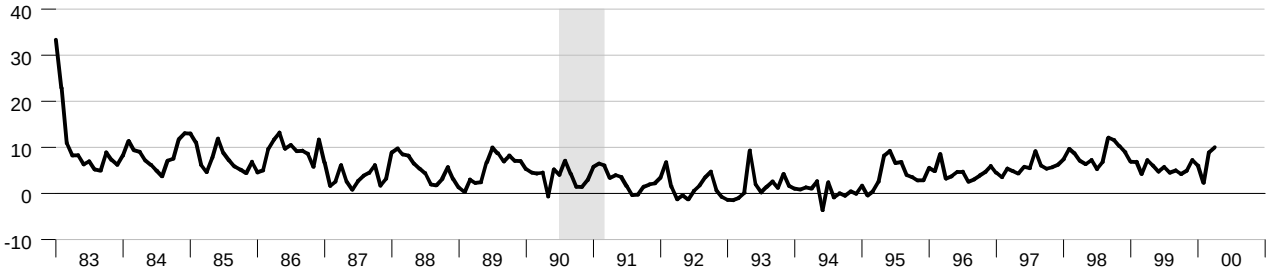
MZM

Percent change at an annual rate



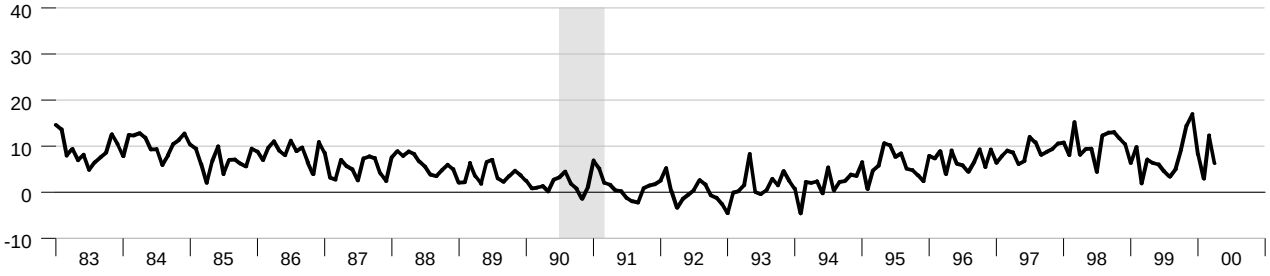
M2

Percent change at an annual rate

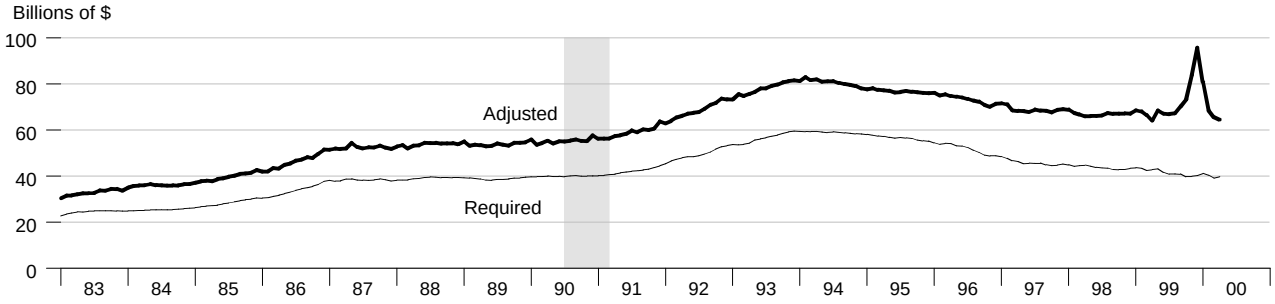


M3

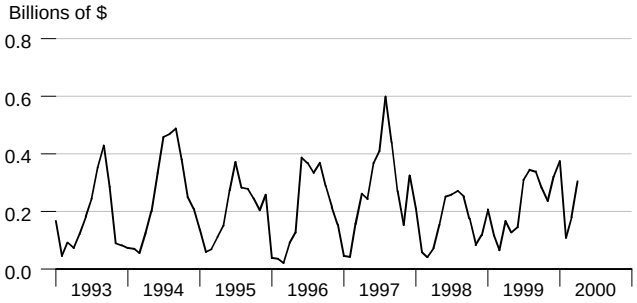
Percent change at an annual rate



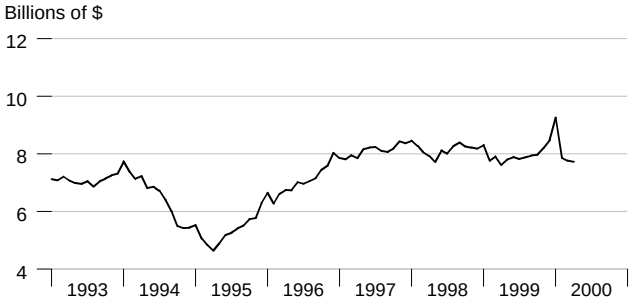
Adjusted and Required Reserves



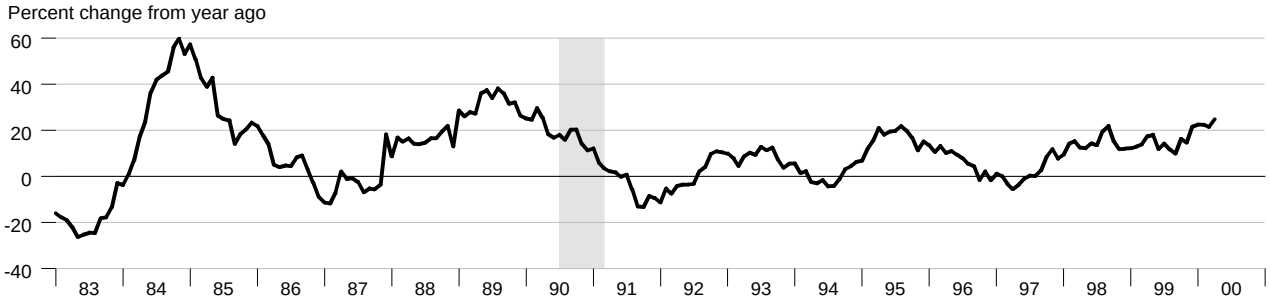
