Uncertainty About When the Fed Will Raise Interest Rates

In response to the current economic crisis, the Federal Reserve has reduced its federal funds rate (FFR) target to zero. With the FFR at zero and a negative rate practically infeasible, the Fed is now in largely uncharted territory when conducting monetary policy. Other types of policies are now the focus of attention.

However, changes in the FFR eventually could again be the primary policy tool. But when might this happen? The answer depends on how the future of the U.S. economy is viewed and how that view maps into monetary policy. Here, I use the most recent forecasts from each member of the Survey of Professional Forecasters (SPF)[1] to show that the current lack of consensus about future economic growth and inflation makes it hard to predict when the Fed will raise interest rates.

To demonstrate this uncertainty, I translate the forecasts into a policy prescription using a Taylor rule. The Taylor rule is a formula that implies a change in the FFR (from its equilibrium value) when there is a change in either the output gap (the difference in log–gross domestic product [GDP] and log–potential GDP) or the inflation gap (the difference in actual inflation and the target rate of inflation) where these two measurements reflect the Fed's dual mandate of price stability and long-term economic growth.

In accordance with recent comments from Federal Open Market Committee (FOMC) members,[2] I set the target inflation rate at 2 percent and the equilibrium FFR target at 2.5 percent. Quarterly forecasts of potential GDP are from the Congressional Budget Office, and forecasts of both log-GDP and log–core personal consumption expenditure inflation are from the SPF. Substituting these values into the Taylor rule provides a predicted path of the FFR for each forecaster starting in 2009:Q2 and ending in 2010:Q3.

The median, maximum, and minimum values of these predictions are plotted in

the chart. The median path implies an FFR that stays near zero through 2010:Q3. Even so, there is considerable disagreement among the survey participants. Some forecasts imply that the FFR should be a bit above ½ percent already and rise to nearly 5 percent by mid-2010. And if a negative FFR were feasible, other forecasts imply that the FFR should be as low as –5 percent in mid-2009 before rising to nearly –3 percent by mid-2010.

It's easy to speculate about the reasons for such a wide range of FFR predictions. For some forecasts, a large and persistent output gap requires low interest rates to stimulate growth. For others, the huge expansion of the Fed's balance sheet requires higher interest rates to moderate future inflation. Not surprisingly, the high degree of uncertainty about the overall economy implies a similar degree of uncertainty about when the FFR will again be a primary tool of monetary policy.

—Michael W. McCracken

[1] The SPF is available at www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/data-files/.

[2] Bernanke, Ben S. Semiannual Monetary Policy Report to the Congress before the Committee on Banking, Housing and Urban Affairs, U.S. Senate. February 24, 2009; www.federalreserve.gov/newsevents/testimony/bernanke20090224a.htm.

Taylor Rule Based on Survey of Professional Forecasters
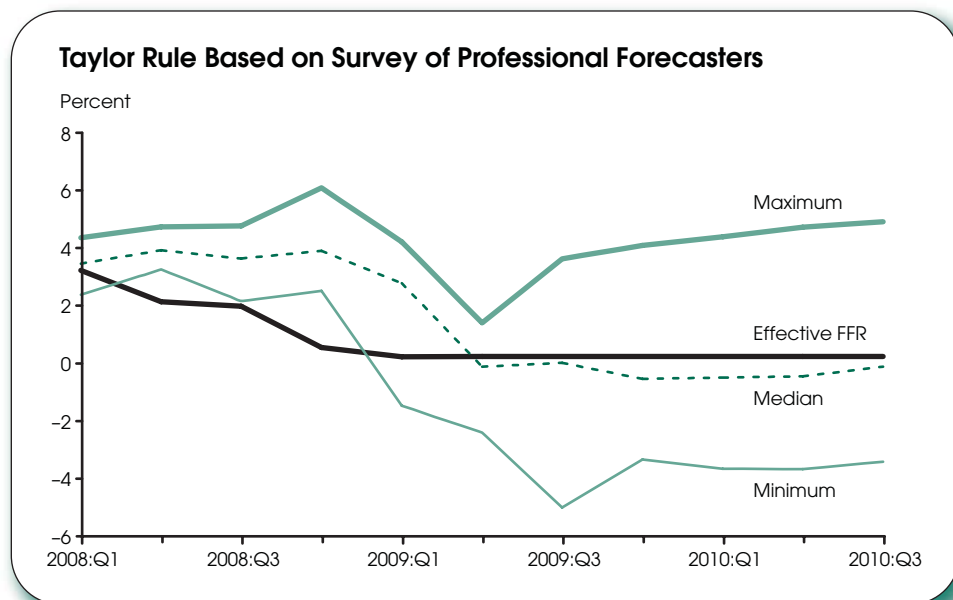
Views expressed do not necessarily reflect official positions of the Federal Reserve System.

Contents

Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.

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

3. *Percent change at an annual rate* is the simple, not compounded, monthly percent change multiplied by 12. For example, using consecutive months, the percent change at an annual rate in x between month $t-1$ and the current month t is: $[(x_t/x_{t-1})-1] \times 1200$. Note that this differs from *National Economic Trends.* In that publication, monthly percent changes are compounded and expressed as annual growth rates.

4. The *percent change from year ago* refers to the percent change from the same period in the previous year. For example, the percent change from year ago in *x* between month $t-12$ and the current month t is: $[(x_t/x_{t-12})-1] \times 100$.
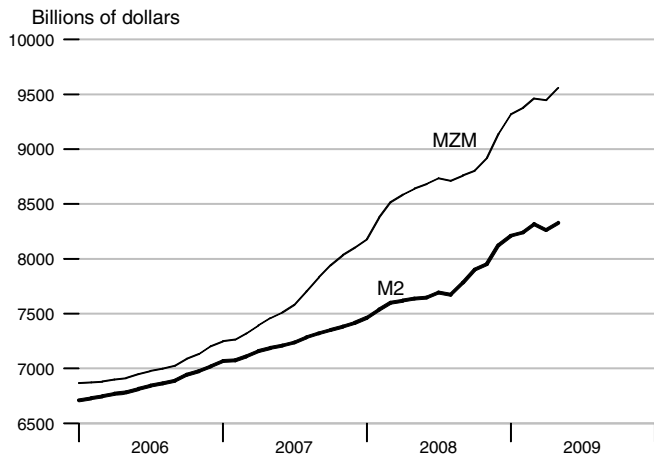
We welcome your comments addressed to:

Editor, *Monetary Trends*
Research Division
Federal Reserve Bank of St. Louis
P.O. Box 442
St. Louis, MO 63166-0442

or to:

stlsFRED@stls.frb.org

On March 23, 2006, the Board of Governors of the Federal Reserve System ceased the publication of the M3 monetary aggregate. It also ceased publishing the following components: large-denomination time deposits, RPs, and eurodollars.
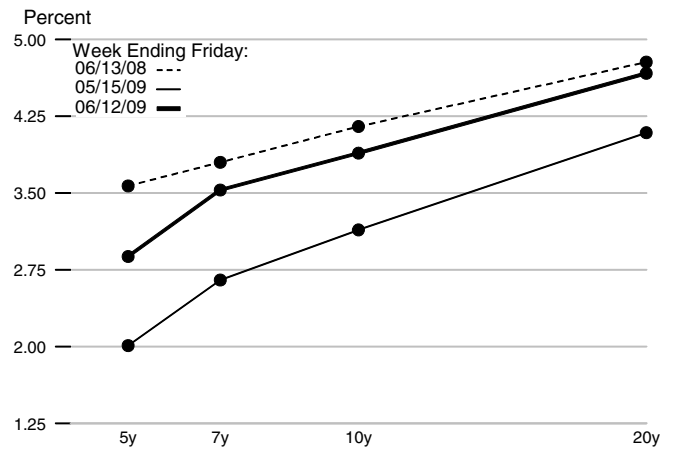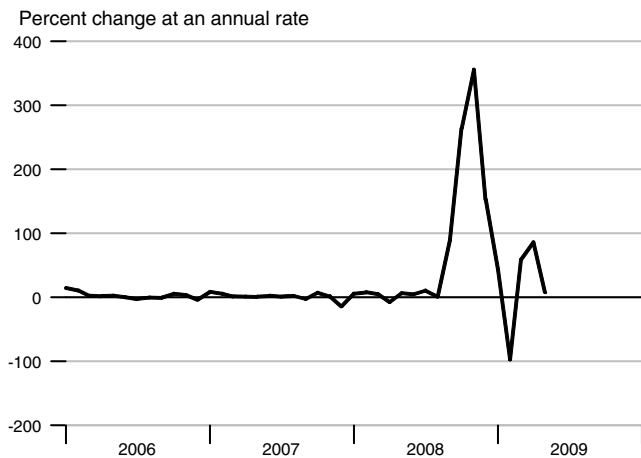
M2 and MZM

Billions of dollars

MZM
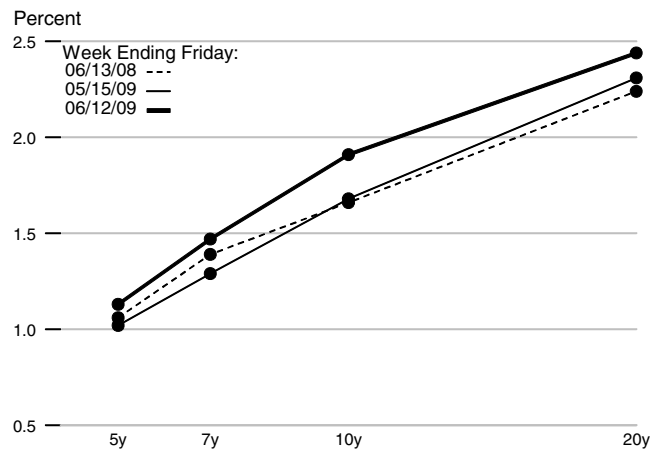
M2

Adjusted Monetary Base

Percent change at an annual rate

Reserve Market Rates

Percent

--- Effective Federal Funds Rate
— Intended Federal Funds Rate
Primary Credit Rate
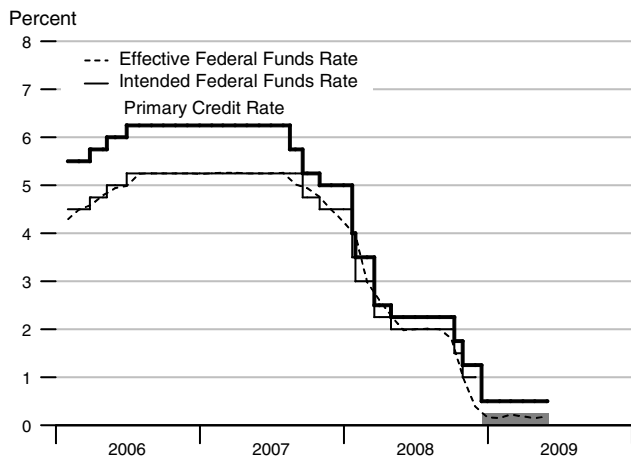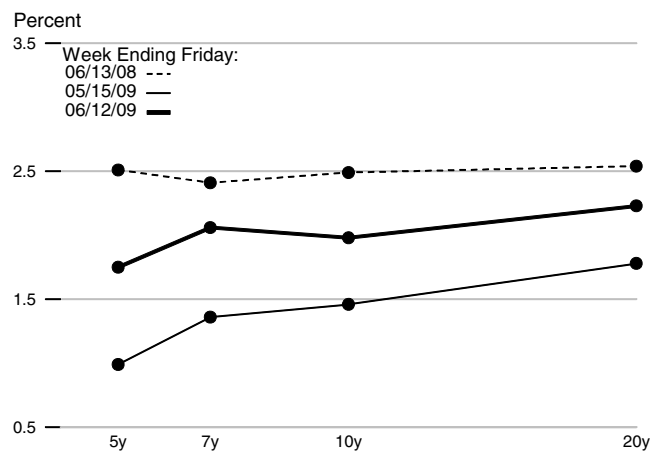
Note: Effective December 16, 2008, FOMC reports the
intended Federal Funds Rate as a range.

