Monetary Trends

May 2010

Monetary Policy and Asset Prices

The housing market crisis is the latest reminder that asset prices can and do run wild at rates capable of negative effects on real economic activity. Not surprisingly, this has reinvigorated debate over whether central banks should respond to asset price bubbles. Economists' views on this subject are divided. Some argue that the central bank should react to asset price misalignments (see, for example, Cecchetti, Genberg, and Wadhwani, 2002). Those opposed to this idea say that monetary policy focused exclusively on stable inflation achieves better long-run outcomes (see Bernanke and Gertler, 2001).

The volatility and unpredictability of asset prices are well-known problems. As Mishkin (2007) notes, however, there are assumptions under which monetary policy could be effective in responding to asset price bubbles. First, the central bank must be able to identify that a bubble truly exists, which is a strong assumption since no rule exists to assess the presence of a bubble. Hindsight is 20/20, and some episodes that at first look like bubbles in retrospect are not.

Second, the central bank must apply the right policy to deflate the bubble. This is not as straightforward as it seems. Bubbles are episodes in which people do not behave in a predictable way. Thus, predicting the consequences of an interest rate increase is difficult. The question is whether no action is better than the wrong action. For example, a central bank response that increases interest rates but results in a recession when no bubble was present is clearly not desirable.

Selecting the correct policy response is further complicated by the difficulty in identifying a clear pattern between monetary policy and asset prices across countries. The chart uses deviations from the Taylor rule to plot the relationship among real house prices, real stock prices, and the monetary stance for 20 industrialized countries.[1] Countries on the upper half of the figure had larger increases in asset prices than the rest of the sample during the recent bubble. Countries on the left-most side practiced looser monetary policies with respect to the Taylor rule. Interestingly, more than half of the countries implemented tighter monetary policy but had higher housing price increases than the United States (these are plotted above and to the right of the United States). Most countries practiced tighter monetary policy and saw higher stock price increases than the United States.

The solid black trend line suggests that looser monetary policy is associated with higher housing prices, but this relationship is weak. The pattern is less clear for stock prices (dashed green line). This suggests that even if the central bank could identify a bubble and apply the best policy, it might not be able to deflate the bubble if the link between interest rates and asset prices is weak.

—Brett Fawley and Luciana Juvenal

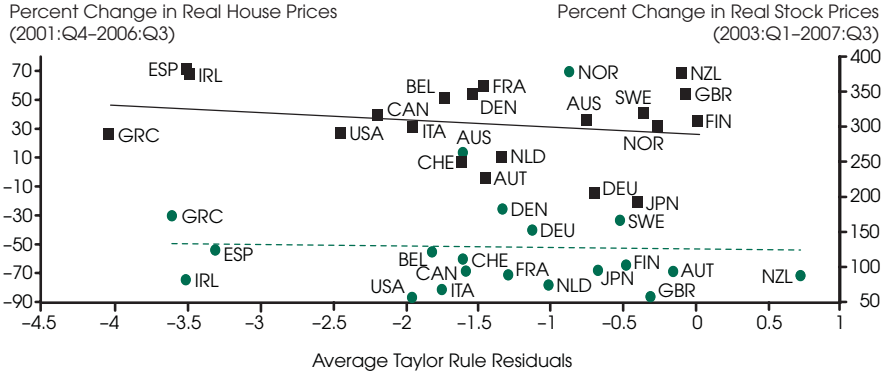
Bernanke, Ben S. and Gertler, Mark. "Should Central Banks Respond to Movements in Asset Prices?" *American Economic Review*, May 2001, *91*(2), pp. 253-57.

Cecchetti, Stephen, G.; Genberg, Hans and Wadhwani, Sushil. "Asset Prices in a Flexible Inflation Targeting Framework." NBER Working Paper 8970, National Bureau of Economic Research, June 2002; www.nber.org/papers/w8970.pdf?new_window=1.

Mishkin, Frederic S. "Housing and the Monetary Transmission Mechanism." Presented at a symposium sponsored by the Federal Reserve Bank of Kansas City, "Housing, Housing Finance, and Monetary Policy," Jackson Hole, Wyoming, August 30-September 1, 2007; www.kansascityfed.org/Publicat/Sympos/2007/PDF/Mishkin_0415.pdf.

[1] The Taylor rule says that if gross domestic product (GDP) is in line with the economy's potential output and inflation is equal to the central bank's target, then interest rates will be at a neutral level and the economy will neither accelerate nor decelerate. If GDP grows above the economy's potential output, or if inflation is higher than the central bank target, then interest rates will be above the neutral level. The effect of below-capacity GDP or below-target inflation is symmetric but opposite.

Taylor Rule Residuals Plotted Against Change in Real House Prices and Change in Real Stock Prices



NOTE: Changes in house prices are plotted against the average Taylor rule residual between 2002:Q1 and 2006:Q3 and appear as black squares; changes in stock prices are plotted against the average Taylor rule residual between 2003:Q2 and 2007:Q3 and appear as green circles. AUS, Australia; AUT, Austria; BEL, Belgium; CAN, Canada; CHE, Switzerland; DEN, Denmark; DEU, Germany; ESP, Spain; GBR, United Kingdom; GRC, Greece; FIN, Finland; FRA, France; IRL, Ireland; ITA, Italy; JPN, Japan; NLD, Netherlands; NOR, Norway; NZL, New Zealand; SWE, Sweden; USA, United States.
SOURCE: International Monetary Fund. *World Economic Outlook: Crisis and Recovery,* April 2009.

Contents

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 December 2007; however, the hatched shading shows that the recession ended in July 2009. We made this determination based on a statistical model for dating business cycle turning points developed by Marcelle Chauvet and Jeremy Piger ("A Comparison of the Real-Time Performance of Business Cycle Dating Methods," *Journal of Business and Economic Statistics*, 2008, 26, 42-49). For more information, see http://www.uoregon.edu/~jpiger/us_recession_probs.htm.
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: $[(x_\tau/x_{\tau-1})-1]\times 1200$. 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: $[(x_\tau/x_{\tau-12})-1]\times 100$.

We welcome your comments addressed to:

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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.

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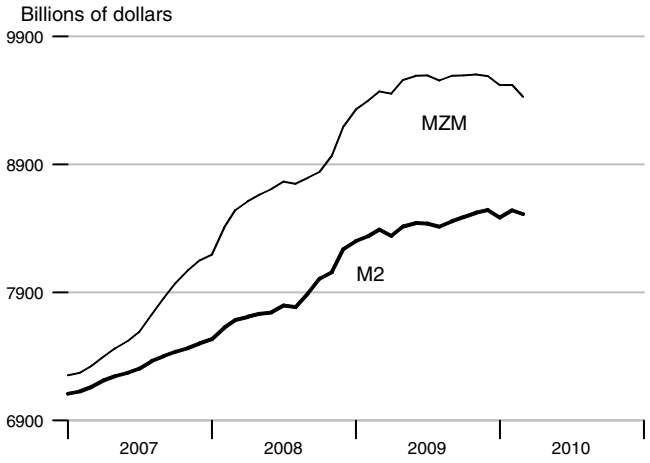
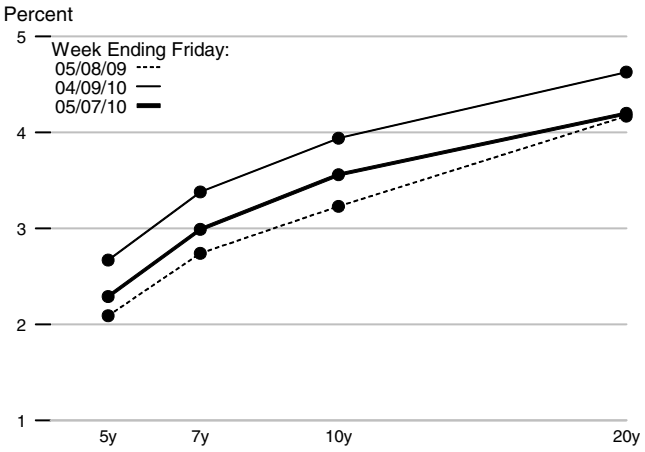
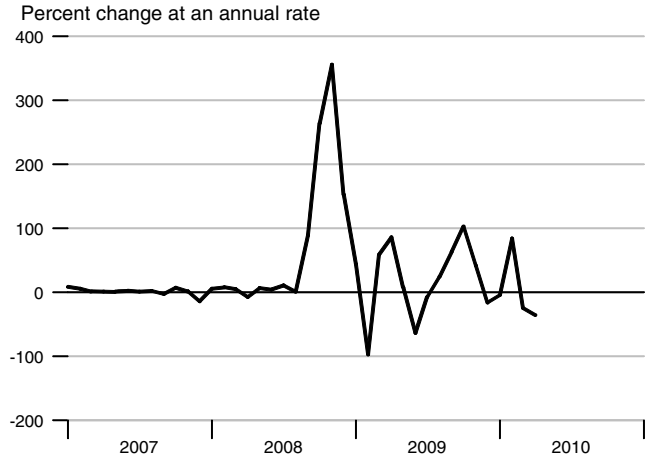
M2 and MZM



