Monetary Trends

January 2010

The Evolving Size Distribution of Banks

Fundamental issues about bank size and the systemic risk implications of so-called too-big-to fail policies are heated topics of discussion for researchers, policymakers, and the press alike.[1] However, significant changes in size distribution of banks have been occurring since at least the 1980s and 1990s, when the structure of the banking industry began to evolve following regulatory changes such as the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 and the Gramm-Leach-Bliley Financial Services Modernization Act of 1999.

To document the changes in the size distribution of banks, we study total assets of commercial banks using the public Call Reports for three selected dates: 1987:Q2, 1998:Q2, and 2009:Q2.[2] During these 22 years the number of banks fell from 15,168 to 10,169 and then to 7,744 after progressive concentration of the industry and bank failures, particularly during the Savings and Loan Crisis of the late 1980s and early 1990s and the current financial crisis.

We can use total assets at the end of these three quarters to compare the distribution over time. We deflate each bank's assets and then rescale them, dividing by the total assets each year relative to 2005. The chart plots the distribution using the logarithm of assets on the horizontal axis and the frequency on the vertical axis. Each curve represents the bank size distribution for one of the three study years.

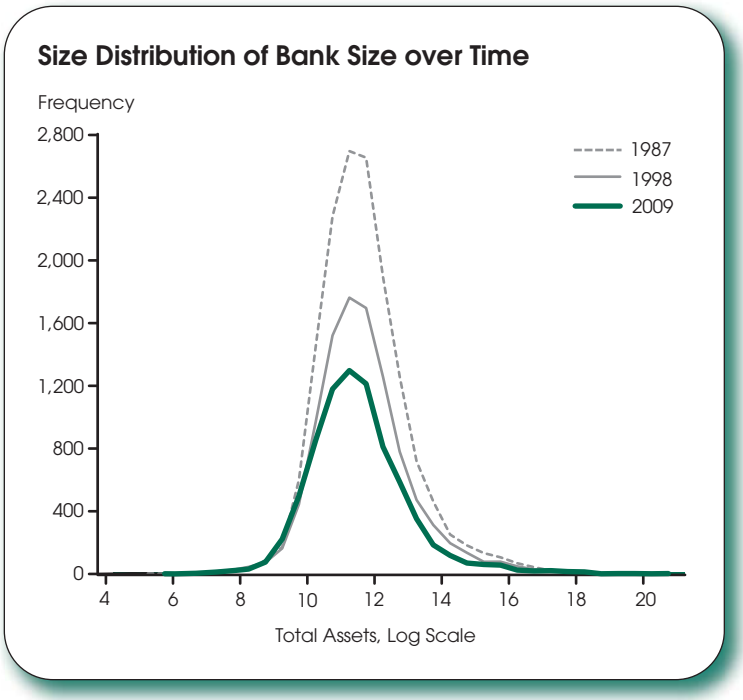
Many key facts can be noticed using this chart. First, the total number of banks in the United States has substantially decreased, although the number is still considered large by international standards. Second, over time the increase in the number of relatively larger banks stretched the tail of the distribution to the right, a common measure of the asymmetry of a distribution around its mean—the skewness of the distribution—increased from 0.92 in 1987 to 0.95 in 2009. Third, the largest banks own an even larger share of total assets, making the right tail of the distribution even thicker, a measure of the thickness of a distribution tail—the kurtosis—has increased from 5.4 in 1987 to 6.7 in 2009. If we dropped the largest 50 banks, the kurtosis would increase by much less and the skewness would fall instead of increasing.

Hence, the flattening of the bank size distribution is part of a long-term trend and may have led to a more concentrated industry with larger average-size and big banks independently of the recent financial crisis and the concurrent policy interventions. The current debate on *too big to fail* is important because it clarifies the tension between profitability, propensity to take risk, economies of scale, and economies of diversification on the one hand, and the competitive and systemic risks imposed by fewer larger yet more complex players on the other hand. However, if limiting the size of large banks were considered appropriate to reduce systemic risk, it would be a clear change of direction relative to the long-term evolution of the industry.

—Silvio Contessi

[1] Bullard, James. "The Fed and the Coming Redefinition of Government Regulation." Presented at the Business Today International Conference: "Weathering the Storm: The Challenges and Opportunities of a Global Slowdown," New York City, November 22, 2009; http://research.stlouisfed.org/econ/bullard/BullardPrincetonFINAL.pdf.

[2] For a more extensive analysis of the changes in the size distribution, see Janicki, Hubert P. and Prescott, Edward S. "Changes in the Size Distribution of U.S. Banks: 1960-2005." Federal Reserve Bank of Richmond *Economic Quarterly*, Fall 2006, *92*(4), pp. 291-316; www.richmondfed.org/publications/research/economic_quarterly/2006/fall/pdf/janicki_prescott.pdf.



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 will cease the publication of the M3 monetary aggregate. It will also cease publishing the following components: large-denomination time deposits, RPs, and eurodollars.

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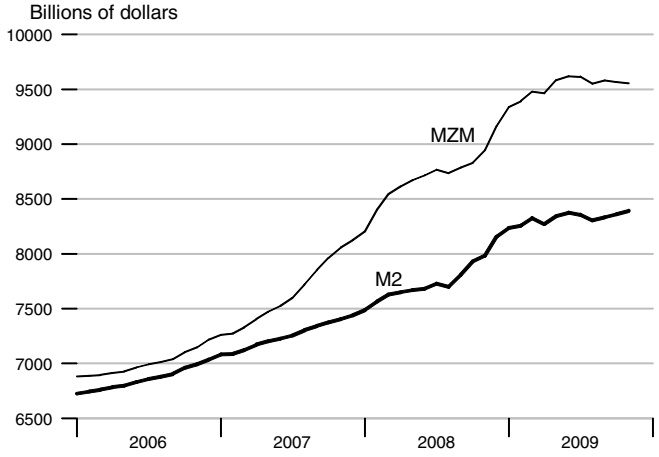
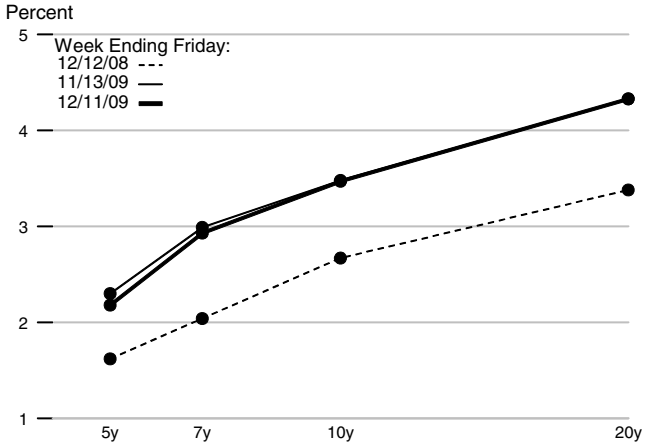
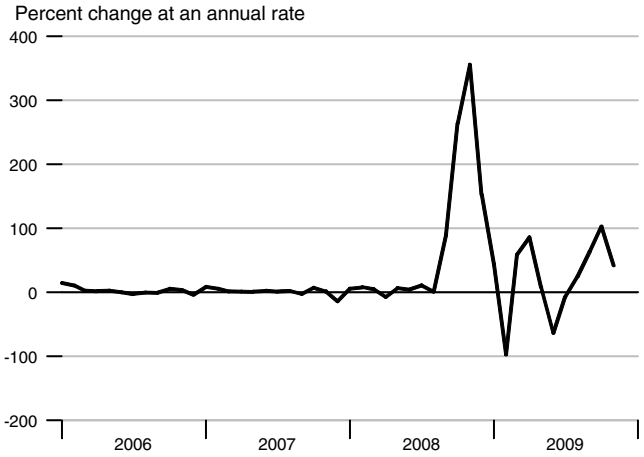
M2 and MZM



