Monetary Trends

March 2010

Money Supply, Credit Expansion, and Housing Price Inflation

Should monetary policy be concerned about housing price inflation? Housing prices are affected by the credit supply because housing purchases are financed by borrowing. When home demand goes up, housing prices also increase. On the other hand, the cost of borrowing depends on nominal interest rates, which in turn may be influenced by monetary policy.

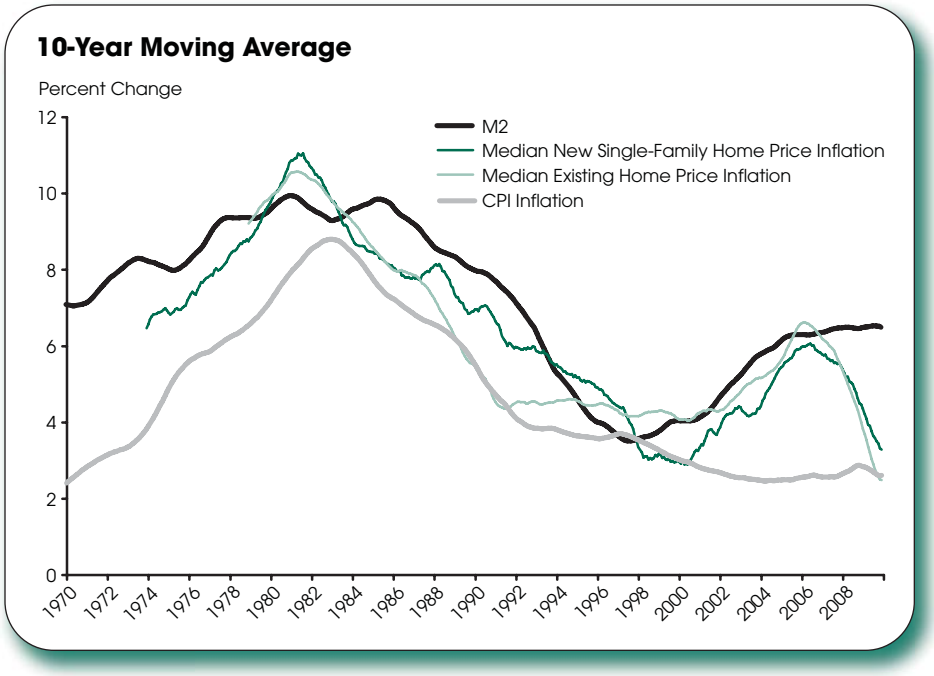
Economists often define inflation as changes in the price level of all commodities currently produced (the gross domestic product deflator) or consumed (the consumer price index [CPI]). Neither measure explicitly includes housing prices because housing purchases are considered investments rather than consumption. Rental prices are included in the CPI; however, they do not fully reflect housing prices for at least two reasons: (i) The rental market is relatively thin, so rental rates and housing prices do not necessarily follow each other closely; and (ii) during "bubble" periods many people buy houses for investment purposes rather than as primary residences. This creates a wedge between rental rates and housing prices. The lack of strong correlation between rental rates and housing prices is evidenced by greater volatility in housing prices than in the present value of future rents.

It is well known that the housing market strongly leads the business cycle. One reason is that home purchases (especially new home purchases) increase aggregate demand by increasing the demand for durable goods (such as furniture, home appliances, flooring materials, and so on). Because housing prices tend to rise with a rise in the rate of home purchases, it is reasonable to assume that home prices and the real economy are well connected.

The chart, which uses post-World War II U.S. data, shows 10-year moving averages of various indicators, including the growth rate of M2 (the solid line on the chart). M2 money stock is composed of currency, travelers checks, demand deposits, checking accounts, savings deposits, small-denomination time deposits, and retail money funds. The chart also shows housing price inflation, measured as the median price of existing homes (the dashed line), new single-family homes (the dotted line), and CPI inflation (the dashed-dotted line). The 10-year moving average captures longer-term relationships for the time series, including a close relationship between (i) money growth and either measure of housing price inflation and (ii) housing inflation and CPI inflation until around 2000. In particular, the steady increase in the housing price inflation rate since the early 2000s is closely associated with the steady increase in the money supply during the same period. Overall, housing price inflation appears to lead CPI inflation.

The chart does not provide any causal relationships among the series. M2 is mostly endogenous, determined more or less simultaneously with credit via financial intermediation. However, credit and M2 may be driven simultaneously as part of a broader financial intermediation process; a common underlying factor may be the interest rate. A lower interest rate may stimulate borrowing and housing demand, which in turn may induce higher demand for durable goods. Because durable goods are purchased with money, the demand for money may also increase. As a result, aggregate demand and the money supply may increase, which raises the aggregate price level. Therefore, policymakers may want to closely watch housing price inflation, not only because it leads CPI inflation, but also because an overheated housing market may encourage more risk-taking behaviors by banks and cause the aggregate money supply to increase, resulting in excess aggregate demand and higher inflation risk.

—Yi Wen



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

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Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.
2. 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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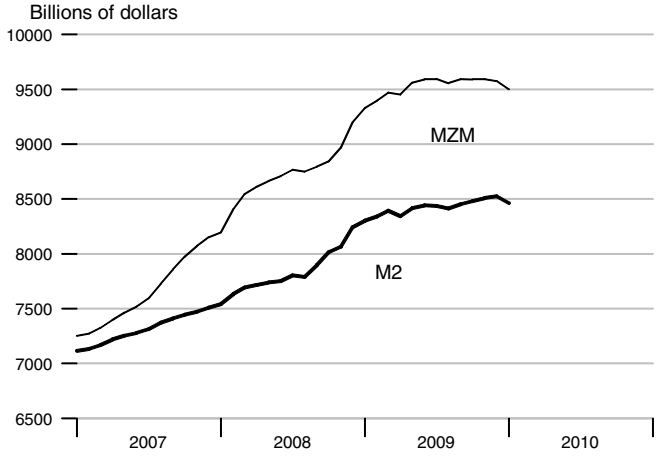
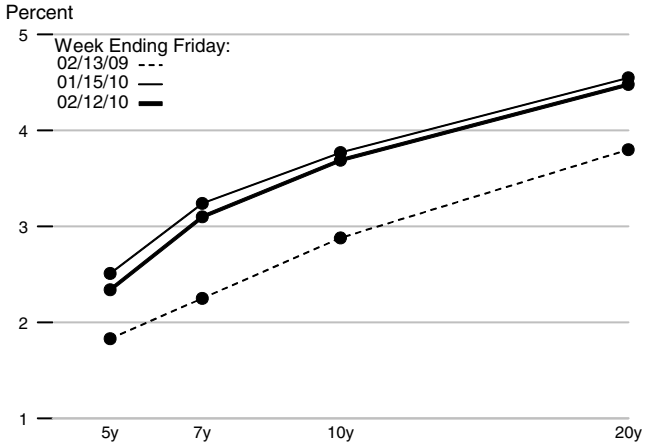
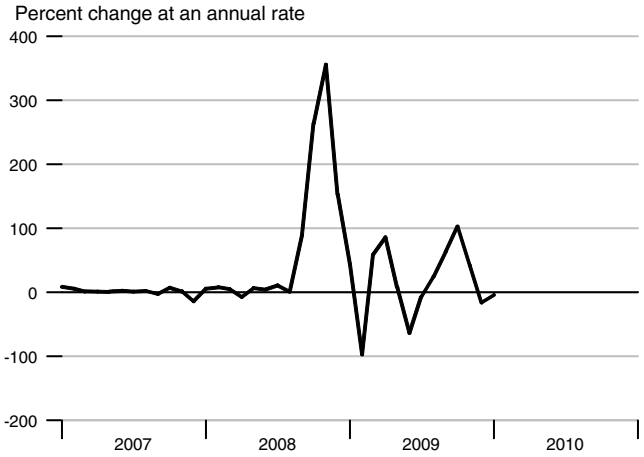
M2 and MZM



