

Monetary Policy, Bubbles, and Goldilocks

Emerging signs of stronger economic activity and the Federal Open Market Committee (FOMC)'s second round of quantitative easing (QE2) have raised concern among some analysts that expansionary policy might be causing bubbles in financial and commodity markets—bubbles that might harm the economy if they burst. Prices for bonds, equities, and commodities have increased sharply since late August: The Reuters Jefferies/CRB weekly futures commodity price index increased by 22 percent (in U.S. dollars) through the week of November 9 (but fell sharply the following week), oil prices by 22 percent, the *Economist* food-price index by 20 percent, the Russell 2000 Index by 22 percent, and the broader S&P 500 Index by 15 percent. Given these increases, the concern over bubbles is reasonable, but it is difficult to distinguish beforehand the line between aggressive (“just right”) monetary policy and *overly* aggressive (“too hot”) monetary policy that generates bubbles.

Rapid increases in commodity and financial market prices by themselves, however, are not reliable indicators of potential bubbles because such increases also occur as part of normal monetary policy. How exactly does policy operate in normal times when the federal funds rate is well above zero? The path begins with a reduction in the target rate, continues with changes in longer-term interest rates, and is followed by increases in real economic activity.¹ Disappointingly low returns on short-term, low-risk investments prompt investors to move to longer-term, higher-risk investments in financial instruments, commodities, and durable goods. In turn, bond and equity prices rise, decreasing corporate borrowing costs and increasing household wealth. There also is a price effect: Broad expectations of higher prices for goods and services in future periods induce firms and households to spend money now rather than later. And there are lags: Increasing the production of residential and nonresidential durable goods (including structures and durable equipment) takes time. During this “time to build,”² both the *size* and *duration* of the difference between the contemporaneous prices of financial and real assets and their long-run values are larger, *ceteris paribus*, when monetary policy is more aggressively expansionary and increases in aggregate demand are stubbornly slow. Eventually, as the economy rejoins its balanced growth path, bond prices fall (yields increase) as real interest rates and expected inflation increase.

Commodity price movements are more complex and involve several factors. One factor is the potential success of expansionary monetary policy: If economic activity expands, demand for commodities likely will increase, pushing futures prices upward, which, in turn, tends to increase current-period prices. Further, some analysts have suggested the expansion of hedge funds and similar investments over the past decade may have increased the speed and volatility of commodity price changes.³ A second factor is the decreased foreign exchange value of the dollar as a result of aggressive monetary policy. Because most commodities are freely traded in international markets, commodity prices in U.S. dollars tend to increase as the dollar's value against other currencies falls. As James Hamilton discussed in his blog on November 10, 2010, recent data show that changes in the U.S. dollar price of oil closely approximate changes in the dollar's exchange value against our trading partners.⁴

As long as the FOMC's pursuit of highly expansionary policy continues, households and businesses remain pessimistic, and demand is sluggish, the potential exists for asset prices to deviate from their long-run levels by large amounts and for long periods. Such increases per se are not bubbles but a commonplace reaction of the monetary transmission mechanism. Yet, monitoring of prices is essential lest future adjustments be misunderstood by the public as part of the dynamics of aggressive monetary policy. Whether bubbles have been generated remains to be seen.

—Richard G. Anderson

¹ During the mid-2000s, it was suggested that the transmission mechanism might have changed because longer-term market yields were dominated by international financial flows (e.g., see Thornton, Daniel T. “The Monetary Policy Transmission Mechanism?” Federal Reserve Bank of St. Louis *Monetary Trends*, September 2005; <http://research.stlouisfed.org/publications/mt/20050901/cover.pdf>). Even if true then, the apparent success of the FOMC's QE program between March 2009 and March 2010 suggests this is no longer the case.

² Kydland, Finn E. and Prescott, Edward C. “Time to Build and Aggregate Fluctuations.” *Econometrica*, November 1982, 50(5), pp. 1345-70.

³ Basu, Parantap and Gavin, William. “What Explains the Growth in Commodity Derivatives?” Federal Reserve Bank of St. Louis *Review*, January/February 2011, 93(1) (forthcoming).

⁴ Hamilton, James. “Commodity Inflation.” *Econbrowser*; November 10, 2010; www.econbrowser.com/archives/2010/11/commodity_infla_2.html.