Treasury Yield Curve

Percent

Week Ending Friday:
06/13/08 ---
05/15/09 —
06/12/09 ▬

Real Treasury Yield Curve

Percent

Week Ending Friday:
06/13/08 ---
05/15/09 —
06/12/09 ▬

Inflation-Indexed Treasury Yield Spreads

Percent

Week Ending Friday:
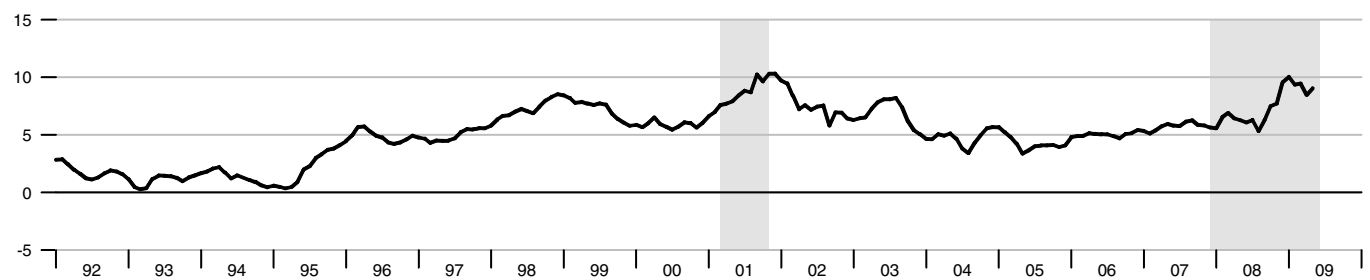06/13/08 ---
05/15/09 —
06/12/09 ▬

MZM and M1

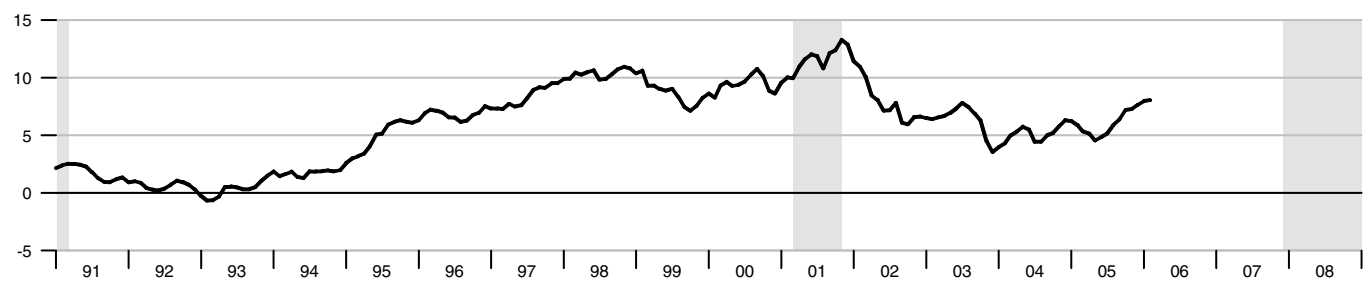Percent change from year ago

M2
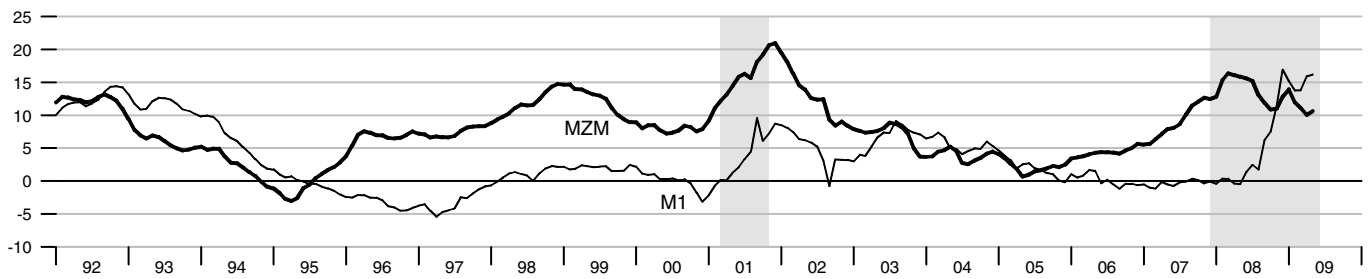
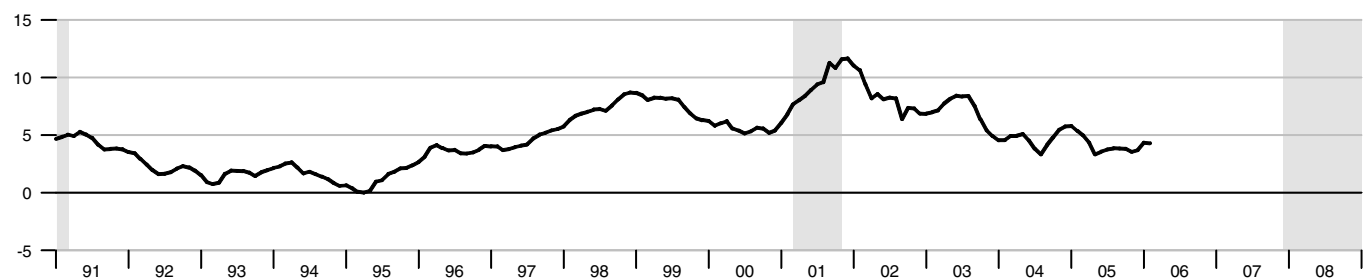Percent change from year ago

M3*

Percent change from year ago

*See table of contents for changes to the series.
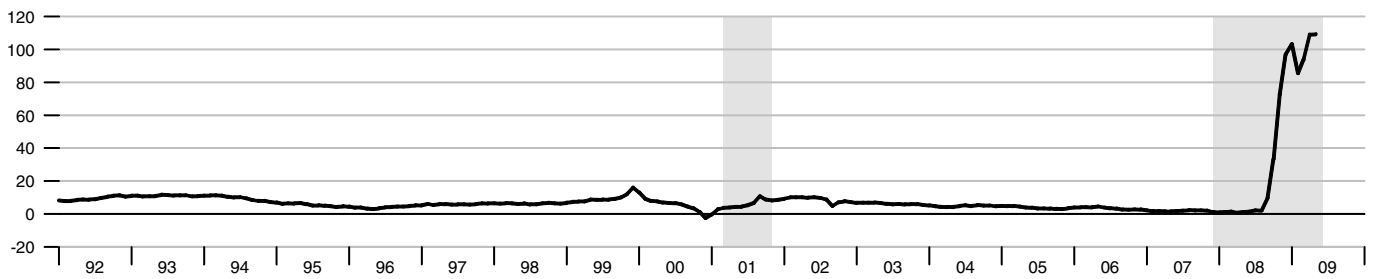
Monetary Services Index - M2**

Percent change from year ago

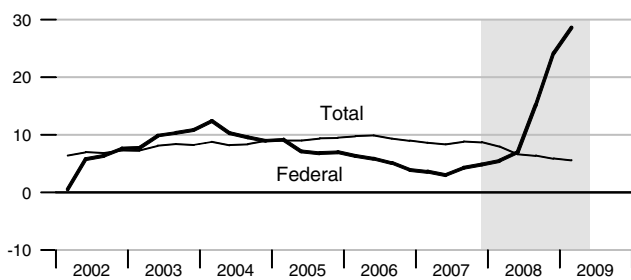**We will not update the MSI series until we revise the code to accomodate the discontinuation of M3.

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
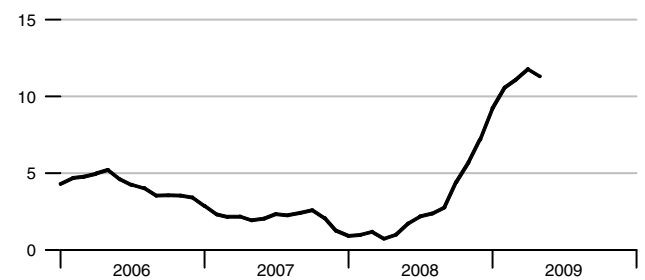
Time Deposits*

Percent change from year ago
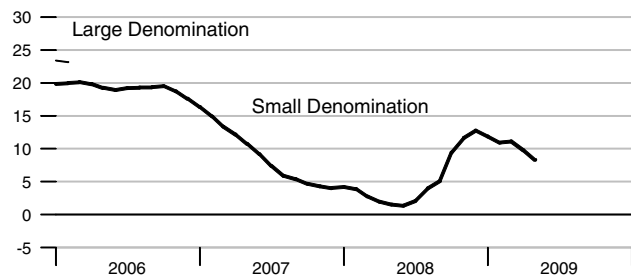
*See table of contents for changes to the series.

Checkable and Savings Deposits

Percent change from year ago
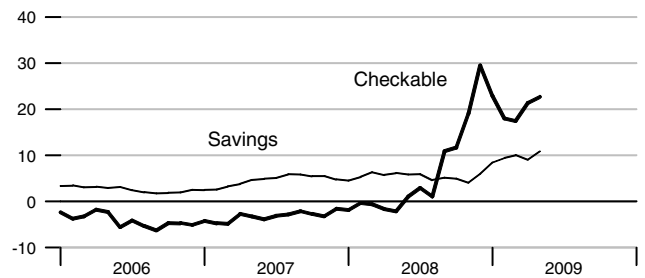
Money Market Mutual Fund Shares

Percent change from year ago
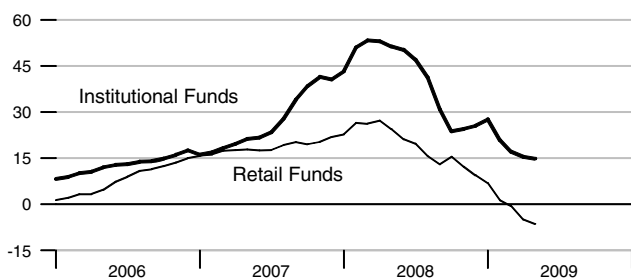
Repurchase Agreements and Eurodollars*

Billions of dollars   Billions of dollars
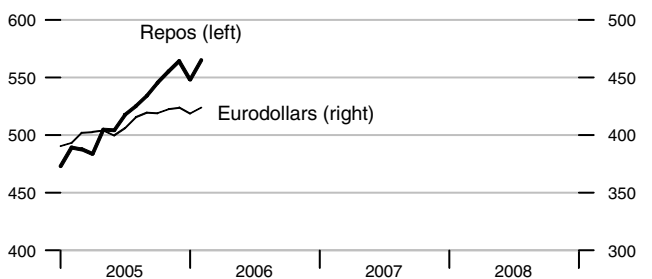
*See table of contents for changes to these series.