Total Borrowings, nsa



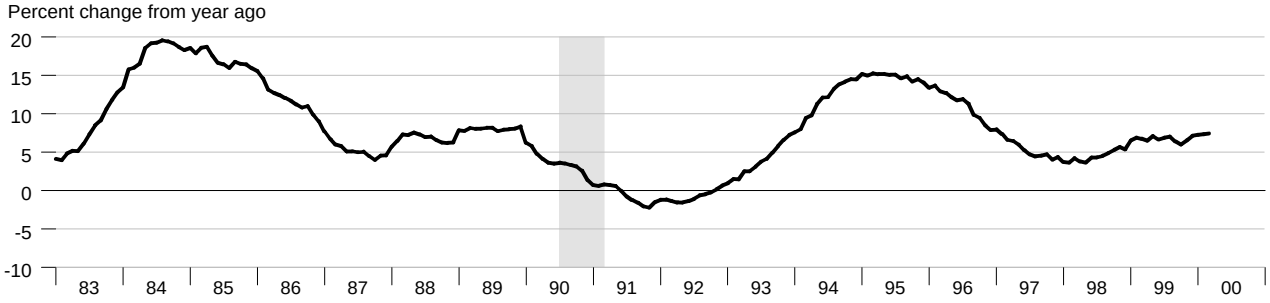
Excess Reserves plus RCB Contracts



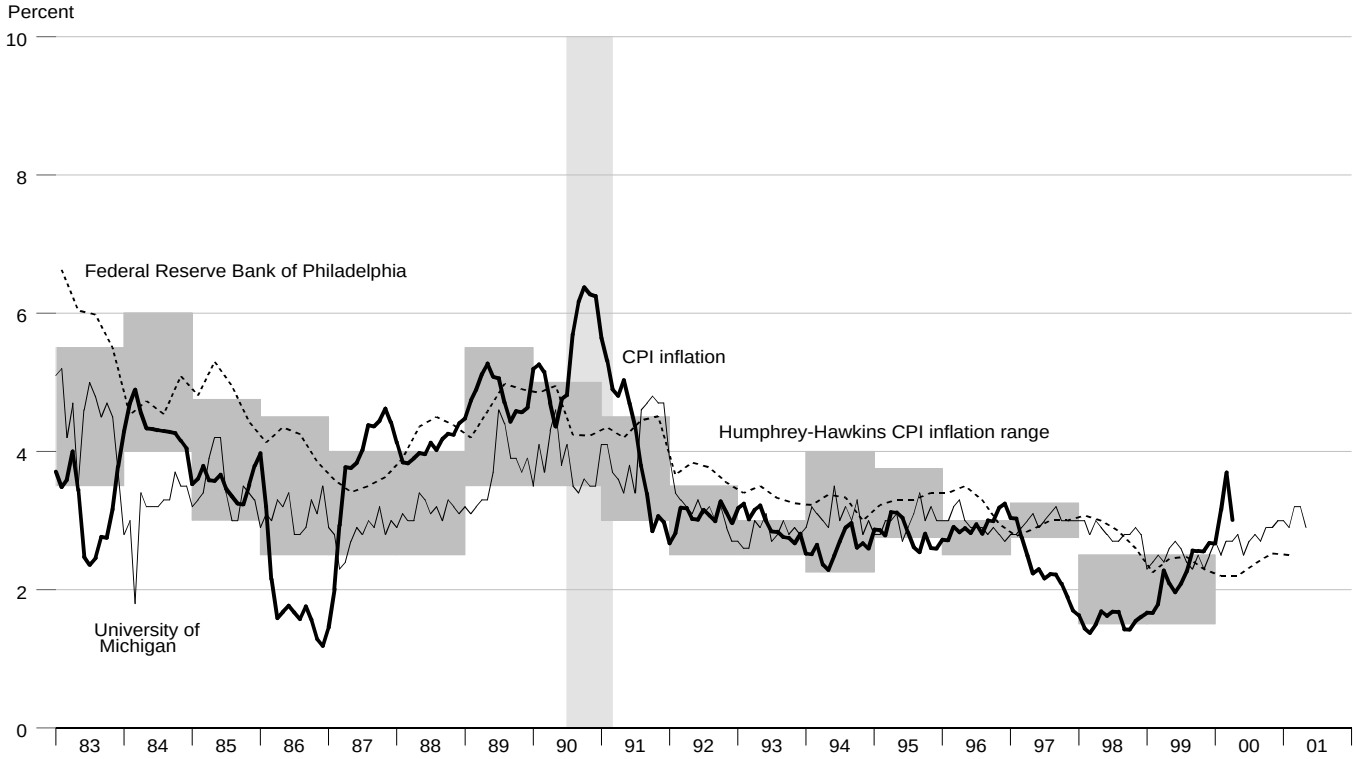
Nonfinancial Commercial Paper



Consumer Credit

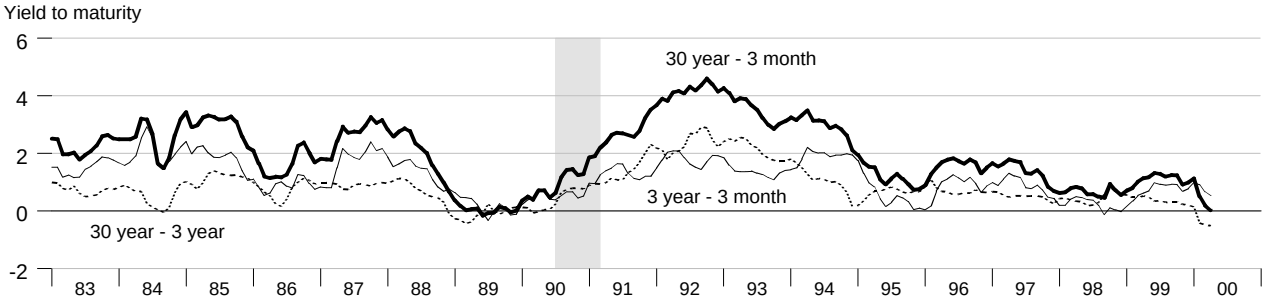


Inflation and Inflation Expectations

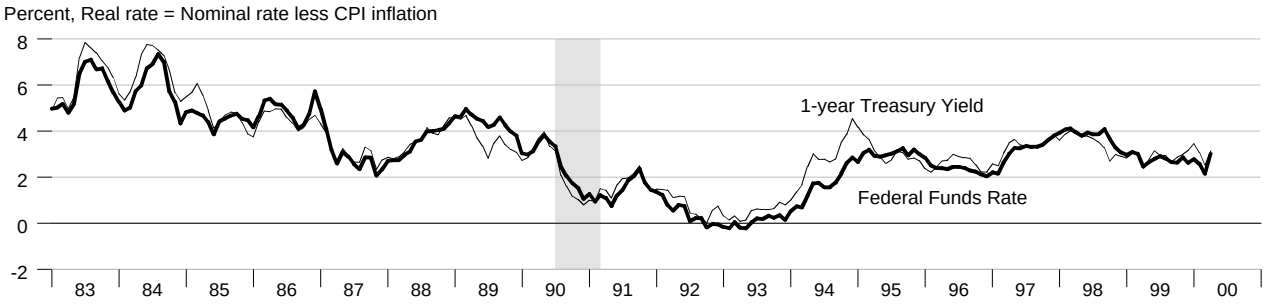


The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph . See page 19 for information.