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Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.
2. Shaded areas indicate recessions, as determined by the National Bureau of Economic Research.
3. *Percent change at an annual rate* is the simple, not compounded, monthly percent change multiplied by 12. For example, using consecutive months, the percent change at an annual rate in x between month $t-1$ and the current month t is: $[(x_t/x_{t-1})-1] \times 1200$. Note that this differs from *National Economic Trends*. In that publication, monthly percent changes are compounded and expressed as annual growth rates.
4. The *percent change from year ago* refers to the percent change from the same period in the previous year. For example, the percent change from year ago in x between month $t-12$ and the current month t is: $[(x_t/x_{t-12})-1] \times 100$.

We welcome your comments addressed to:

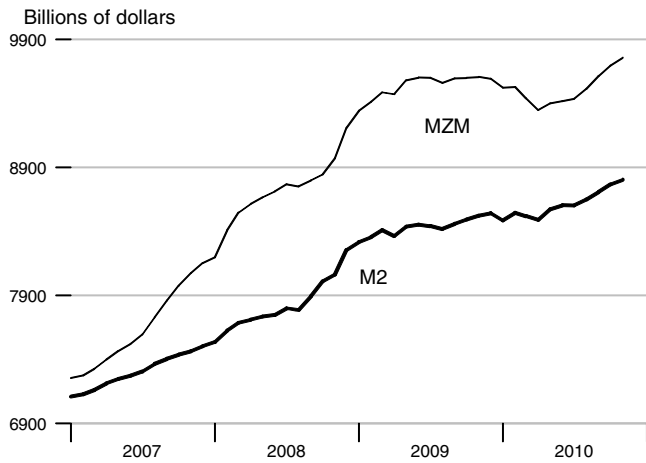
Editor, *Monetary Trends*
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St. Louis, MO 63166-0442

or to:

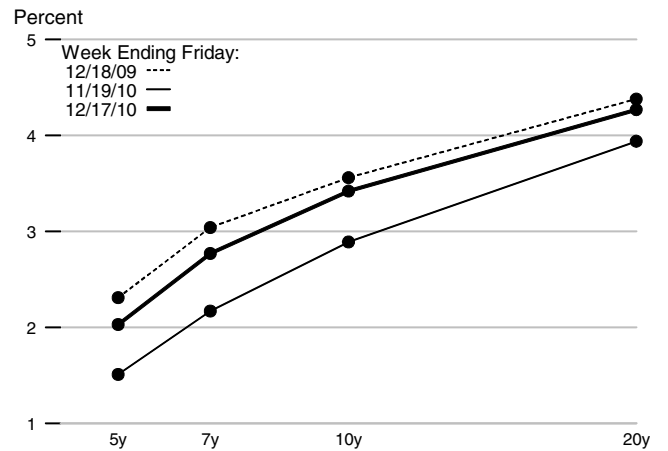
stlsFRED@stls.frb.org

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

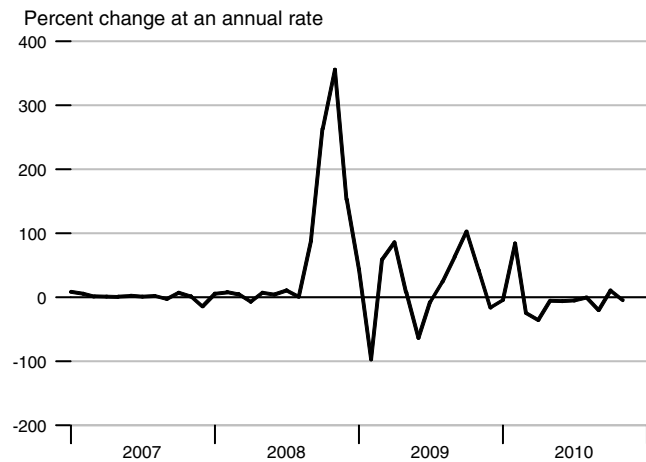
M2 and MZM



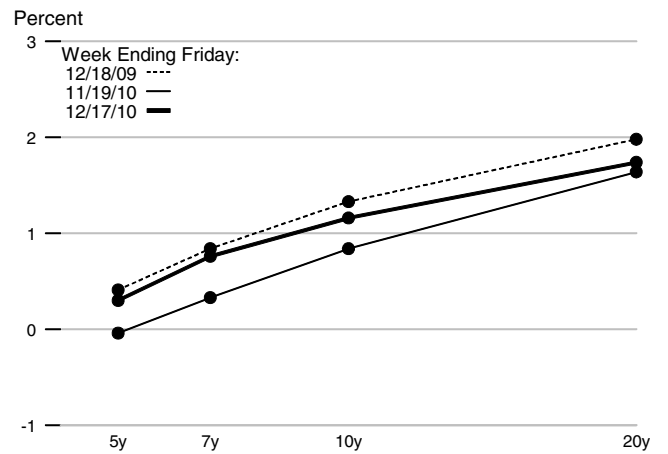
Treasury Yield Curve



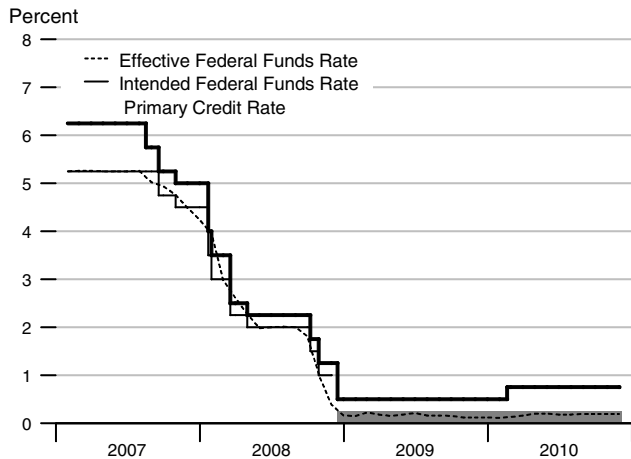
Adjusted Monetary Base



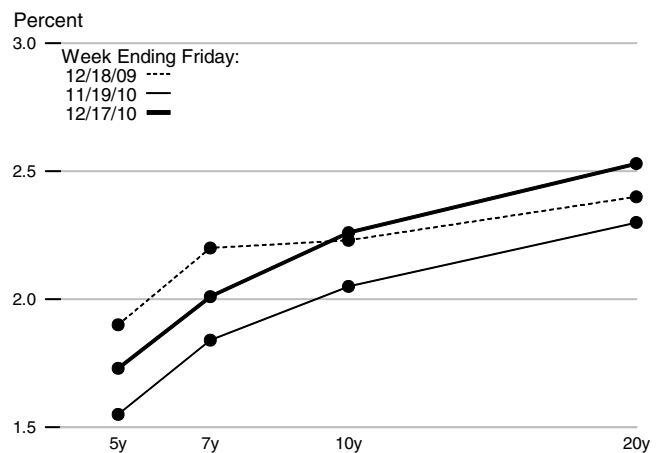
Real Treasury Yield Curve



Reserve Market Rates



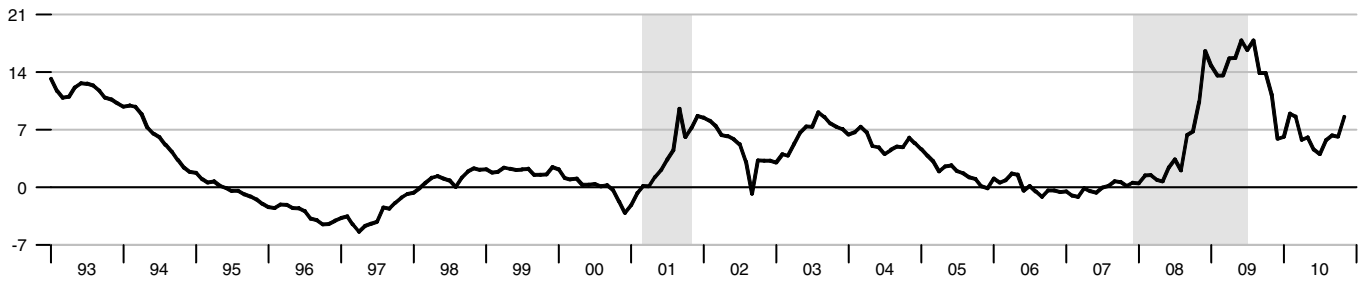
Inflation-Indexed Treasury Yield Spreads