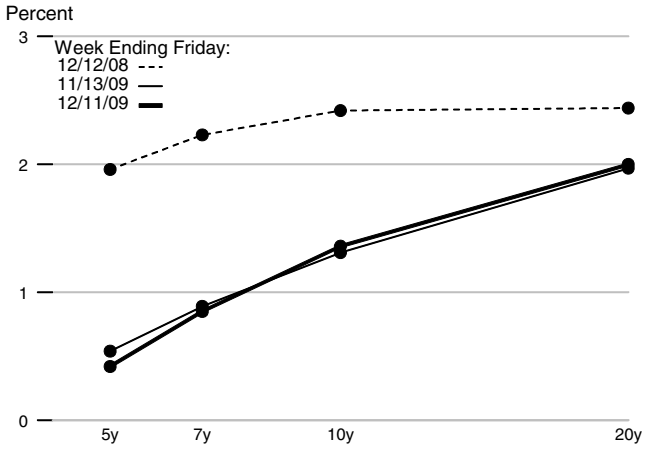
Treasury Yield Curve



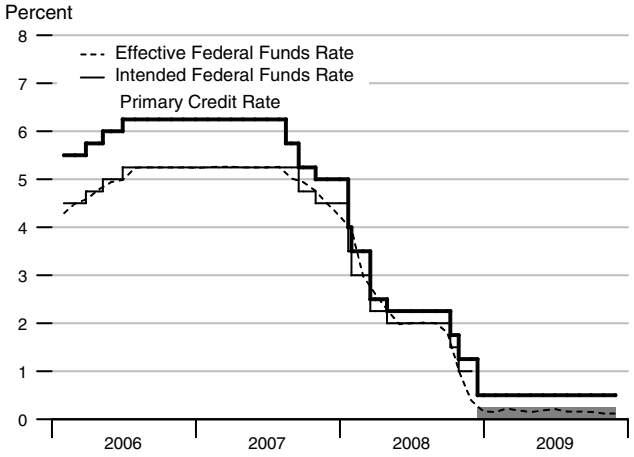
Adjusted Monetary Base



Real Treasury Yield Curve

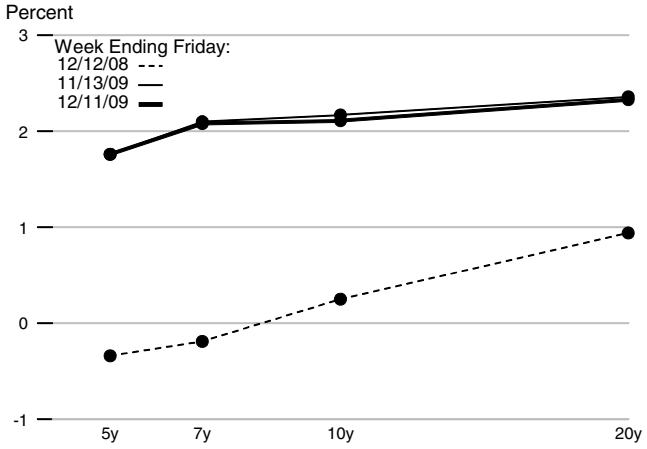


Reserve Market Rates



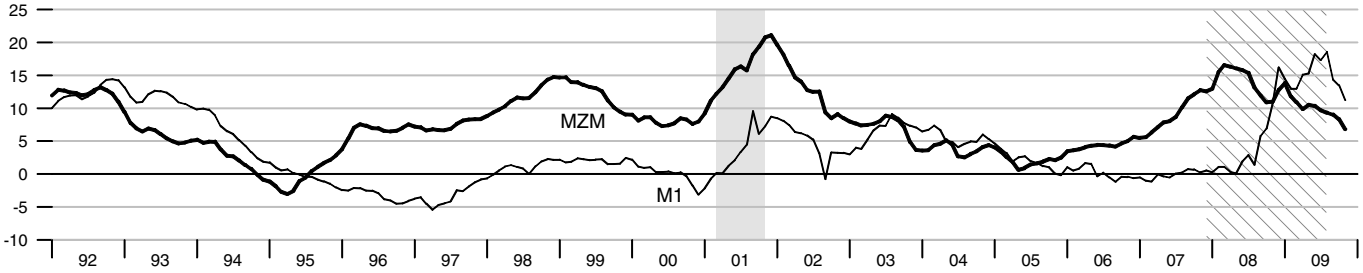
Note: Effective December 16, 2008, FOMC reports the intended Federal Funds Rate as a range.

Inflation-Indexed Treasury Yield Spreads



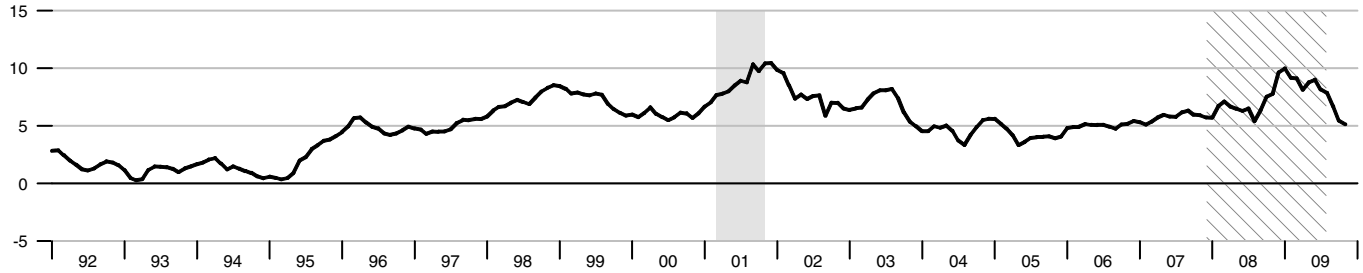
MZM and M1

Percent change from year ago



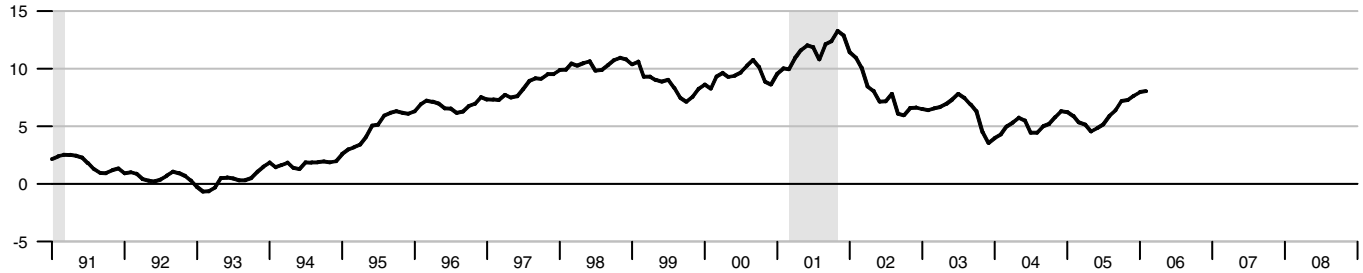
M2

Percent change from year ago



M3*

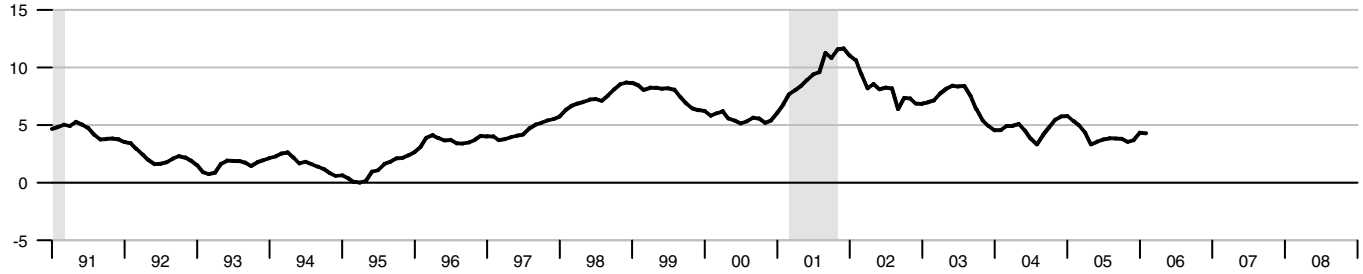
Percent change from year ago



*See table of contents for changes to the series.