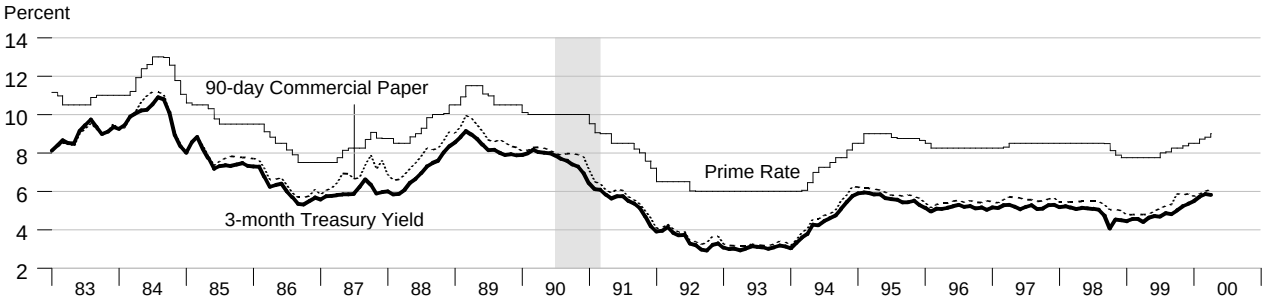
Treasury Security Yield Spreads



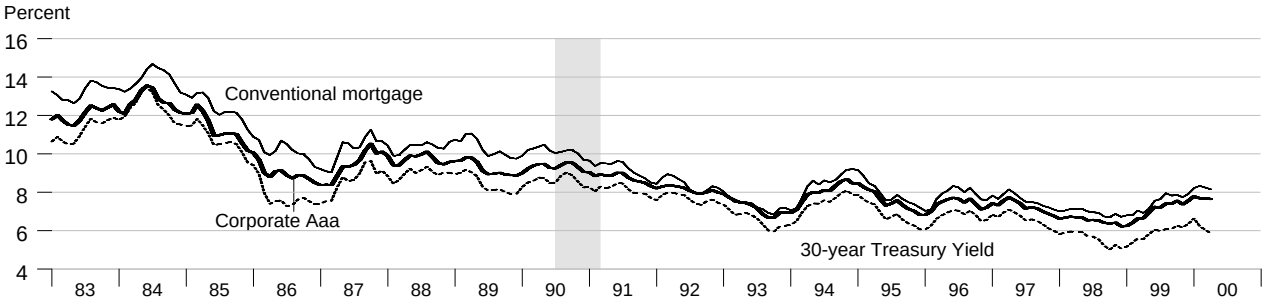
Real Interest Rates



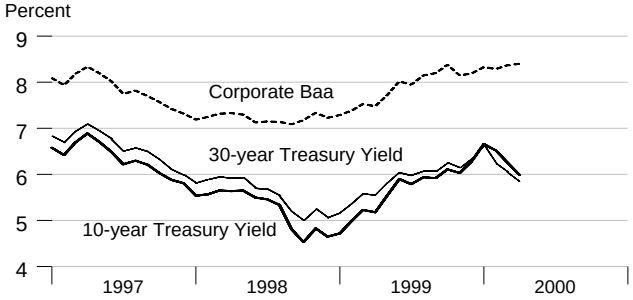
Short Term Interest Rates



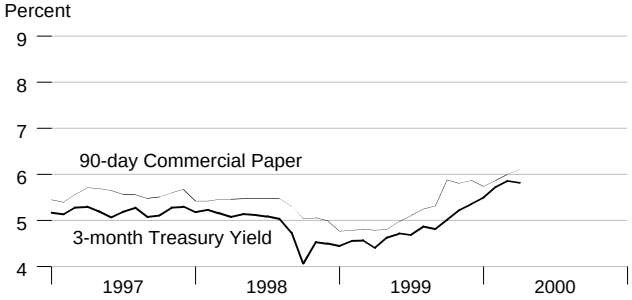
Long Term Interest Rates



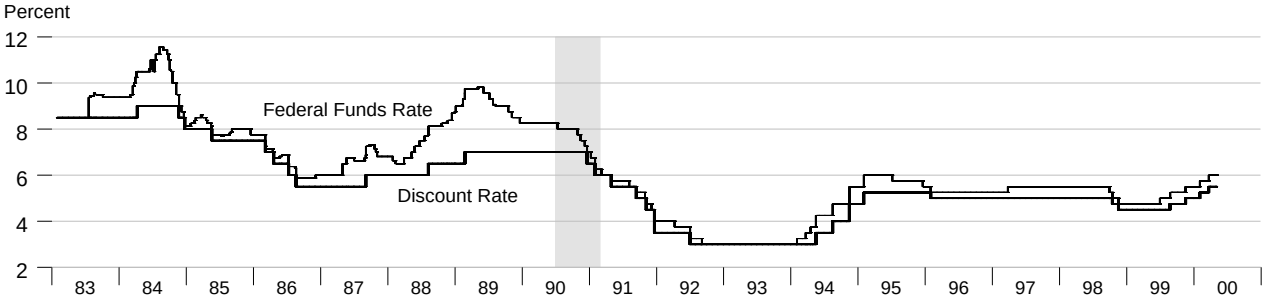
Long Term Interest Rates



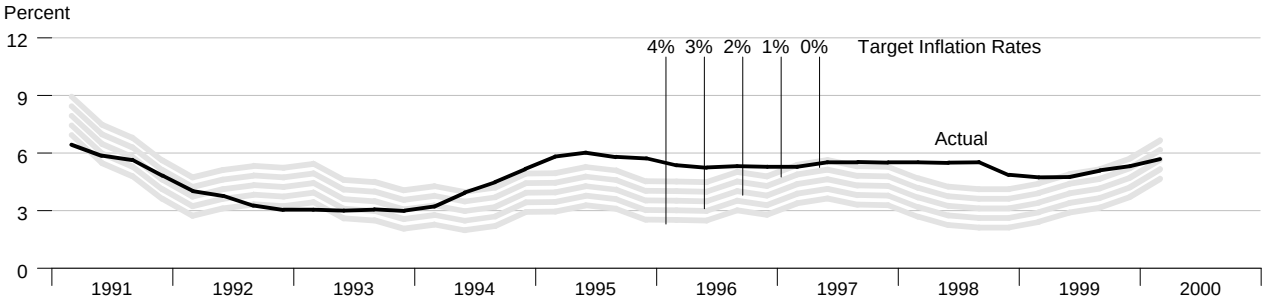
Short Term Interest Rates



FOMC Expected Federal Funds Rate and Discount Rate

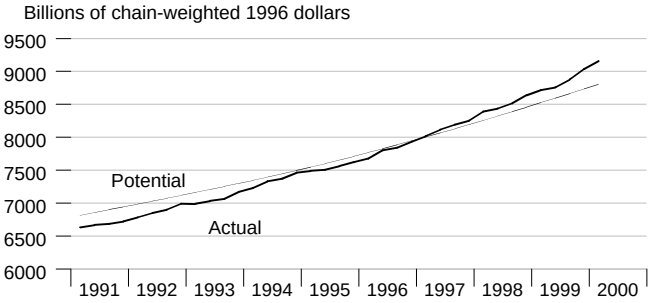


Federal Funds Rate and Inflation Targets

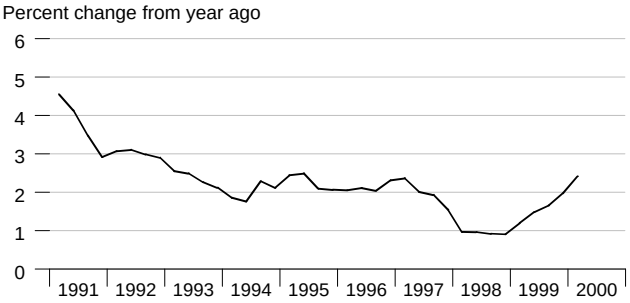


Calculated federal funds rate is based on Taylor's rule. See notes on page 19.

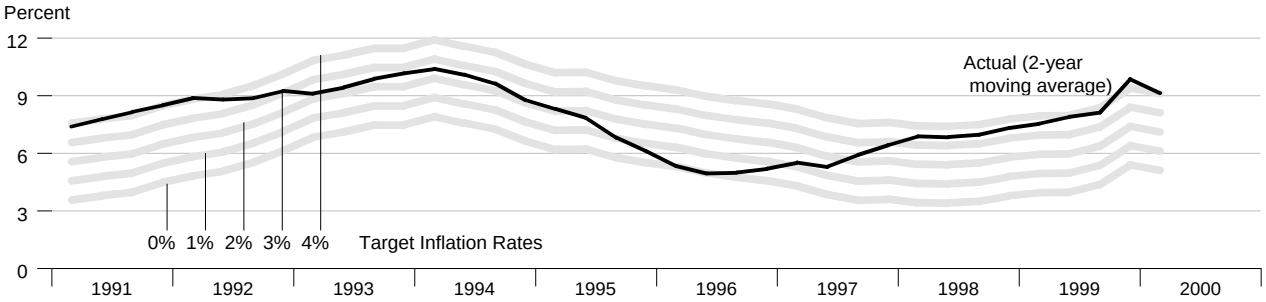
Actual and Potential Real GDP



PCE Inflation

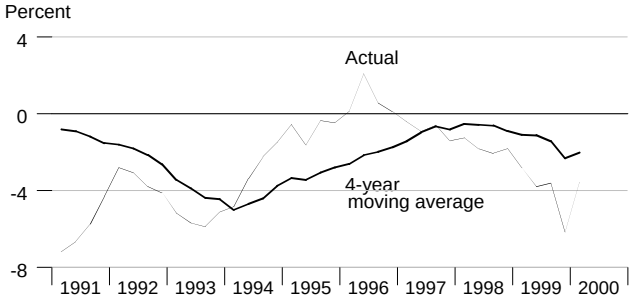


Monetary Base Growth* and Inflation Targets

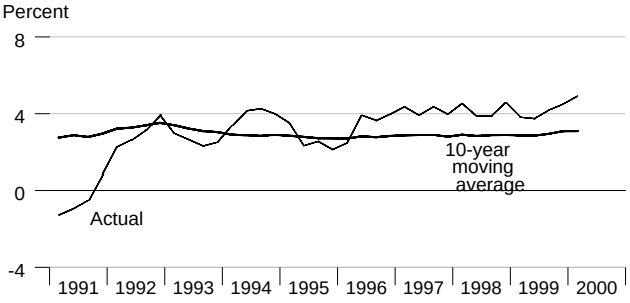


*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. See notes on page 19.