M1

Percent change at an annual rate
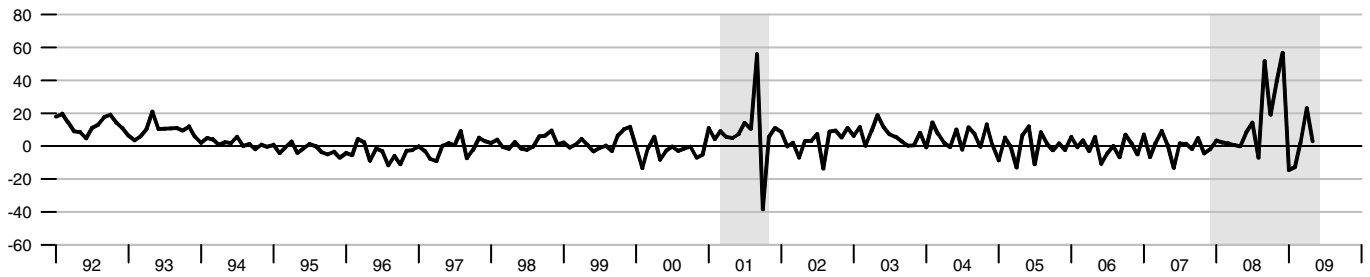
MZM

Percent change at an annual rate
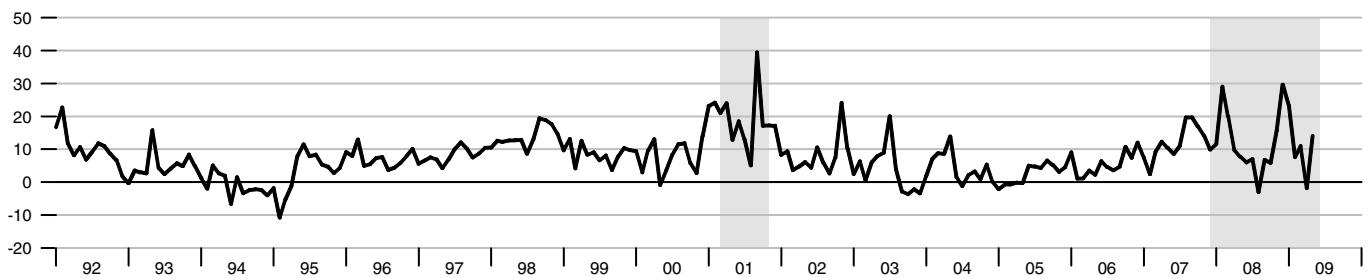
M2

Percent change at an annual rate

M3*
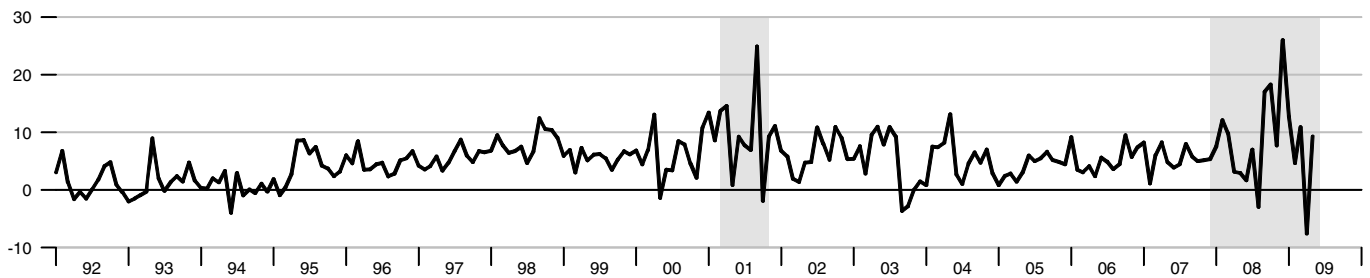
Percent change at an annual rate
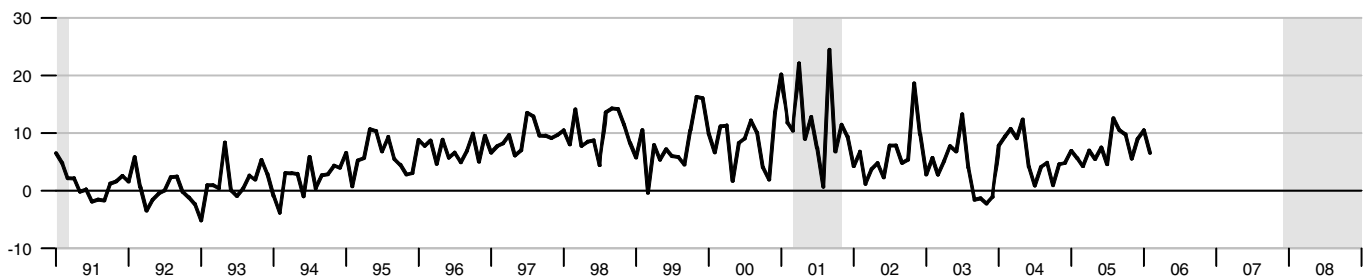
*See table of contents for changes to the series.

Adjusted and Required Reserves

Billions of dollars
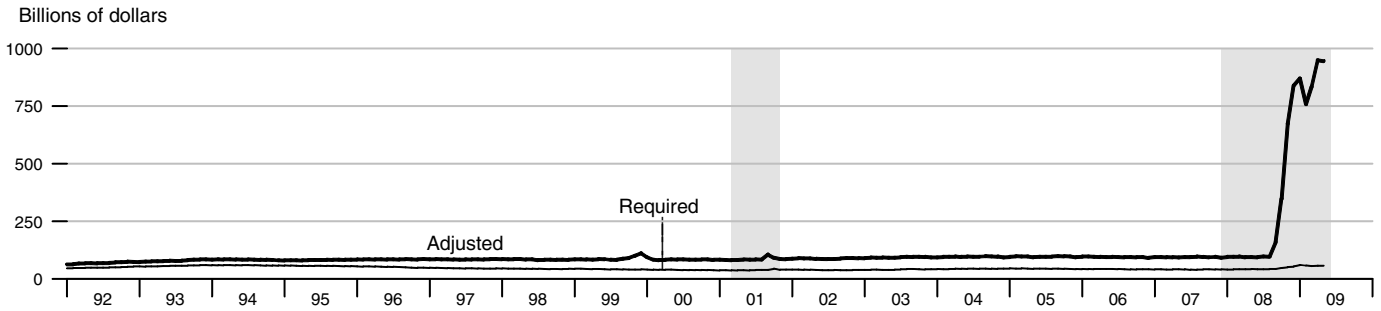
Total Borrowings, nsa

Billions of dollars
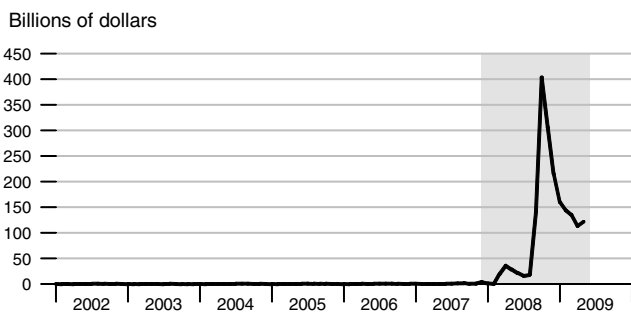
* Data exclude term auction credit

Excess Reserves plus RCB Contracts

Billions of dollars

Nonfinancial Commercial Paper

Percent change from year ago
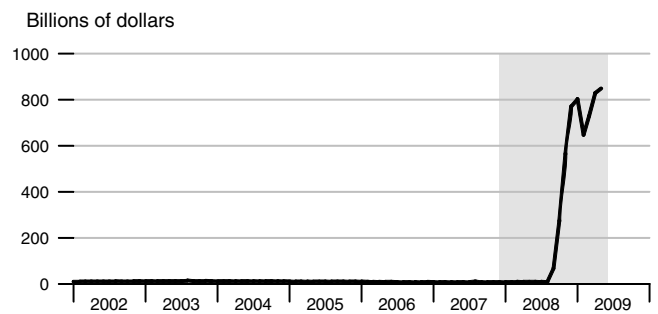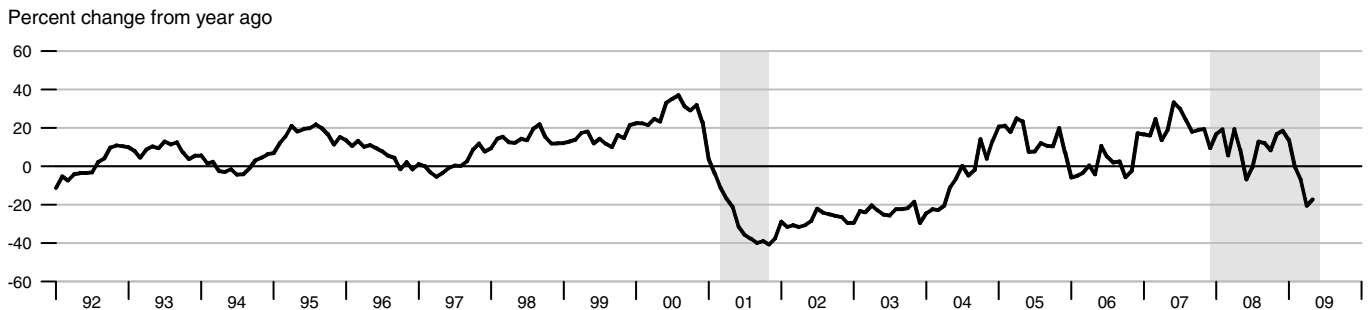
As of April 10, 2006, the Federal Reserve Board made major changes to its commercial paper calculations.
For more information, please refer to http://www.federalreserve.gov/releases/cp/about.htm.

Consumer Credit

Percent change from year ago
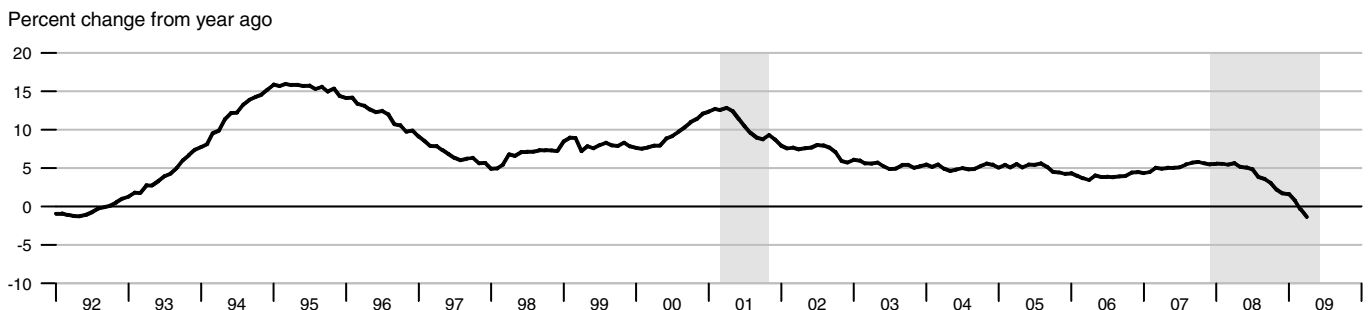
CPI Inflation and 1-Year-Ahead CPI Inflation Expectations