Monetary Services Index - M2**

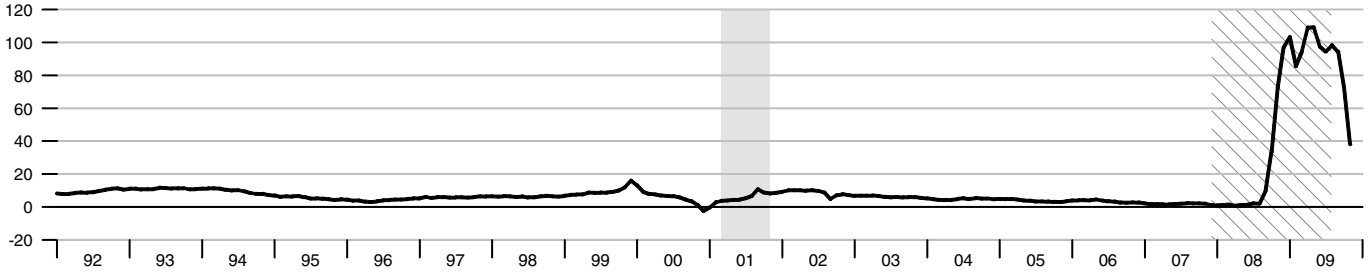
Percent change from year ago



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

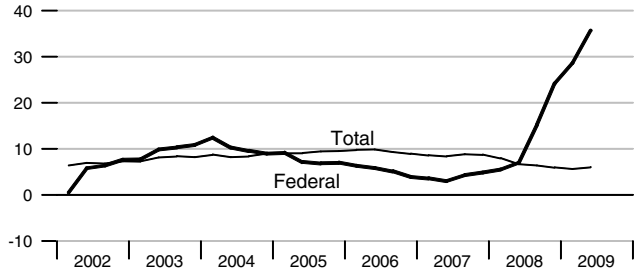
Adjusted Monetary Base

Percent change from year ago



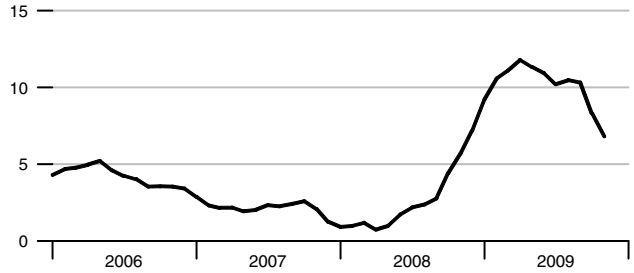
Domestic Nonfinancial Debt

Percent change from year ago



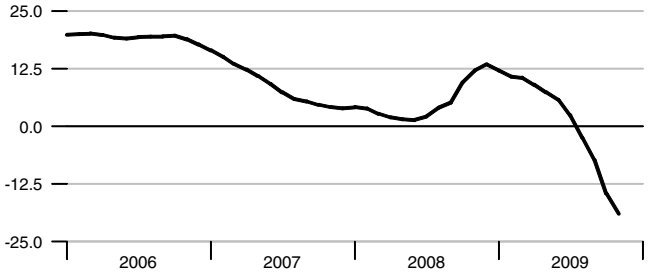
Currency Held by the Nonbank Public

Percent change from year ago



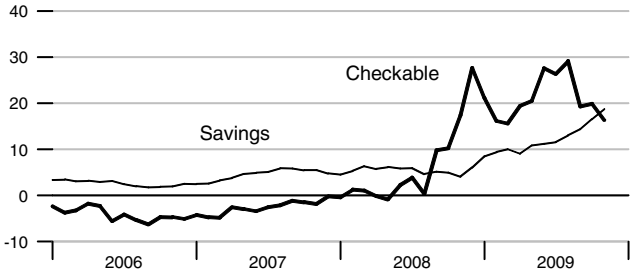
Small Denomination Time Deposits*

Percent change from year ago



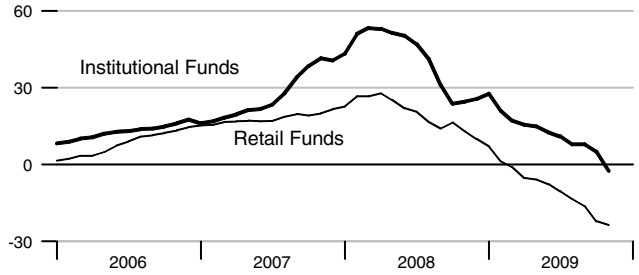
Checkable and Savings Deposits

Percent change from year ago



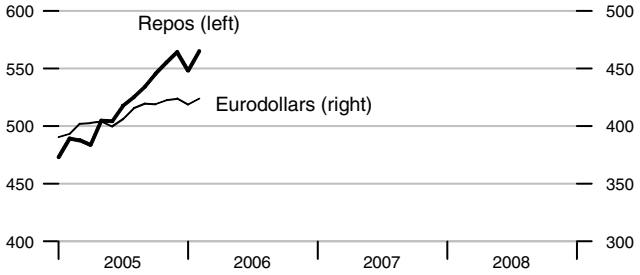
Money Market Mutual Fund Shares

Percent change from year ago



Repurchase Agreements and Eurodollars*

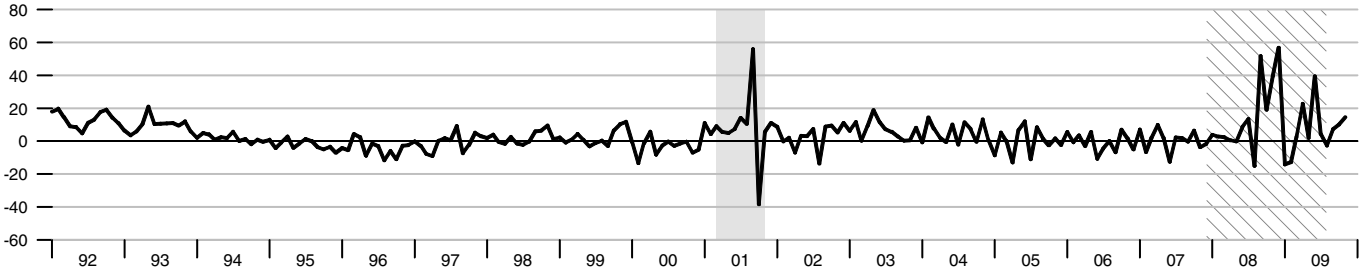
Billions of dollars | Billions of dollars



*See table of contents for changes to these series.

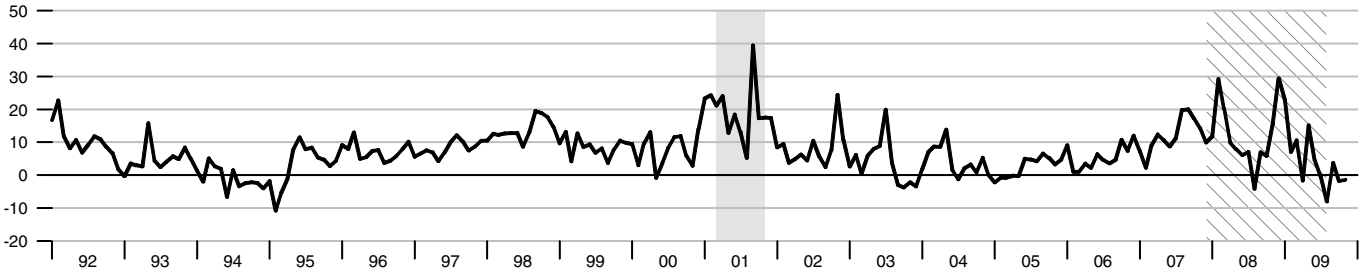
M1

Percent change at an annual rate



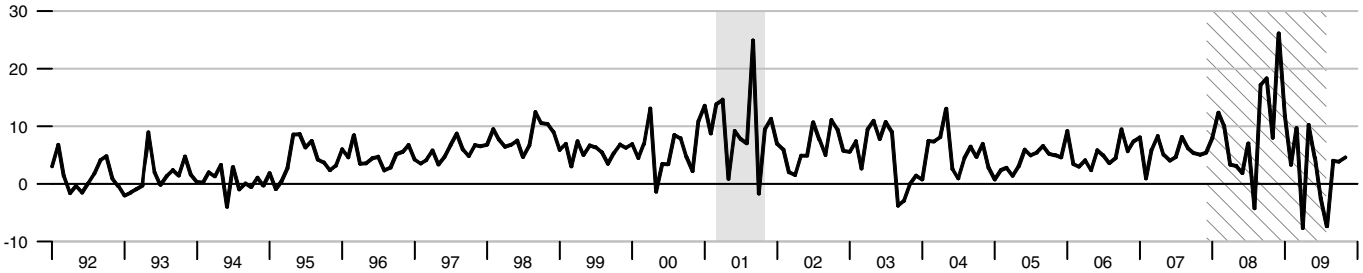
MZM

Percent change at an annual rate



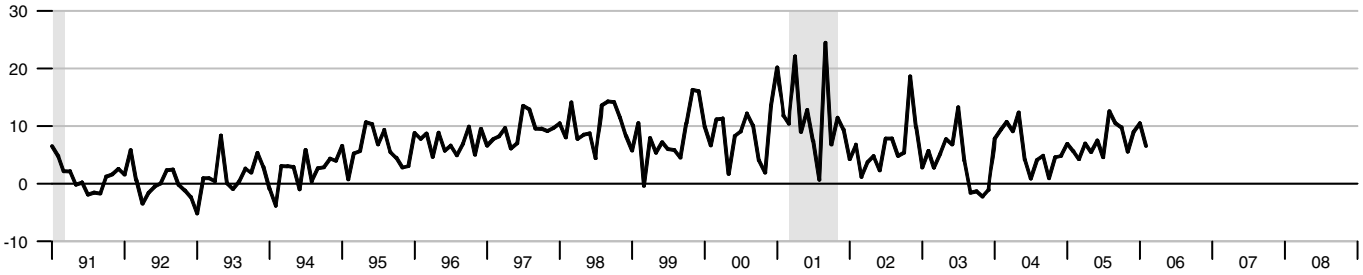
M2

Percent change at an annual rate



M3*

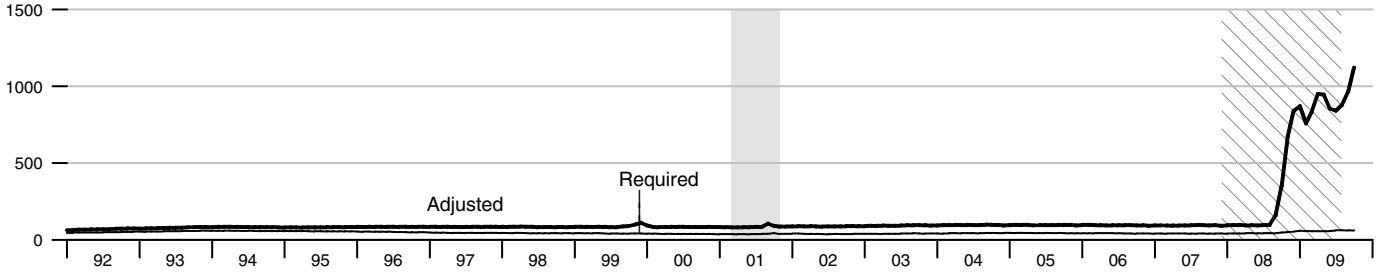
Percent change at an annual rate



*See table of contents for changes to the series.