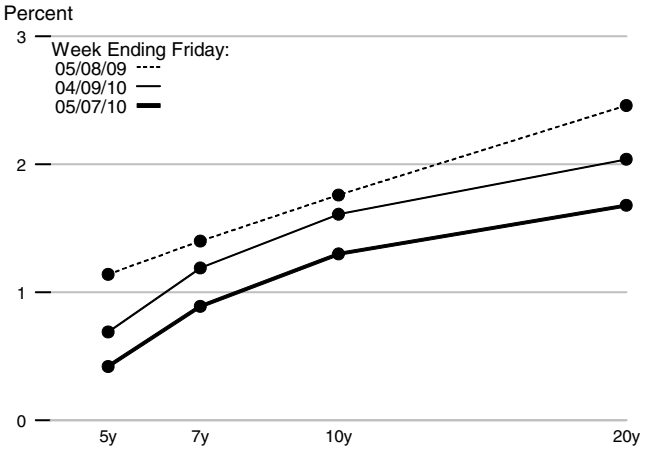
Treasury Yield Curve



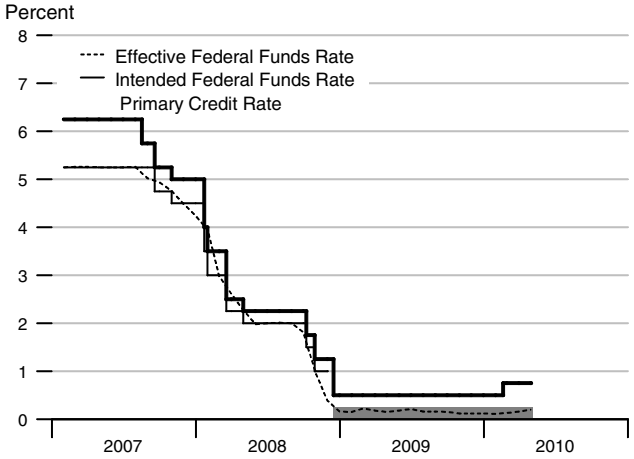
Adjusted Monetary Base



Real Treasury Yield Curve

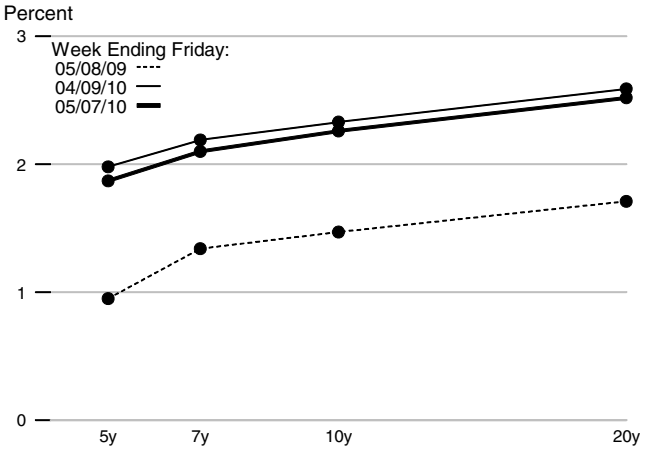


Reserve Market Rates



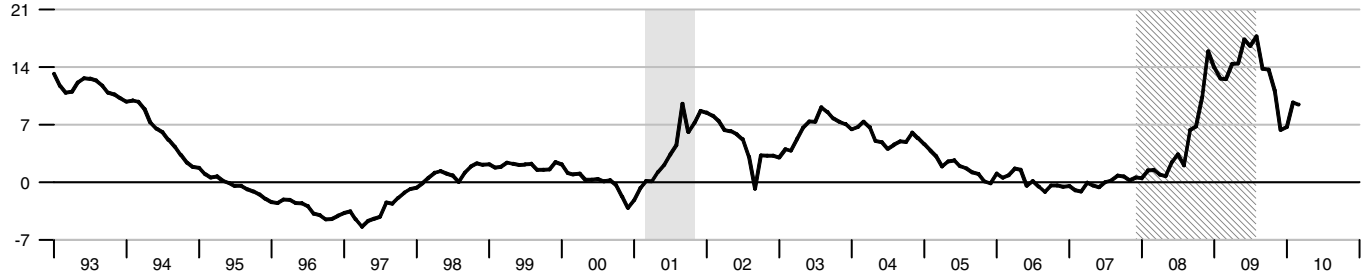
Note: Effective December 16, 2008, FOMC reports the intended Federal Funds Rate as a range.