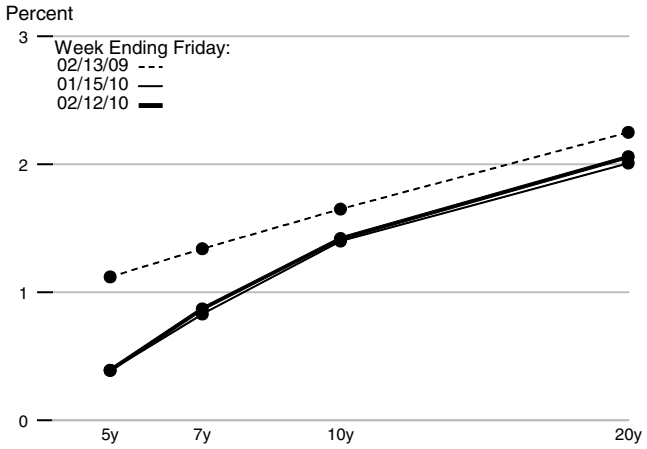
Treasury Yield Curve



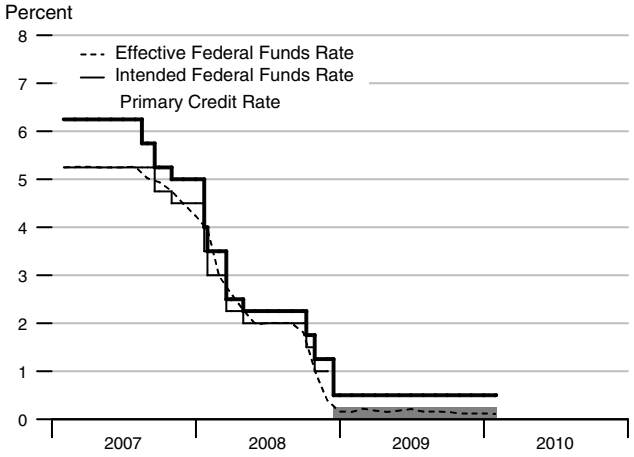
Adjusted Monetary Base



Real Treasury Yield Curve

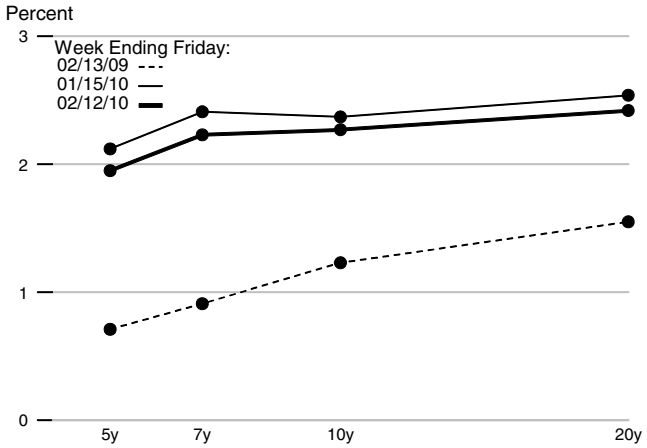


Reserve Market Rates



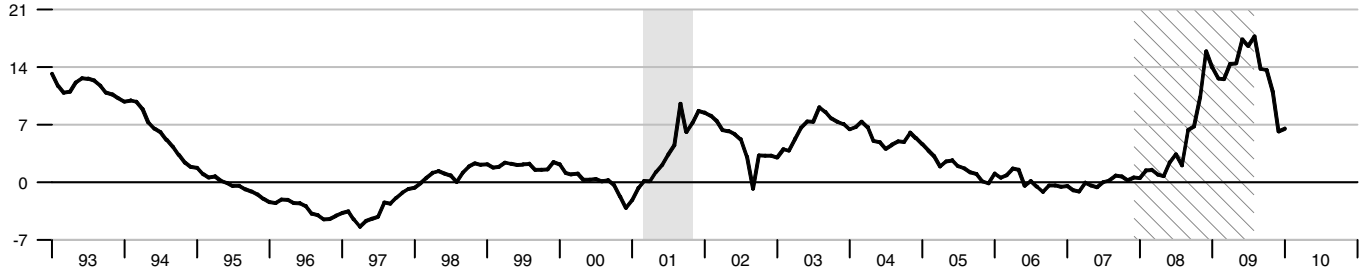
Note: Effective December 16, 2008, FOMC reports the intended Federal Funds Rate as a range.