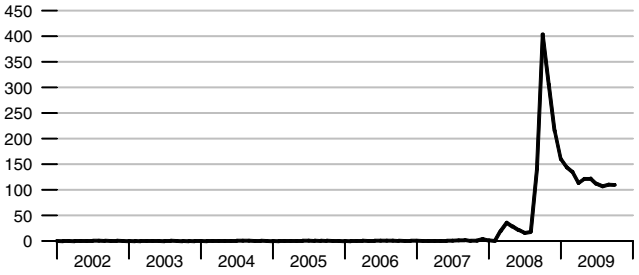
Adjusted and Required Reserves

Billions of dollars



Total Borrowings, nsa

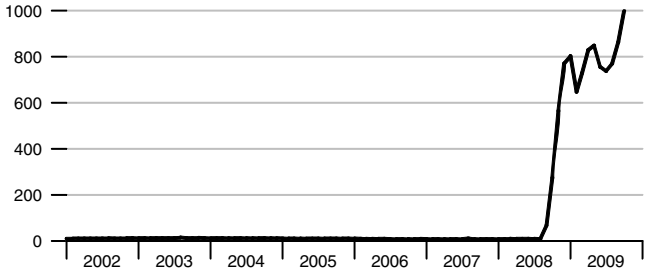
Billions of dollars



* Data exclude term auction credit

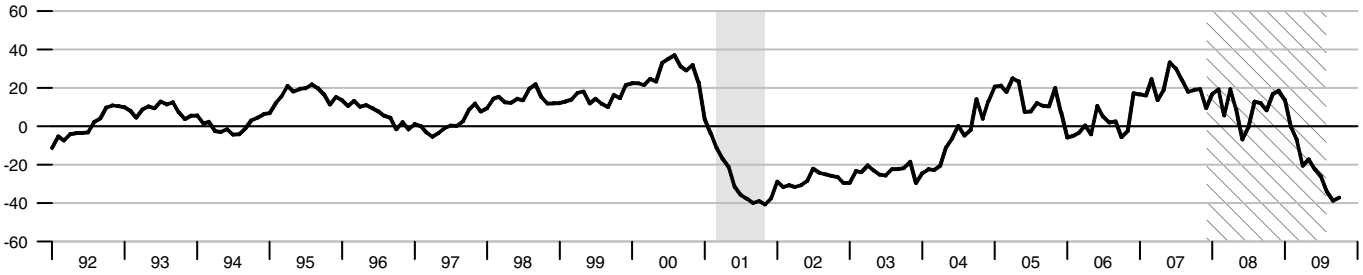
Excess Reserves plus RCB Contracts

Billions of dollars



Nonfinancial Commercial Paper

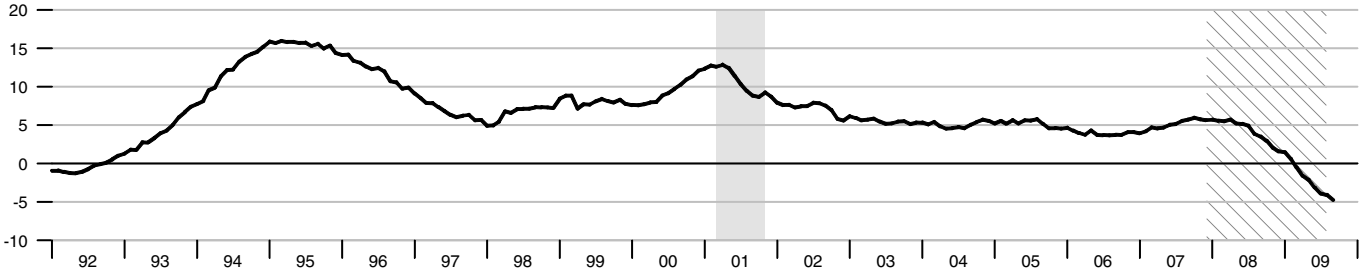
Percent change from year ago



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

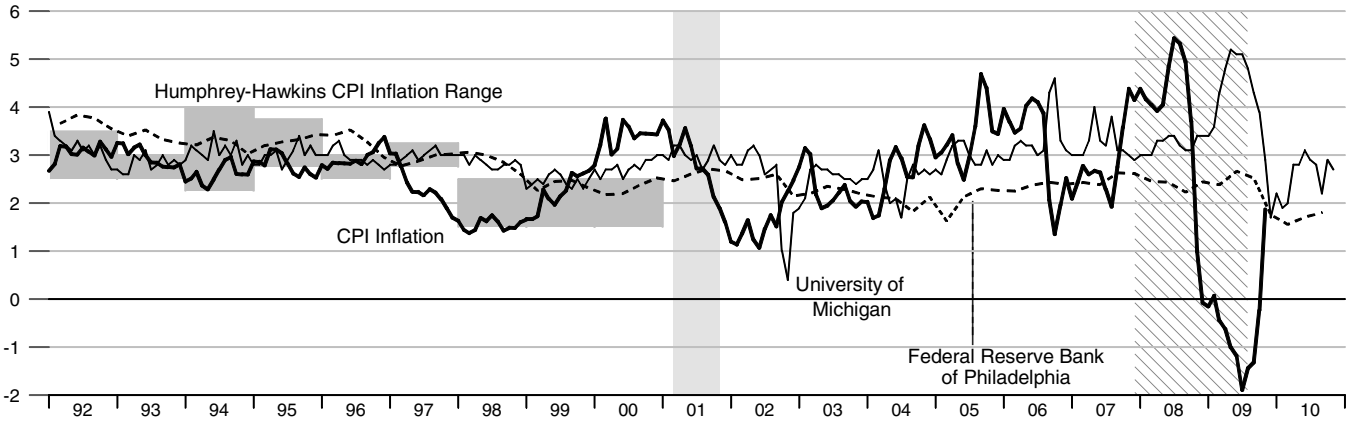
Consumer Credit

Percent change from year ago



CPI Inflation and 1-Year-Ahead CPI Inflation Expectations

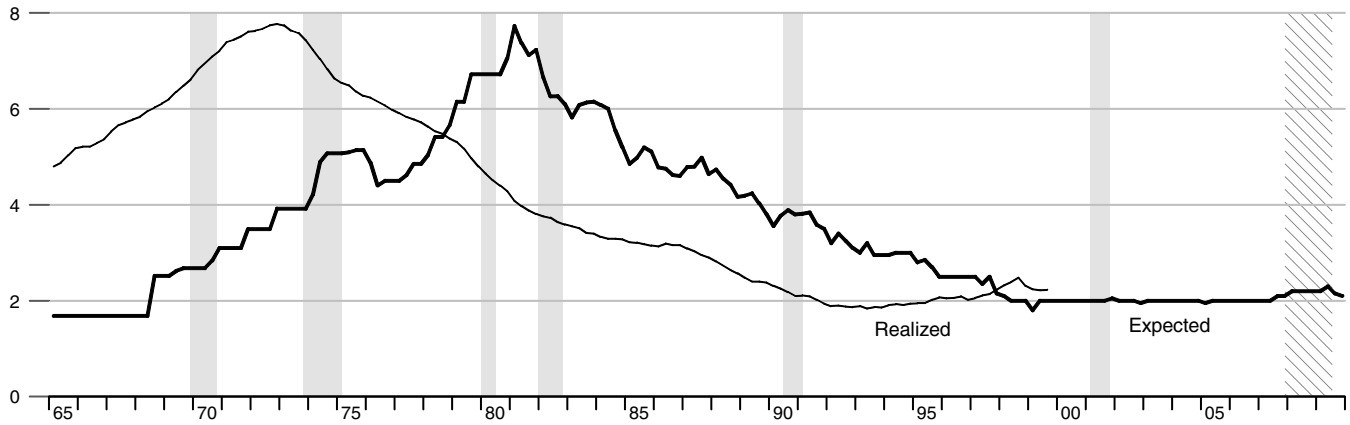
Percent



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

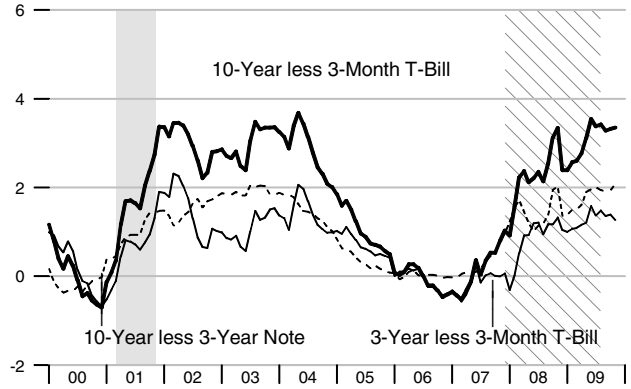
Percent



See the notes section for an explanation of the chart.

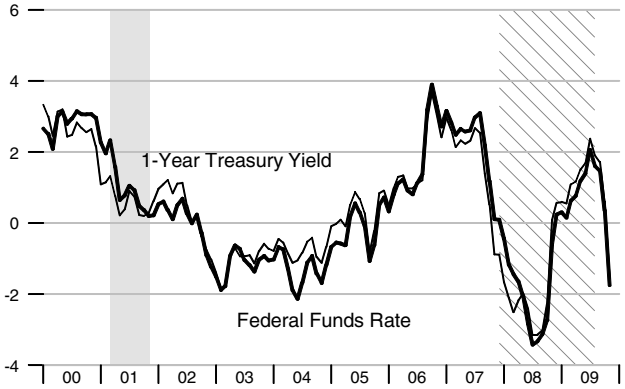
Treasury Security Yield Spreads

Yield to maturity

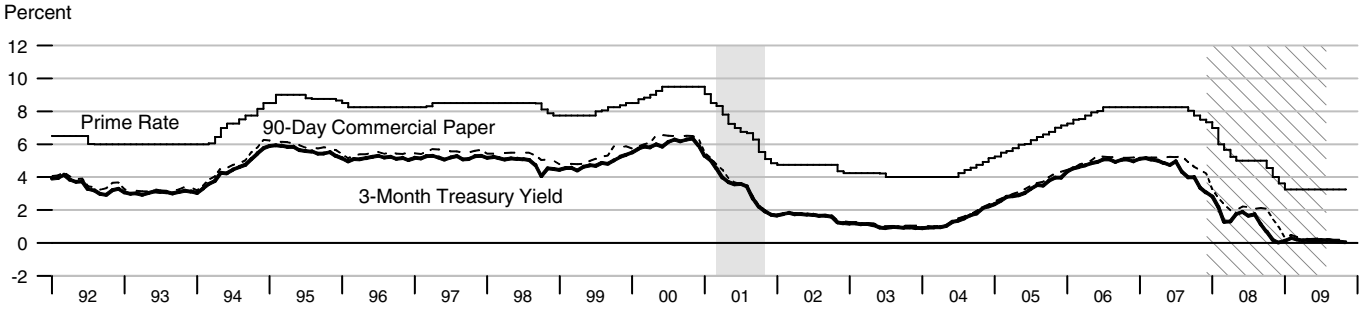


Real Interest Rates

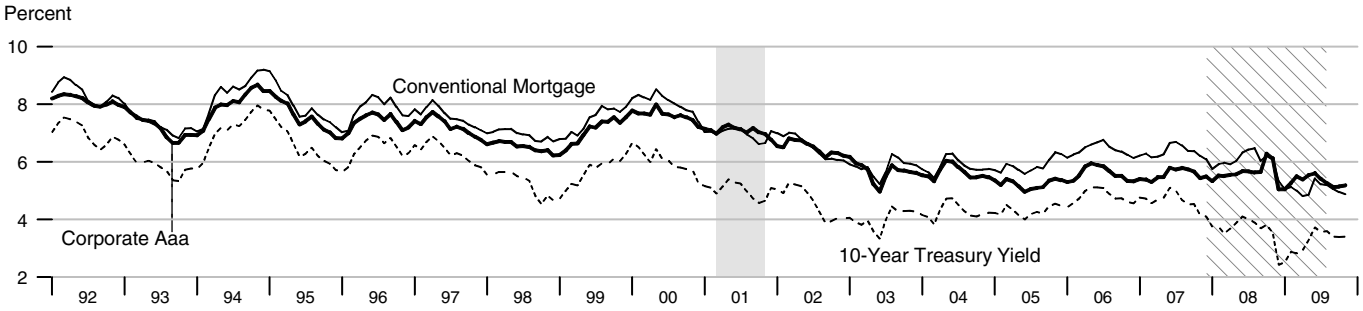
Percent, Real rate = Nominal rate less year-over-year CPI inflation