Inflation-Indexed Treasury Yield Spreads



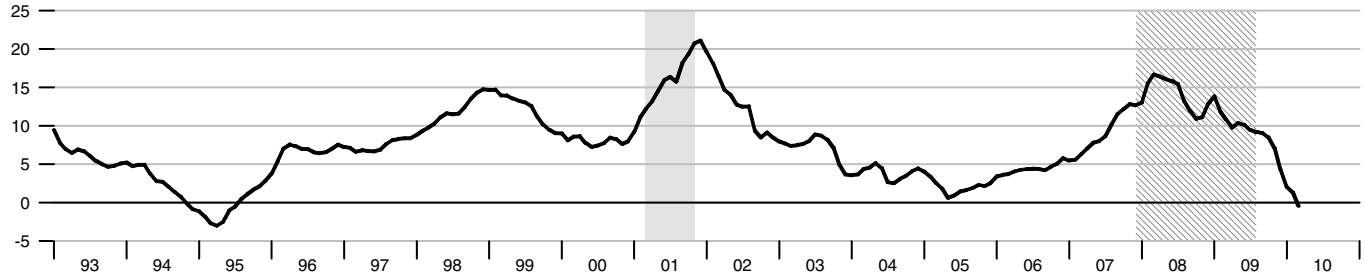
M1

Percent change from year ago



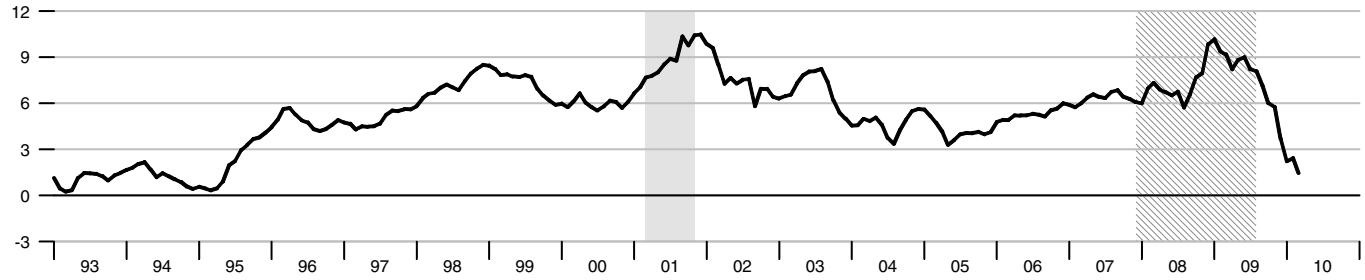
MZM

Percent change from year ago



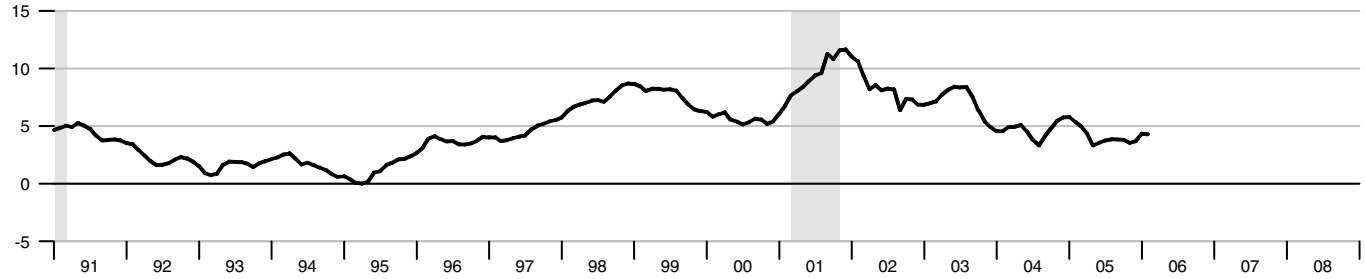
M2

Percent change from year ago



Monetary Services Index - M2**

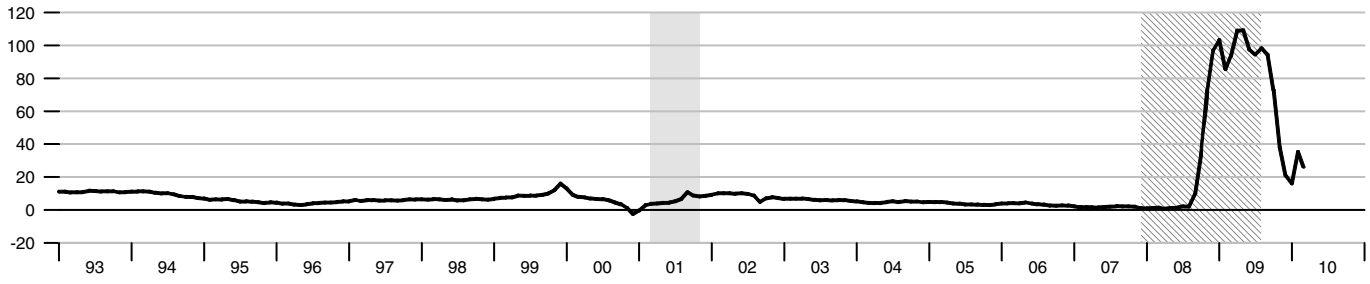
Percent change from year ago



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

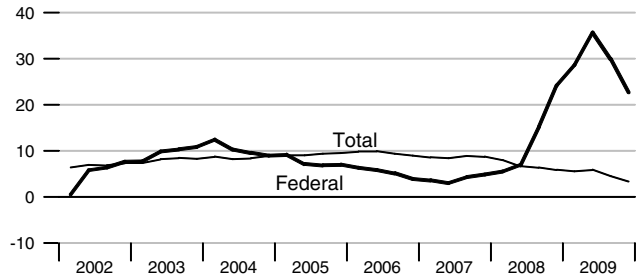
Adjusted Monetary Base

Percent change from year ago



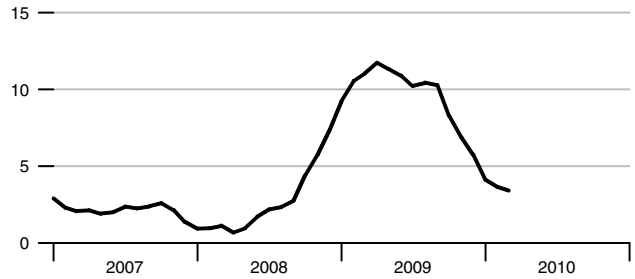
Domestic Nonfinancial Debt

Percent change from year ago



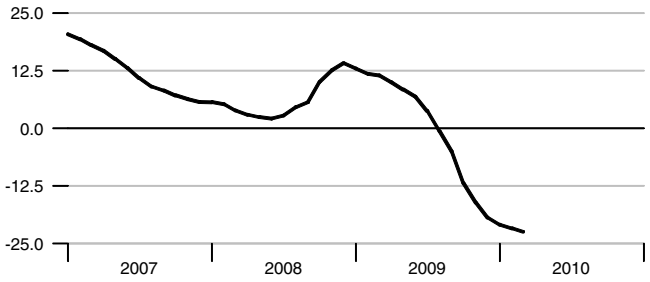
Currency Held by the Nonbank Public

Percent change from year ago



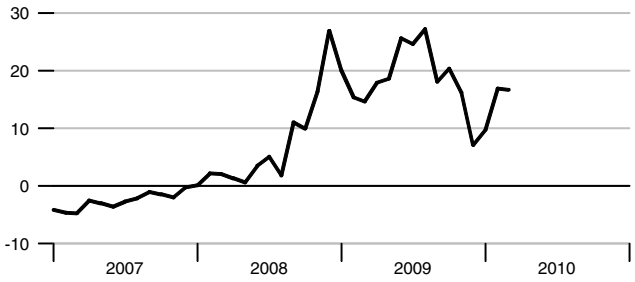
Small Denomination Time Deposits*

Percent change from year ago



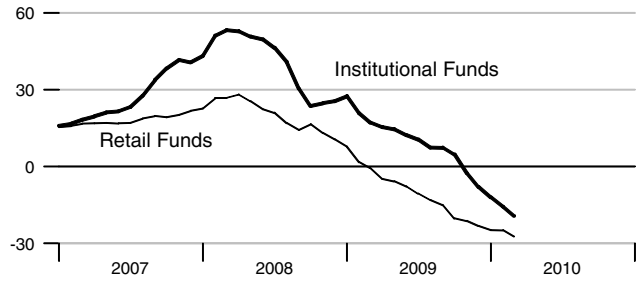
Checkable Deposits

Percent change from year ago



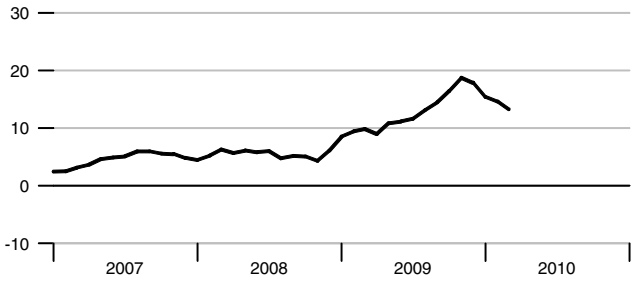
Money Market Mutual Fund Shares

Percent change from year ago



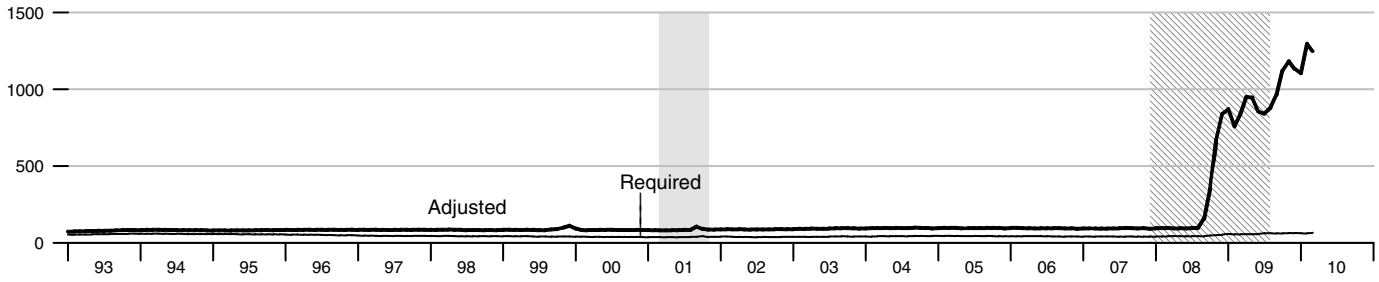
Savings Deposits

Percent change from year ago



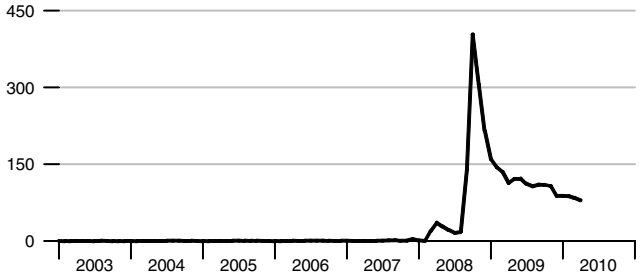
Adjusted and Required Reserves

Billions of dollars



Total Borrowings, nsa

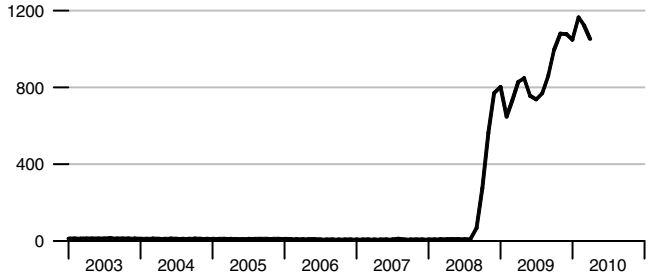
Billions of dollars



* Data exclude term auction credit

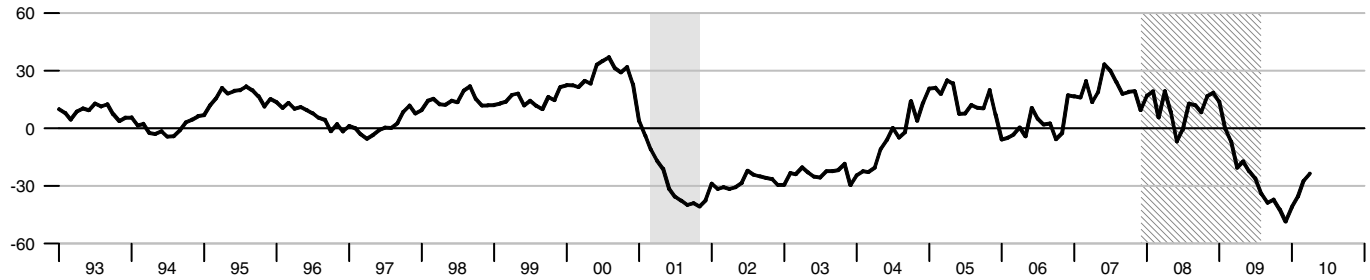
Excess Reserves plus RCB Contracts

Billions of dollars



Nonfinancial Commercial Paper

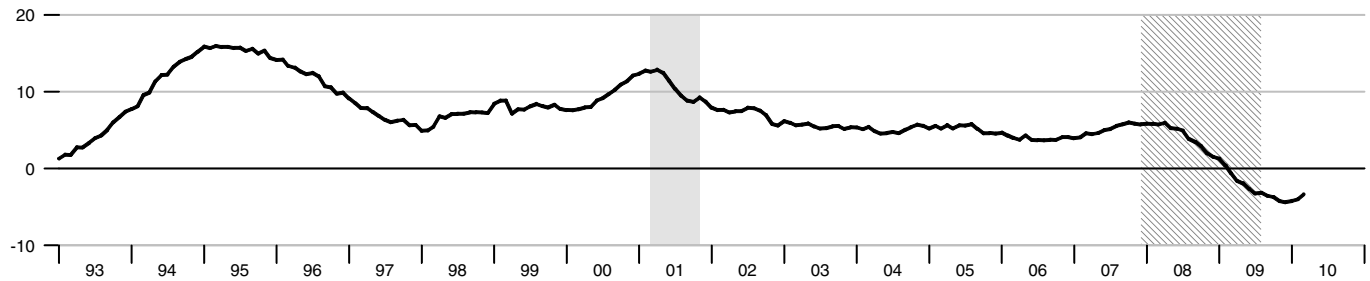
Percent change from year ago



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.

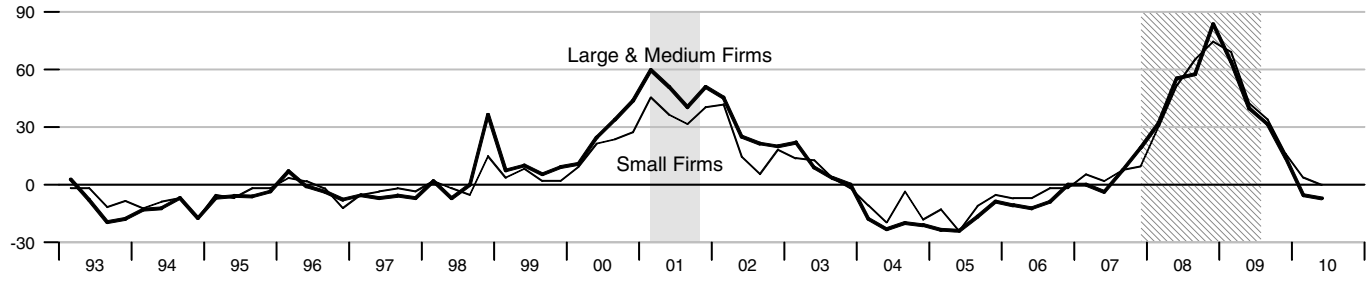
Consumer Credit

Percent change from year ago



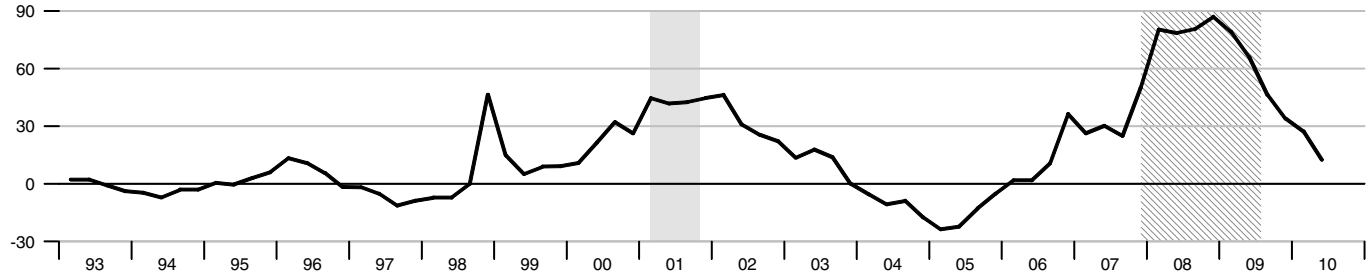
Net Percentage of Domestic Banks Tightening Standards for Commercial and Industrial Loans

Percentage



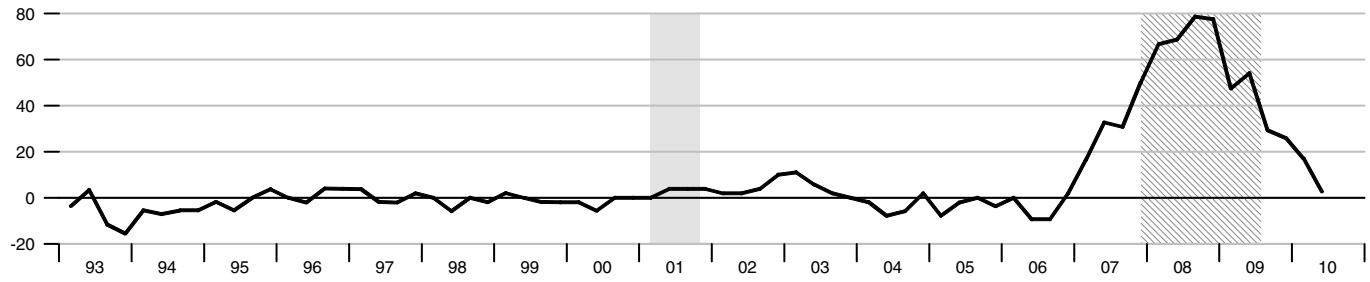
Net Percentage of Domestic Banks Tightening Standards for Commercial Real Estate Loans