Inflation-Indexed Treasury Yield Spreads



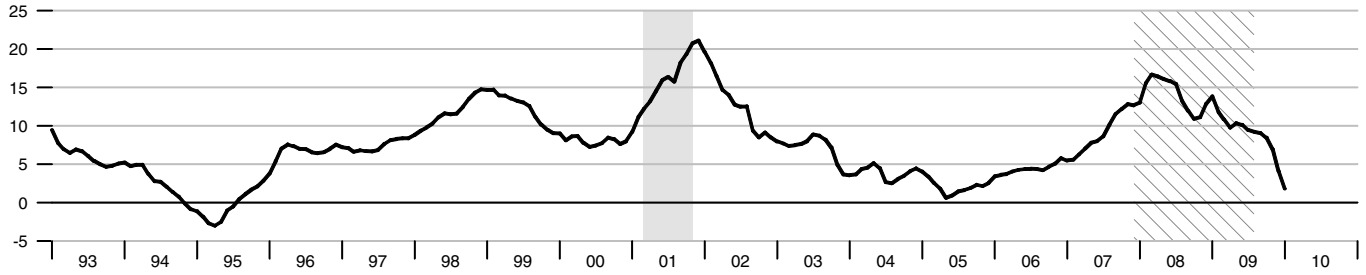
M1

Percent change from year ago



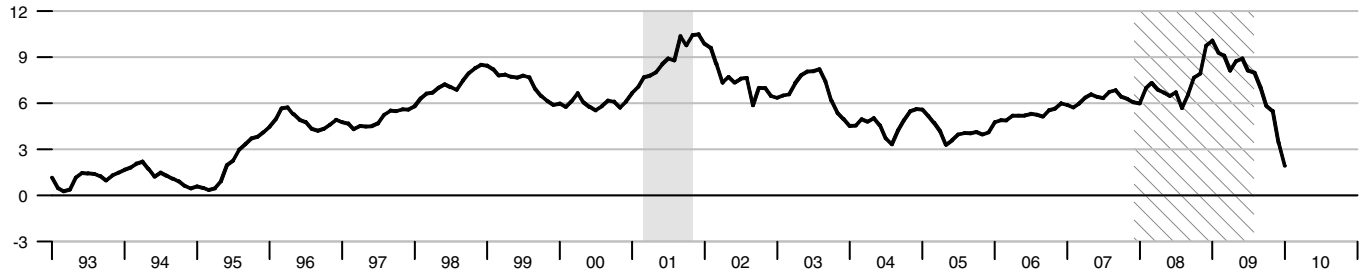
MZM

Percent change from year ago



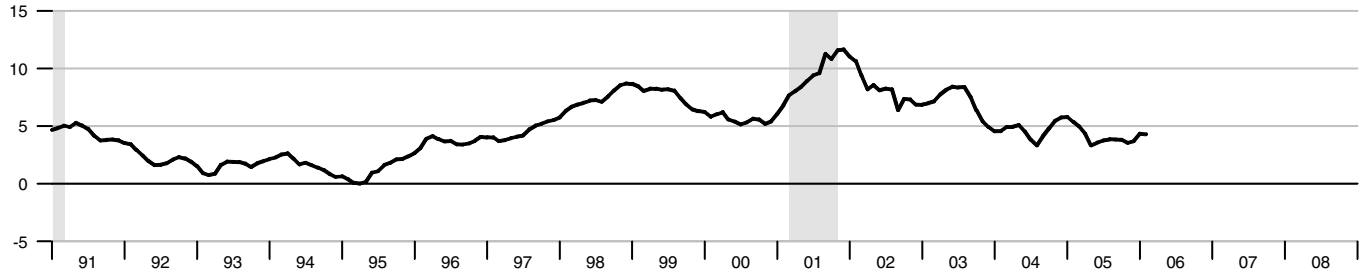
M2

Percent change from year ago



Monetary Services Index - M2**

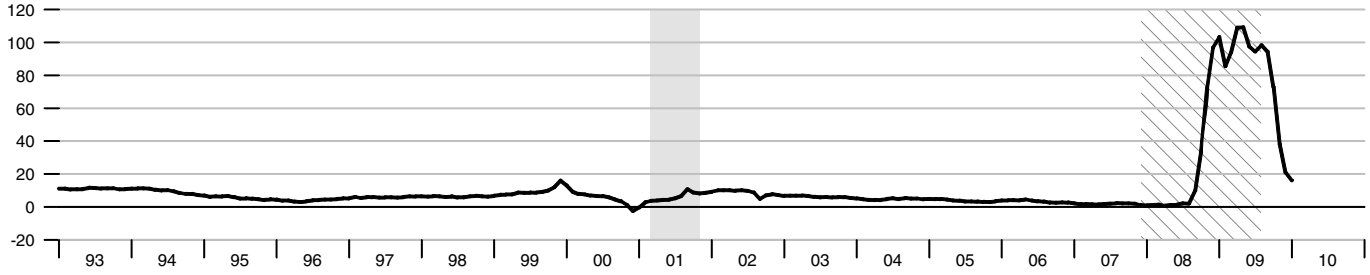
Percent change from year ago



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

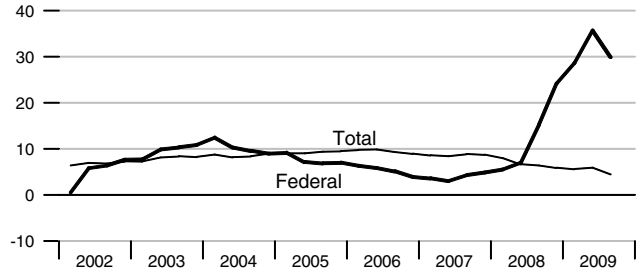
Adjusted Monetary Base

Percent change from year ago



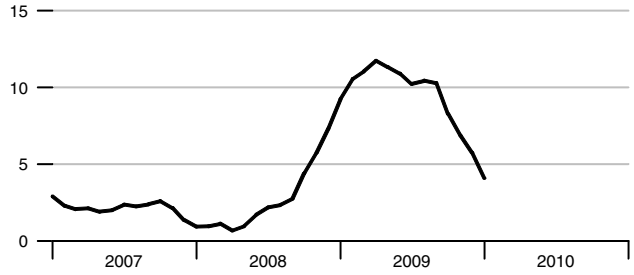
Domestic Nonfinancial Debt

Percent change from year ago



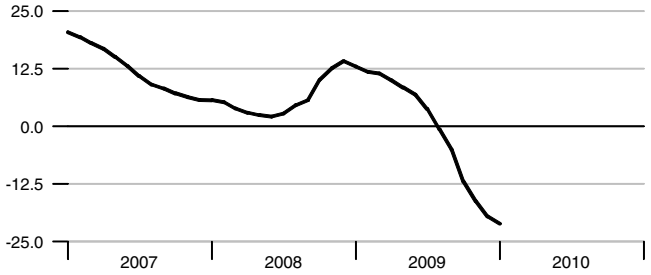
Currency Held by the Nonbank Public

Percent change from year ago



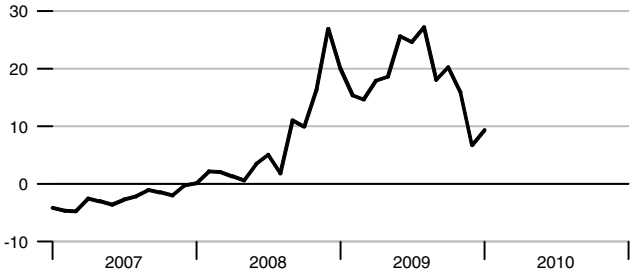
Small Denomination Time Deposits*

Percent change from year ago



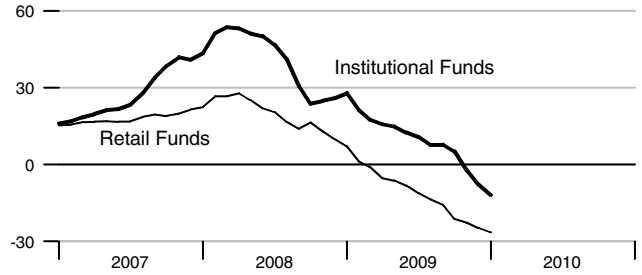
Checkable Deposits

Percent change from year ago



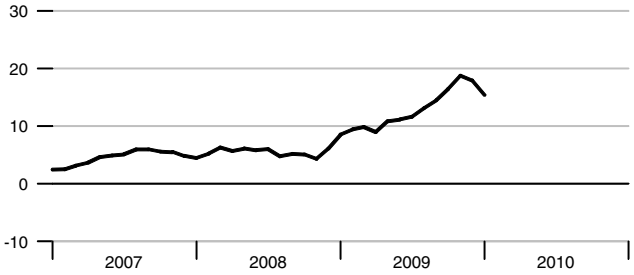
Money Market Mutual Fund Shares

Percent change from year ago



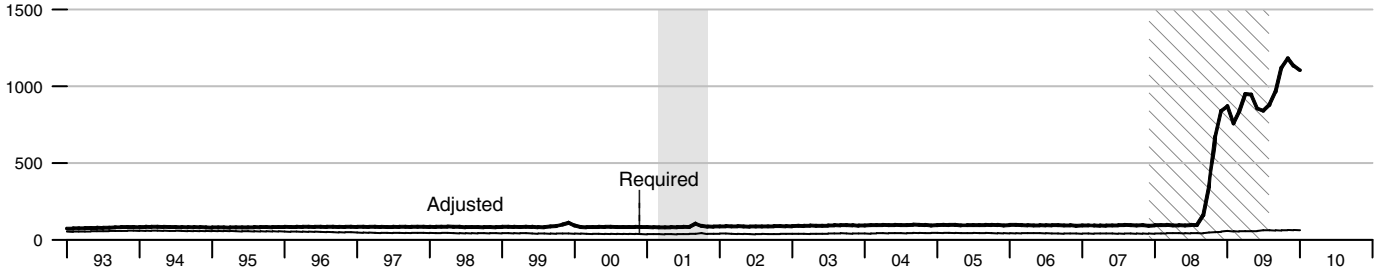
Savings Deposits

Percent change from year ago



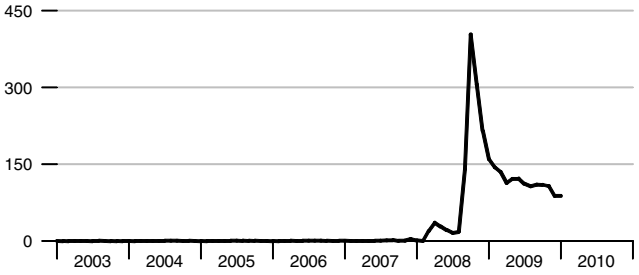
Adjusted and Required Reserves

Billions of dollars



Total Borrowings, nsa

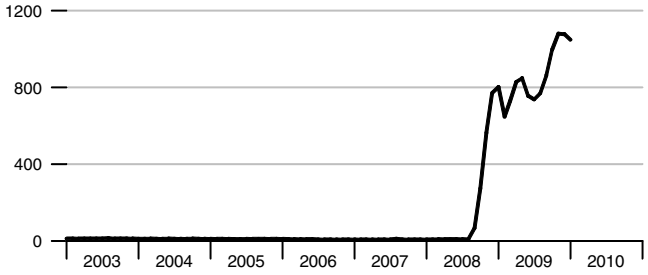
Billions of dollars



* Data exclude term auction credit

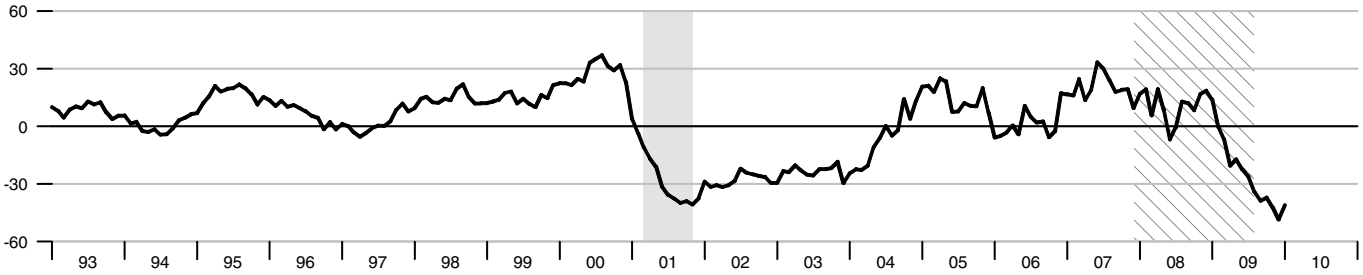
Excess Reserves plus RCB Contracts

Billions of dollars



Nonfinancial Commercial Paper

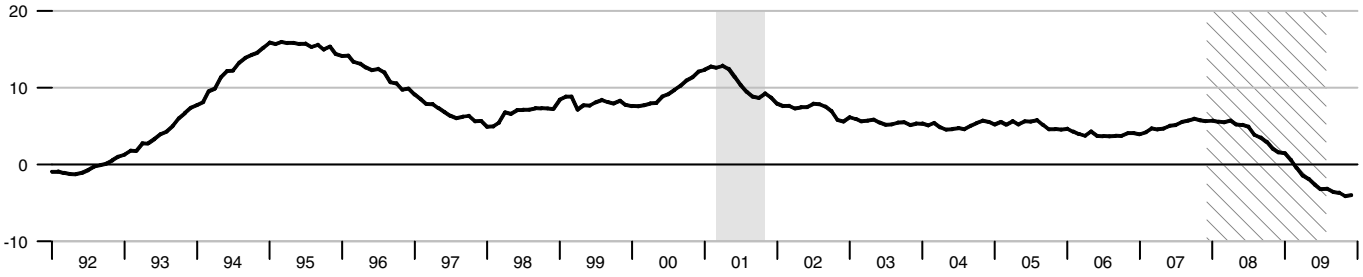
Percent change from year ago



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.

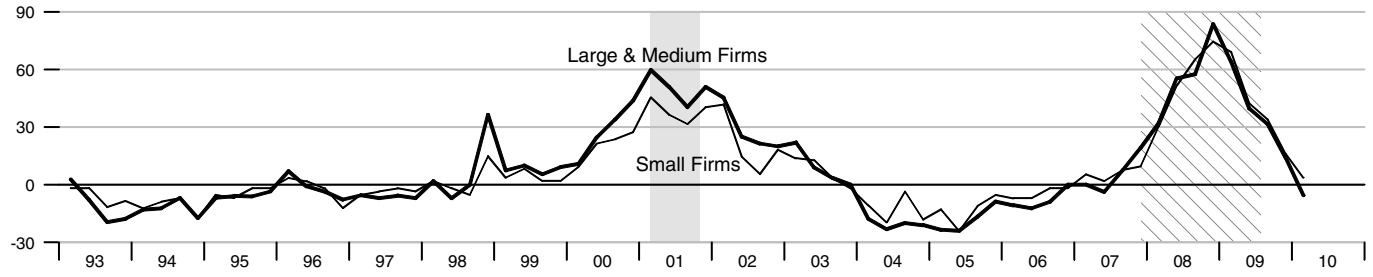
Consumer Credit

Percent change from year ago



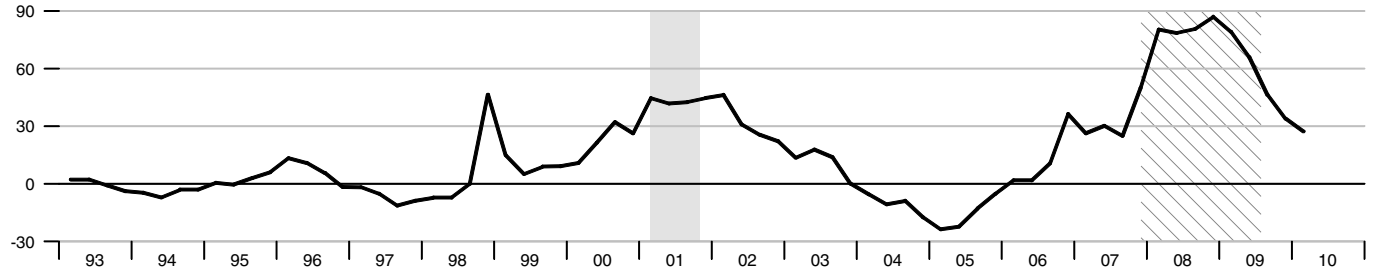
Net Percentage of Domestic Respondents Tightening Standards for Commercial and Industrial Loans

Percentage



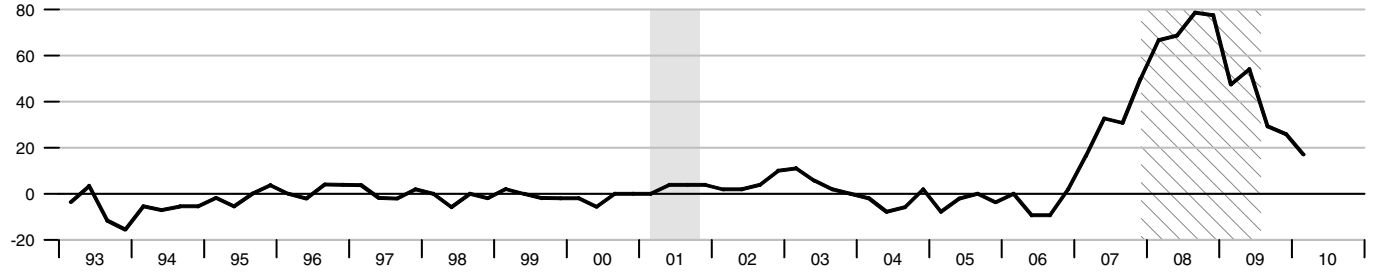
Net Percentage of Domestic Respondents Tightening Standards for Commercial Real Estate Loans