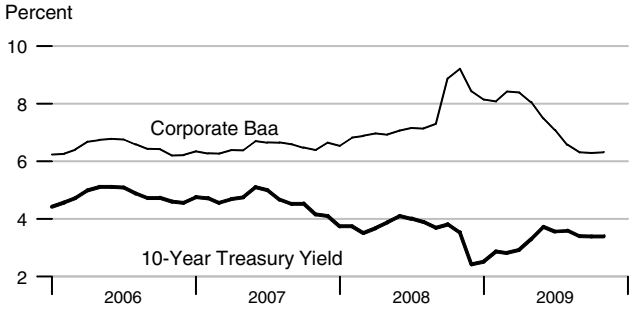
Short-Term Interest Rates



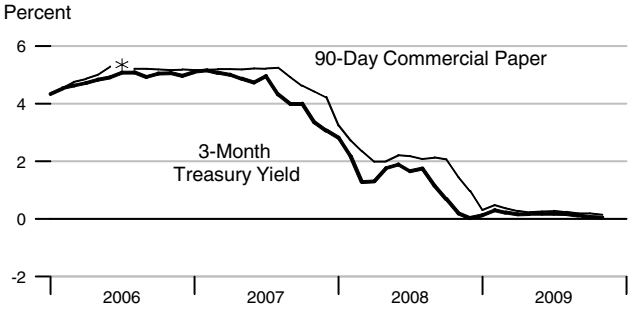
Long-Term Interest Rates



Long-Term Interest Rates

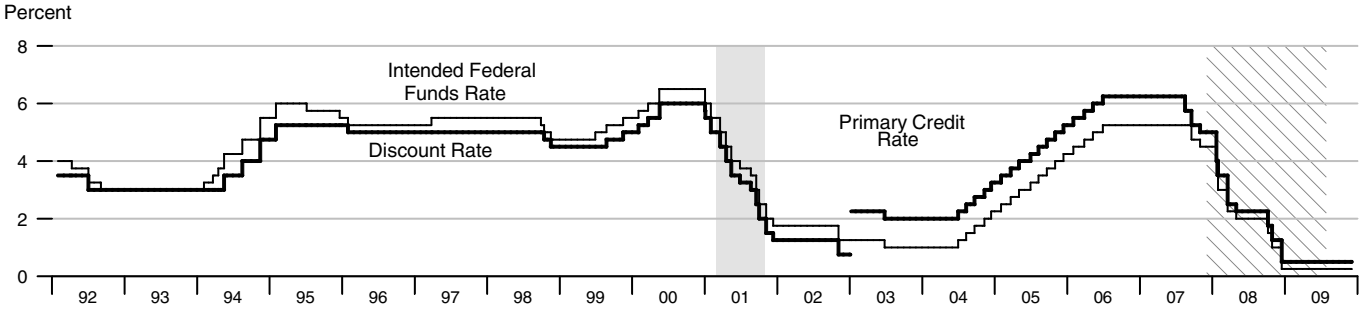


Short-Term Interest Rates

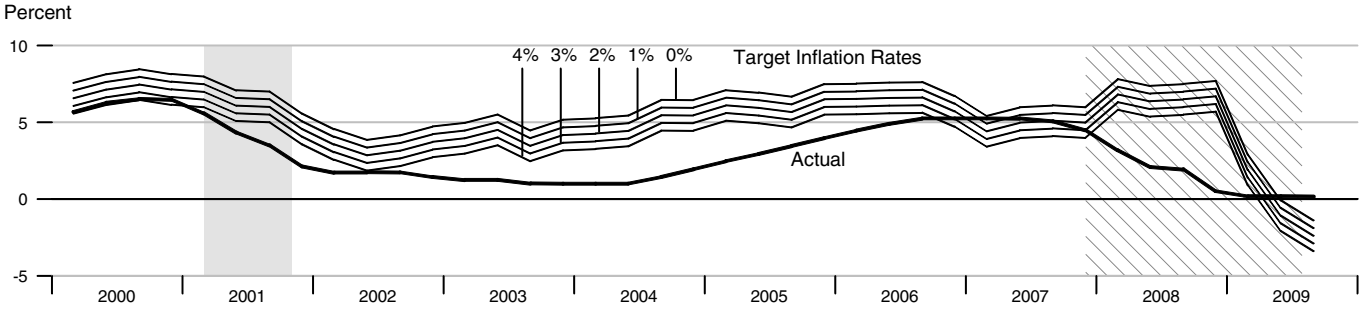


*90-Day Commercial Paper data are not available for December 2005, January 2006, and July 2006.

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



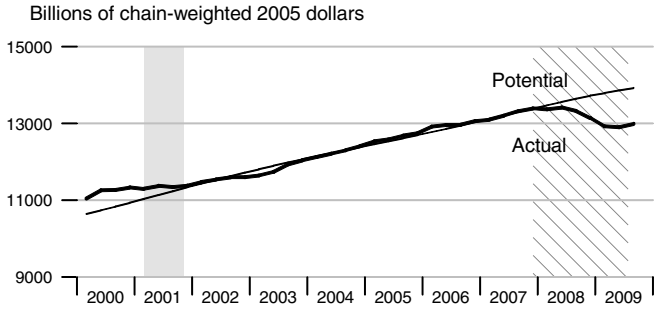
Federal Funds Rate and Inflation Targets



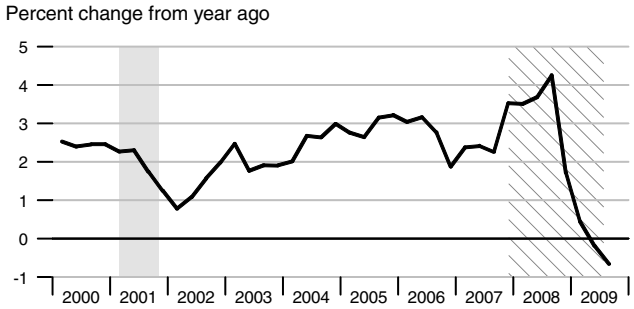
Calculated federal funds rate is based on Taylor's rule.

Components of Taylor's Rule

Actual and Potential Real GDP

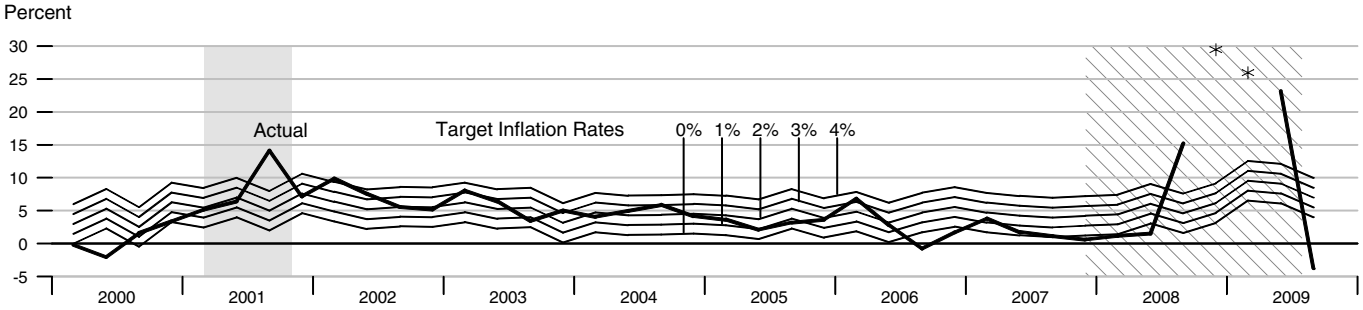


PCE Inflation



See notes section for further explanation.

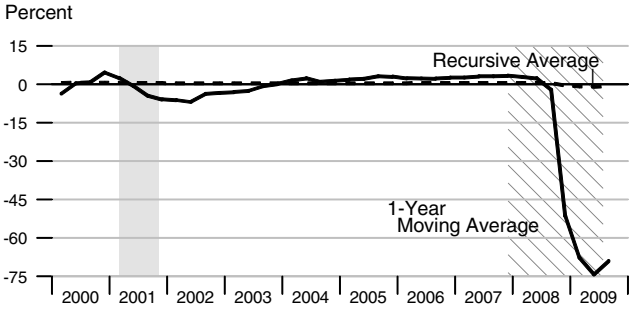
Monetary Base Growth and Inflation Targets



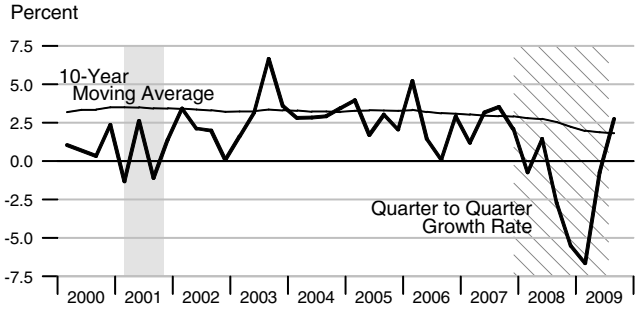
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter
*Actual values for 2008:Q4 and 2009:Q1 are 188.38 percent and 60.77 percent, respectively.

Components of McCallum's Rule

Monetary Base Velocity Growth

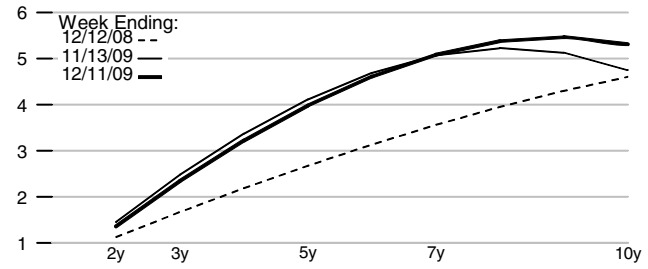


Real Output Growth



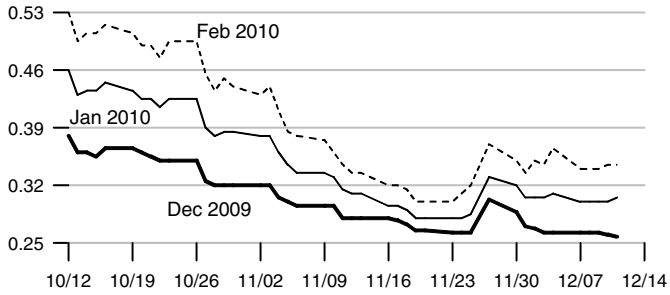
Implied One-Year Forward Rates

Percent



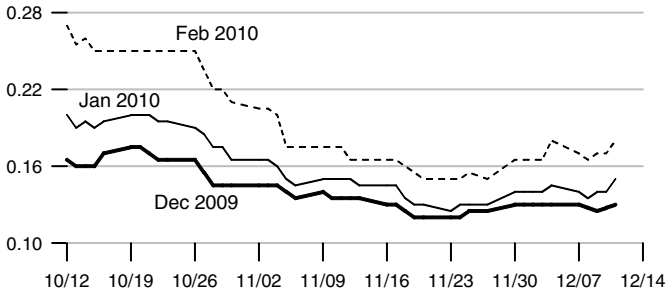
Rates on 3-Month Eurodollar Futures

Percent, daily data



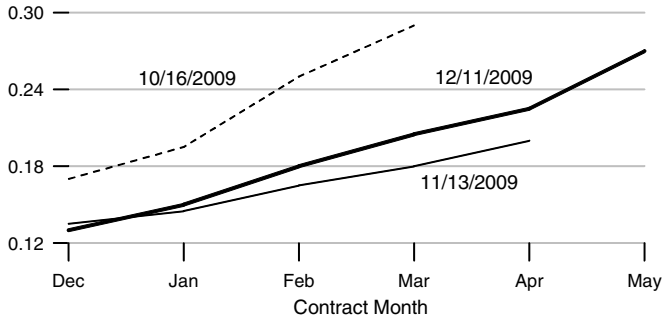
Rates on Selected Federal Funds Futures Contracts