Percentage



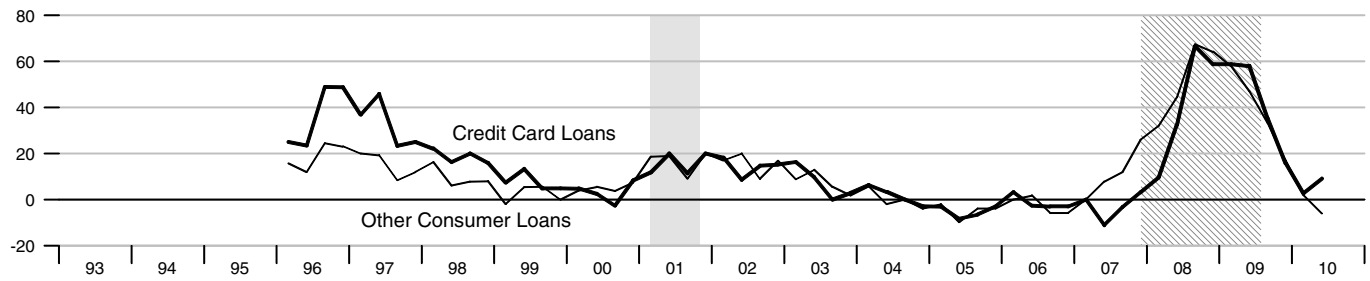
Net Percentage of Domestic Banks Tightening Standards for Residential Mortgage Loans

Percentage



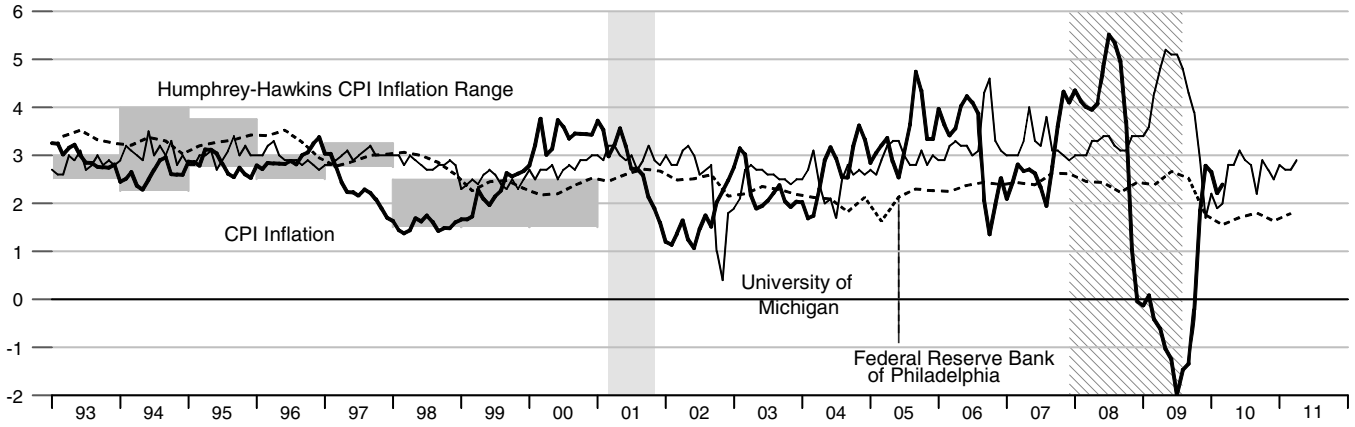
Net Percentage of Domestic Banks Tightening Standards for Consumer Loans

Percentage



CPI Inflation and 1-Year-Ahead CPI Inflation Expectations

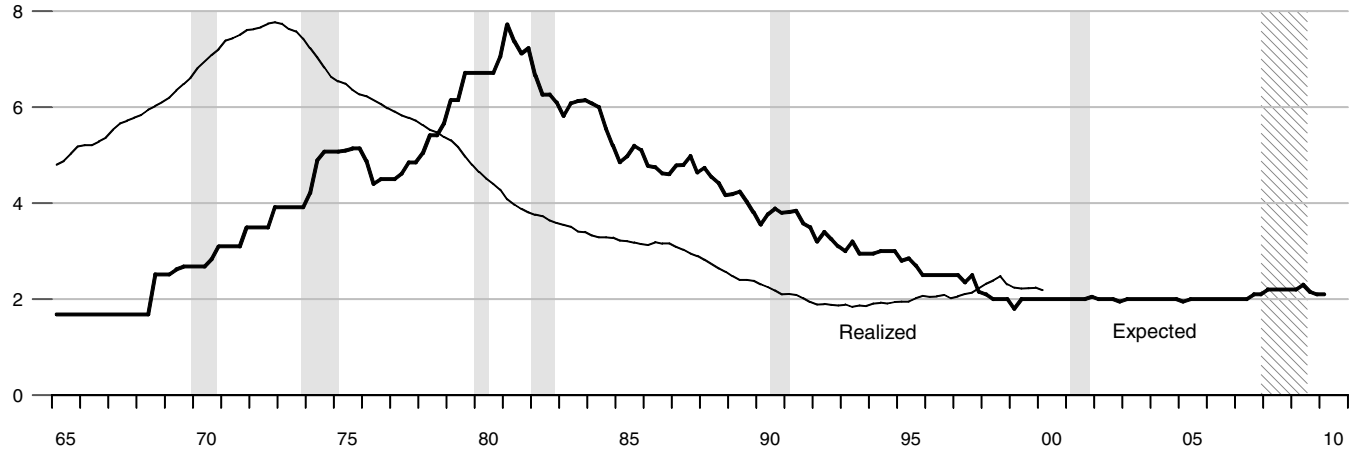
Percent



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

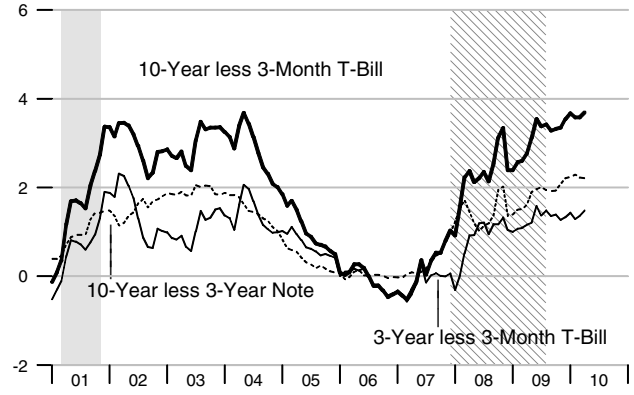
Percent



See the notes section for an explanation of the chart.

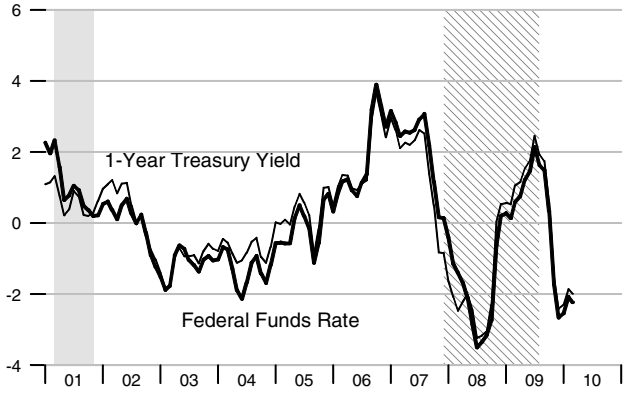
Treasury Security Yield Spreads

Yield to maturity

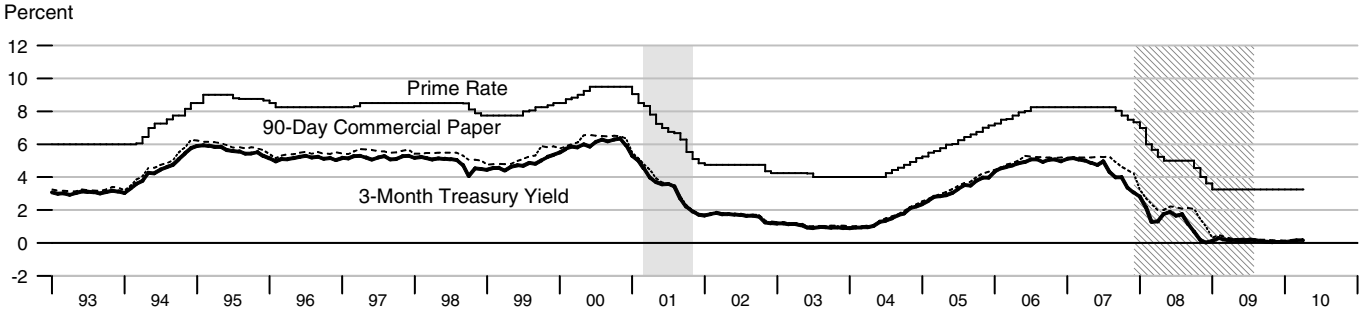


Real Interest Rates

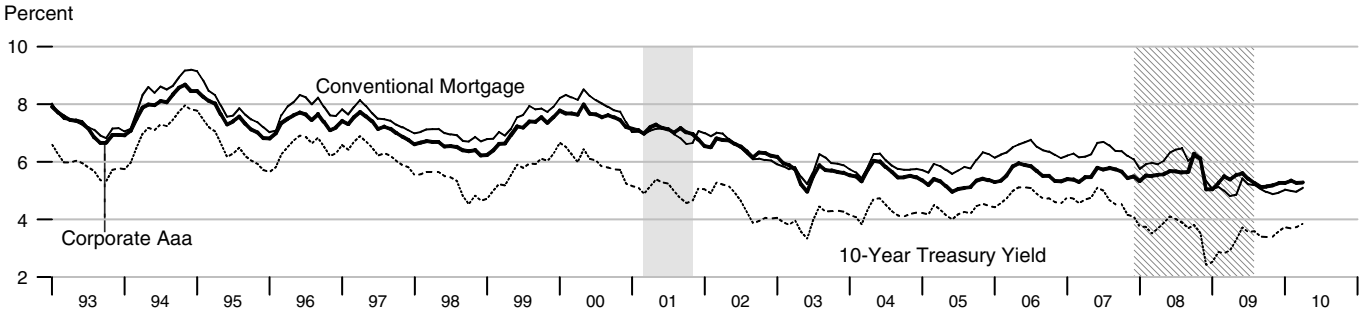
Percent, Real rate = Nominal rate less year-over-year CPI inflation