Percentage



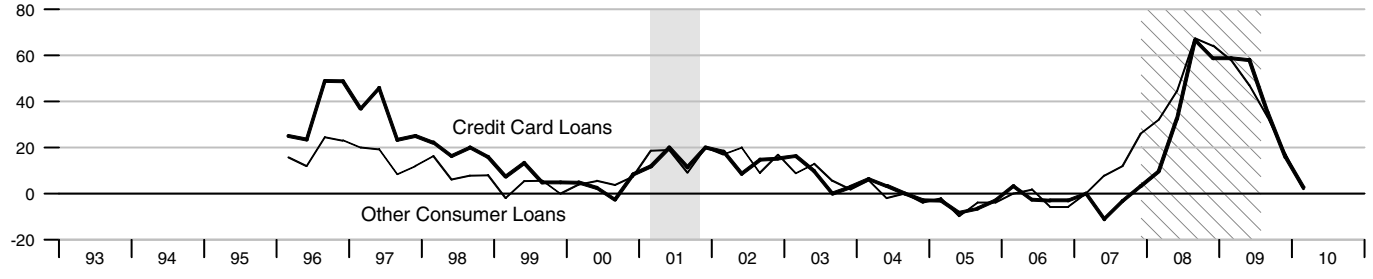
Net Percentage of Domestic Respondents Tightening Standards for Residential Mortgage Loans

Percentage



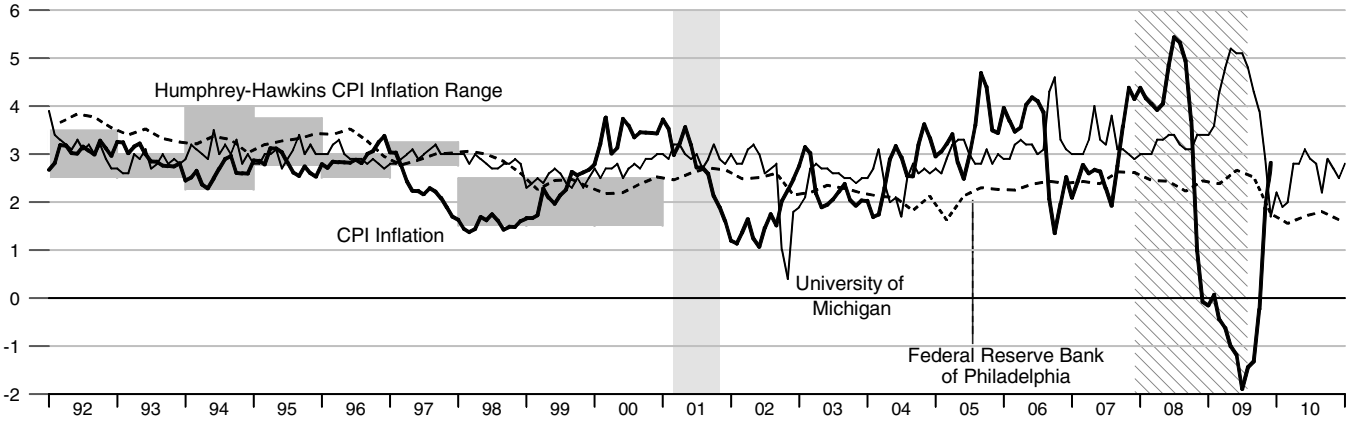
Net Percentage of Domestic Respondents Tightening Standards for Consumer Loans

Percentage



CPI Inflation and 1-Year-Ahead CPI Inflation Expectations

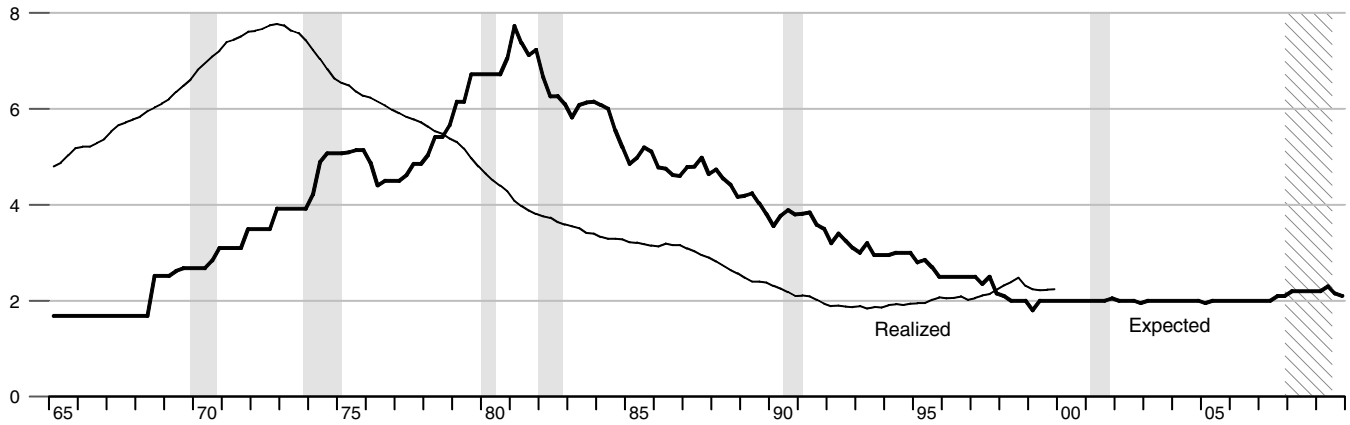
Percent



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

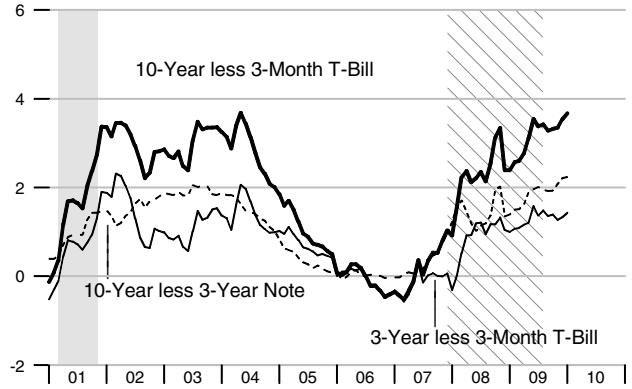
Percent



See the notes section for an explanation of the chart.

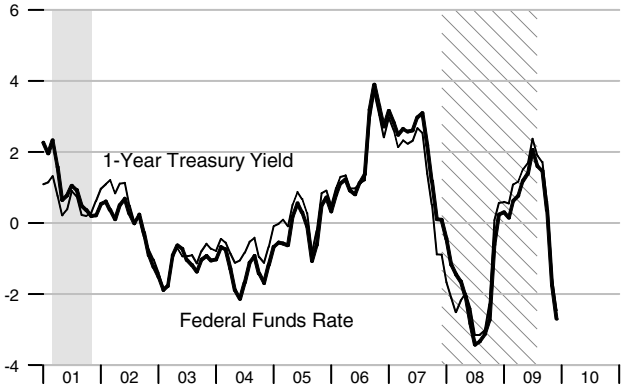
Treasury Security Yield Spreads

Yield to maturity

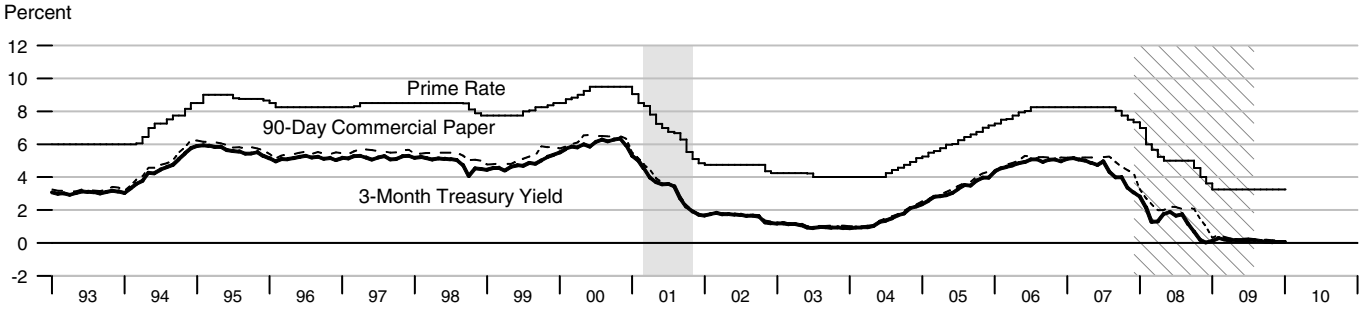


Real Interest Rates

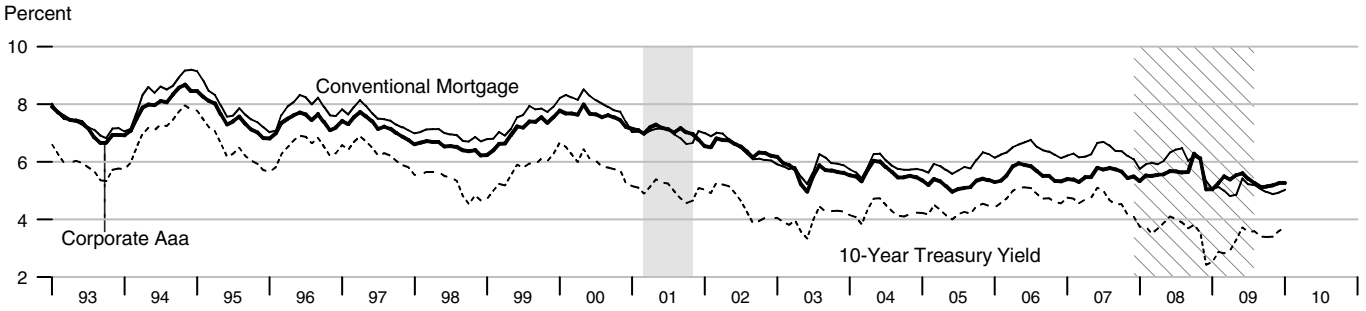
Percent, Real rate = Nominal rate less year-over-year CPI inflation