Percent

Humphrey-Hawkins CPI Inflation Range

CPI Inflation

University of
Michigan

Federal Reserve Bank
of Philadelphia
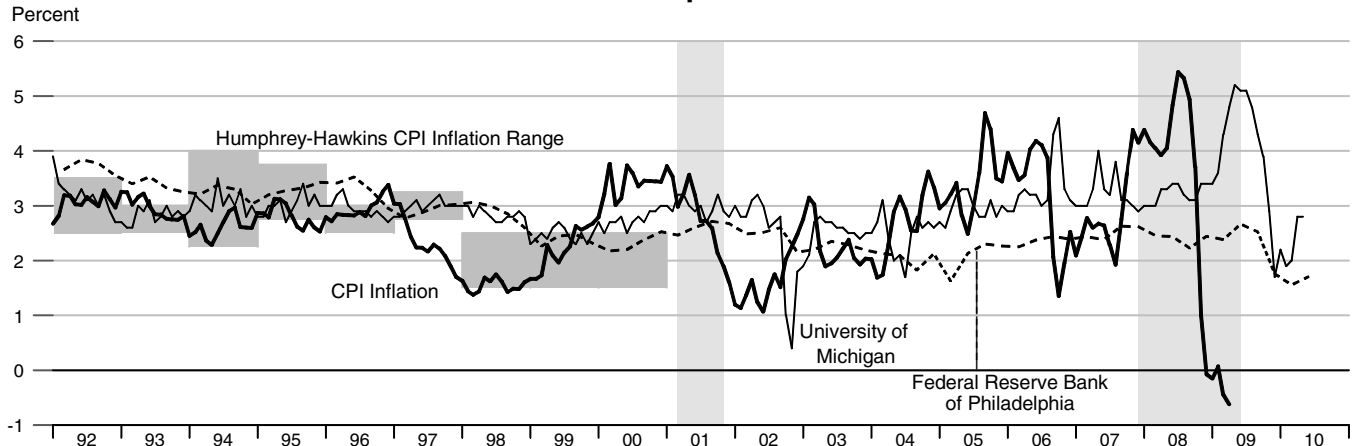
The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph.

10-Year Ahead PCE Inflation Expectations and Realized Inflation

Percent

Realized

Expected

See the notes section for an explanation of the chart.

Treasury Security Yield Spreads
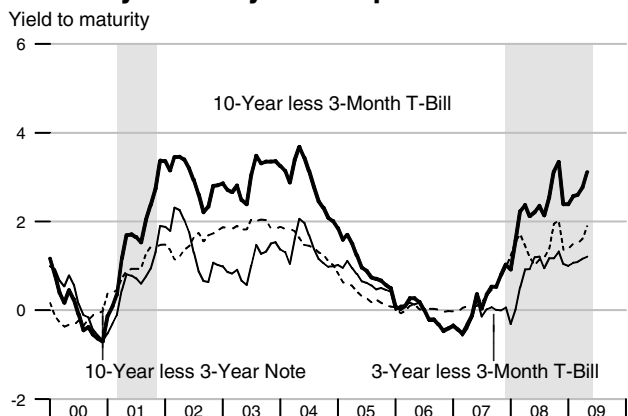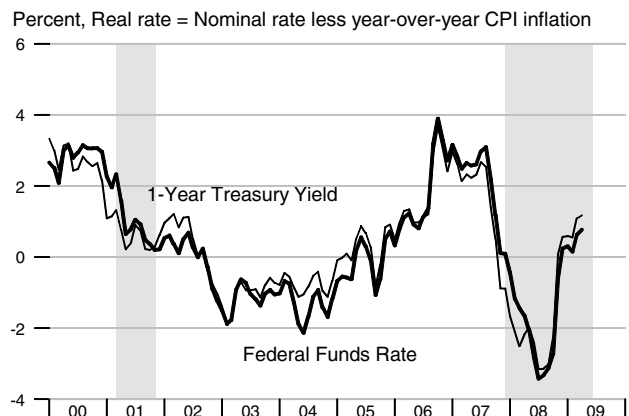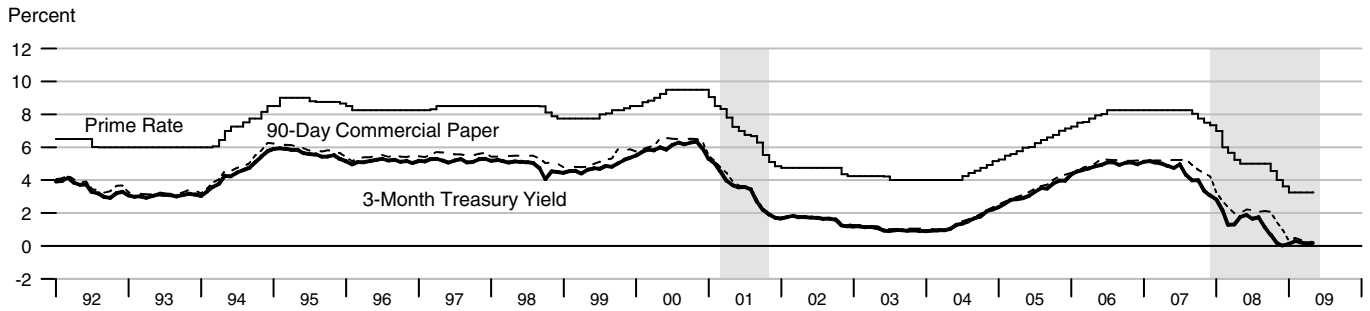
Yield to maturity

10-Year less 3-Month T-Bill

10-Year less 3-Year Note

3-Year less 3-Month T-Bill

Real Interest Rates

Percent, Real rate = Nominal rate less year-over-year 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
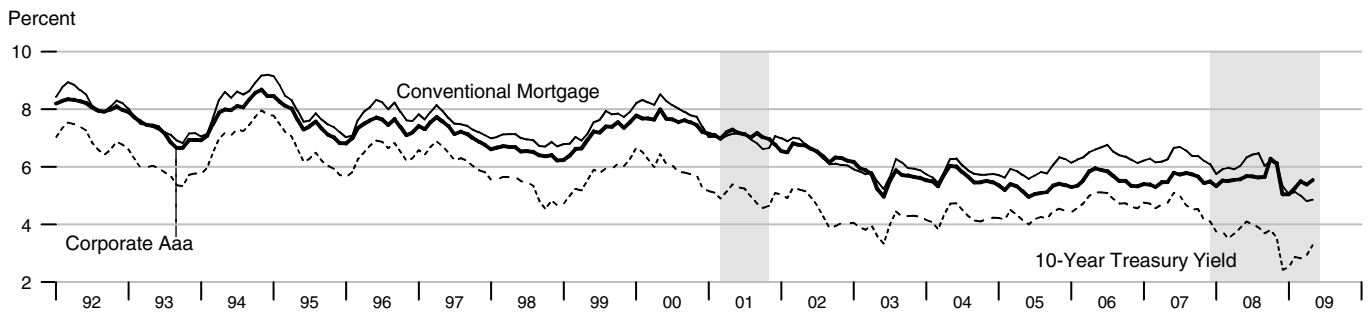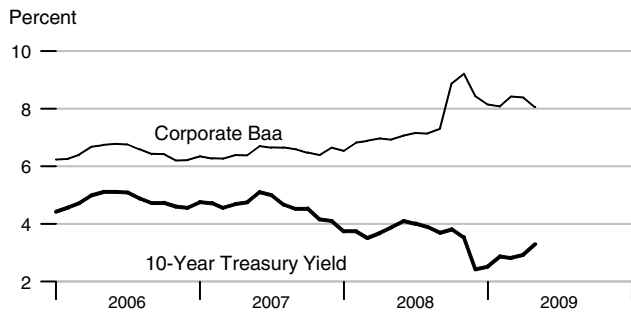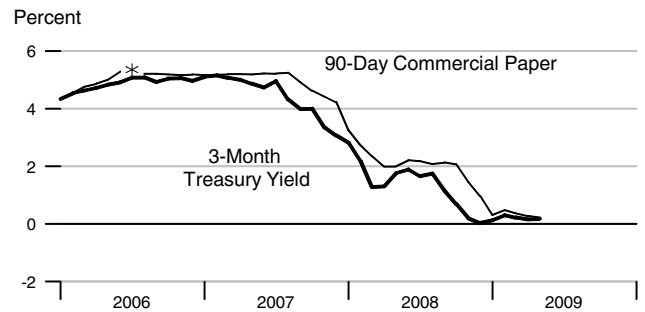
*90-Day Commercial Paper data are not available for December 2005, January 2006, and July 2006.

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
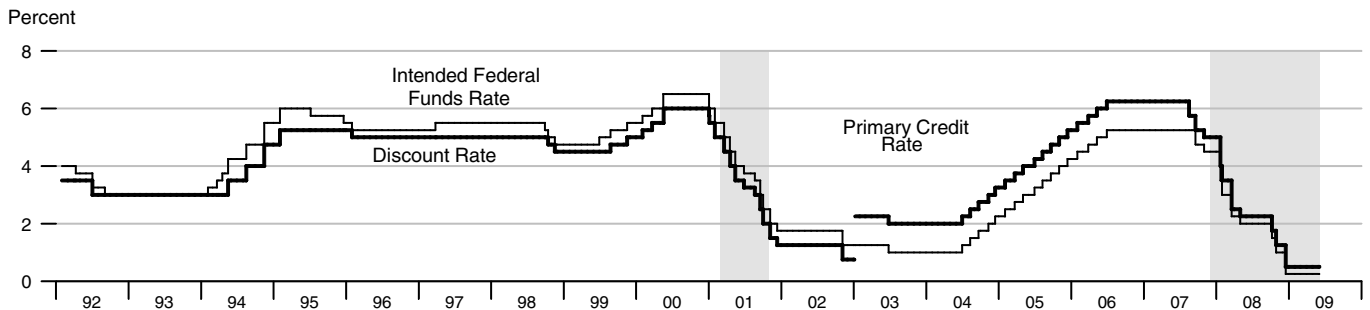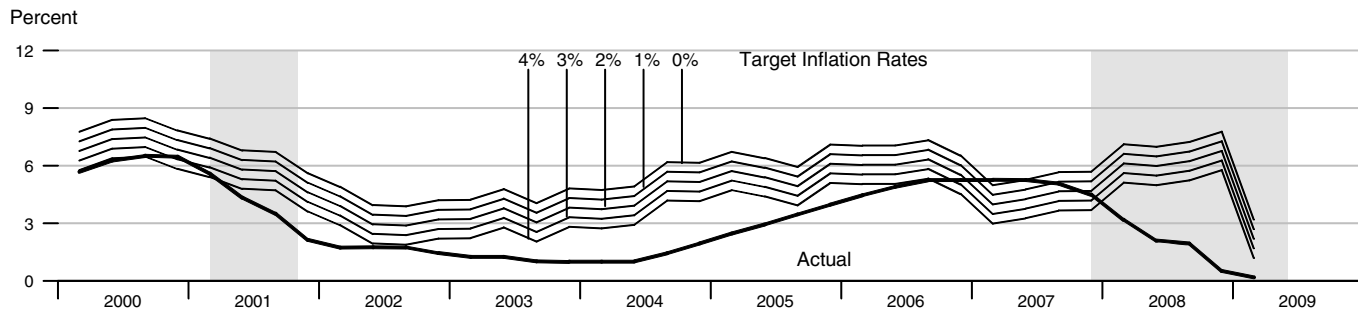
Actual