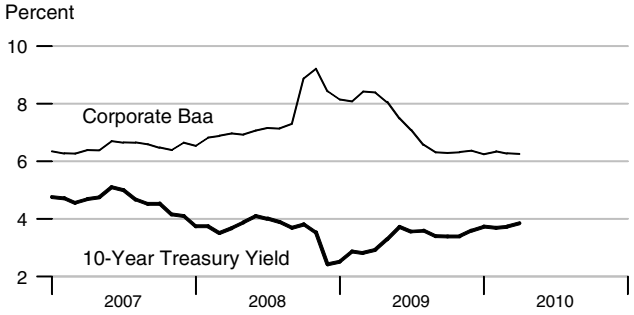
Short-Term Interest Rates



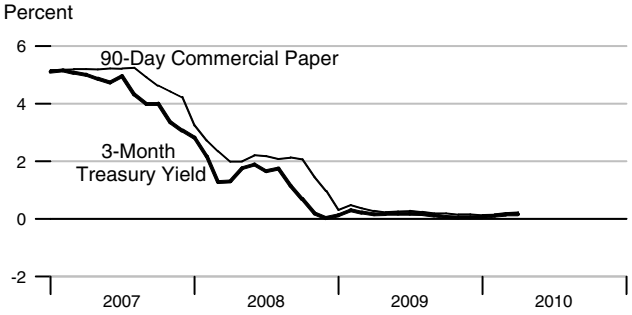
Long-Term Interest Rates



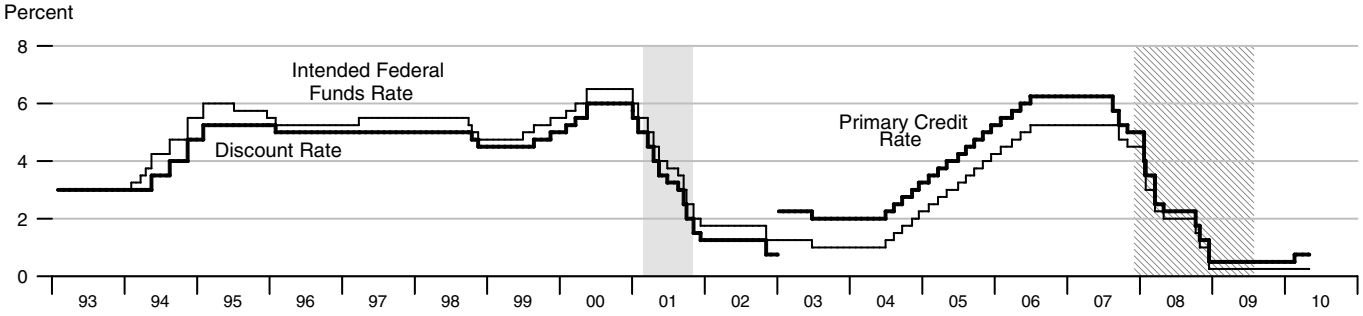
Long-Term Interest Rates



Short-Term Interest Rates

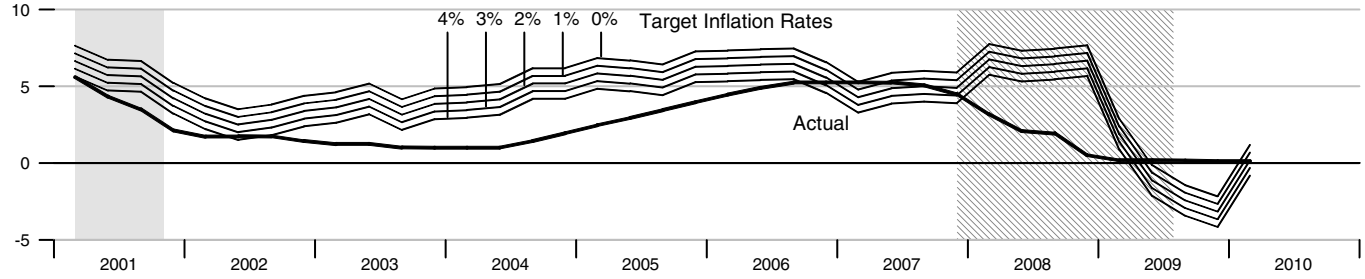


FOMC Intended Federal Funds Rate, Discount Rate, and Primary Credit Rate



Federal Funds Rate and Inflation Targets

Percent

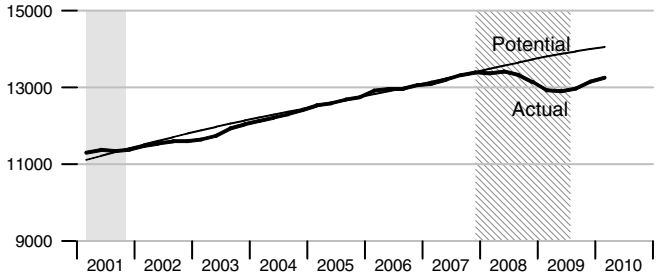


Calculated federal funds rate is based on Taylor's rule.

Components of Taylor's Rule

Actual and Potential Real GDP

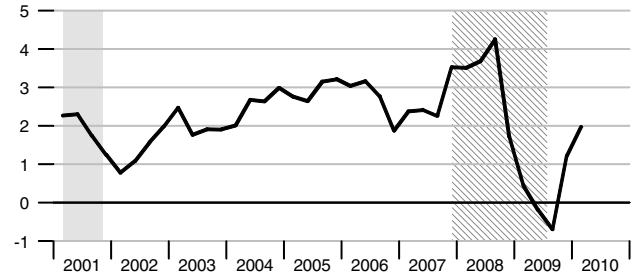
Billions of chain-weighted 2005 dollars



See notes section for further explanation.

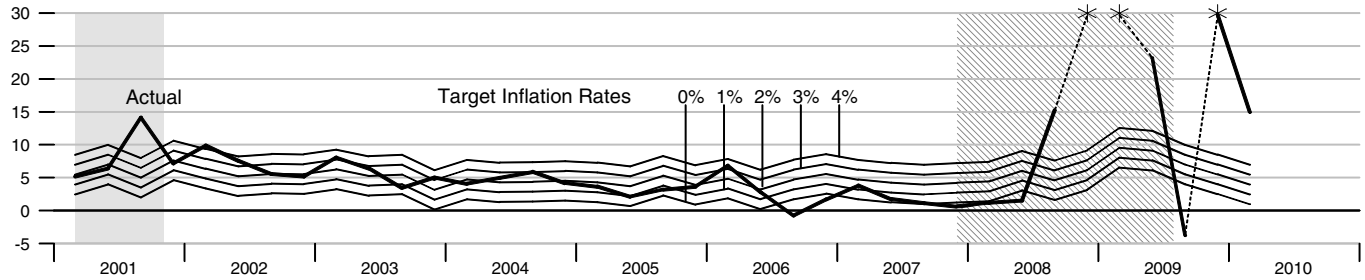
PCE Inflation

Percent change from year ago



Monetary Base Growth and Inflation Targets

Percent

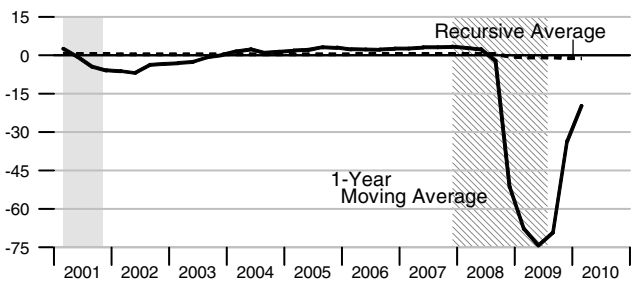


Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter.
*Actual values for 2008:Q4, 2009:Q1, and 2009:Q4 are 188.38 percent, 60.77 percent, and 56.51, respectively.

Components of McCallum's Rule

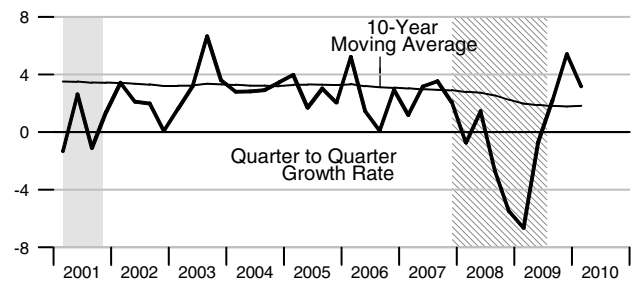
Monetary Base Velocity Growth

Percent



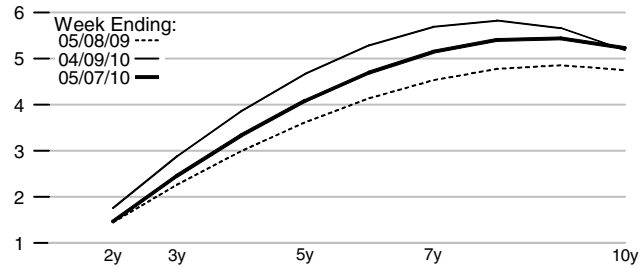
Real Output Growth

Percent



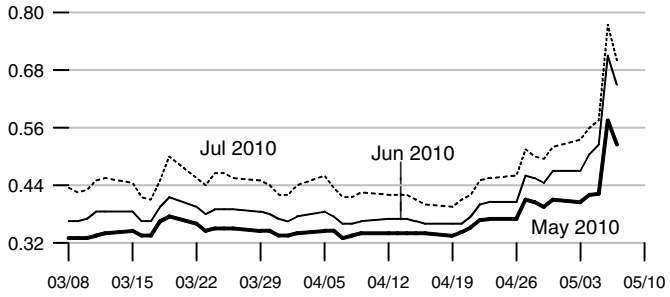
Implied One-Year Forward Rates

Percent



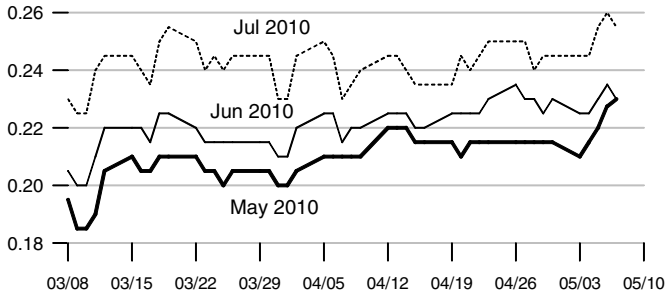
Rates on 3-Month Eurodollar Futures

Percent, daily data



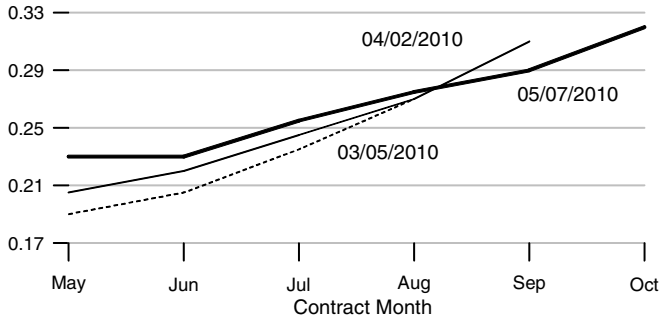
Rates on Selected Federal Funds Futures Contracts