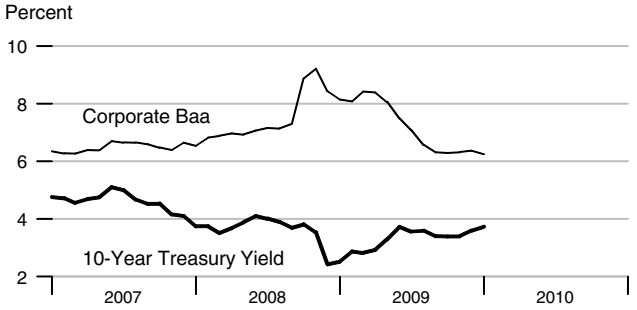
Short-Term Interest Rates



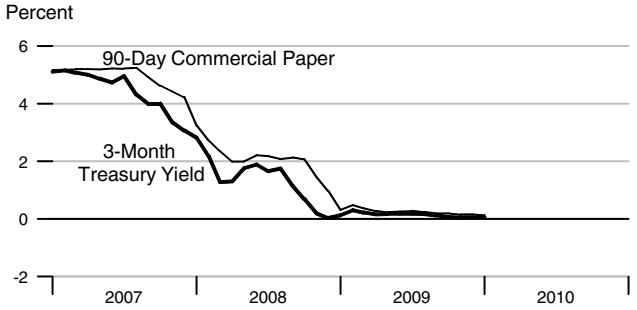
Long-Term Interest Rates



Long-Term Interest Rates

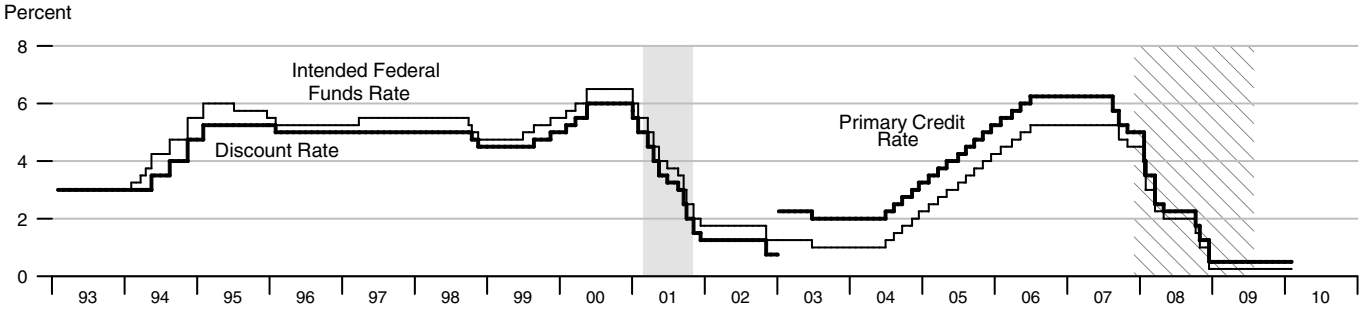


Short-Term Interest Rates

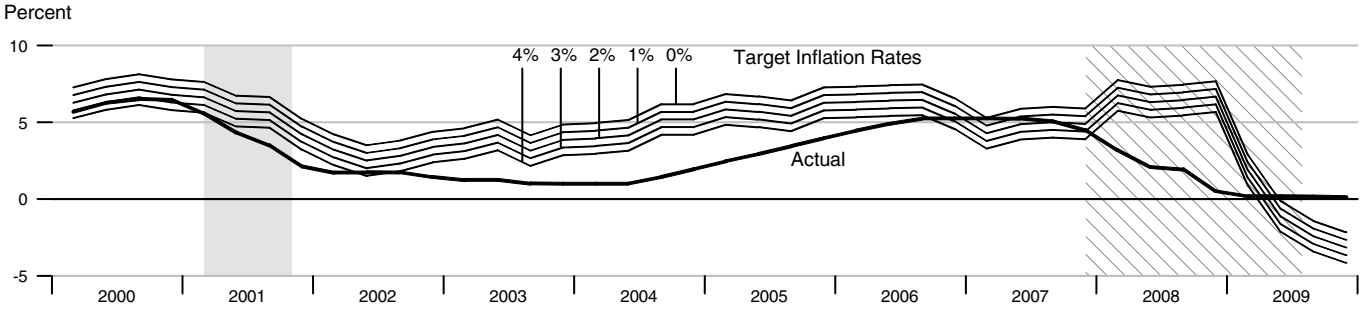


*90-Day Commercial Paper data are not available for December 2005, January 2006, and July 2006.

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



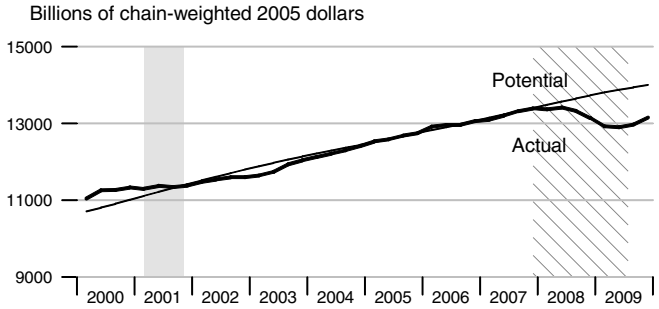
Federal Funds Rate and Inflation Targets



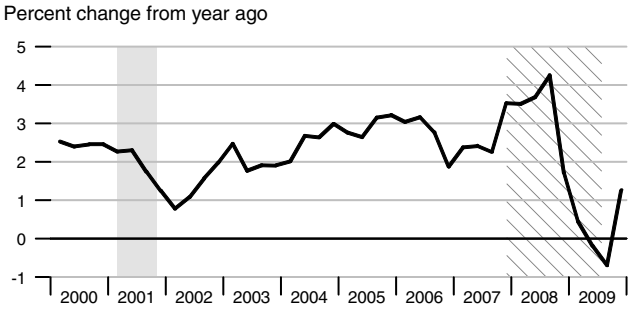
Calculated federal funds rate is based on Taylor's rule.

Components of Taylor's Rule

Actual and Potential Real GDP

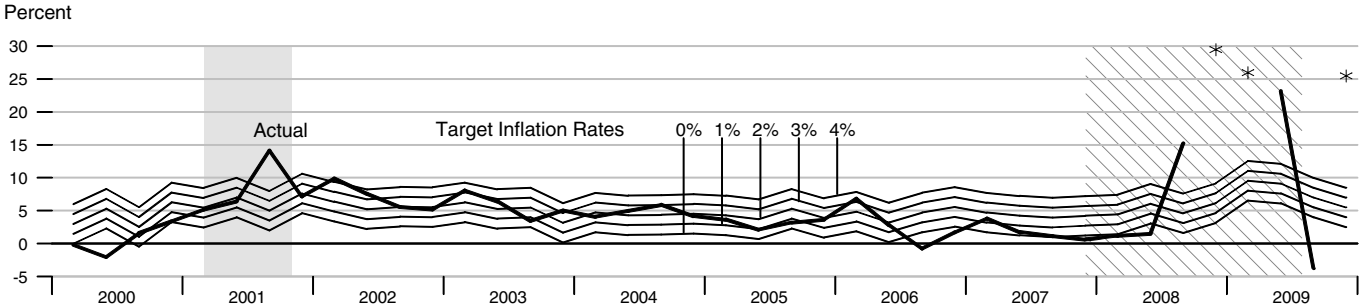


PCE Inflation



See notes section for further explanation.

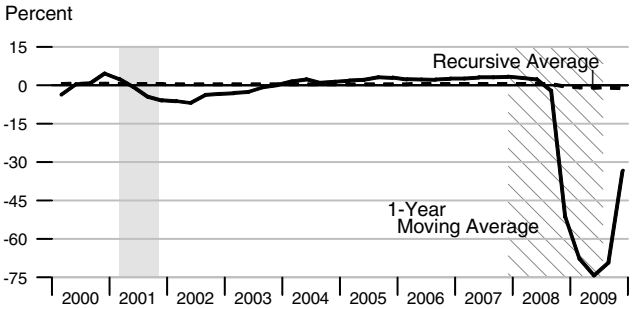
Monetary Base Growth and Inflation Targets



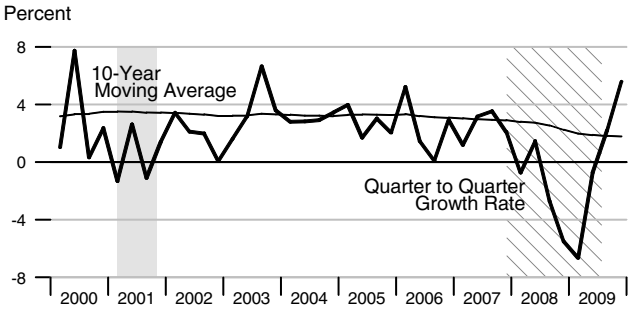
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter
*Actual values for 2008:Q4, 2009:Q1, and 2009:Q4 are 188.38 percent, 60.77 percent, and 56.51, respectively.

Components of McCallum's Rule

Monetary Base Velocity Growth

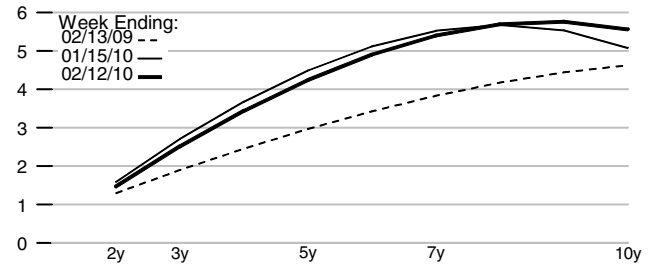


Real Output Growth



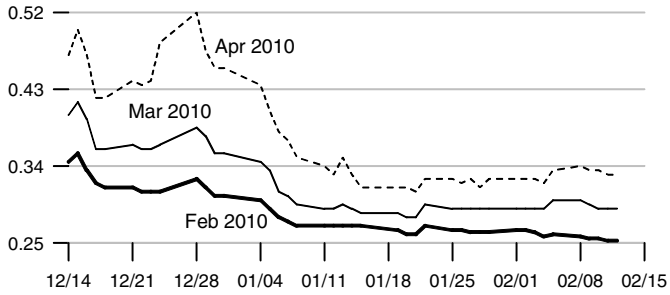
Implied One-Year Forward Rates

Percent



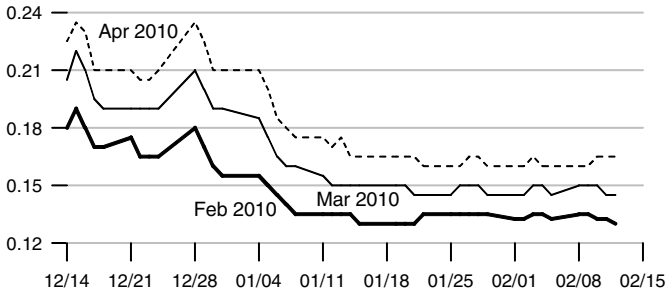
Rates on 3-Month Eurodollar Futures

Percent, daily data



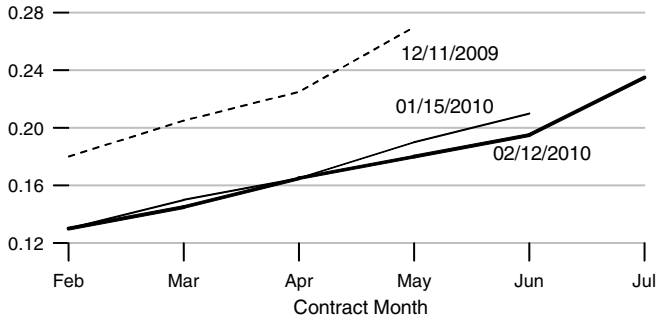
Rates on Selected Federal Funds Futures Contracts