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

Components of Taylor's Rule

Actual and Potential Real GDP

Billions of chain-weighted 2000 dollars

Potential

Actual

PCE Inflation

Percent change from year ago

Monetary Base Growth* and Inflation Targets

Percent

Actual (right)

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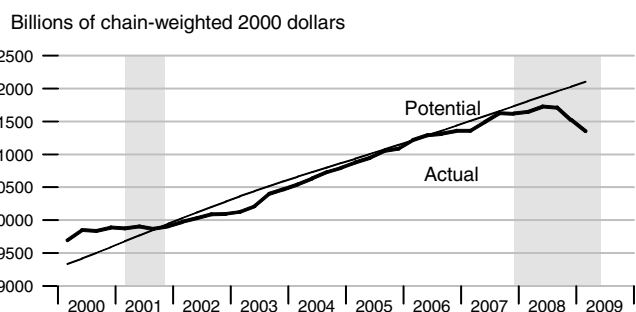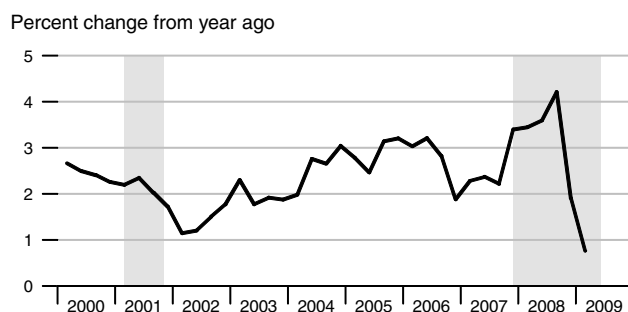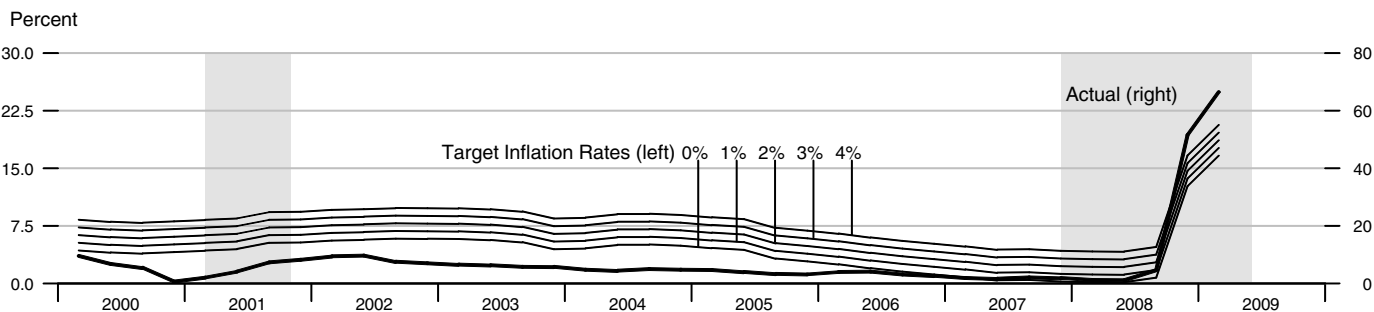
*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago.

See notes on page 19.

Components of McCallum's Rule

Monetary Base Velocity Growth
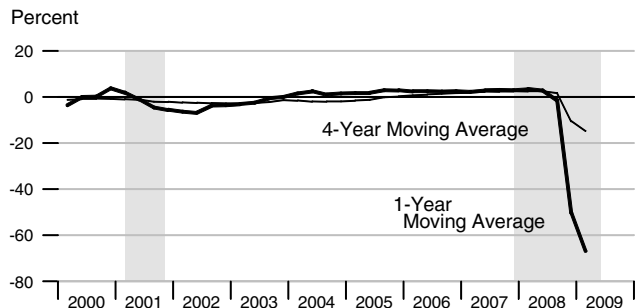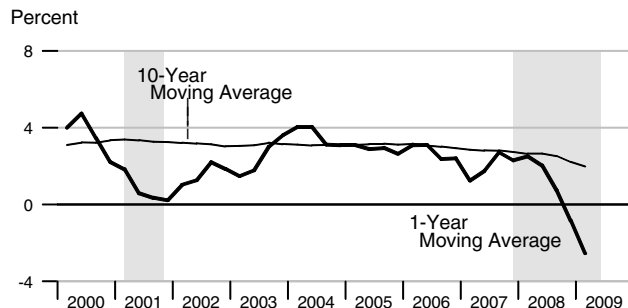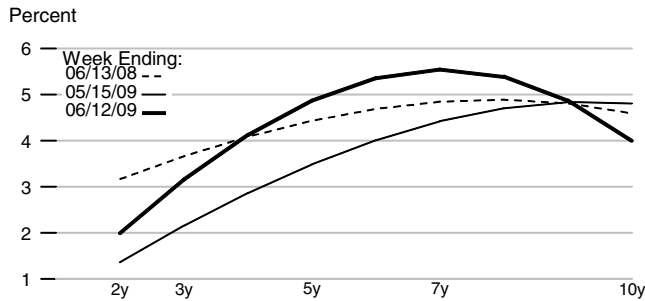
Percent

4-Year Moving Average

1-Year
Moving Average

Real Output Growth

Percent

10-Year
Moving Average

1-Year
Moving Average

Implied One-Year Forward Rates

Percent

Week Ending:
06/13/08 - -
05/15/09 —
06/12/09 —

Rates on 3-Month Eurodollar Futures

Percent, daily data

Aug 2009

Jul 2009

Jun 2009

Rates on Selected Federal Funds Futures Contracts

Percent, daily data

Aug 2009

Jul 2009

Jun 2009

Rates on Federal Funds Futures on Selected Dates

Percent

06/12/2009

04/17/2009

05/15/2009

Contract Month
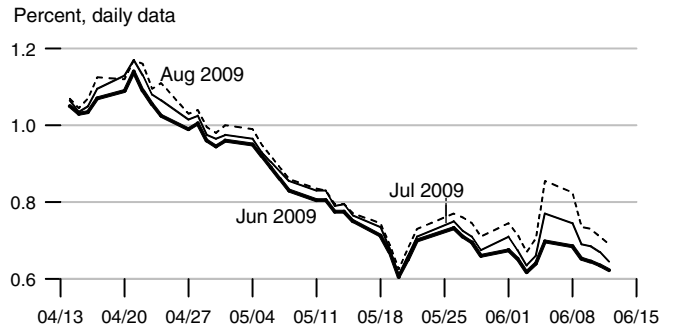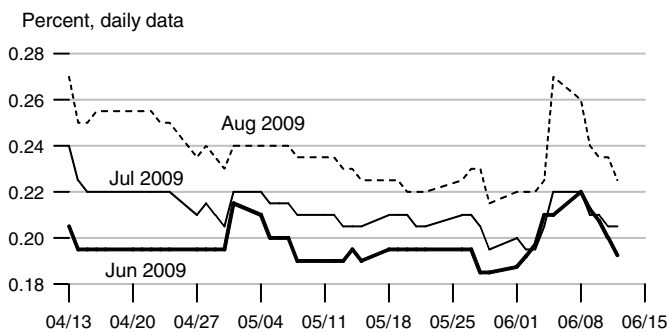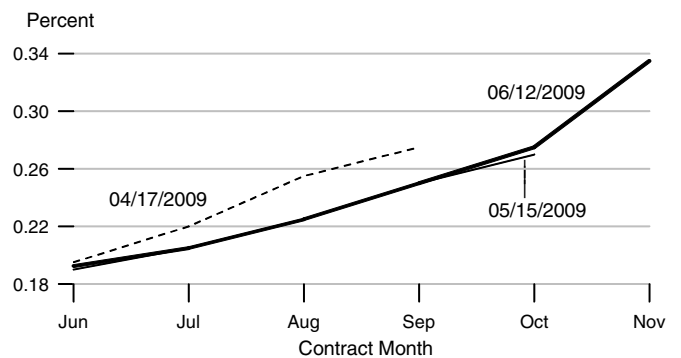
Inflation-Indexed Treasury Securities

Weekly data

Percent
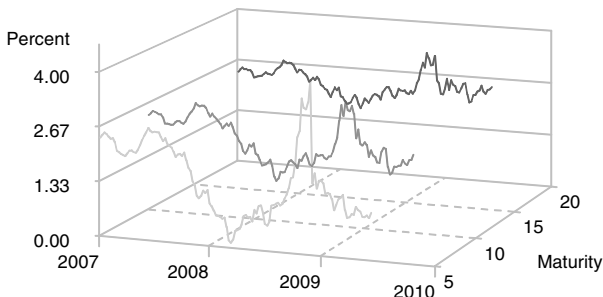
Maturity

Note: Yields are inflation-indexed constant maturity
U.S. Treasury securities

Inflation-Indexed Treasury Yield Spreads

Weekly data

Percent

Horizon
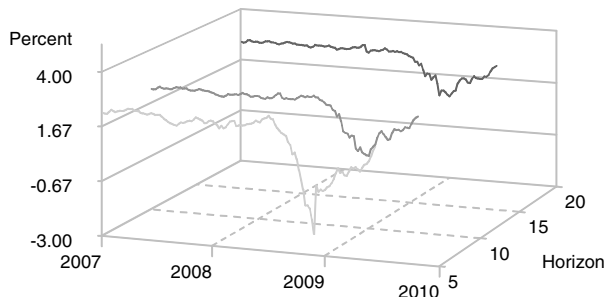
Note: Yield spread is between nominal and inflation-indexed
constant maturity U.S. Treasury securities.

Inflation-Indexed 10-Year Government Notes

Percent, weekly data

U.K.

U.S.

France
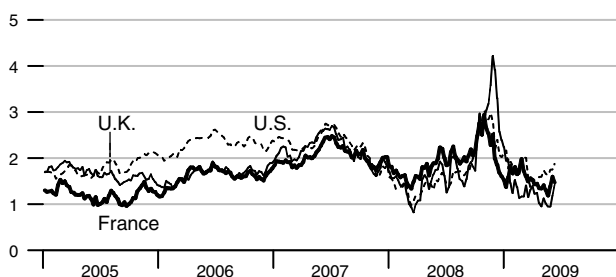
Inflation-Indexed 10-Year Government Yield Spreads

Percent, weekly data

U.K.