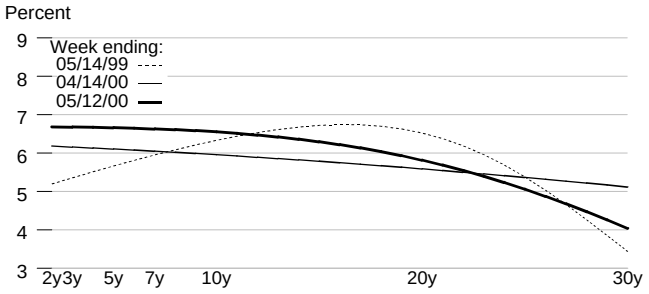
Monetary Base Velocity Growth



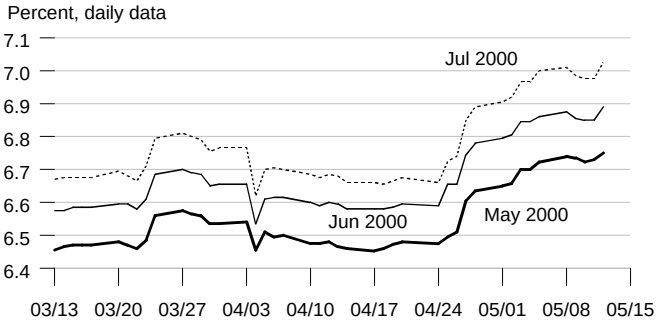
Real Output Growth



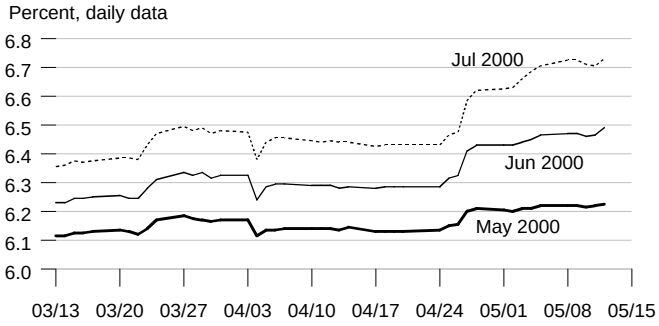
Implied One-Year Forward Rates



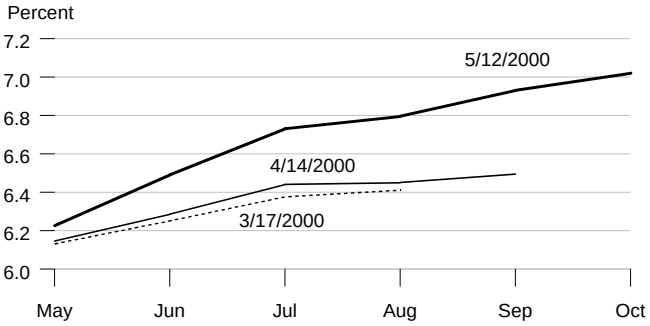
Rates on 3-Month Eurodollar Futures



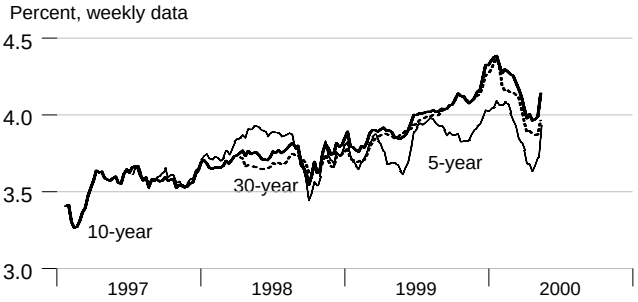
Rates on Selected Fed Funds Futures Contracts



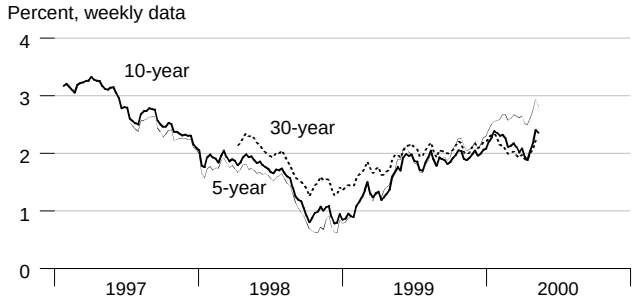
Implied Yields on Fed Funds Futures



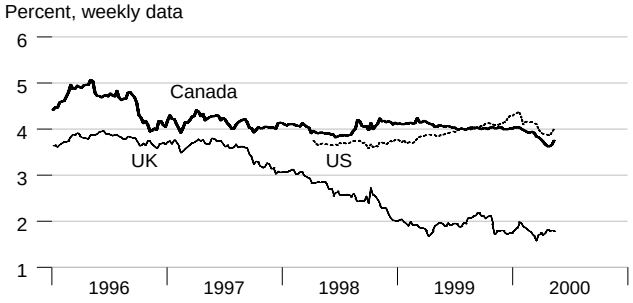
Inflation-Protected Treasury Yields



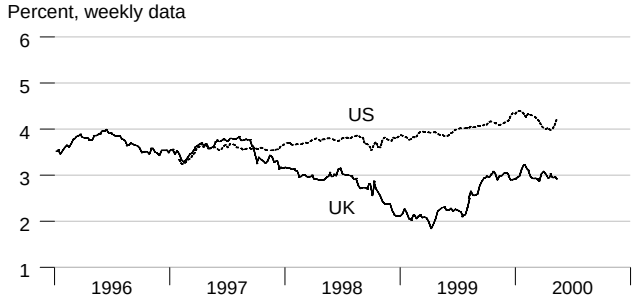
Inflation-Protected Treasury Yield Spreads