Percent, daily data



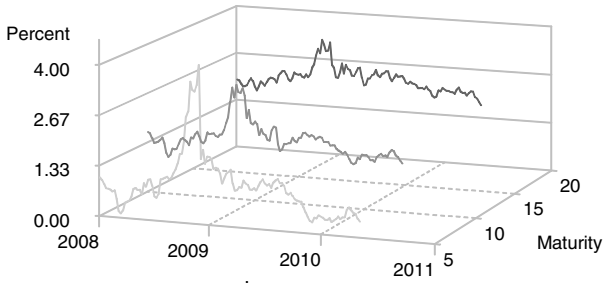
Rates on Federal Funds Futures on Selected Dates

Percent



Inflation-Indexed Treasury Securities

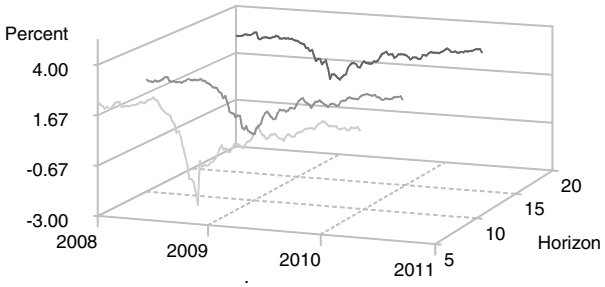
Weekly data



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

Inflation-Indexed Treasury Yield Spreads

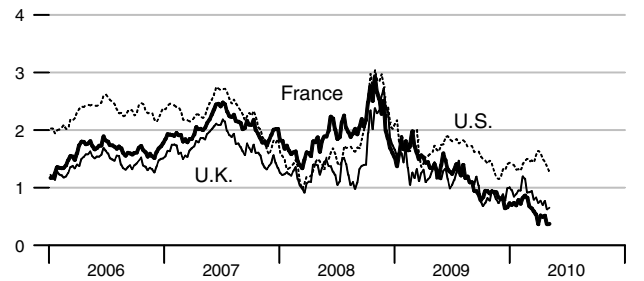
Weekly data



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

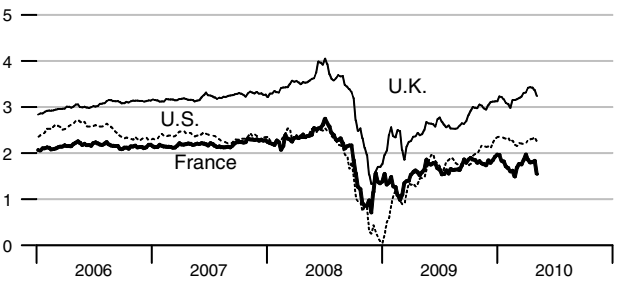
Inflation-Indexed 10-Year Government Notes

Percent, weekly data



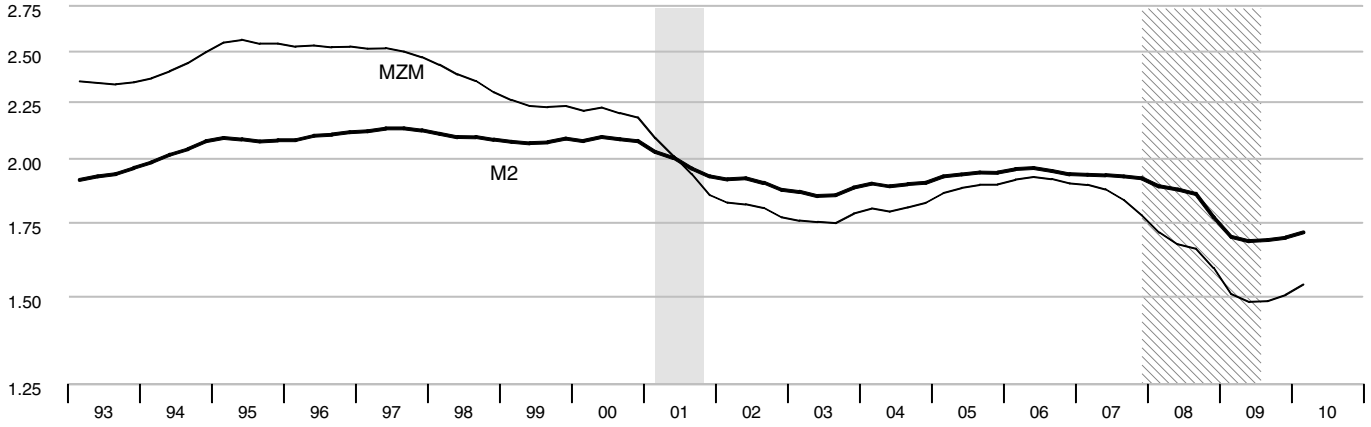
Inflation-Indexed 10-Year Government Yield Spreads

Percent, weekly data



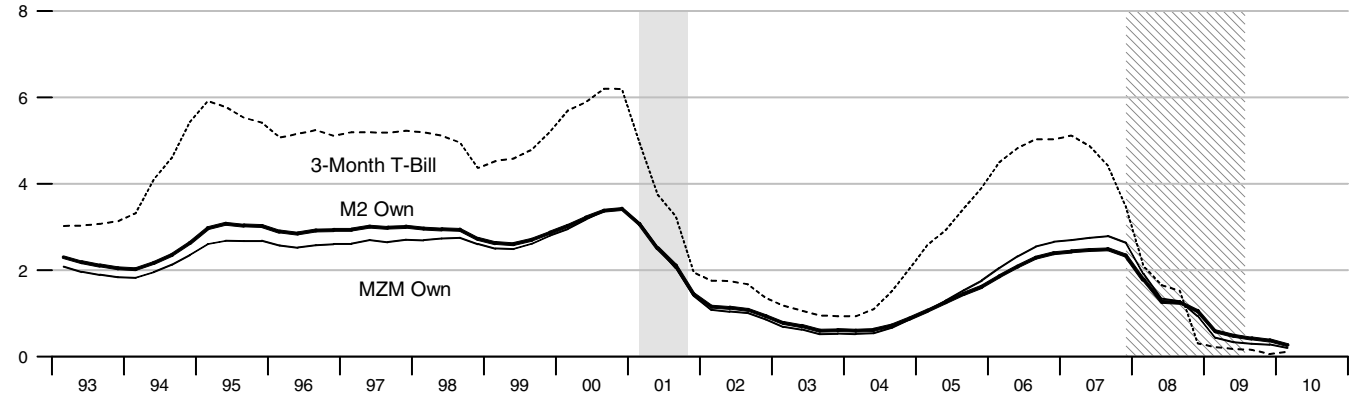
Velocity

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



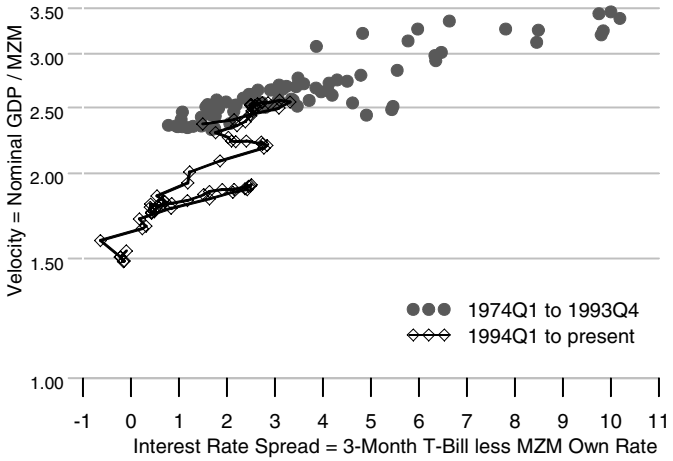
Interest Rates

Percent



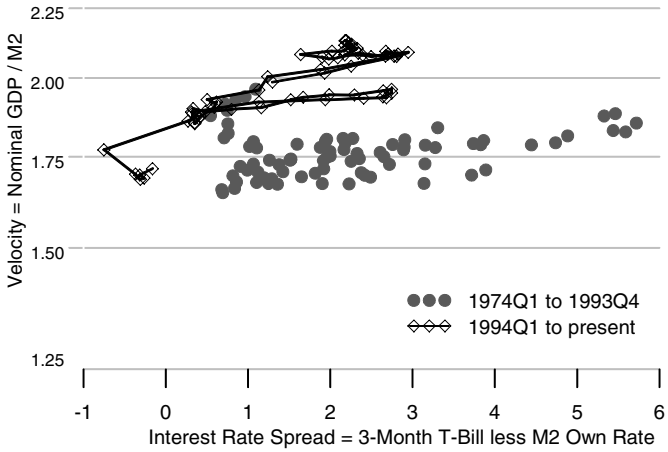
MZM Velocity and Interest Rate Spread

Ratio Scale



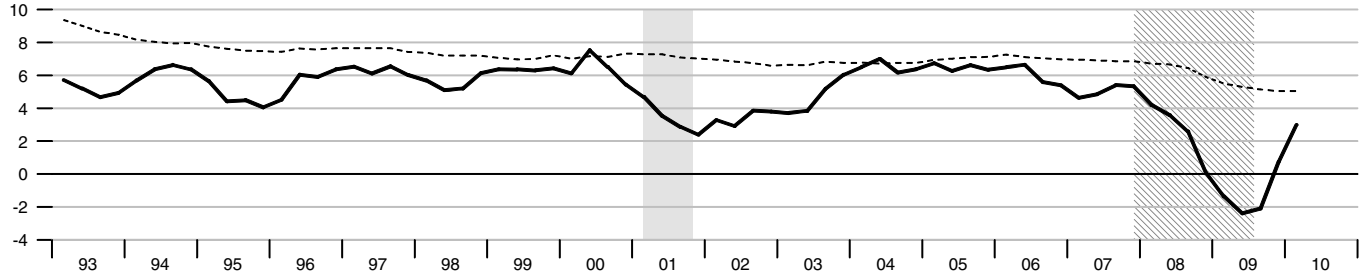
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