Percent, daily data



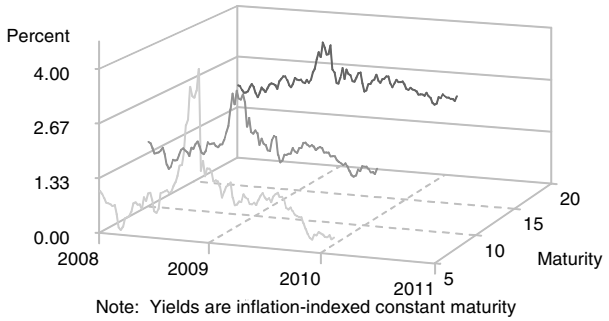
Rates on Federal Funds Futures on Selected Dates

Percent



Inflation-Indexed Treasury Securities

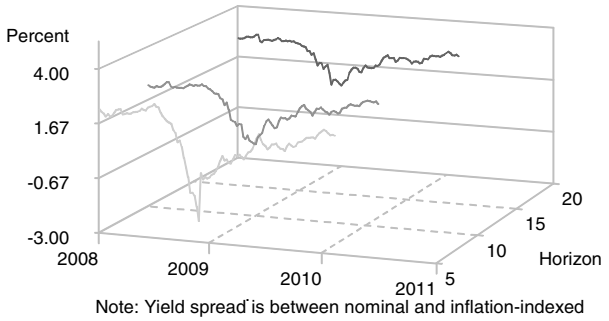
Weekly data



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

Inflation-Indexed Treasury Yield Spreads

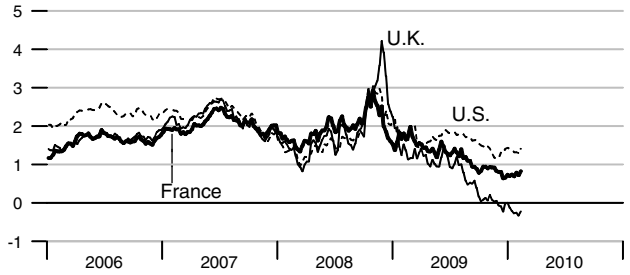
Weekly data



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

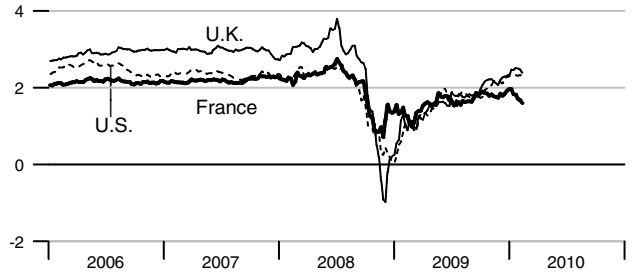
Inflation-Indexed 10-Year Government Notes

Percent, weekly data



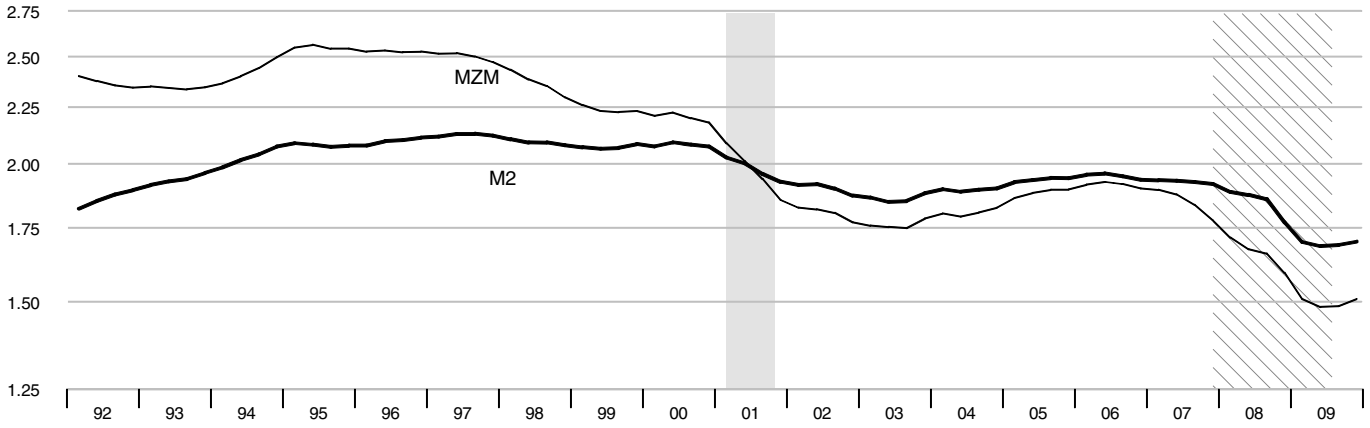
Inflation-Indexed 10-Year Government Yield Spreads

Percent, weekly data



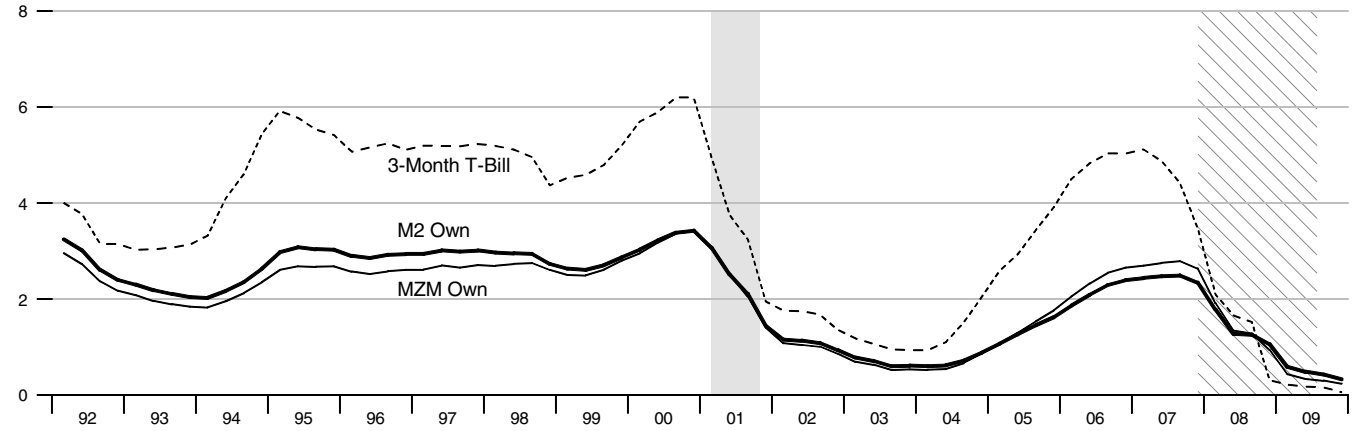
Velocity

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



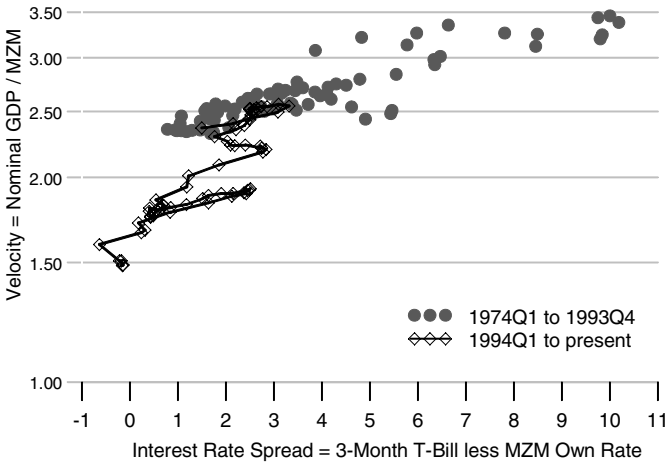
Interest Rates

Percent



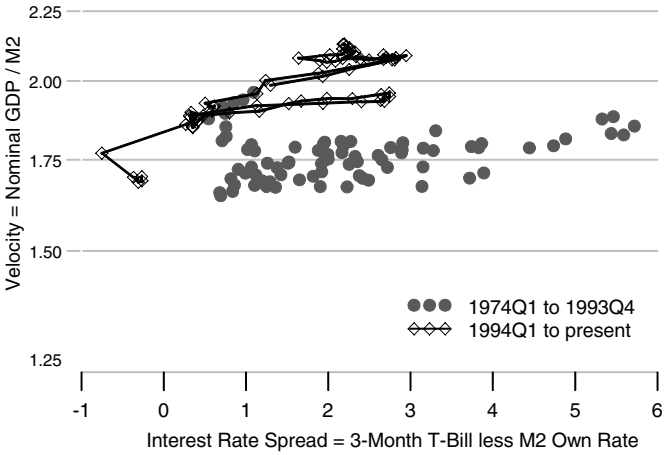
MZM Velocity and Interest Rate Spread

Ratio Scale



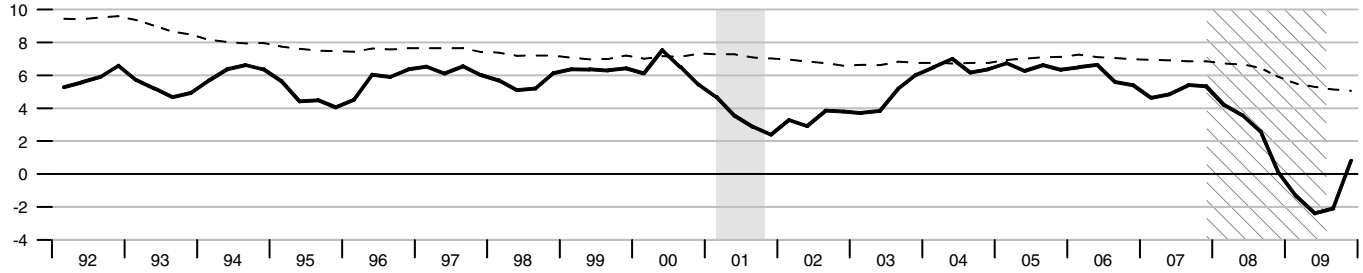
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