Percent, daily data



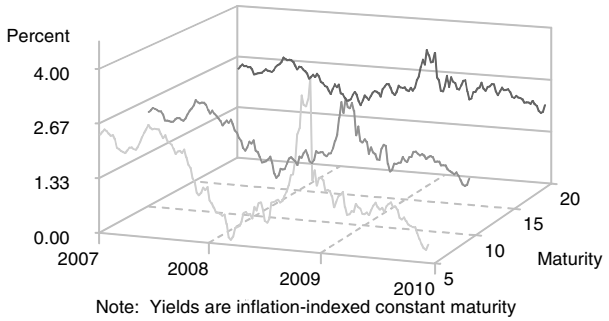
Rates on Federal Funds Futures on Selected Dates

Percent



Inflation-Indexed Treasury Securities

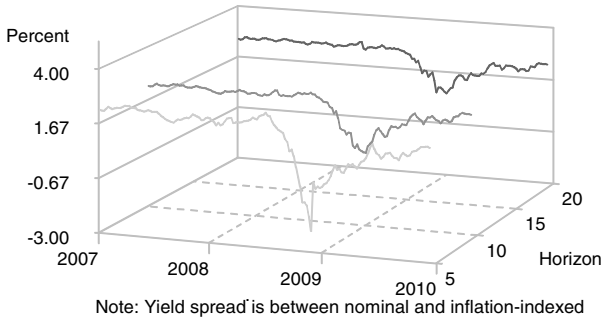
Weekly data



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

Inflation-Indexed Treasury Yield Spreads

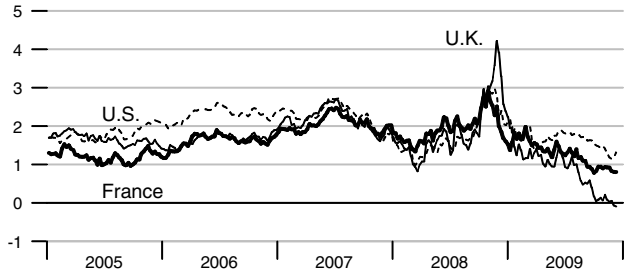
Weekly data



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

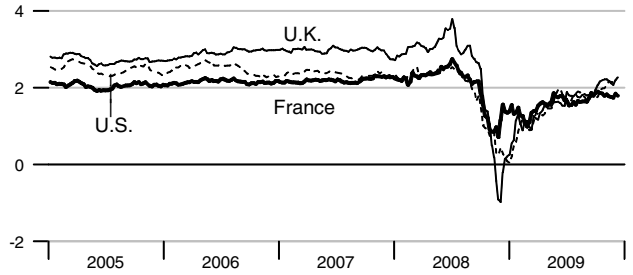
Inflation-Indexed 10-Year Government Notes

Percent, weekly data



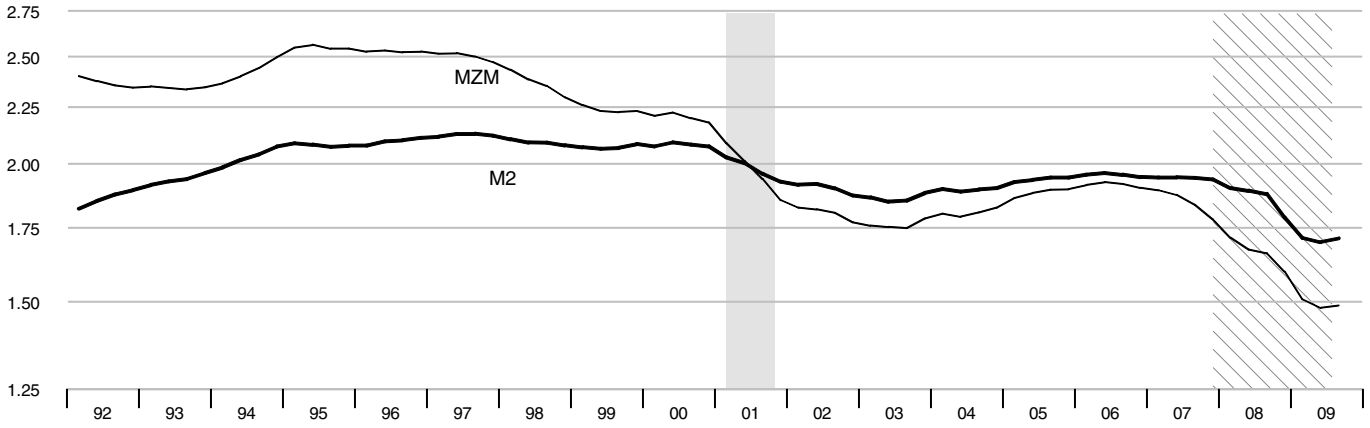
Inflation-Indexed 10-Year Government Yield Spreads

Percent, weekly data



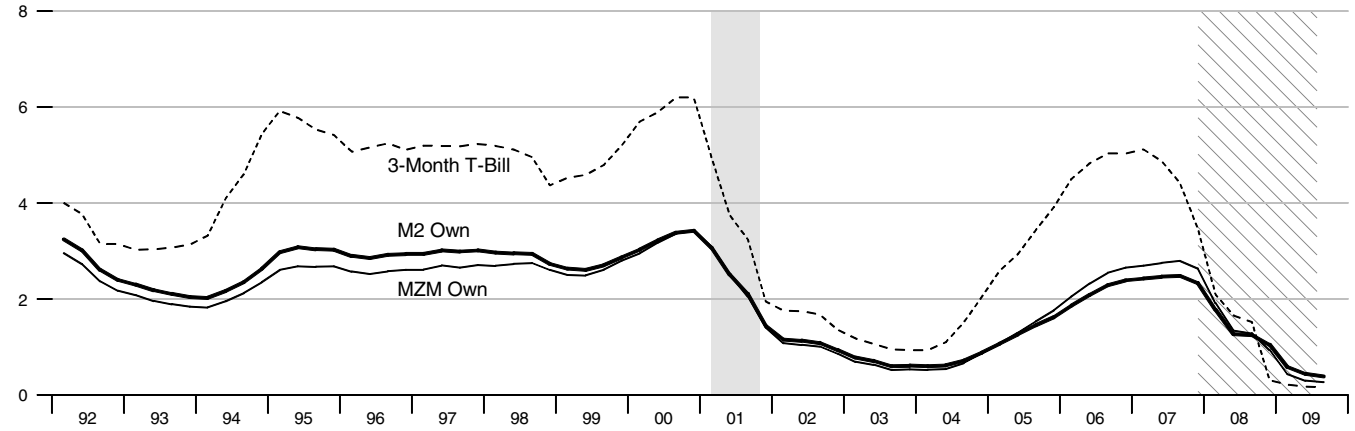
Velocity

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



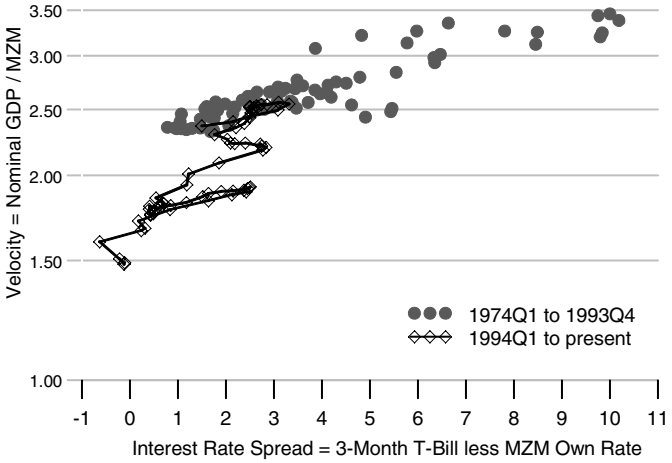
Interest Rates

Percent



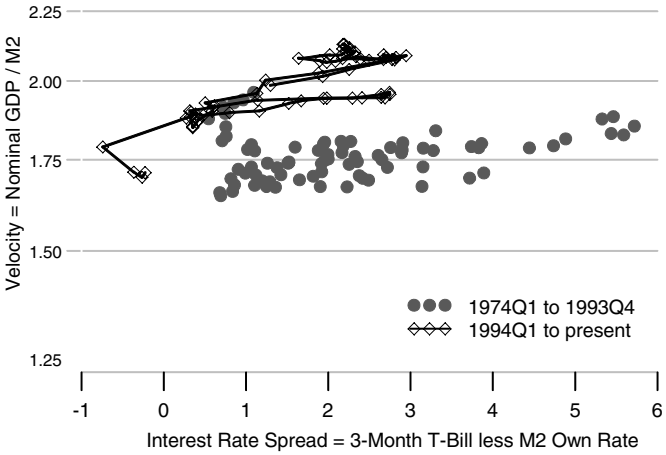
MZM Velocity and Interest Rate Spread

Ratio Scale



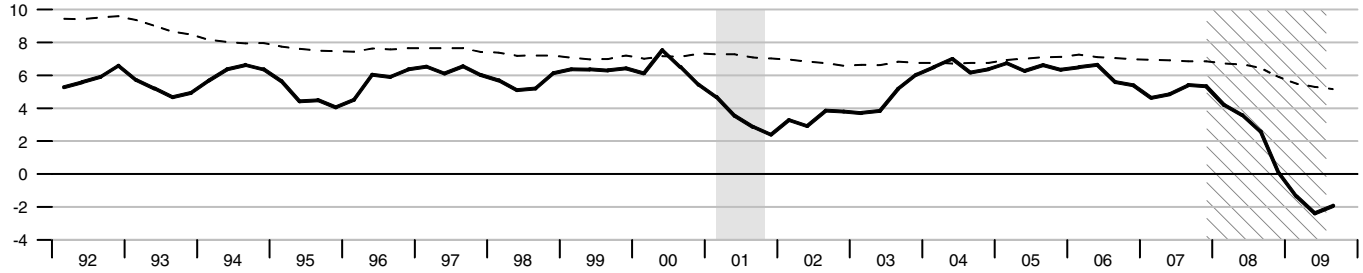
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