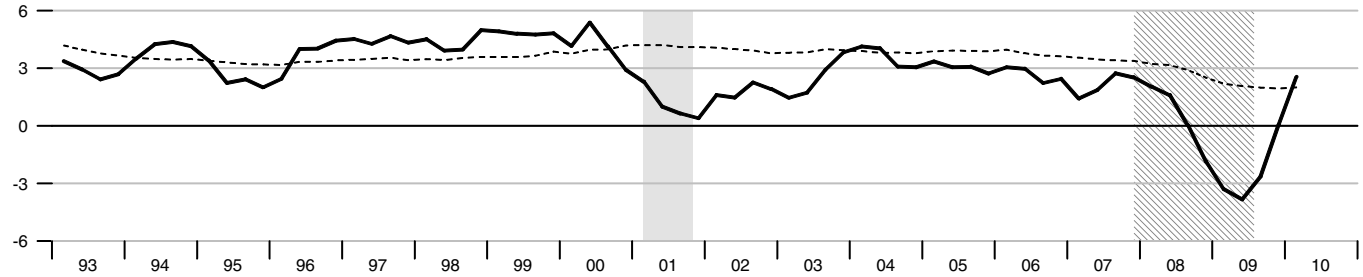
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

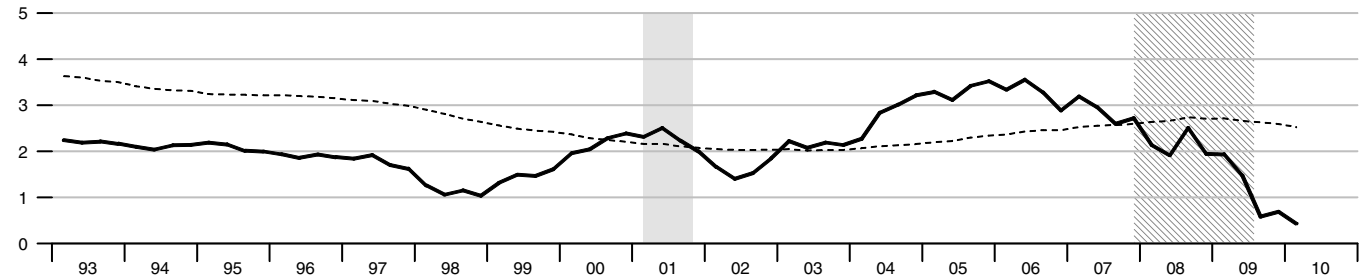
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

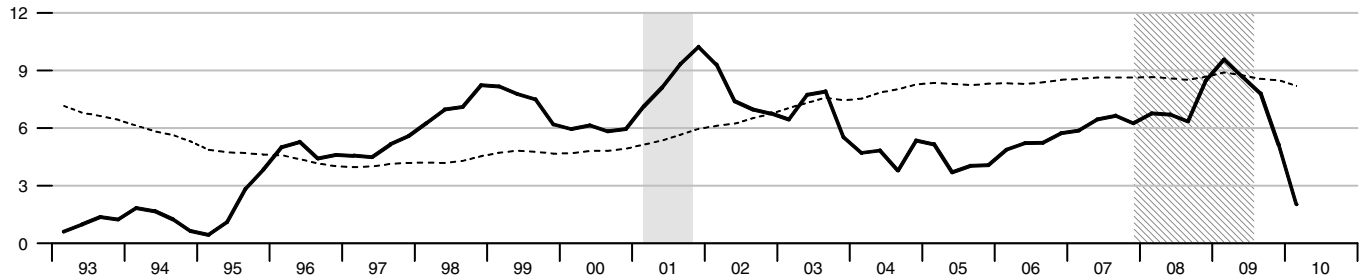
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

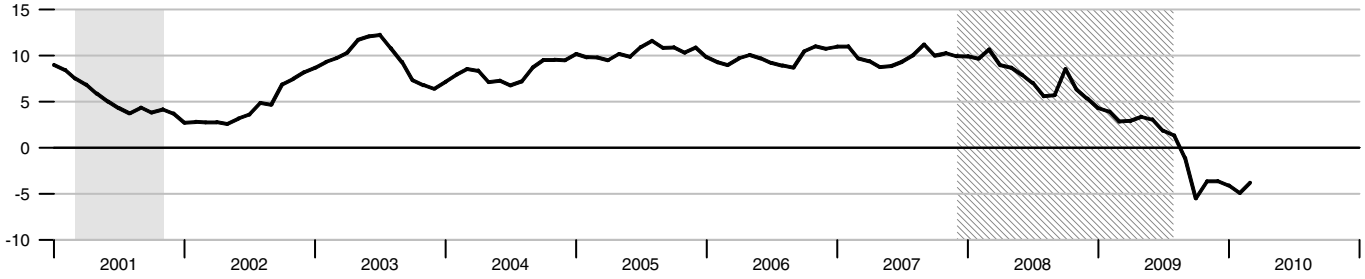
Percent change from year ago



Dashed lines indicate 10-year moving averages.

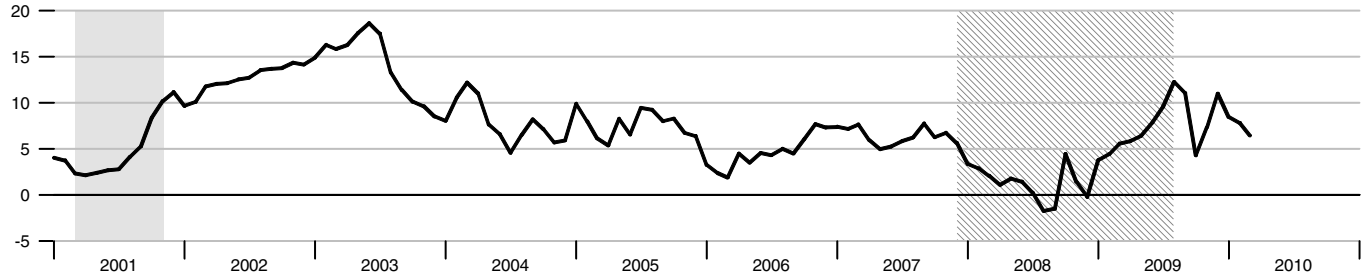
Bank Credit

Percent change from year ago



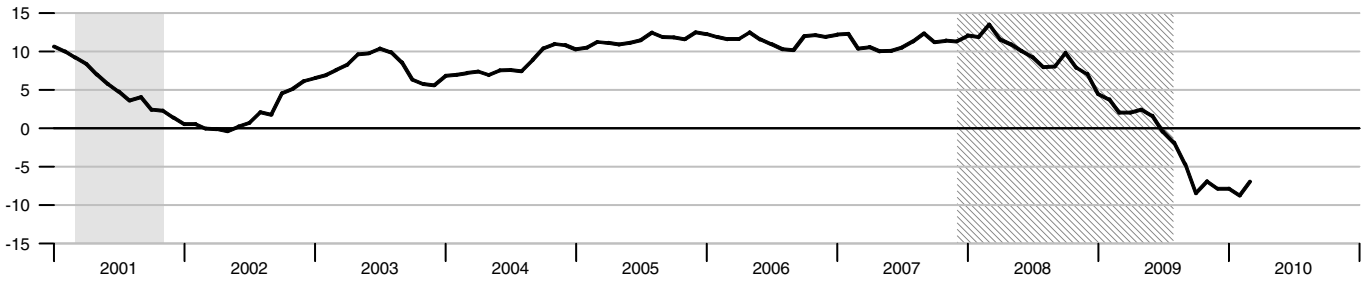
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



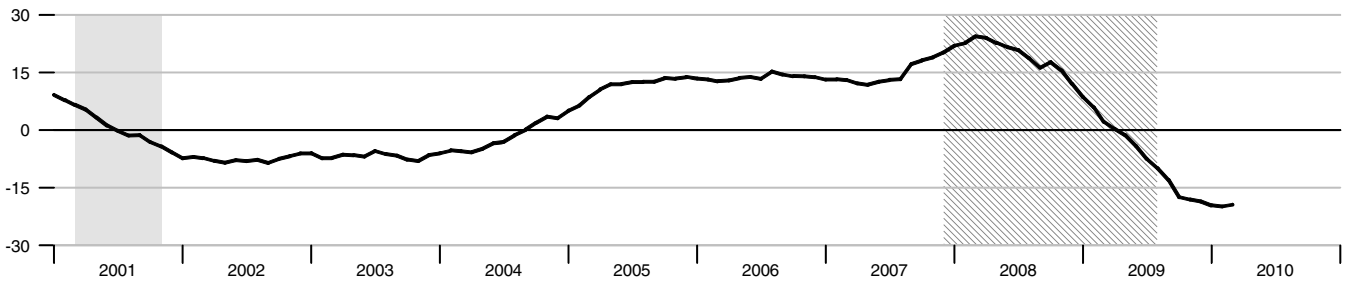
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