France

U.S.
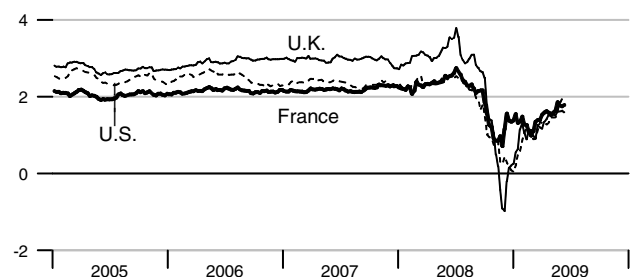
Velocity

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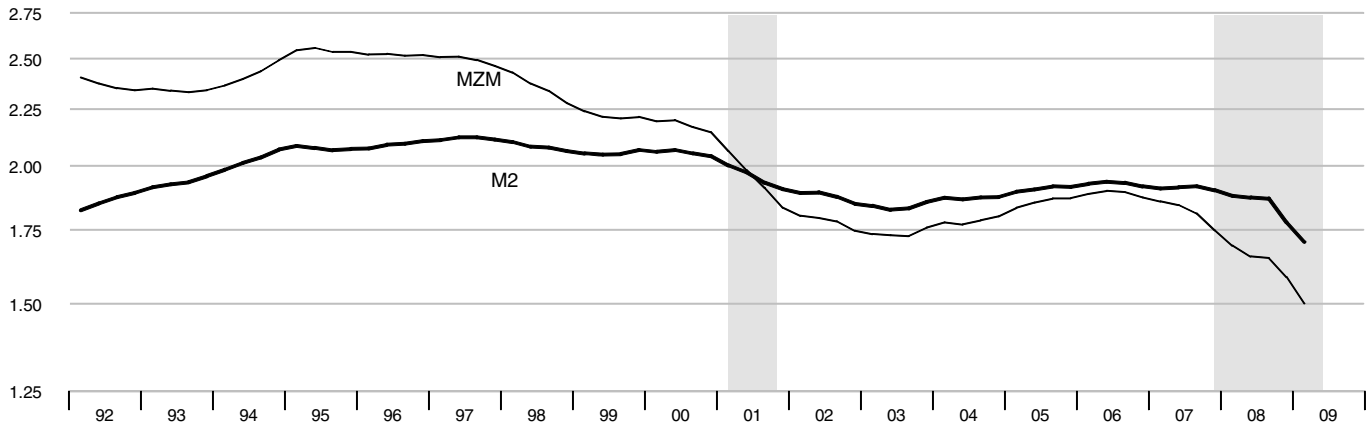
Interest Rates

Percent
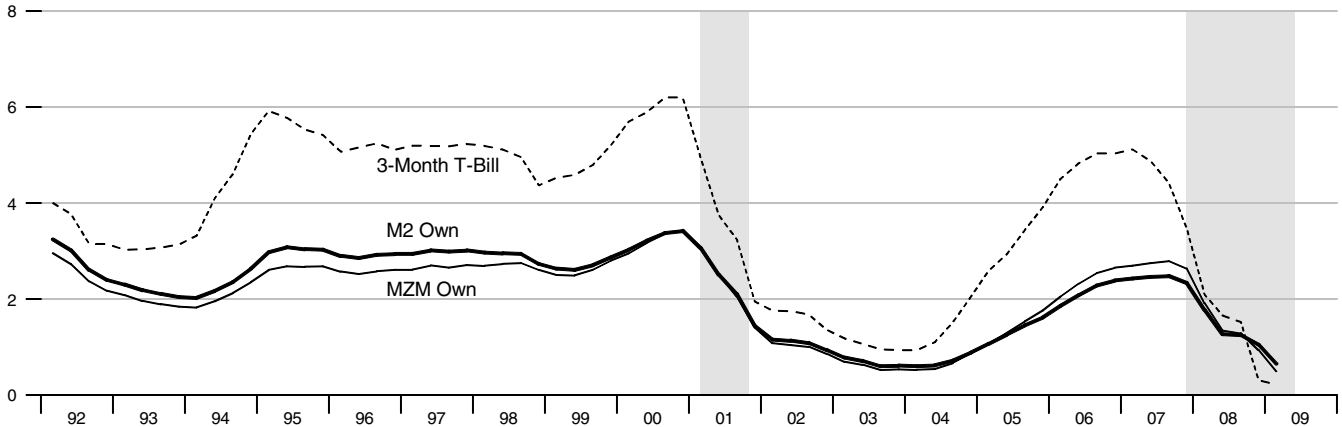
MZM Velocity and Interest Rate Spread
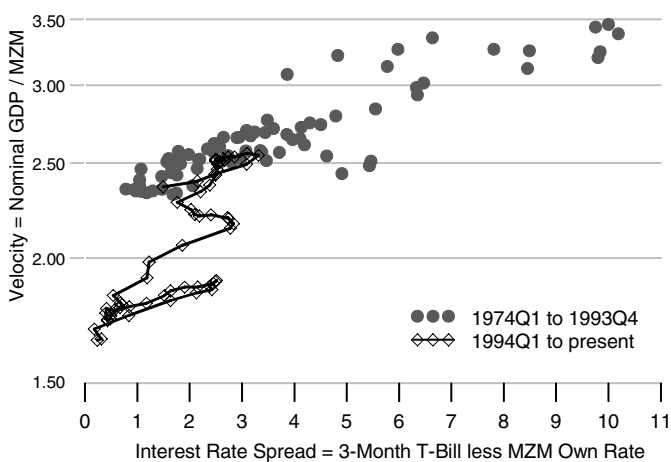
Ratio Scale

M2 Velocity and Interest Rate Spread
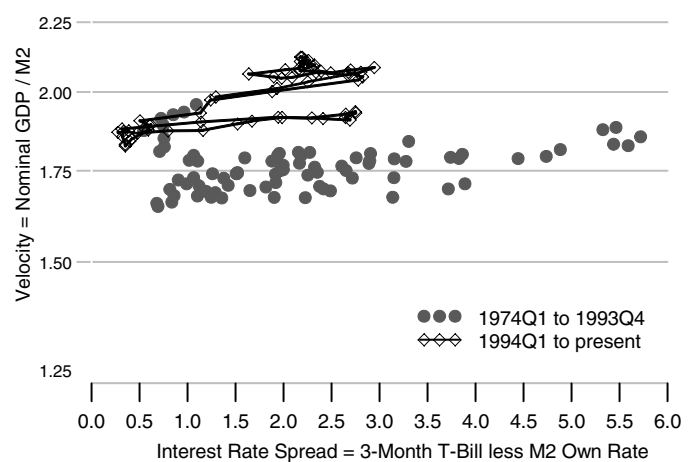
Ratio Scale

Gross Domestic Product

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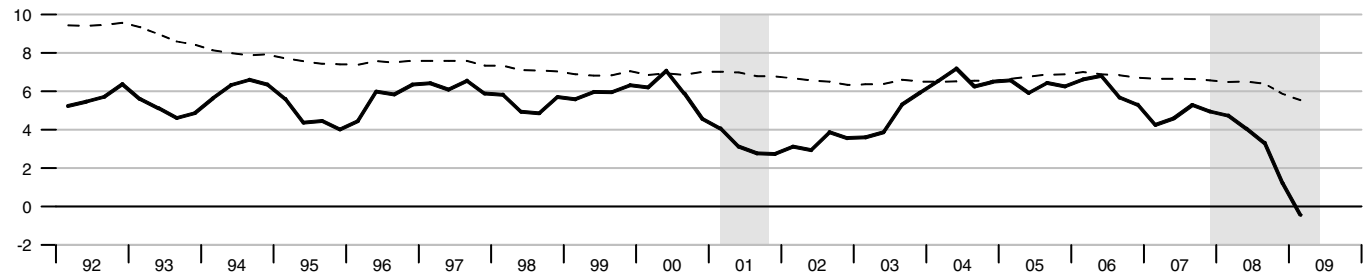
Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

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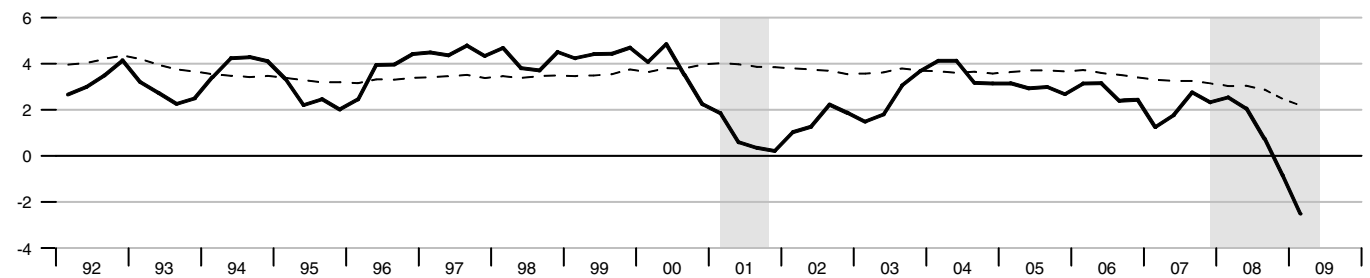
Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

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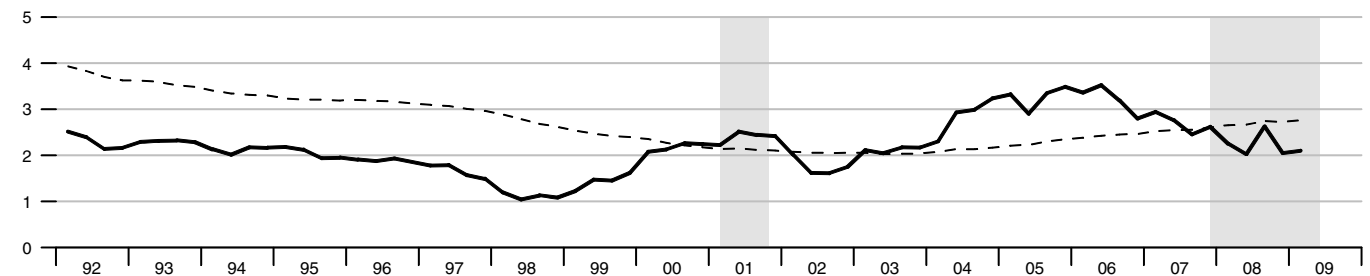
Dashed lines indicate 10-year moving averages.

M2

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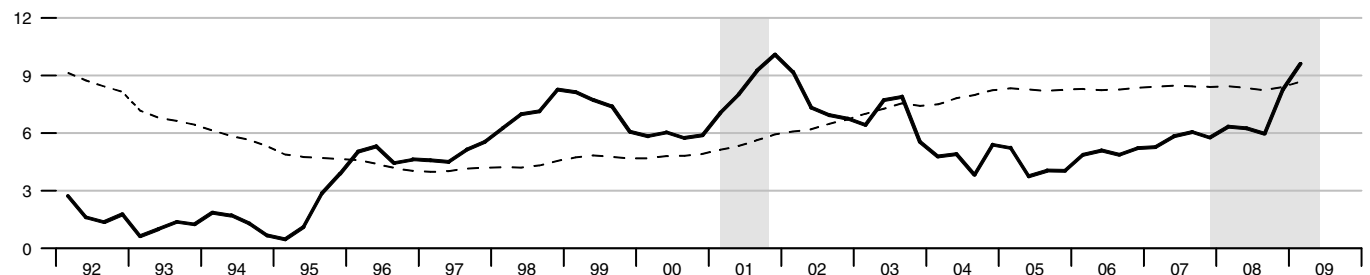
Dashed lines indicate 10-year moving averages.