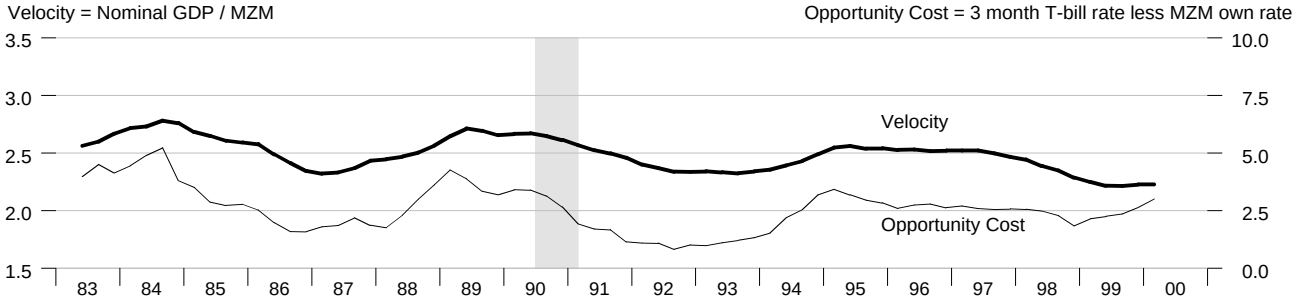
Inflation-Indexed 30-Year Bonds



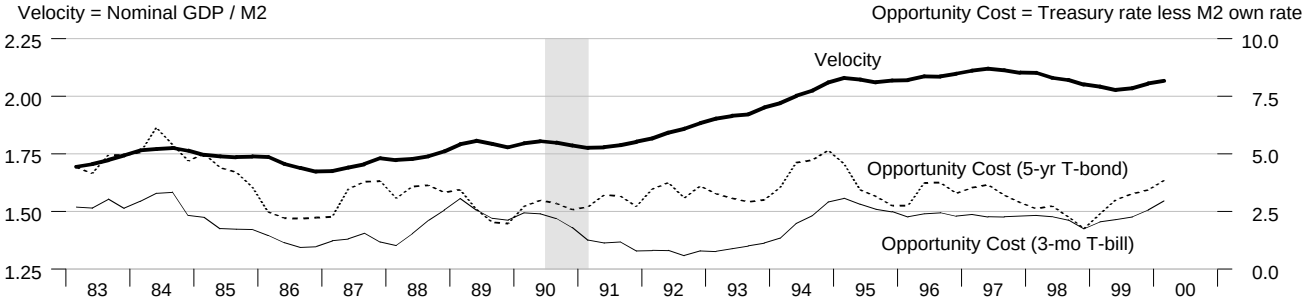
Inflation-Indexed 10-Year Bonds



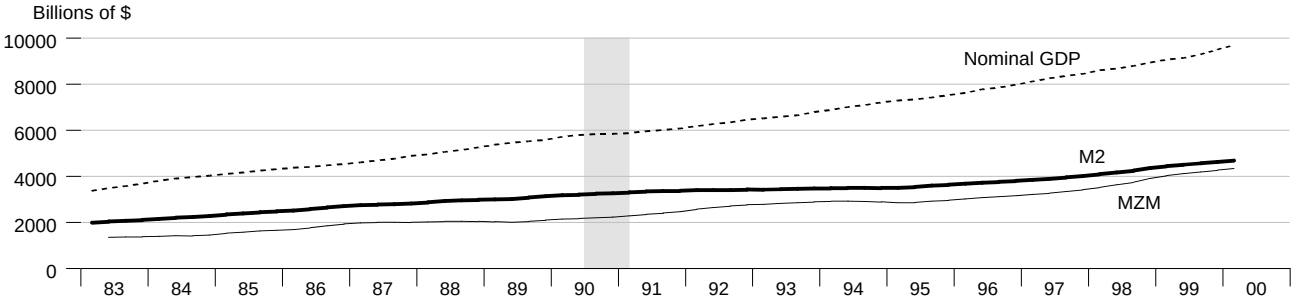
MZM Velocity and Opportunity Cost



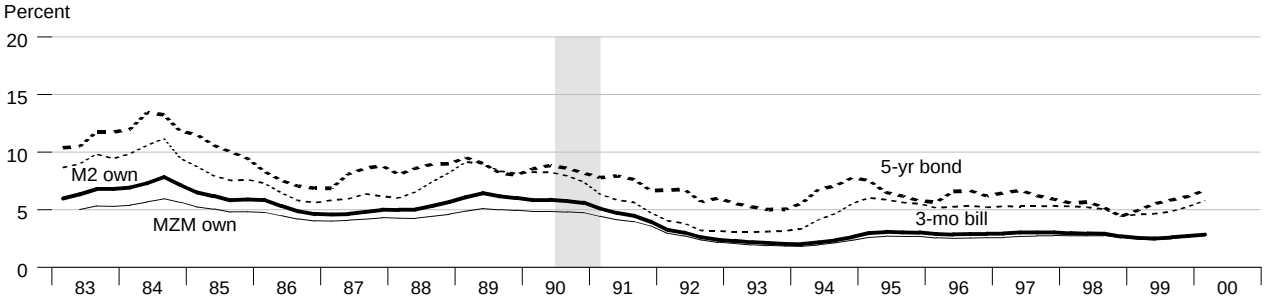
M2 Velocity and Opportunity Cost



M2, MZM and Nominal GDP

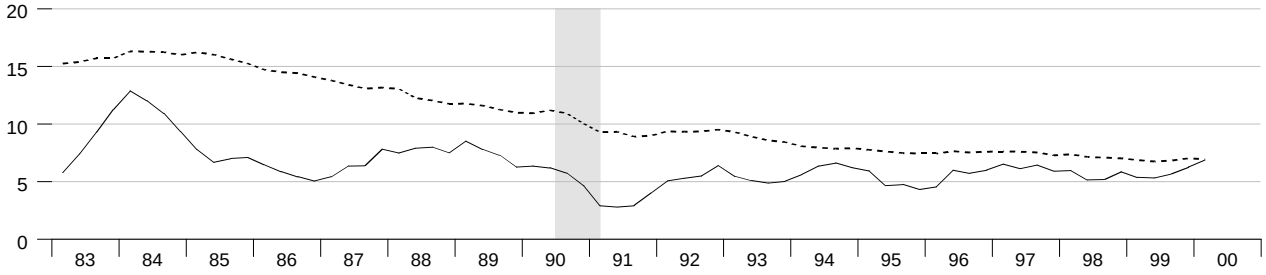


Interest Rates



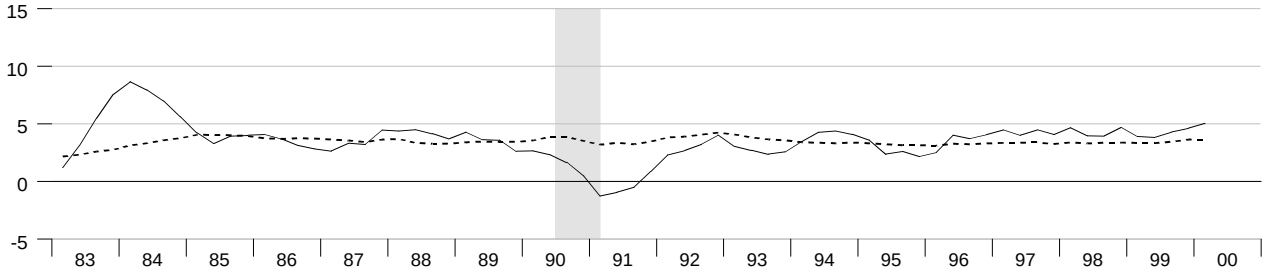
Gross Domestic Product

Percent change from year ago



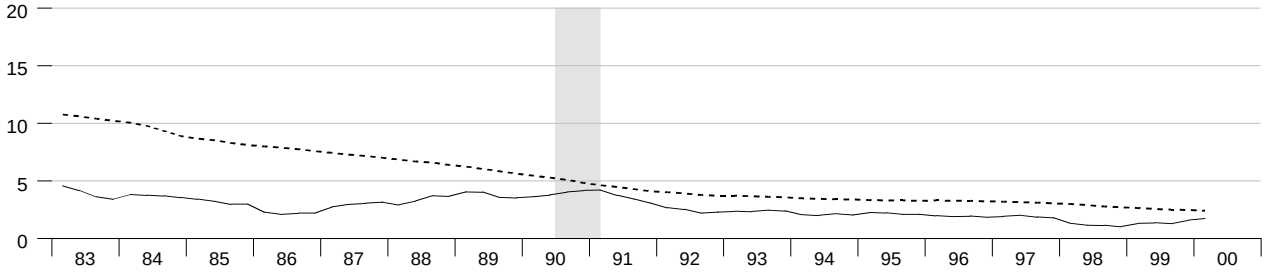
Real Gross Domestic Product