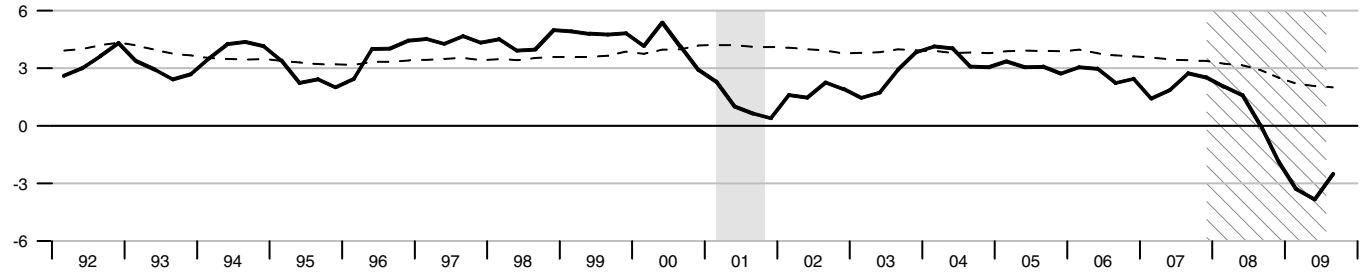
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

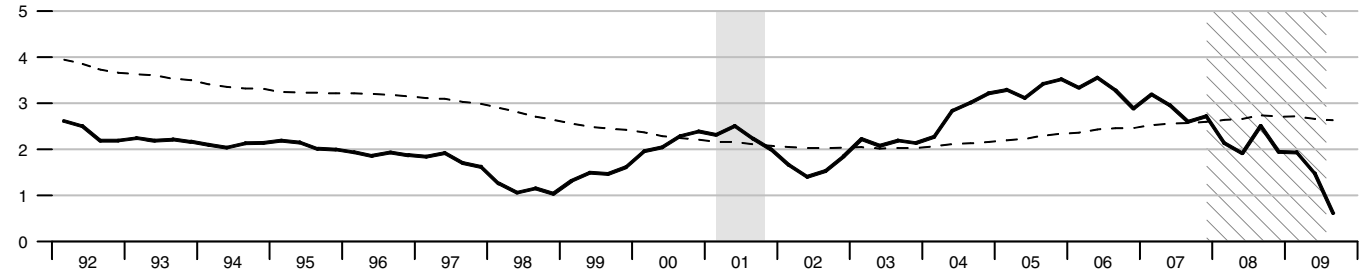
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

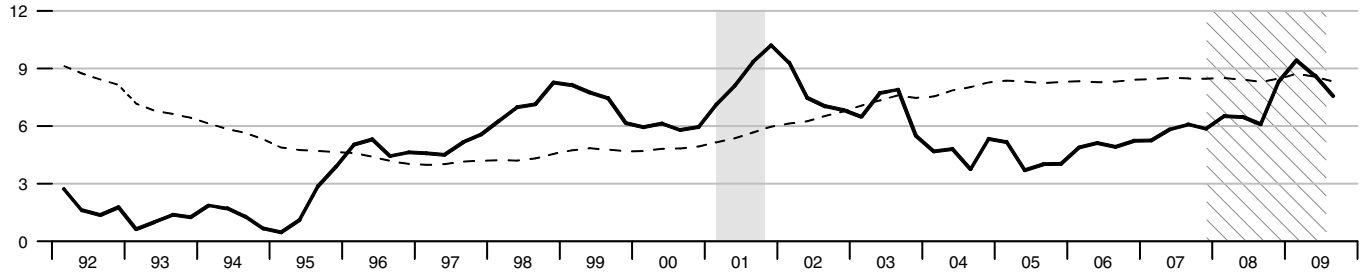
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

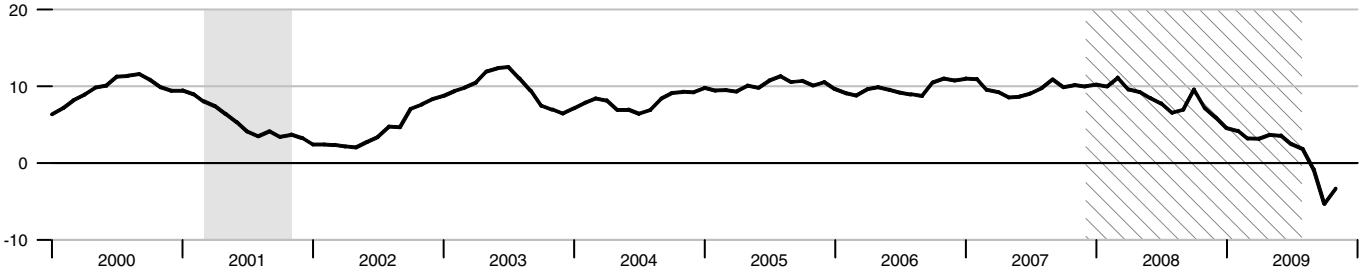
Percent change from year ago



Dashed lines indicate 10-year moving averages.

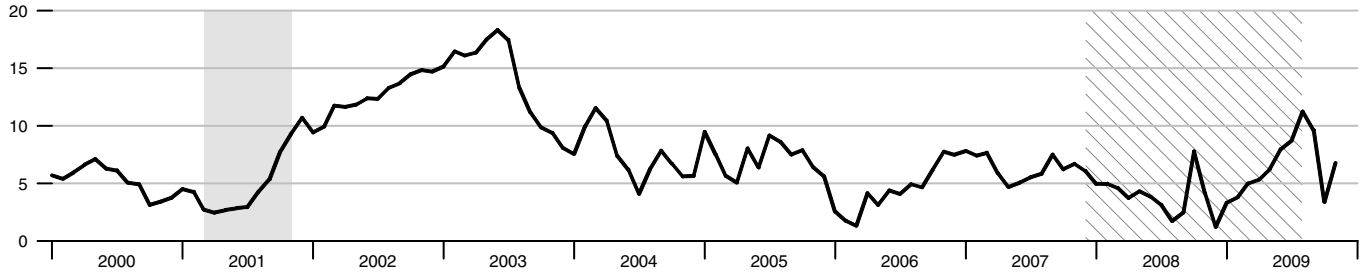
Bank Credit

Percent change from year ago



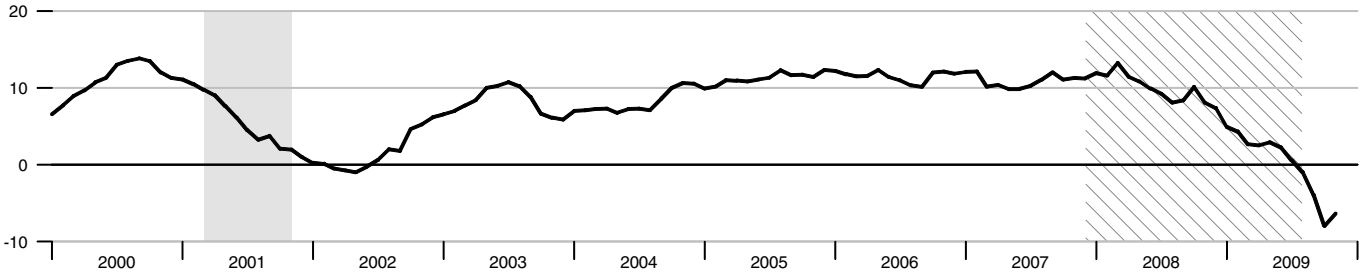
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



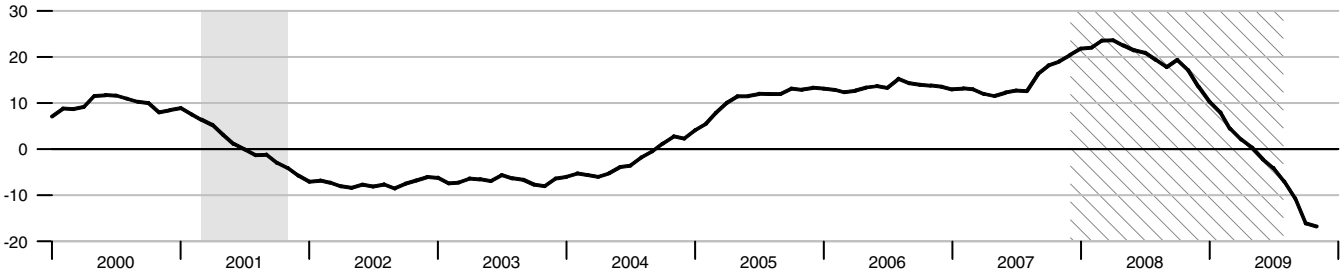
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