Bank Credit

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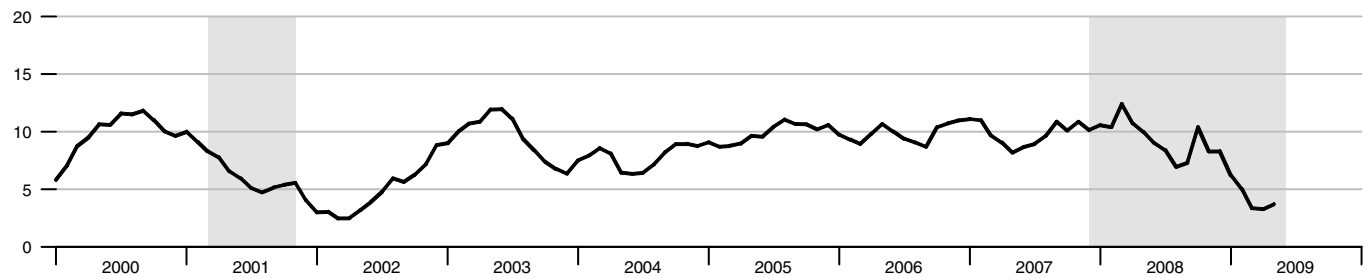
Investment Securities in Bank Credit at Commercial Banks

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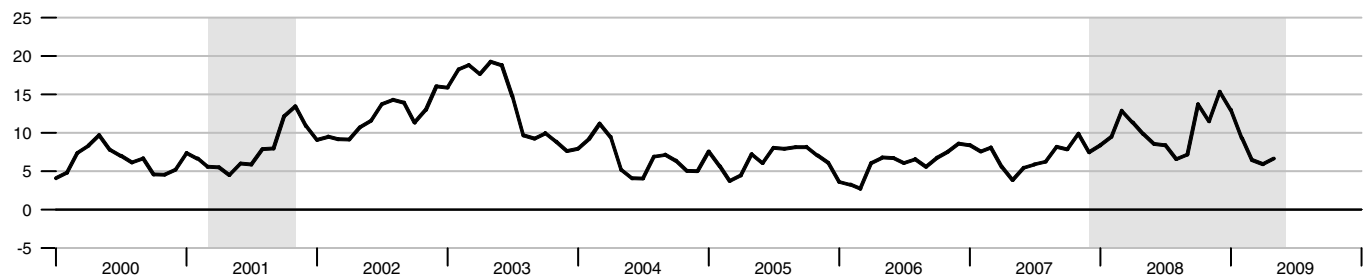
Total Loans and Leases in Bank Credit at Commercial Banks

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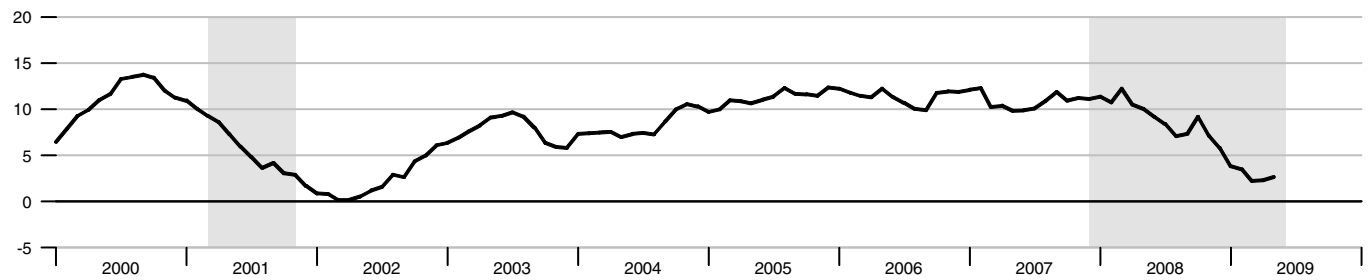
Commercial and Industrial Loans at Commercial Banks

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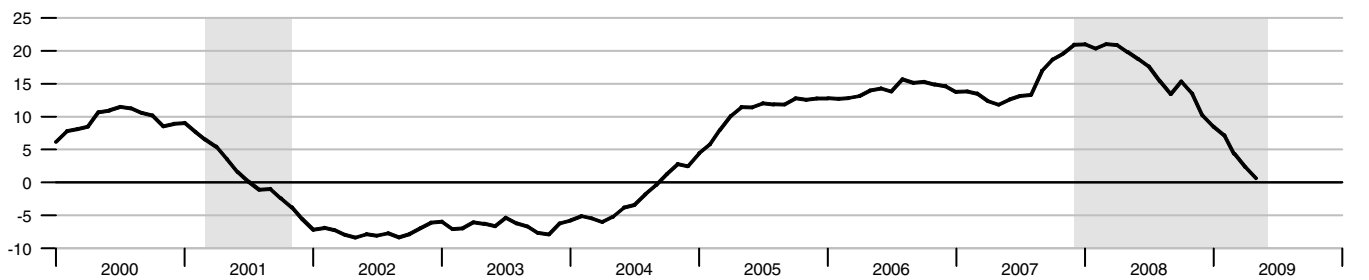
Standard & Poor's 500
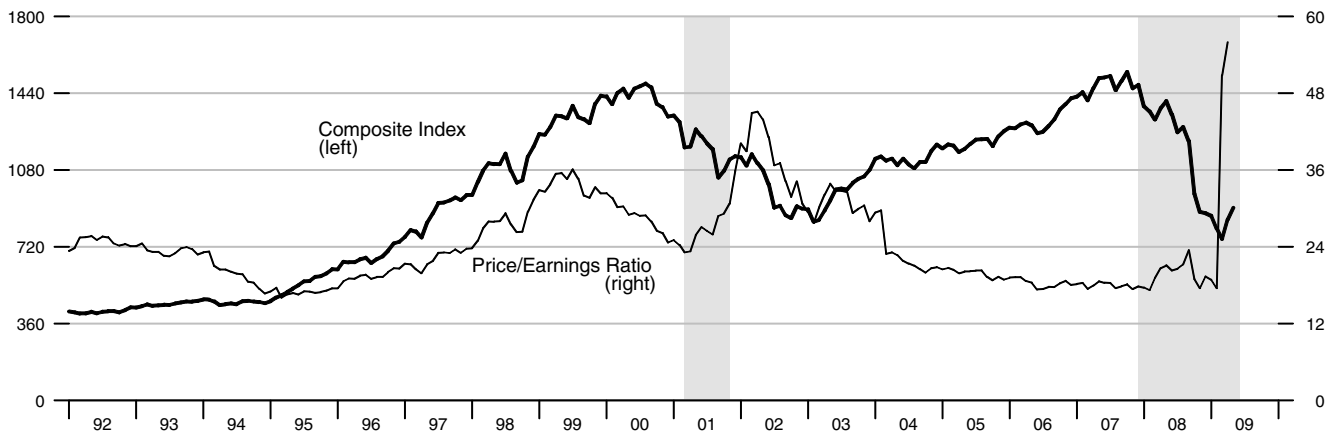
Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2008Q2	2008Q3	2008Q4	2009Q1	Feb09	Mar09	Apr09	May09
United States	4.27	5.23	1.53	-0.18	2.87	2.82	2.93	3.29
Canada	2.36	3.43	1.91	1.25	2.97	2.90	2.92	.
France	3.30	3.25	1.76	0.63	3.68	3.65	.	.
Germany	2.90	3.07	1.65	0.82	3.13	3.02	.	.
Italy	3.57	3.97	2.80	1.48	4.54	4.46	4.36	.
Japan	1.40	2.06	1.03	-0.10	1.30	1.30	1.44	1.44
United Kingdom	3.37	4.81	3.88	3.01	3.69	3.25	3.41	3.63

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Inflation and Long-Term Interest Rate Differentials
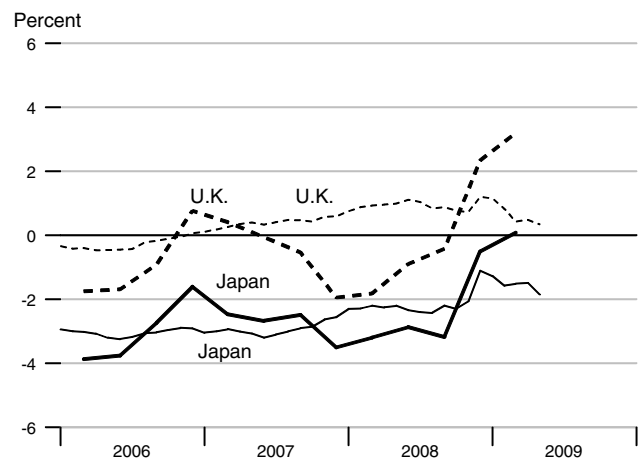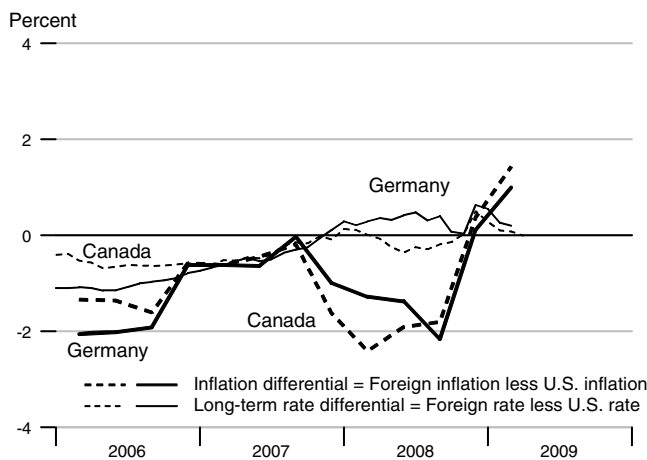
| | | Money Stock | | | Bank | Adjusted | | |
	M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	MSI M2**
2004	1344.402	6554.572	6247.501	9234.718	6595.977	776.768	96.130	329.873
2005	1371.751	6694.430	6513.905	9786.477	7247.080	806.628	96.560	343.539
2006	1374.358	6983.573	6840.378	10270.74	7958.707	835.039	94.913	
2007	1369.521	7615.031	7232.867		8742.625	850.576	94.198	
2008	1423.357	8670.761	7718.667		9561.224	1009.766	232.160	
2007 1	1369.265	7276.088	7083.417		8449.774	846.309	94.123	
2	1374.355	7454.023	7184.966		8568.495	849.919	93.559	
3	1366.869	7704.958	7280.629		8810.462	852.262	95.424	
4	1367.594	8025.054	7382.455		9141.768	853.815	93.685	
2008 1	1370.664	8356.791	7532.399		9390.037	856.317	96.170	
2	1376.944	8635.866	7634.399		9416.755	859.325	94.366	
3	1414.541	8735.643	7715.840		9475.191	892.677	117.739	
4	1531.279	8954.745	7992.031		9962.914	1430.746	620.366	
2009 1	1565.969	9385.464	8256.198		9845.819	1663.069	820.809	
2007 May	1379.732	7457.672	7186.718		8569.651	849.619	92.777	
Jun	1364.564	7511.107	7209.936		8627.703	851.177	94.295	
Jul	1366.456	7580.095	7236.871		8698.363	851.877	94.624	
Aug	1368.069	7704.166	7284.905		8807.431	853.429	96.639	
Sep	1366.083	7830.613	7320.112		8925.593	851.481	95.008	
Oct	1371.657	7940.938	7350.456		9048.154	856.449	93.515	
Nov	1366.605	8033.931	7381.983		9169.899	857.510	95.751	
Dec	1364.519	8100.294	7414.927		9207.250	847.487	91.789	
2008 Jan	1368.318	8178.689	7461.703		9308.790	851.441	95.077	
Feb	1370.840	8376.218	7536.900		9363.551	856.940	96.187	
Mar	1372.835	8515.466	7598.594		9497.769	860.570	97.246	
Apr	1373.640	8584.516	7618.442		9420.411	855.241	94.369	
May	1373.637	8639.934	7637.032		9425.366	859.686	94.906	
Jun	1383.556	8683.147	7647.723		9404.488	863.047	93.823	
Jul	1399.978	8733.881	7692.178		9429.677	870.533	96.823	
Aug	1391.868	8711.929	7673.216		9418.979	871.320	96.511	
Sep	1451.778	8761.118	7782.127		9576.916	936.179	159.882	
Oct	1474.950	8804.188	7900.710		9987.599	1142.208	347.644	
Nov	1523.454	8919.888	7951.526		9929.705	1480.771	674.082	
Dec	1595.434	9140.159	8123.858		9971.438	1669.260	839.373	
2009 Jan	1576.138	9317.457	8210.063		9887.857	1730.457	870.228	
Feb	1559.476	9376.723	8241.889		9833.328	1590.239	758.714	
Mar	1562.293	9462.213	8316.641		9816.273	1668.511	833.485	
Apr	1592.259	9447.884	8264.043		9728.549	1787.782	949.580	
May	1596.245	9558.385	8327.868		9774.776	1799.286	946.366	

Note: All values are given in billions of dollars. *See table of contents for changes to the series.