Percent change from year ago



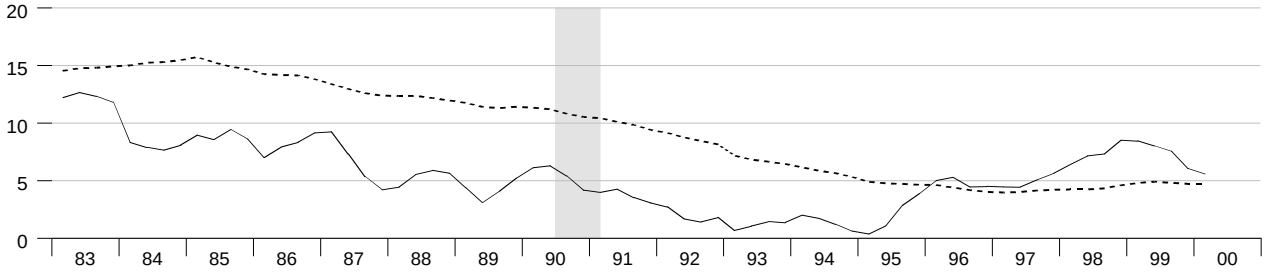
Gross Domestic Product Price Index

Percent change from year ago



M2

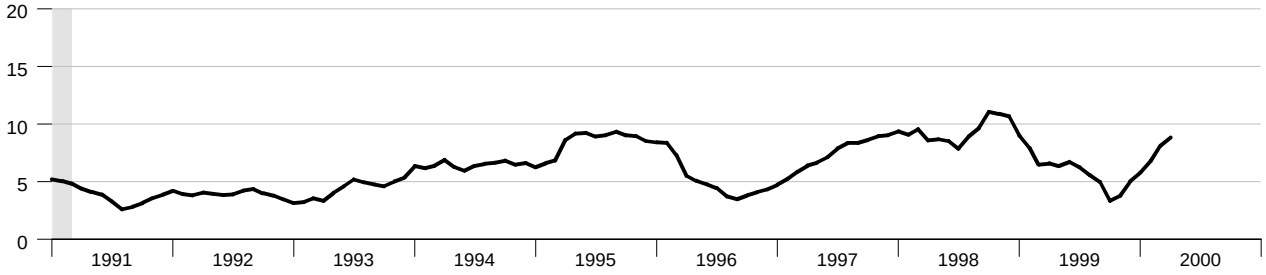
Percent change from year ago



Dashed lines indicate 10-year moving averages

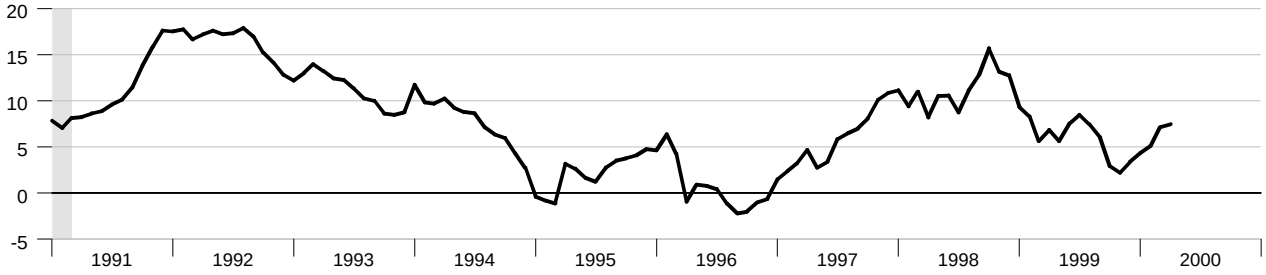
Bank Credit

Percent change from year ago



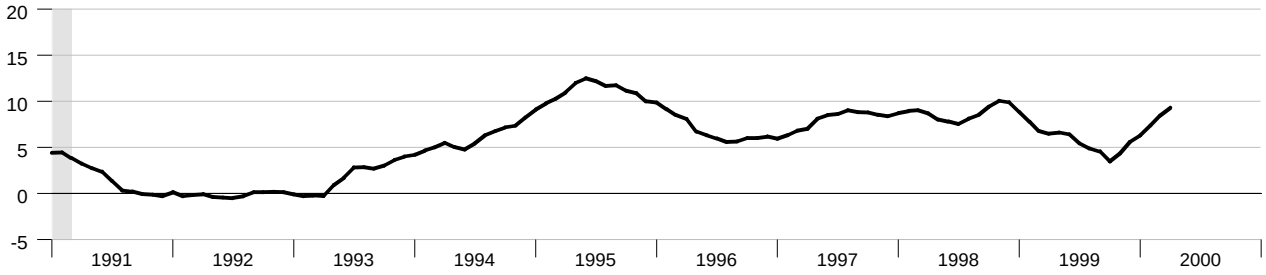
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



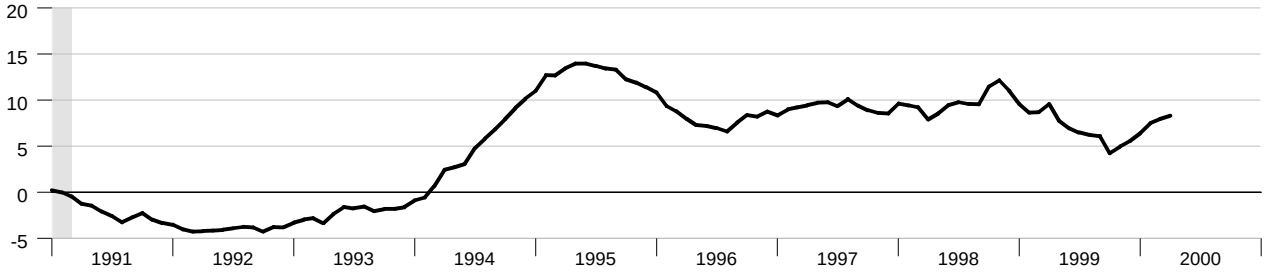
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