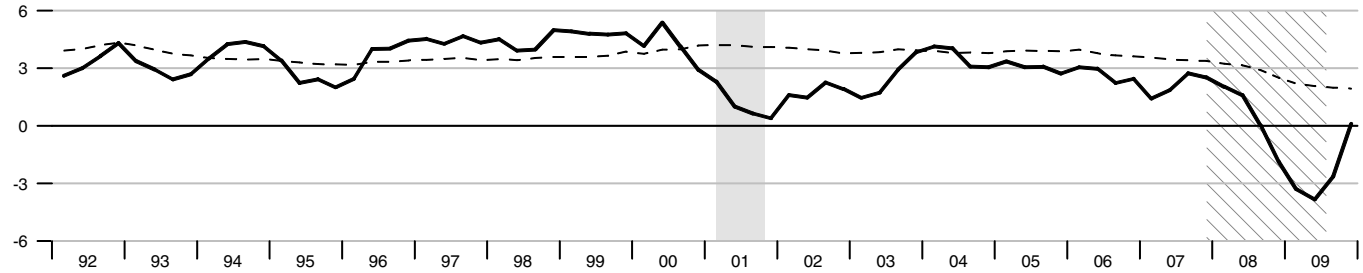
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

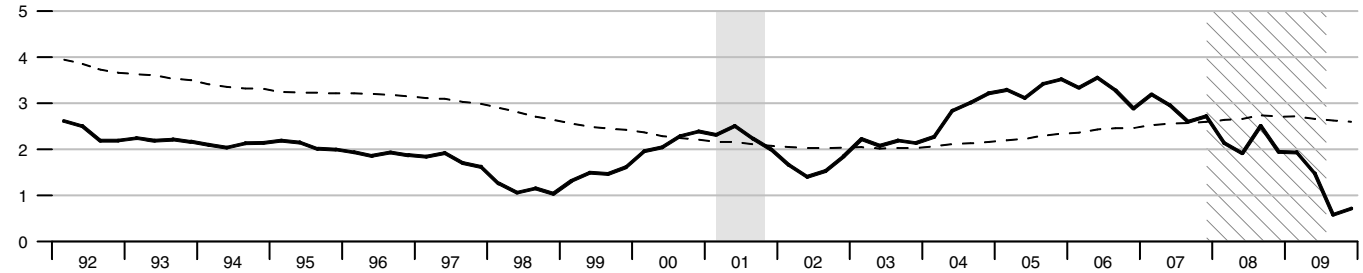
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

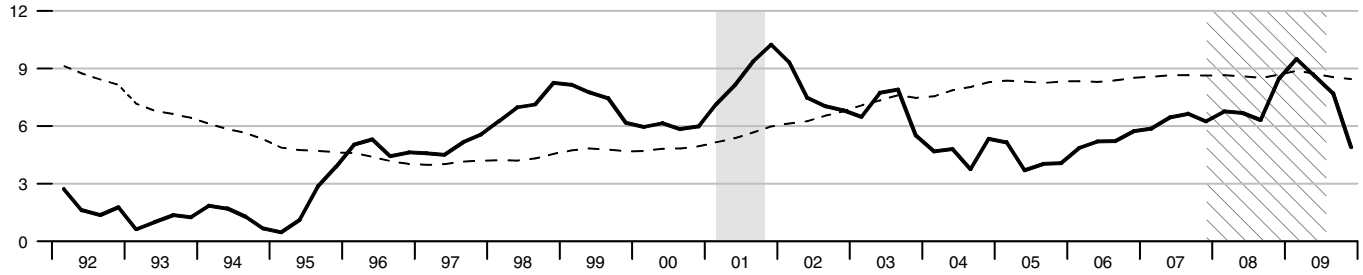
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

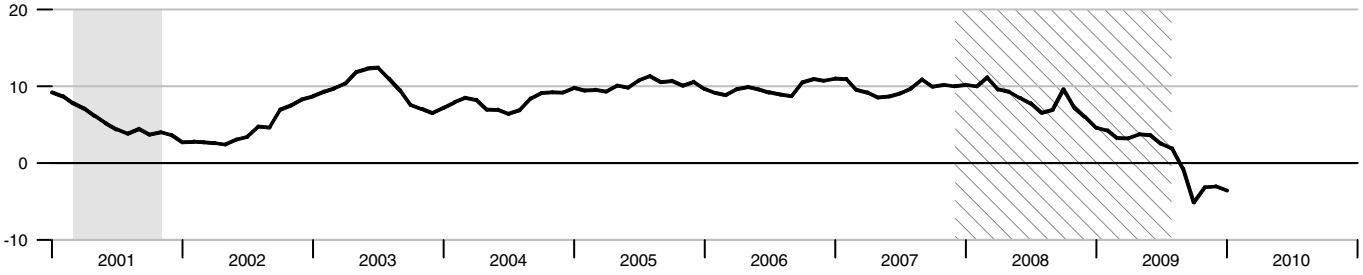
Percent change from year ago



Dashed lines indicate 10-year moving averages.

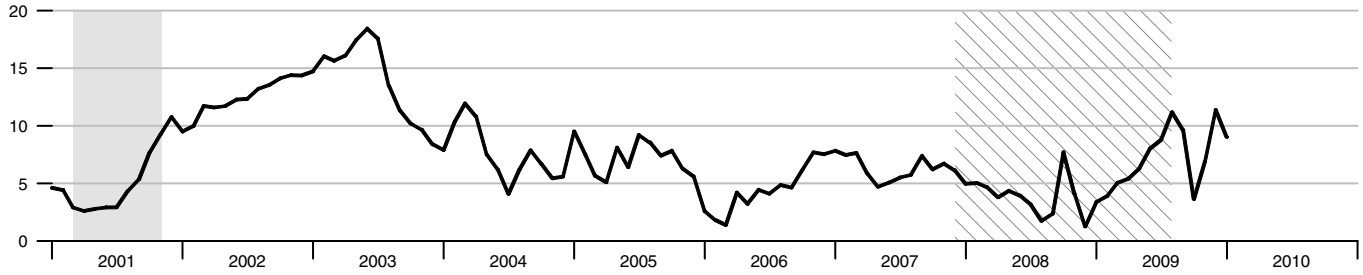
Bank Credit

Percent change from year ago



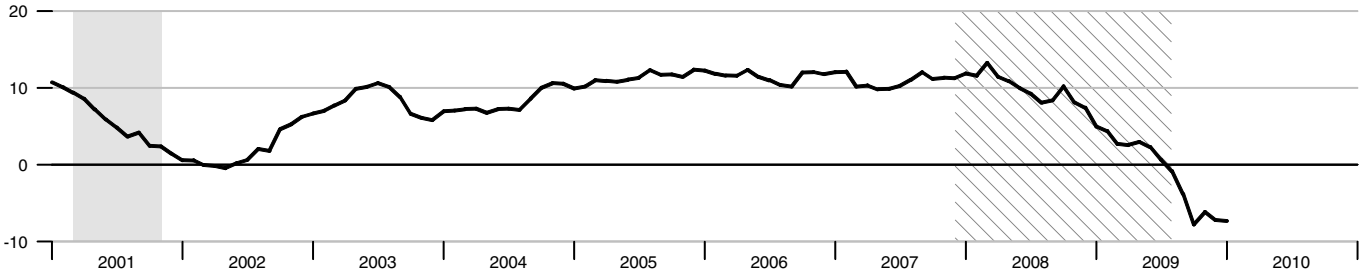
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



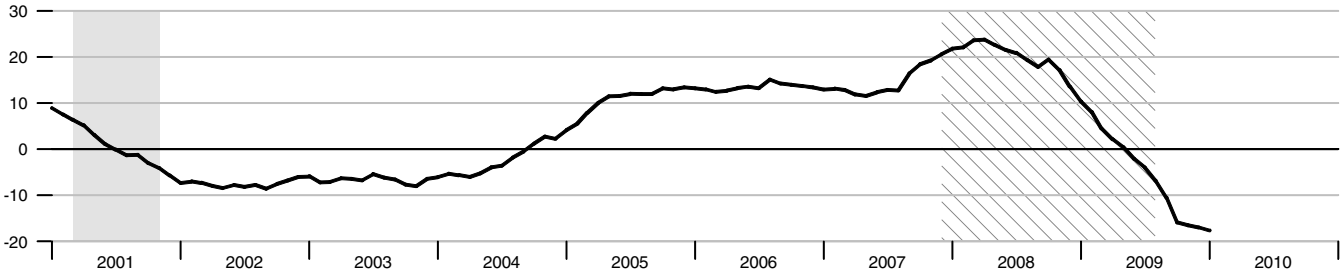
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