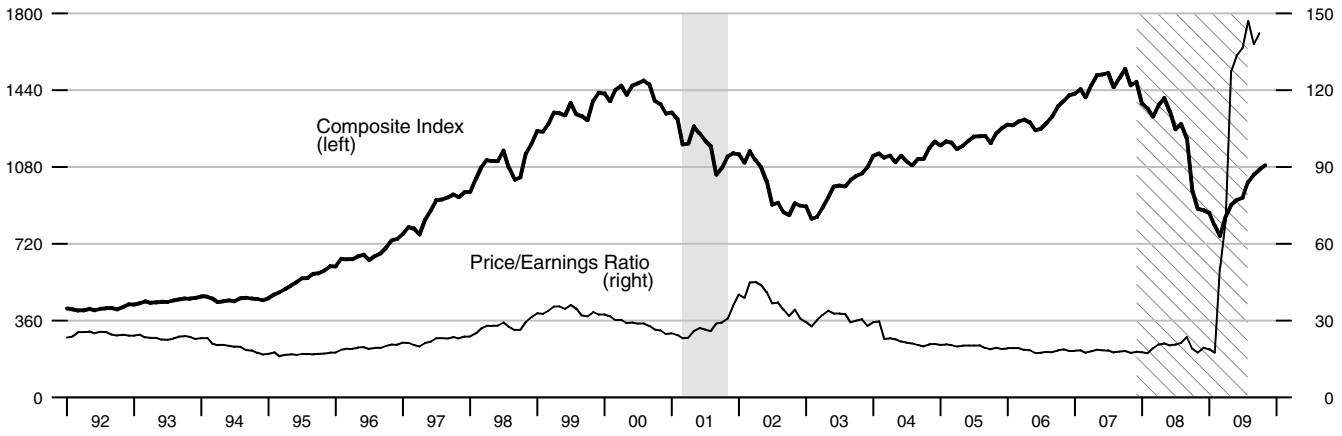


Commercial and Industrial Loans at Commercial Banks

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			
	2008Q4	2009Q1	2009Q2	2009Q3	Aug09	Sep09	Oct09	Nov09
United States	1.53	-0.18	-0.94	-1.55	3.59	3.40	3.39	3.40
Canada	1.91	1.25	0.06	-0.87	3.47	3.37	3.42	3.41
France	1.76	0.63	-0.21	-0.42	3.58	3.59	3.56	.
Germany	1.65	0.82	0.25	-0.25	3.31	3.26	3.21	3.22
Italy	2.80	1.48	0.85	0.12	4.12	4.09	4.10	4.06
Japan	1.03	-0.10	-0.98	-2.25	1.31	1.26	1.40	.
United Kingdom	3.88	3.01	2.12	1.46	3.71	3.66	3.57	3.76

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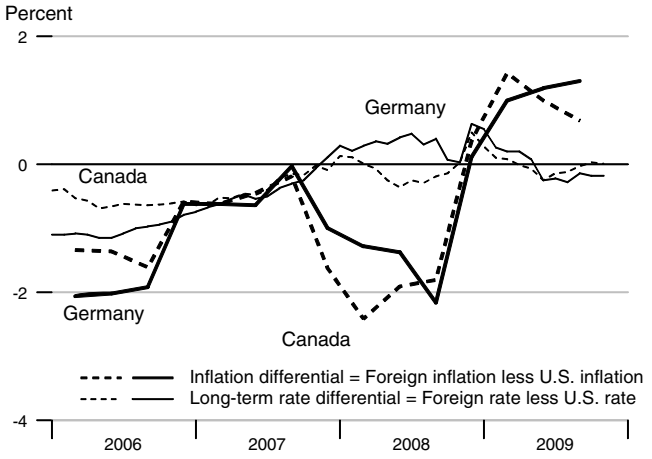
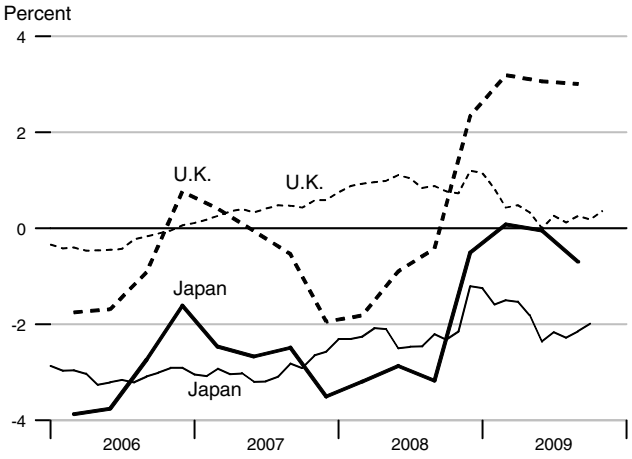
Inflation and Long-Term Interest Rate Differentials





		Money Stock				Bank	Adjusted		
		M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	MSI M2**
	2004	1344.401	6569.679	6262.679	9234.718	6335.109	776.768	96.130	329.873
	2005	1371.751	6707.775	6527.248	9786.477	6980.053	806.628	96.560	343.539
	2006	1374.358	6998.369	6856.042	10270.74	7653.923	835.039	94.913	
	2007	1373.207	7632.049	7251.158		8405.137	850.565	94.182	
	2008	1429.042	8698.672	7748.994		9120.772	1009.814	232.217	
2007	1	1369.341	7289.108	7097.940		8124.398	846.309	94.123	
	2	1376.333	7467.984	7200.443		8240.032	849.917	93.536	
	3	1371.420	7722.863	7300.125		8480.940	852.247	95.410	
	4	1375.734	8048.240	7406.125		8775.178	853.787	93.658	
2008	1	1380.439	8384.159	7560.830		8973.646	856.300	96.153	
	2	1387.174	8667.178	7667.286		8989.548	859.394	94.440	
	3	1417.516	8763.332	7745.460		9082.889	892.824	117.901	
	4	1531.037	8980.018	8022.401		9437.005	1430.738	620.373	
2009	1	1566.477	9403.715	8273.319		9330.859	1663.079	820.761	
	2	1612.006	9555.736	8329.703		9302.646	1763.776	917.203	
	3	1654.426	9582.991	8331.729		9186.856	1747.155	895.366	
2007	Nov	1374.972	8057.383	7405.317		8780.687	857.480	95.722	
	Dec	1373.009	8124.214	7438.839		8842.512	847.454	91.758	
2008	Jan	1377.414	8204.131	7488.190		8929.070	851.405	95.043	
	Feb	1380.574	8403.584	7565.327		8965.444	856.964	96.211	
	Mar	1383.330	8544.761	7628.973		9026.426	860.532	97.205	
	Apr	1383.980	8614.811	7650.054		8980.328	855.222	94.350	
	May	1383.770	8671.288	7669.845		9001.182	859.920	95.142	
	Jun	1393.771	8715.434	7681.958		8987.134	863.041	93.827	
	Jul	1409.317	8766.530	7726.867		9016.790	870.771	97.074	
	Aug	1391.659	8736.351	7699.561		9038.883	871.530	96.736	
	Sep	1451.572	8787.114	7809.953		9192.995	936.171	159.892	
	Oct	1474.699	8830.304	7929.177		9535.304	1142.202	347.655	
	Nov	1523.164	8945.365	7982.133		9407.667	1480.759	674.088	
	Dec	1595.249	9164.385	8155.894		9368.043	1669.252	839.377	
2009	Jan	1576.451	9339.366	8235.858		9335.390	1730.461	870.224	
	Feb	1559.675	9394.505	8258.690		9342.188	1590.256	758.678	
	Mar	1563.305	9477.273	8325.409		9314.999	1668.519	833.381	
	Apr	1592.771	9464.519	8272.181		9265.174	1787.813	949.452	
	May	1595.455	9583.600	8342.611		9332.919	1799.379	946.291	
	Jun	1647.792	9619.090	8374.318		9309.846	1704.135	855.866	
	Jul	1653.581	9615.828	8356.680		9238.649	1693.704	841.448	
	Aug	1649.835	9551.938	8305.371		9204.921	1728.092	879.512	
	Sep	1659.862	9581.208	8333.136		9116.999	1819.670	965.139	
	Oct	1673.905	9567.051	8360.111		9029.634	1975.378	1122.168	
	Nov	1694.208	9555.963	8392.060		9092.837	2044.603	1182.271	

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

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

		M1	MZM	M2	M3*
Percent change at an annual rate					
	2004	5.57	3.83	4.64	5.09
	2005	2.03	2.10	4.22	5.97
	2006	0.19	4.33	5.04	4.95
	2007	-0.08	9.05	5.76	
	2008	4.07	13.98	6.87	
2007	1	0.16	7.49	5.85	
	2	2.04	9.82	5.78	
	3	-1.43	13.65	5.54	
	4	1.26	16.85	5.81	
2008	1	1.37	16.70	8.36	
	2	1.95	13.50	5.63	
	3	8.75	4.44	4.08	
	4	32.03	9.89	14.30	
2009	1	9.26	18.87	12.51	
	2	11.63	6.47	2.73	
	3	10.53	1.14	0.10	
2007	Nov	-3.70	14.20	5.06	
	Dec	-1.71	9.95	5.43	
2008	Jan	3.85	11.80	7.96	
	Feb	2.75	29.17	12.36	
	Mar	2.40	20.16	10.10	
	Apr	0.56	9.84	3.32	
	May	-0.18	7.87	3.10	
	Jun	8.67	6.11	1.90	
	Jul	13.38	7.04	7.02	
	Aug	-15.04	-4.13	-4.24	
	Sep	51.66	6.97	17.20	
	Oct	19.12	5.90	18.32	
	Nov	39.44	15.64	8.01	
	Dec	56.79	29.38	26.12	
2009	Jan	-14.14	22.91	11.77	
	Feb	-12.77	7.08	3.33	
	Mar	2.79	10.57	9.69	
	Apr	22.62	-1.61	-7.67	
	May	2.02	15.10	10.22	
	Jun	39.36	4.44	4.56	
	Jul	4.22	-0.41	-2.53	
	Aug	-2.72	-7.97	-7.37	
	Sep	7.29	3.68	4.01	
	Oct	10.15	-1.77	3.88	
	Nov	14.55	-1.39	4.59	

*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. **Large Time Deposits** are deposits of $100,000 or more. **Retail** and **Institutional Money Market Mutual Funds** are as included in M2 and the non-M2 component of M3, respectively.

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

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

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

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

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

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

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where f_t^* is the implied federal funds rate, π_{t-1} is the previous period's inflation rate (PCE) measured on a year-over-year basis, y_{t-1} is the log of the previous period's level of real gross domestic product (GDP), and y_{t-1}^P is the log of an estimate of the previous period's level of potential output. **Potential Real GDP** is estimated by the Congressional Budget Office (CBO). Since the July 2009 NIPA revision, there is a discrepancy between real GDP (in billions of chained 2005 dollars) and CBO real potential GDP (in billions of chained 2000 dollars). We have multiplied each quarterly observation of CBO real potential GDP by a factor of 1.14. This scaling factor is the average of the ratio of real GDP in billions of chained 2005 dollars to real GDP in billions of chained 2000 dollars for the four quarters of 2005.

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.

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/.