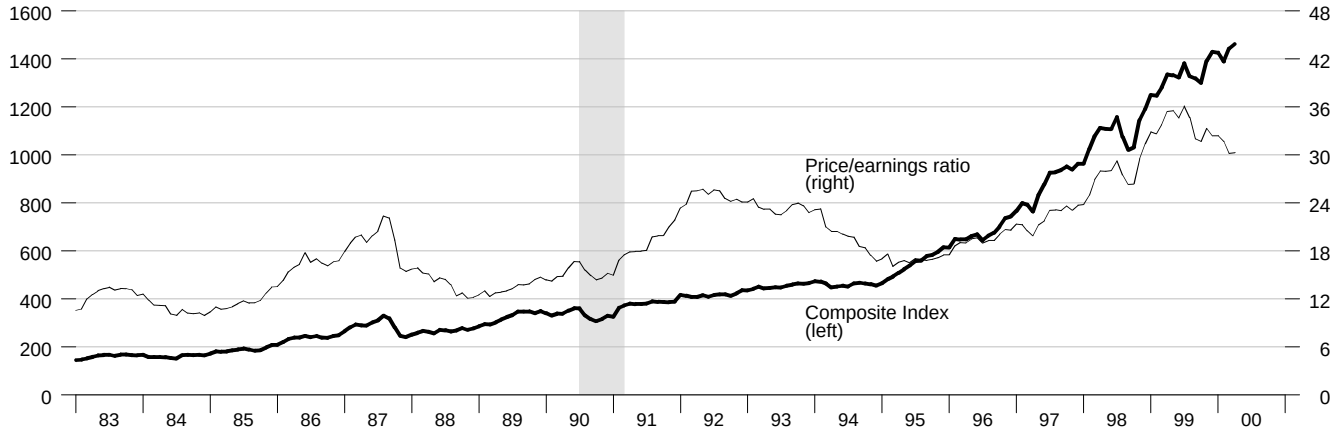


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



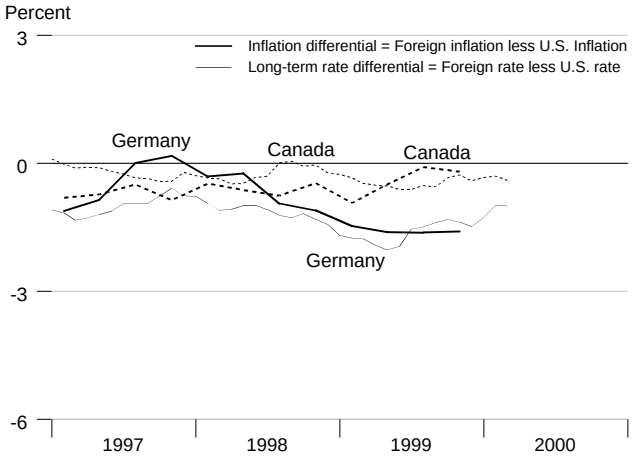
Standard and Poor's 500

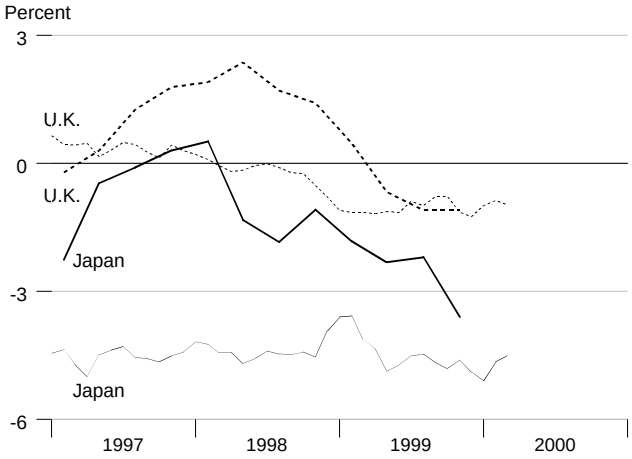


Inflation and Long-Term Interest Rates

	Trend in Consumer Price Inflation Rates Percent change from year ago				Recent Long-Term Government Bond Rates Percent			
	1999Q2	1999Q3	1999Q4	2000Q1	Jan00	Feb00	Mar00	Apr00
United States	2.09	2.26	2.56	3.15	6.81	6.49	6.33	6.14
Canada	1.59	2.18	2.36	.	6.48	6.19	5.93	.
France	0.36	0.53	1.00	.	6.11	5.96	5.73	.
Germany	0.48	0.64	0.96	.	5.54	5.51	5.33	.
Italy	1.44	1.72	2.06	2.36	5.79	5.77	5.61	.
Japan	-0.22	0.07	-1.04	.	1.71	1.84	1.82	.
United Kingdom	1.42	1.17	1.47	.	5.82	5.62	5.36	.

Inflation and Long-Term Interest Rates Differentials





		Money Stock				Bank			
		M1	MZM	M2	M3	Credit	Monetary Base	Reserves	MSI M2
	1995	1143.037	2906.093	3575.434	4500.288	3500.750	443.499	76.838	210.451
	1996	1106.428	3096.347	3747.395	4796.863	3683.810	455.572	73.401	217.848
	1997	1069.928	3318.613	3931.933	5179.573	3951.956	478.708	68.873	227.070
	1998	1080.851	3705.090	4221.490	5710.897	4323.837	508.942	66.925	242.228
	1999	1102.447	4157.567	4538.439	6208.925	4581.143	557.863	71.648	258.535
1998	1	1076.718	3523.710	4097.751	5498.386	4185.414	498.320	67.645	235.917
	2	1078.686	3637.300	4176.066	5638.533	4248.575	502.020	66.044	239.943
	3	1076.071	3746.116	4249.253	5763.384	4348.501	511.546	66.905	243.733
	4	1091.927	3913.233	4362.888	5943.284	4512.859	523.881	67.105	249.320
1999	1	1097.220	4033.485	4444.488	6064.827	4511.245	536.335	67.691	253.370
	2	1103.061	4127.357	4511.460	6155.764	4526.828	545.912	66.526	257.007
	3	1098.074	4198.569	4570.573	6231.278	4591.476	557.969	68.112	260.270
	4	1111.433	4270.856	4627.236	6383.832	4695.022	591.238	84.263	263.493
2000	1	1112.795	4353.859	4693.459	6546.328	4821.748	592.963	71.539	266.917
1998	Apr	1081.657	3601.717	4152.912	5594.709	4225.998	499.537	65.937	238.890
	May	1076.489	3637.081	4174.983	5638.310	4246.394	502.322	66.071	239.820
	Jun	1077.912	3673.103	4200.304	5682.580	4273.334	504.200	66.125	241.120
	Jul	1076.877	3700.662	4218.927	5703.551	4295.576	507.618	66.307	242.270
	Aug	1073.126	3739.452	4242.999	5762.211	4351.090	511.031	67.371	243.440
	Sep	1078.211	3798.233	4285.832	5824.390	4398.837	515.990	67.036	245.490
	Oct	1084.671	3860.123	4327.305	5887.775	4484.506	520.806	67.058	247.530
	Nov	1093.735	3915.841	4364.342	5945.154	4517.585	524.379	67.182	249.420
	Dec	1097.375	3963.734	4397.018	5996.923	4536.485	526.458	67.074	251.010
1999	Jan	1095.980	3998.710	4422.360	6028.749	4524.588	531.761	68.517	252.260
	Feb	1094.290	4039.737	4447.669	6077.971	4514.756	538.190	68.067	253.460
	Mar	1101.391	4062.008	4463.435	6087.761	4494.391	539.053	66.488	254.390
	Apr	1107.226	4099.557	4490.355	6123.735	4504.221	539.609	64.109	255.900
	May	1101.751	4129.187	4513.053	6156.255	4516.234	548.331	68.424	257.080
	Jun	1100.206	4153.327	4530.973	6187.303	4560.028	549.797	67.046	258.040
	Jul	1099.569	4177.179	4552.715	6210.837	4563.901	553.061	66.882	259.230
	Aug	1098.668	4200.217	4569.938	6228.405	4593.221	556.713	67.249	260.230
	Sep	1095.985	4218.310	4589.066	6254.592	4617.307	564.133	70.206	261.350
	Oct	1101.146	4240.711	4605.250	6302.928	4633.632	572.986	73.315	262.260
	Nov	1109.356	4267.266	4624.240	6379.253	4687.982	588.662	83.810	263.330
	Dec	1123.797	4304.590	4652.219	6469.314	4763.451	612.065	95.665	264.890
2000	Jan	1121.127	4337.991	4675.724	6513.228	4786.003	604.798	80.729	266.090
	Feb	1105.748	4335.607	4684.867	6529.370	4820.852	589.903	68.353	266.510
	Mar	1111.510	4387.979	4719.786	6596.387	4858.389	584.187	65.535	268.150
	Apr	1115.371	4418.109	4759.261	6631.162	4901.674	582.441	64.518	270.250