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

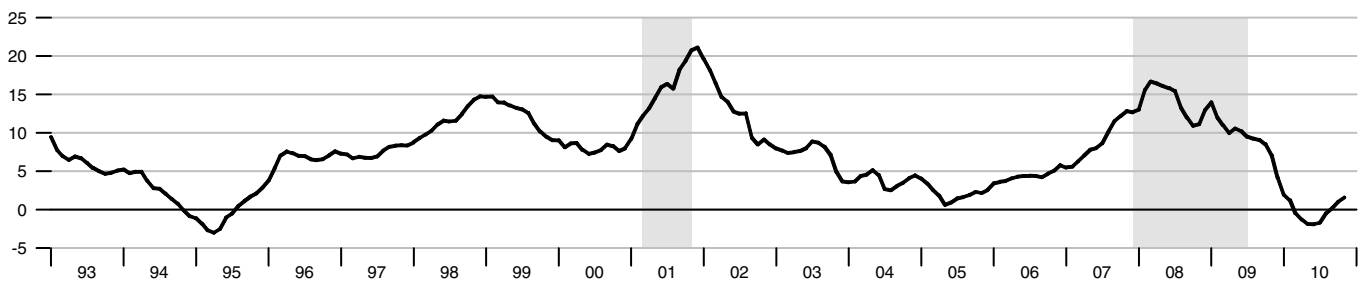
M1

Percent change from year ago



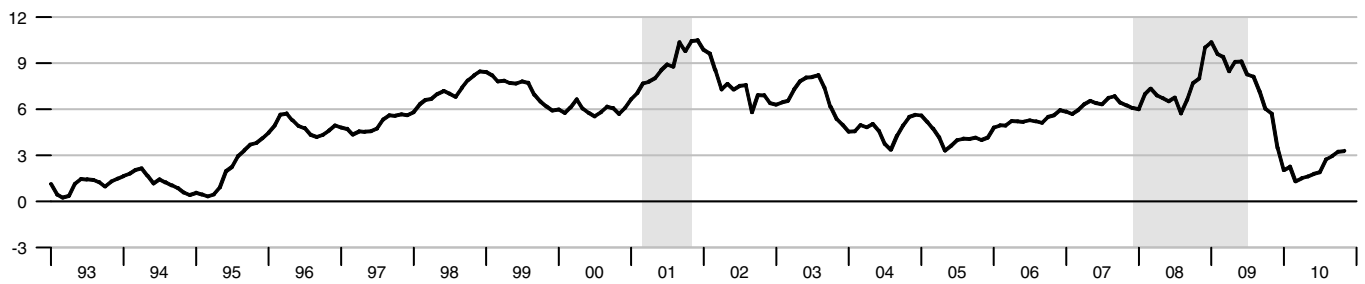
M2M

Percent change from year ago



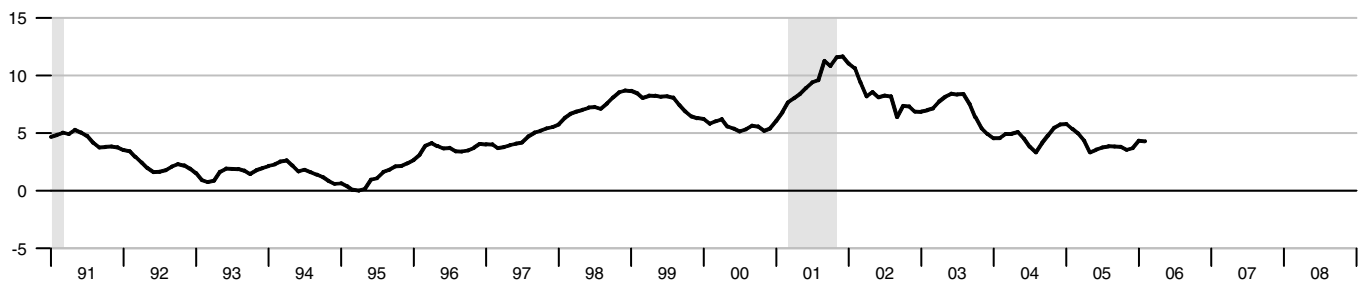
M2

Percent change from year ago



Monetary Services Index - M2**

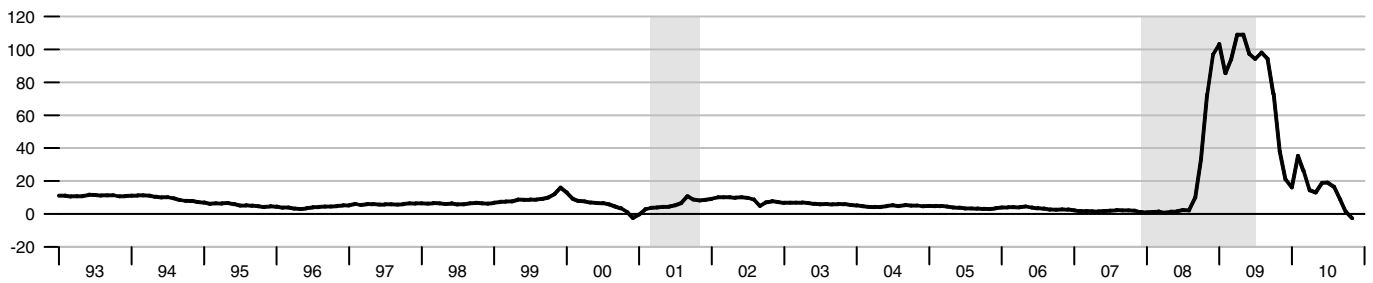
Percent change from year ago



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

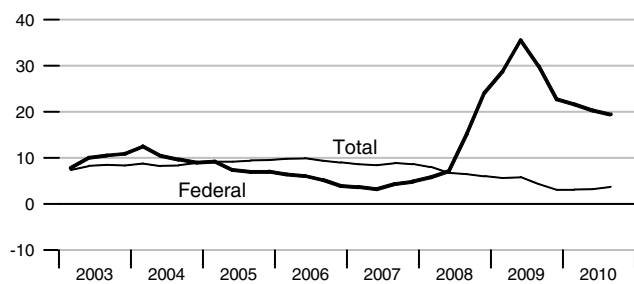