**We will not update the MSI series until we revise the code to accommodate the discontinuation of M3.

		Federal Funds	Primary Credit Rate	Prime Rate	3-mo CDs	Treasury Yields			Corporate Aaa Bonds	Municipal Aaa Bonds	Conventional Mortgage
						3-mo	3-yr	10-yr			
	2004	1.35	2.34	4.34	1.56	1.40	2.78	4.27	5.63	4.50	5.84
	2005	3.21	4.19	6.19	3.51	3.21	3.93	4.29	5.23	4.28	5.86
	2006	4.96	5.96	7.96	5.15	4.85	4.77	4.79	5.59	4.15	6.41
	2007	5.02	5.86	8.05	5.27	4.47	4.34	4.63	5.56	4.13	6.34
	2008	1.93	2.39	5.09	2.97	1.39	2.24	3.67	5.63	4.58	6.04
2007	1	5.26	6.25	8.25	5.31	5.12	4.68	4.68	5.36	3.91	6.22
	2	5.25	6.25	8.25	5.32	4.87	4.76	4.85	5.58	4.13	6.37
	3	5.07	5.93	8.18	5.42	4.42	4.41	4.73	5.75	4.27	6.55
	4	4.50	5.02	7.52	5.02	3.47	3.50	4.26	5.53	4.24	6.23
2008	1	3.18	3.67	6.21	3.23	2.09	2.17	3.66	5.46	4.39	5.88
	2	2.09	2.33	5.08	2.76	1.65	2.67	3.89	5.60	4.43	6.09
	3	1.94	2.25	5.00	3.06	1.52	2.63	3.86	5.65	4.50	6.31
	4	0.51	1.31	4.06	2.82	0.30	1.48	3.25	5.82	5.02	5.87
2009	1	0.18	0.50	3.25	1.08	0.22	1.27	2.74	5.27	4.64	5.06
2007 May		5.25	6.25	8.25	5.31	4.87	4.69	4.75	5.47	4.04	6.26
	Jun	5.25	6.25	8.25	5.33	4.74	5.00	5.10	5.79	4.36	6.66
	Jul	5.26	6.25	8.25	5.32	4.96	4.82	5.00	5.73	4.24	6.70
	Aug	5.02	6.01	8.25	5.49	4.32	4.34	4.67	5.79	4.30	6.57
	Sep	4.94	5.53	8.03	5.46	3.99	4.06	4.52	5.74	4.26	6.38
	Oct	4.76	5.24	7.74	5.08	4.00	4.01	4.53	5.66	4.20	6.38
	Nov	4.49	5.00	7.50	4.97	3.35	3.35	4.15	5.44	4.26	6.21
	Dec	4.24	4.83	7.33	5.02	3.07	3.13	4.10	5.49	4.25	6.10
2008 Jan		3.94	4.48	6.98	3.84	2.82	2.51	3.74	5.33	4.13	5.76
	Feb	2.98	3.50	6.00	3.06	2.17	2.19	3.74	5.53	4.42	5.92
	Mar	2.61	3.04	5.66	2.79	1.28	1.80	3.51	5.51	4.63	5.97
	Apr	2.28	2.49	5.24	2.85	1.31	2.23	3.68	5.55	4.45	5.92
	May	1.98	2.25	5.00	2.66	1.76	2.69	3.88	5.57	4.34	6.04
	Jun	2.00	2.25	5.00	2.76	1.89	3.08	4.10	5.68	4.50	6.32
	Jul	2.01	2.25	5.00	2.79	1.66	2.87	4.01	5.67	4.44	6.43
	Aug	2.00	2.25	5.00	2.79	1.75	2.70	3.89	5.64	4.44	6.48
	Sep	1.81	2.25	5.00	3.59	1.15	2.32	3.69	5.65	4.61	6.04
	Oct	0.97	1.81	4.56	4.32	0.69	1.86	3.81	6.28	5.05	6.20
	Nov	0.39	1.25	4.00	2.36	0.19	1.51	3.53	6.12	4.83	6.09
	Dec	0.16	0.86	3.61	1.77	0.03	1.07	2.42	5.05	5.17	5.33
2009 Jan		0.15	0.50	3.25	1.02	0.13	1.13	2.52	5.05	4.64	5.06
	Feb	0.22	0.50	3.25	1.16	0.30	1.37	2.87	5.27	4.56	5.13
	Mar	0.18	0.50	3.25	1.07	0.22	1.31	2.82	5.50	4.74	5.00
	Apr	0.15	0.50	3.25	0.89	0.16	1.32	2.93	5.39	4.48	4.81
	May	0.18	0.50	3.25	0.57	0.18	1.39	3.29	5.54		4.86

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

		M1	MZM	M2	M3*
Percent change at an annual rate					
	2004	5.57	3.91	4.73	5.09
	2005	2.03	2.13	4.26	5.97
	2006	0.19	4.32	5.01	4.95
	2007	-0.35	9.04	5.74	
	2008	3.93	13.86	6.72	
2007	1	0.14	7.60	5.96	
	2	1.49	9.78	5.73	
	3	-2.18	13.47	5.33	
	4	0.21	16.62	5.59	
2008	1	0.90	16.54	8.12	
	2	1.83	13.36	5.42	
	3	10.92	4.62	4.27	
	4	33.01	10.03	14.32	
2009	1	9.06	19.24	13.22	

		M1	MZM	M2	M3*
2007	May	0.84	10.45	4.77	
	Jun	-13.19	8.60	3.88	
	Jul	1.66	11.02	4.48	
	Aug	1.42	19.64	7.96	
	Sep	-1.74	19.70	5.80	
	Oct	4.90	16.91	4.97	
	Nov	-4.42	14.05	5.15	
	Dec	-1.83	9.91	5.36	
2008	Jan	3.34	11.61	7.57	
	Feb	2.21	28.98	12.09	
	Mar	1.75	19.95	9.82	
	Apr	0.70	9.73	3.13	
	May	-0.00	7.75	2.93	
	Jun	8.67	6.00	1.68	
	Jul	14.24	7.01	6.98	
	Aug	-6.95	-3.02	-2.96	
	Sep	51.65	6.78	17.03	
	Oct	19.15	5.90	18.29	
	Nov	39.46	15.77	7.72	
	Dec	56.70	29.63	26.01	
2009	Jan	-14.51	23.28	12.73	
	Feb	-12.69	7.63	4.65	
	Mar	2.17	10.94	10.88	
	Apr	23.02	-1.82	-7.59	
	May	3.00	14.04	9.27	

*See table of contents for changes to the series.

Definitions

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

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

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

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

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

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

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

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

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

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

Notes

Page 3: Readers are cautioned that, since early 1994, the level and growth of M1 have been depressed by retail sweep programs that reclassify transactions deposits (demand deposits and other checkable deposits) as savings deposits overnight, thereby reducing banks' required reserves; see Anderson and Rasche (2001) and research.stlouisfed.org/aggreg/swdata.html. **Primary Credit Rate**, **Discount Rate,** and **Intended Federal Funds Rate** shown in the chart **Reserve Market Rates** are plotted as of the date of the change, while the **Effective Federal Funds Rate** is plotted as of the end of the month. Interest rates in the table are monthly averages from the Board of Governors H.15 Statistical Release. The **Treasury Yield Curve** and **Real Treasury Yield Curve** show constant maturity yields calculated by the U.S. Treasury for securities 5, 7, 10, and 20 years to maturity. **Inflation-Indexed Treasury Yield Spreads** are a measure of inflation compensation at those horizons, and it is simply the nomi-

nal constant maturity yield less the real constant maturity yield. Daily data and descriptions are available at research.stlouisfed.org/fred2/. See also *Statistical Supplement to the Federal Reserve Bulletin*, table 1.35. The 30-year constant maturity series was discontinued by the Treasury as of February 18, 2002.

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

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

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

From 1991 to the present the source of the long-term PCE inflation expectations data is the Federal Reserve Bank of Philadelphia's *Survey of Professional Forecasters*. Prior to 1991, the data were obtained from the Board of Governors of the Federal Reserve System. Realized (actual) inflation is the annualized rate of change for the 40-quarter period that corresponds to the forecast horizon (the expectations measure). For example, in 1965:Q1, annualized PCE inflation over the next 40 quarters was expected to average 1.7 percent. In actuality, the average annualized rate of change measured 4.8 percent from 1965:Q1 to 1975:Q1. Thus, the vertical distance between the two lines in the chart at any point is the forecast error.

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

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

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

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

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

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

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where ΔMB_t^* is the implied growth rate of the adjusted monetary base. The 10-year moving average growth of real GDP for a quarter t is calculated as the average quarterly growth during the previous 40 quarters, at an annual rate, by the formula

$((y_t - y_{t-40})/40) \times 400$, where y_t is the log of real GDP. The 4-year moving average of base velocity growth is calculated similarly. To adjust the monetary base for the effect of retail-deposit sweep programs, we add to the monetary base an amount equal to 10 percent of the total amount swept, as estimated by the Federal Reserve Board staff. These estimates are imprecise, at best. Sweep program data are found at research.stlouisfed.org/aggreg/swdata.html.

Page 11: **Implied One-Year Forward Rates** are calculated by this Bank from Treasury constant maturity yields. Yields to maturity, $R(m)$, for securities with $m = 1,..., 10$ years to maturity are obtained by linear interpolation between reported yields. These yields are smoothed by fitting the regression suggested by Nelson and Siegel (1987),

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

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

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

where duration is approximated as $D(m) = (1 - e^{-R(m) \times m})/R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). **Rates on 3-Month Eurodollar Futures** and **Rates on Selected Federal Funds Futures Contracts** trace through time the yield on three specific contracts. **Rates on Federal Funds Futures on Selected Dates** displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. **Inflation-Indexed Treasury Securities and Yield Spreads** are those plotted on page 3. **Inflation-Indexed 10-Year Government Notes** shows the yield of an inflation-indexed note that is scheduled to mature in approximately (but not greater than) 10 years. The current French note has a maturity date of 7/25/2015, the current U.K. note has a maturity date of 8/16/2013, and the current U.S. note has a maturity date of 1/15/2018. **Inflation-Indexed Treasury Yield Spreads** and **Inflation-Indexed 10-Year Government Yield Spreads** equal the difference between the yields on the most recently issued inflation-indexed securities and the unadjusted security yields of similar maturity.

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

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

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

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

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

Sources

Agence France Trésor: French note yields.

Bank of Canada: Canadian note yields.

Bank of England: U.K. note yields.

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

Bureau of Economic Analysis: GDP.

Bureau of Labor Statistics: CPI.

Chicago Board of Trade: Federal funds futures contract.

Chicago Mercantile Exchange: Eurodollar futures.

Congressional Budget Office: Potential real GDP.

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

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

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

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

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

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

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