*All values are given in billions of dollars

		Federal Funds	Discount Rate	Prime Rate	3-mo CDs	Treasury Yields 3 mo	3 yr	30 yr	Corporate Aaa Bonds	S & L Aaa Bonds	Conventional Mortgage
	1995	5.84	5.21	8.83	5.92	5.66	6.26	6.88	7.59	5.80	7.95
	1996	5.30	5.02	8.27	5.39	5.15	5.99	6.70	7.37	5.52	7.80
	1997	5.46	5.00	8.44	5.62	5.20	6.10	6.61	7.26	5.32	7.60
	1998	5.35	4.92	8.35	5.47	4.91	5.14	5.58	6.53	4.93	6.94
	1999	4.97	4.62	7.99	5.33	4.78	5.49	5.87	7.04	5.28	7.43
1998	1	5.52	5.00	8.50	5.55	5.19	5.46	5.88	6.67	4.94	7.05
	2	5.50	5.00	8.50	5.59	5.11	5.57	5.85	6.64	5.00	7.09
	3	5.53	5.00	8.50	5.53	4.96	5.11	5.47	6.49	4.95	6.87
	4	4.86	4.66	7.92	5.20	4.37	4.41	5.11	6.33	4.82	6.76
1999	1	4.73	4.50	7.75	4.90	4.53	4.87	5.37	6.42	4.87	6.88
	2	4.75	4.50	7.75	4.98	4.59	5.35	5.80	6.93	5.05	7.20
	3	5.09	4.60	8.10	5.38	4.79	5.71	6.04	7.33	5.42	7.80
	4	5.31	4.87	8.37	6.06	5.20	6.00	6.25	7.49	5.79	7.83
2000	1	5.68	5.19	8.69	6.03	5.70	6.56	6.30	7.71	5.82	8.26
1998	Apr	5.45	5.00	8.50	5.58	5.08	5.58	5.92	6.69	5.00	7.14
	May	5.49	5.00	8.50	5.59	5.14	5.61	5.93	6.69	5.04	7.14
	Jun	5.56	5.00	8.50	5.60	5.12	5.52	5.70	6.53	4.97	7.00
	Jul	5.54	5.00	8.50	5.59	5.09	5.47	5.68	6.55	5.01	6.95
	Aug	5.55	5.00	8.50	5.58	5.04	5.24	5.54	6.52	5.01	6.92
	Sep	5.51	5.00	8.49	5.41	4.74	4.62	5.20	6.40	4.84	6.72
	Oct	5.07	4.86	8.12	5.21	4.07	4.18	5.01	6.37	4.76	6.71
	Nov	4.83	4.63	7.89	5.24	4.53	4.57	5.25	6.41	4.87	6.87
	Dec	4.68	4.50	7.75	5.14	4.50	4.48	5.06	6.22	4.83	6.72
1999	Jan	4.63	4.50	7.75	4.89	4.45	4.61	5.16	6.24	4.85	6.79
	Feb	4.76	4.50	7.75	4.90	4.56	4.90	5.37	6.40	4.80	6.81
	Mar	4.81	4.50	7.75	4.91	4.57	5.11	5.58	6.62	4.96	7.04
	Apr	4.74	4.50	7.75	4.88	4.41	5.03	5.55	6.64	4.89	6.92
	May	4.74	4.50	7.75	4.92	4.63	5.33	5.81	6.93	5.05	7.15
	Jun	4.76	4.50	7.75	5.13	4.72	5.70	6.04	7.23	5.22	7.55
	Jul	4.99	4.50	8.00	5.24	4.69	5.62	5.98	7.19	5.24	7.63
	Aug	5.07	4.56	8.06	5.41	4.87	5.77	6.07	7.40	5.47	7.94
	Sep	5.22	4.75	8.25	5.50	4.82	5.75	6.07	7.39	5.56	7.82
	Oct	5.20	4.75	8.25	6.13	5.02	5.94	6.26	7.55	5.78	7.85
	Nov	5.42	4.86	8.37	6.00	5.23	5.92	6.15	7.36	5.77	7.74
	Dec	5.30	5.00	8.50	6.05	5.36	6.14	6.35	7.55	5.82	7.91
2000	Jan	5.45	5.00	8.50	5.95	5.50	6.49	6.63	7.78	5.91	8.21
	Feb	5.73	5.24	8.73	6.01	5.73	6.65	6.23	7.68	5.88	8.33
	Mar	5.85	5.34	8.83	6.14	5.86	6.53	6.05	7.68	5.68	8.24
	Apr	6.02	5.50	9.00	6.28	5.82	6.36	5.85	7.64	5.60	8.15

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

		M1	MZM	M2	M3
Percent change from previous period					
	1995	-0.21	-0.46	2.06	4.56
	1996	-3.20	6.55	4.81	6.59
	1997	-3.30	7.18	4.92	7.98
	1998	1.02	11.65	7.36	10.26
	1999	2.00	12.21	7.51	8.72
1998	1	0.73	2.83	1.92	2.64
	2	0.18	3.22	1.91	2.55
	3	-0.24	2.99	1.75	2.21
	4	1.47	4.46	2.67	3.12
1999	1	0.48	3.07	1.87	2.05
	2	0.53	2.33	1.51	1.50
	3	-0.45	1.73	1.31	1.23
	4	1.22	1.72	1.24	2.45
2000	1	0.12	1.94	1.43	2.55
1998	Apr	0.12	1.09	0.59	0.68
	May	-0.48	0.98	0.53	0.78
	Jun	0.13	0.99	0.61	0.79
	Jul	-0.10	0.75	0.44	0.37
	Aug	-0.35	1.05	0.57	1.03
	Sep	0.47	1.57	1.01	1.08
	Oct	0.60	1.63	0.97	1.09
	Nov	0.84	1.44	0.86	0.97
	Dec	0.33	1.22	0.75	0.87
1999	Jan	-0.13	0.88	0.58	0.53
	Feb	-0.15	1.03	0.57	0.82
	Mar	0.65	0.55	0.35	0.16
	Apr	0.53	0.92	0.60	0.59
	May	-0.49	0.72	0.51	0.53
	Jun	-0.14	0.58	0.40	0.50
	Jul	-0.06	0.57	0.48	0.38
	Aug	-0.08	0.55	0.38	0.28
	Sep	-0.24	0.43	0.42	0.42
	Oct	0.47	0.53	0.35	0.77
	Nov	0.75	0.63	0.41	1.21
	Dec	1.30	0.87	0.61	1.41
2000	Jan	-0.24	0.78	0.51	0.68
	Feb	-1.37	-0.05	0.20	0.25
	Mar	0.52	1.21	0.75	1.03
	Apr	0.35	0.69	0.84	0.53

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). Due to distortions caused by regulatory changes, the largest of which the introduction of money market accounts, data for MZM begin March 1983 in this publication.

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 firms except depository institutions and money market mutual funds.

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 http://www.stls.frb.org/research/newbase.html.

Monetary Services Index: an index which 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 http://www.stls.frb.org/research/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 http://www.stls.frb.org/research/swdata.html. For analytical purposes, MZM largely replaces M1. The **Discount Rate** and **Expected 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. **Treasury Yield Curve** shows constant maturity yields calculated by the U.S. Treasury Department for securities with 3 months and 1, 2, 3, 5, 7,10, 20 and 30 years to maturity. Daily data and a description are available at http://www.stls.frb.org/fred/data/wkly.html. See also *Federal Reserve Bulletin*, table 1.35.

Page 5: **Total Checkable Deposits** is the sum of demand and other checkable deposits. **Total Savings Deposits** is the sum of money market deposit accounts (MMDA), 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 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 CPI for all urban consumers. **Real Interest Rates** are ex post measures, equal to nominal rates minus CPI inflation.

Page 9: **FOMC Expected Federal Funds Rate** is the level (or midpoint of the range, if applicable) of the federal funds rate that the staff of the Federal Open Market Committee expected to be consistent with the desired degree of pressure on bank reserve positions.

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), y_{t-1} is the log of the previous period's level of real GDP, and y_{t-1}^P is the log of an estimate of the previous period's level of potential output. **Potential real output** 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

http://www.stls.frb.org/research/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 $m = 1,..., 30$ 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)

$$f(m) = [D(m)R(m) - D(m\text{-}1)] / [D(m) - D(m\text{-}1)]$$

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. 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 Yield Spreads** equal, for 5, 10, and 30 year maturities, the difference between the Treasury constant maturity yield and the yield on the most recently issued inflation-protected security. **Inflation-Indexed Bonds** for Canada are the 31-year bond with a maturity date of 12/01/2026; for the U.K., the 37.5-year bond with a maturity date of 07/17/2024 and the 12.1-year bond with a maturity date of 10/21/2004; and, for the U.S., the 30-year bond with a maturity date of 04/15/2028 and the 10-year bond with a maturity date of 01/15/2007.

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 1992 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 1992 dollars.

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

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, nonfinancial debt: 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 and G.13 releases; nonfinancial commercial paper: Board of Governors web site; M2 and MZM own rates.

Bureau of Economic Analysis
Gross domestic product.

Bureau of Labor Statistics
Consumer price index.

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

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

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

University of Michigan Survey Research Center
Median expected price change.

Congressional Budget Office
Potential real GDP.

Dow Jones and Co. (Wall Street Journal)
Federal funds futures contracts, Eurodollar futures.

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

U.S. Department of the Treasury
U.S. inflation-protected security yields.

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Note: Articles from this Bank's *Review* are available on the Internet at www.stls.frb.org/research/reviewdat.html.