Adjusted Monetary Base

Percent change from year ago



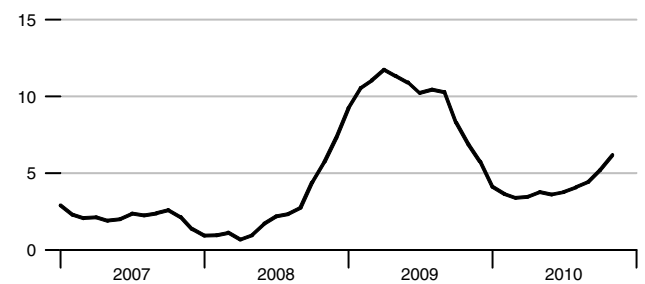
Domestic Nonfinancial Debt

Percent change from year ago



Currency Held by the Nonbank Public

Percent change from year ago



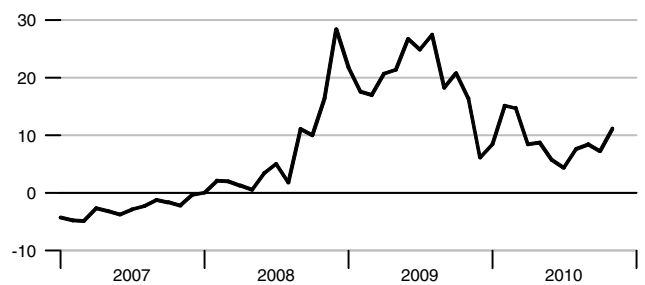
Small Denomination Time Deposits*

Percent change from year ago



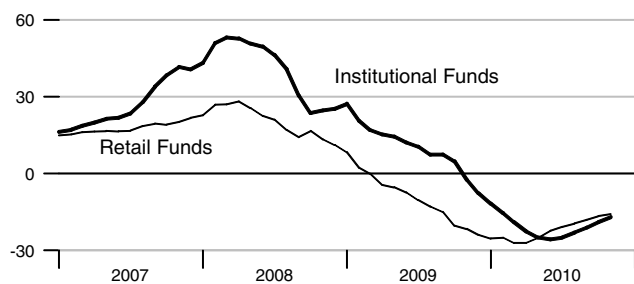
Checkable Deposits

Percent change from year ago



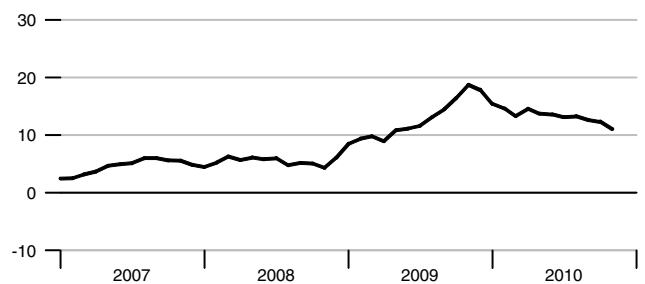