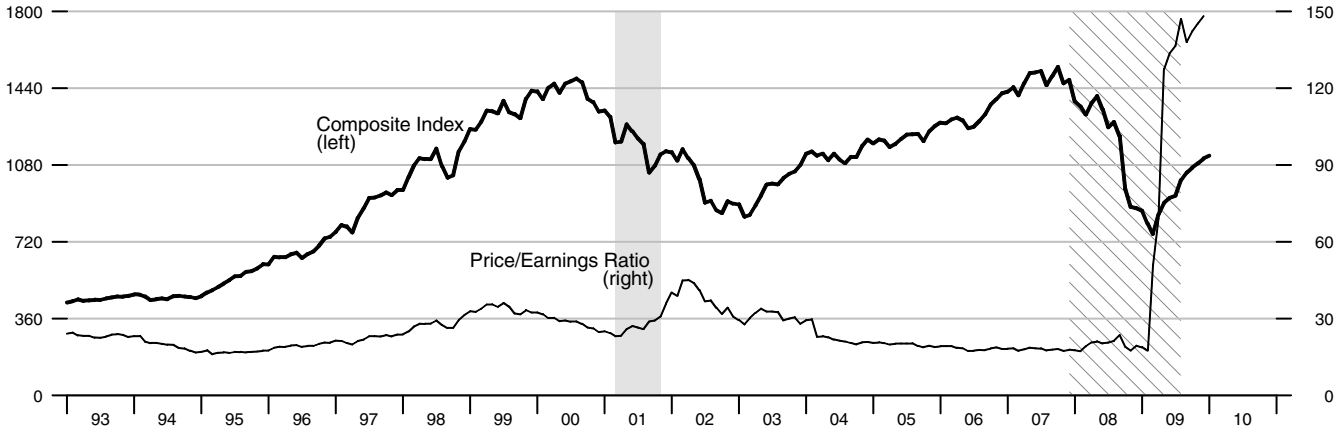


Commercial and Industrial Loans at Commercial Banks

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			
	2009Q1	2009Q2	2009Q3	2009Q4	Sep09	Oct09	Nov09	Dec09
United States	-0.18	-0.94	-1.55	1.47	3.40	3.39	3.40	3.59
Canada	1.25	0.06	-0.87	0.79	3.37	3.42	3.41	3.43
France	0.63	-0.21	-0.42	0.36	3.59	3.56	3.55	3.48
Germany	0.82	0.25	-0.25	0.44	3.26	3.21	3.22	3.14
Italy	1.48	0.85	0.12	0.65	4.09	4.10	4.06	4.01
Japan	-0.07	-0.98	-2.31	-2.03	1.26	1.40	1.25	1.27
United Kingdom	3.01	2.12	1.46	2.09	3.66	3.57	3.76	3.89

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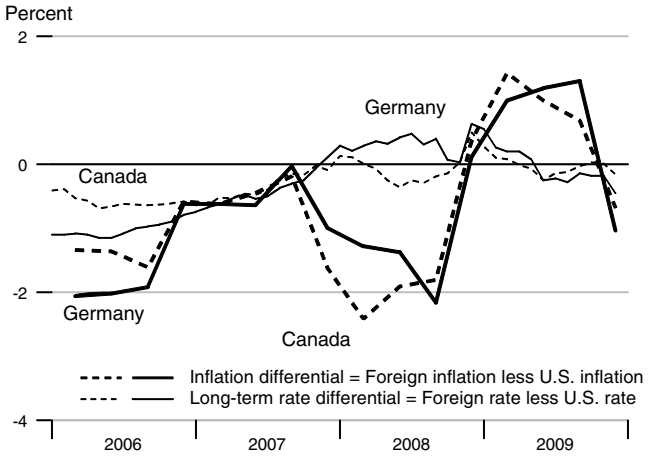
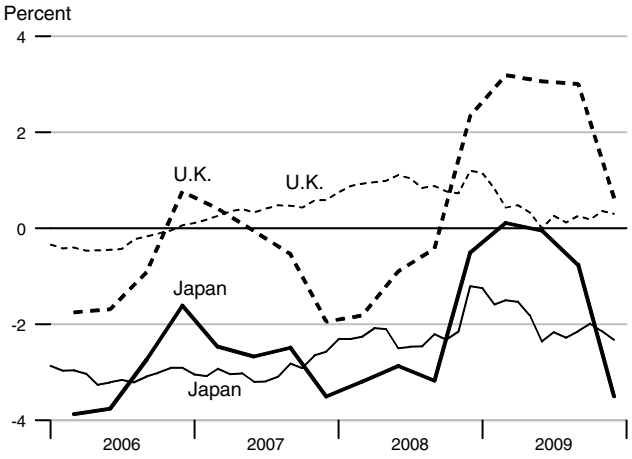
Inflation and Long-Term Interest Rate Differentials





		Money Stock				Bank	Adjusted		
		M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	MSI M2**
2005		1371.763	6708.412	6530.373	9786.477	6979.881	806.628	96.560	343.539
2006		1374.373	6999.284	6873.785	10270.74	7654.675	835.039	94.913	
2007		1373.157	7633.092	7307.280		8405.882	850.567	94.184	
2008		1433.315	8704.525	7823.744		9122.718	1009.796	232.199	
2009		1628.204	9525.320	8421.241		9231.413	1796.607	944.872	
2007	1	1370.052	7283.043	7138.852		8126.387	846.309	94.123	
	2	1374.886	7459.548	7250.549		8238.876	849.917	93.536	
	3	1370.933	7724.906	7364.638		8482.787	852.247	95.410	
	4	1376.757	8064.873	7475.082		8775.478	853.795	93.666	
2008	1	1385.938	8382.047	7621.846		8975.618	856.293	96.145	
	2	1393.902	8661.816	7735.455		8990.338	859.364	94.409	
	3	1424.884	8770.613	7830.474		9084.945	892.790	117.867	
	4	1528.538	9003.623	8107.199		9439.970	1430.736	620.373	
2009	1	1566.707	9398.846	8345.331		9337.750	1663.090	820.775	
	2	1608.890	9535.093	8400.692		9308.185	1763.779	917.209	
	3	1652.996	9580.930	8434.086		9195.976	1747.162	895.453	
	4	1684.224	9586.413	8504.856		9083.742	2012.399	1146.052	
2008	Jan	1381.146	8196.159	7542.254		8926.168	851.409	95.046	
	Feb	1386.988	8405.875	7631.682		8965.333	856.955	96.202	
	Mar	1389.679	8544.106	7691.603		9035.353	860.514	97.187	
	Apr	1392.086	8612.117	7716.287		8976.564	855.200	94.328	
	May	1391.474	8663.717	7739.014		9001.601	859.886	95.108	
	Jun	1398.146	8709.614	7751.065		8992.851	863.006	93.792	
	Jul	1415.119	8765.711	7802.660		9021.507	870.737	97.042	
	Aug	1400.022	8750.308	7790.579		9038.214	871.497	96.703	
	Sep	1459.510	8795.819	7898.182		9195.113	936.136	159.857	
	Oct	1472.746	8842.954	8014.681		9541.168	1142.178	347.631	
	Nov	1518.122	8969.315	8065.311		9406.200	1480.765	674.097	
	Dec	1594.746	9198.600	8241.606		9372.542	1669.266	839.392	
2009	Jan	1573.818	9329.335	8302.598		9337.104	1730.475	870.241	
	Feb	1562.052	9397.774	8340.668		9347.561	1590.273	758.699	
	Mar	1564.251	9469.428	8392.727		9328.584	1668.522	833.384	
	Apr	1592.673	9453.042	8343.736		9266.851	1787.815	949.453	
	May	1592.995	9560.253	8416.120		9338.100	1799.382	946.295	
	Jun	1641.002	9591.983	8442.219		9319.603	1704.141	855.879	
	Jul	1649.859	9594.853	8436.584		9249.622	1693.710	841.495	
	Aug	1648.293	9556.356	8413.290		9210.442	1728.095	879.603	
	Sep	1660.836	9591.580	8452.385		9127.863	1819.680	965.261	
	Oct	1673.776	9591.300	8481.375		9053.276	1975.382	1122.290	
	Nov	1685.557	9592.339	8508.930		9109.891	2044.532	1182.291	
	Dec	1693.340	9575.601	8524.264		9088.059	2017.282	1133.576	
2010	Jan	1676.510	9500.234	8463.069		9003.655	2010.120	1105.572	

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
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
	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
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	4.26	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		5.03

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	4.23	5.97
2006		0.19	4.34	5.26	4.95
2007		-0.09	9.06	6.31	
2008		4.38	14.04	7.07	
2009		13.60	9.43	7.64	
2007	1	0.08	6.58	5.89	
	2	1.41	9.69	6.26	
	3	-1.15	14.23	6.29	
	4	1.70	17.60	6.00	
2008	1	2.67	15.73	7.85	
	2	2.30	13.35	5.96	
	3	8.89	5.02	4.91	
	4	29.10	10.63	14.14	
2009	1	9.99	17.56	11.75	
	2	10.77	5.80	2.65	
	3	10.97	1.92	1.59	
	4	7.56	0.23	3.36	
2008	Jan	4.68	6.71	5.25	
	Feb	5.08	30.70	14.23	
	Mar	2.33	19.73	9.42	
	Apr	2.08	9.55	3.85	
	May	-0.53	7.19	3.53	
	Jun	5.75	6.36	1.87	
	Jul	14.57	7.73	7.99	
	Aug	-12.80	-2.11	-1.86	
	Sep	50.99	6.24	16.57	
	Oct	10.88	6.43	17.70	
	Nov	36.97	17.15	7.58	
	Dec	60.57	30.68	26.23	
2009	Jan	-15.75	17.05	8.88	
	Feb	-8.97	8.80	5.50	
	Mar	1.69	9.15	7.49	
	Apr	21.80	-2.08	-7.00	
	May	0.24	13.61	10.41	
	Jun	36.16	3.98	3.72	
	Jul	6.48	0.36	-0.80	
	Aug	-1.14	-4.81	-3.31	
	Sep	9.13	4.42	5.58	
	Oct	9.35	-0.04	4.12	
	Nov	8.45	0.13	3.90	
	Dec	5.54	-2.09	2.16	
2010	Jan	-11.93	-9.44	-8.61	

*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 $m = 1,\ldots, 10$ years to maturity are obtained by linear interpolation between reported yields. These yields are smoothed by fitting the regression suggested by Nelson and Siegel (1987),

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

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

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

where duration is approximated as $D(m) = (1 - e^{-R(m) \times m})/R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). **Rates on 3-Month Eurodollar Futures** and **Rates on Selected 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 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/.