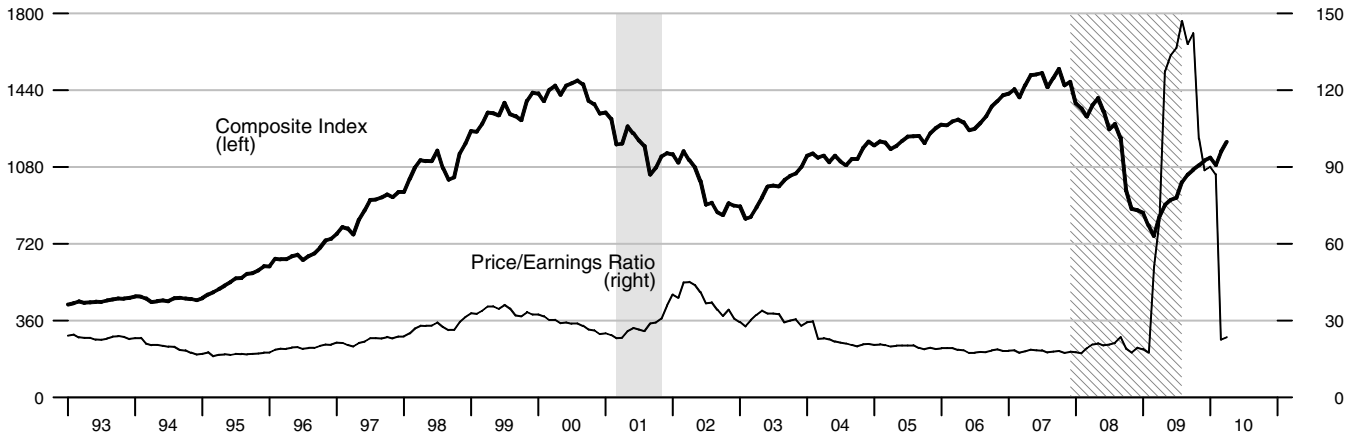


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



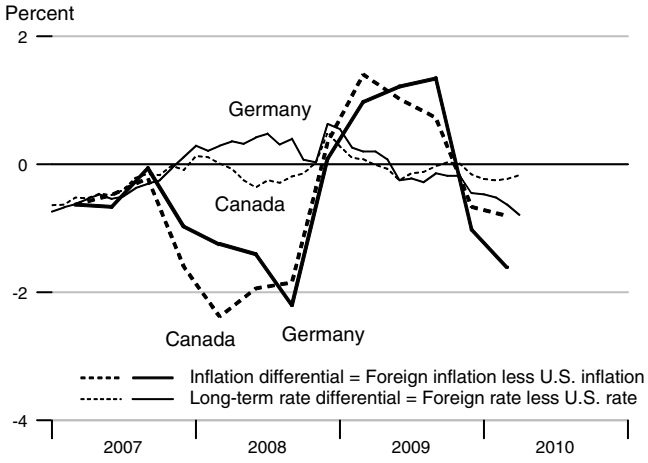
Standard & Poor's 500

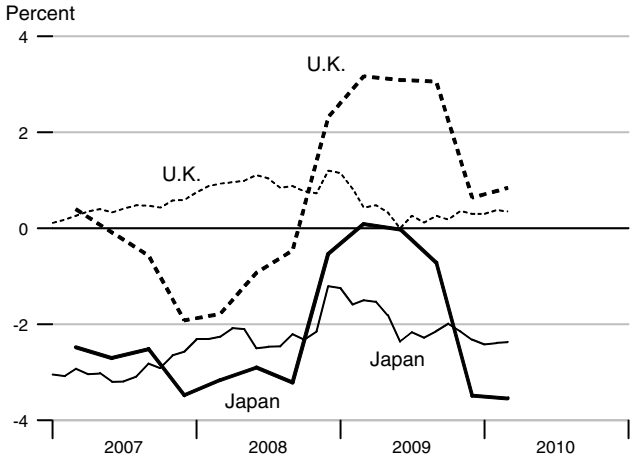


Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2009Q2	2009Q3	2009Q4	2010Q1	Jan10	Feb10	Mar10	Apr10
United States	-0.97	-1.60	1.46	2.42	3.73	3.69	3.73	3.85
Canada	0.06	-0.87	0.79	1.61	3.50	3.44	3.50	3.68
France	-0.21	-0.42	0.36	1.32	3.52	3.50	3.44	.
Germany	0.25	-0.25	0.44	0.81	3.26	3.17	3.10	3.06
Italy	0.85	0.12	0.65	1.29	4.08	4.05	3.94	4.00
Japan	-0.98	-2.31	-2.03	-1.12	1.31	1.30	1.36	.
United Kingdom	2.12	1.46	2.09	3.26	4.03	4.07	4.08	.

Inflation and Long-Term Interest Rate Differentials





		Money Stock				Bank	Adjusted		
		M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	MSI M2**
	2005	1371.763	6708.425	6522.507	9786.477	7012.652	806.628	96.560	343.539
	2006	1374.373	6999.309	6866.220	10270.74	7694.938	835.039	94.913	
	2007	1373.157	7633.169	7299.638		8460.781	850.567	94.184	
	2008	1433.316	8704.724	7817.420		9123.269	1009.796	232.198	
	2009	1628.702	9528.546	8424.297		9191.346	1796.608	944.860	
2008	1	1385.940	8382.125	7614.067		9000.092	856.293	96.144	
	2	1393.903	8661.973	7729.096		9003.683	859.364	94.409	
	3	1424.884	8770.769	7824.651		9075.594	892.790	117.867	
	4	1528.539	9004.027	8101.864		9413.706	1430.736	620.373	
2009	1	1566.702	9399.705	8343.187		9331.745	1663.090	820.776	
	2	1608.877	9536.079	8400.003		9284.243	1763.779	917.211	
	3	1653.038	9581.461	8435.813		9137.324	1747.162	895.468	
	4	1686.190	9596.940	8518.186		9012.073	2012.399	1145.986	
2010	1	1701.895	9489.560	8512.911		8933.602	2089.181	1216.980	
2008	Mar	1389.681	8544.297	7684.284		9054.014	860.514	97.186	
	Apr	1392.088	8612.347	7709.266		8995.764	855.200	94.327	
	May	1391.475	8663.838	7732.773		9012.850	859.886	95.107	
	Jun	1398.147	8709.733	7745.249		9002.435	863.006	93.792	
	Jul	1415.119	8765.882	7796.971		9028.665	870.737	97.042	
	Aug	1400.022	8750.445	7784.956		9032.806	871.497	96.702	
	Sep	1459.511	8795.979	7892.027		9165.311	936.136	159.856	
	Oct	1472.747	8843.102	8007.148		9499.135	1142.178	347.630	
	Nov	1518.123	8969.579	8058.746		9389.305	1480.765	674.096	
	Dec	1594.746	9199.401	8239.699		9352.677	1669.266	839.392	
2009	Jan	1573.816	9330.237	8300.717		9331.390	1730.476	870.242	
	Feb	1562.047	9398.629	8338.448		9352.089	1590.273	758.700	
	Mar	1564.244	9470.250	8390.396		9311.757	1668.522	833.385	
	Apr	1592.662	9453.862	8342.549		9258.241	1787.815	949.455	
	May	1592.981	9561.252	8415.364		9315.180	1799.382	946.297	
	Jun	1640.988	9593.124	8442.097		9279.307	1704.141	855.882	
	Jul	1649.869	9595.753	8437.718		9195.555	1693.710	841.504	
	Aug	1648.335	9556.551	8414.485		9153.588	1728.095	879.620	
	Sep	1660.911	9592.079	8455.237		9062.830	1819.680	965.281	
	Oct	1674.599	9595.380	8487.872		8977.340	1975.382	1122.271	
	Nov	1687.565	9603.645	8522.767		9045.562	2044.532	1182.223	
	Dec	1696.405	9591.794	8543.919		9013.318	2017.282	1133.464	
2010	Jan	1679.822	9519.369	8485.563		8949.216	2010.118	1105.423	
	Feb	1713.671	9520.842	8541.084		8893.925	2150.905	1296.124	
	Mar	1712.191	9428.469	8512.085		8957.666	2106.521	1249.393	

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 3-mo	3-yr	10-yr	Corporate Aaa Bonds	Municipal Aaa Bonds	Conventional Mortgage
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
2009	0.16	0.50	3.25	0.56	0.15	1.43	3.26	5.31	4.27	5.04
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
2	0.18	0.50	3.25	0.62	0.17	1.49	3.31	5.51	4.43	5.03
3	0.16	0.50	3.25	0.30	0.16	1.56	3.52	5.27	4.11	5.16
4	0.12	0.50	3.25	0.22	0.06	1.39	3.46	5.20	3.91	4.92
2010 1	0.13	0.61	3.25	0.21	0.11	1.47	3.72	5.29	3.93	5.00
2008 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	4.26	4.86
Jun	0.21	0.50	3.25	0.39	0.18	1.76	3.72	5.61	4.56	5.42
Jul	0.16	0.50	3.25	0.35	0.18	1.55	3.56	5.41	4.36	5.22
Aug	0.16	0.50	3.25	0.30	0.17	1.65	3.59	5.26	4.17	5.19
Sep	0.15	0.50	3.25	0.25	0.12	1.48	3.40	5.13	3.81	5.06
Oct	0.12	0.50	3.25	0.24	0.07	1.46	3.39	5.15	3.85	4.95
Nov	0.12	0.50	3.25	0.21	0.05	1.32	3.40	5.19	3.99	4.88
Dec	0.12	0.50	3.25	0.22	0.05	1.38	3.59	5.26	3.89	4.93
2010 Jan	0.11	0.50	3.25	0.20	0.06	1.49	3.73	5.26	3.96	5.03
Feb	0.13	0.59	3.25	0.19	0.11	1.40	3.69	5.35	3.91	4.99
Mar	0.16	0.75	3.25	0.23	0.15	1.51	3.73	5.27	3.91	4.97
Apr	0.20	0.75	3.25	0.30	0.16	1.64	3.85	5.29	3.95	5.10

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

		M1	MZM	M2	M3*
Percent change at an annual rate					
	2005	2.03	2.11	4.24	5.97
	2006	0.19	4.34	5.27	4.95
	2007	-0.09	9.06	6.31	
	2008	4.38	14.04	7.09	
	2009	13.63	9.46	7.76	
2008	1	2.67	15.73	7.86	
	2	2.30	13.35	6.04	
	3	8.89	5.02	4.95	
	4	29.10	10.64	14.17	
2009	1	9.99	17.58	11.91	
	2	10.77	5.80	2.72	
	3	10.98	1.90	1.71	
	4	8.01	0.64	3.91	
2010	1	3.73	-4.47	-0.25	
2008	Mar	2.33	19.75	9.56	
	Apr	2.08	9.56	3.90	
	May	-0.53	7.17	3.66	
	Jun	5.75	6.36	1.94	
	Jul	14.57	7.74	8.01	
	Aug	-12.80	-2.11	-1.85	
	Sep	50.99	6.24	16.50	
	Oct	10.88	6.43	17.50	
	Nov	36.97	17.16	7.73	
	Dec	60.57	30.75	26.95	
2009	Jan	-15.75	17.07	8.89	
	Feb	-8.97	8.80	5.45	
	Mar	1.69	9.14	7.48	
	Apr	21.80	-2.08	-6.84	
	May	0.24	13.63	10.47	
	Jun	36.16	4.00	3.81	
	Jul	6.49	0.33	-0.62	
	Aug	-1.12	-4.90	-3.30	
	Sep	9.15	4.46	5.81	
	Oct	9.88	0.41	4.63	
	Nov	9.29	1.03	4.93	
	Dec	6.28	-1.48	2.98	
2010	Jan	-11.74	-9.06	-8.20	
	Feb	24.19	0.19	7.85	
	Mar	-0.99	-11.61	-4.07	

*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 nominal 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. **Retail Money Market Mutual Funds** are included in M2. **Institutional** money market funds are not included in M2.

Page 6: **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 7: Data are reported in the Senior Loan Officer Opinion Survey on Bank Lending Practices.

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 estimated by the Congressional Budget Office (CBO).

Monetary Base Growth and Inflation Targets shows the quarterly growth of the adjusted monetary base implied by applying McCallum's (2000, p. 52) equation

$$\Delta b_t = \Delta x_t^* - \Delta v_t^a + \lambda\,(\Delta x_t^* - \Delta x_{t-1}),$$
$$\Delta x_t^* = \pi^* + \Delta y_t^*$$

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where Δb_t is the implied growth rate of the adjusted monetary base, Δy_t^* is the 10-year

moving average growth in real GDP, Δv_t^{α} is the average base velocity growth (calculated recursively), Δx_{t-1} is the lag growth rate of nominal GDP, and $\lambda = 0.5$.

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 4/16/2020, and the current U.S. note has a maturity date of 11/15/2019. **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 2005 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. Senior Loan Officer Opinion Survey on Bank Lending Practices.

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/.