Money Market Mutual Fund Shares

Percent change from year ago



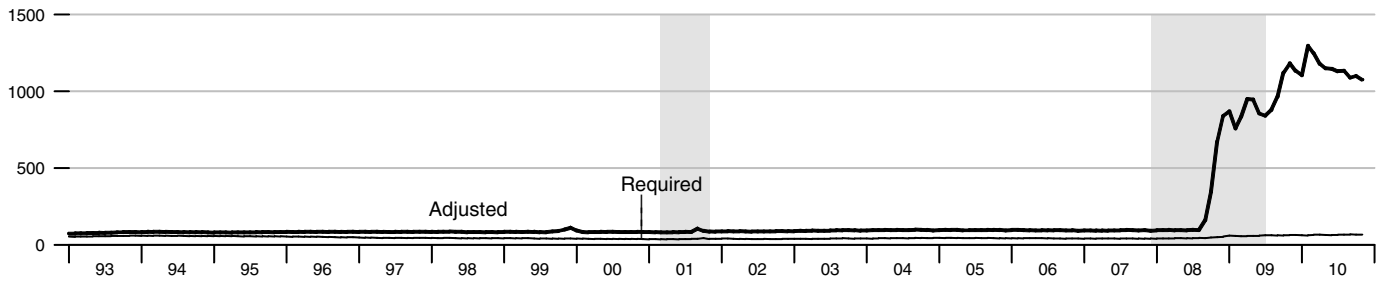
Savings Deposits

Percent change from year ago



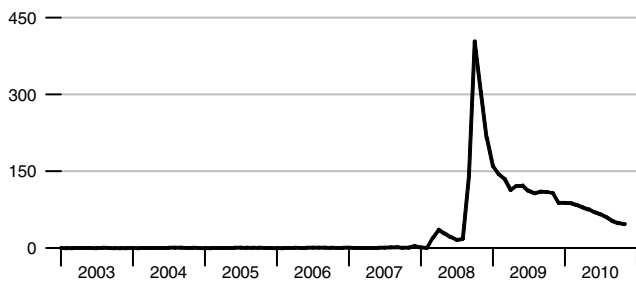
Adjusted and Required Reserves

Billions of dollars



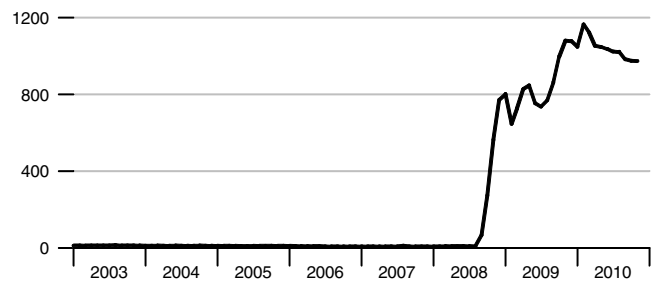
Total Borrowings, nsa

Billions of dollars



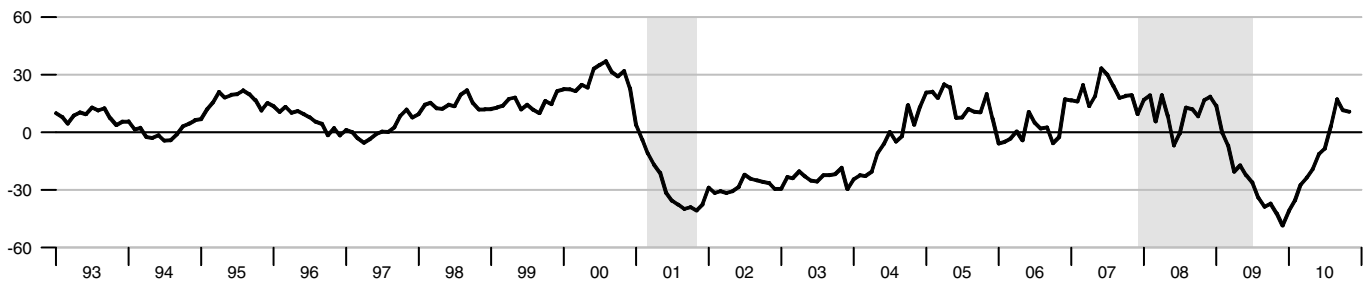
Excess Reserves plus RCB Contracts

Billions of dollars



Nonfinancial Commercial Paper

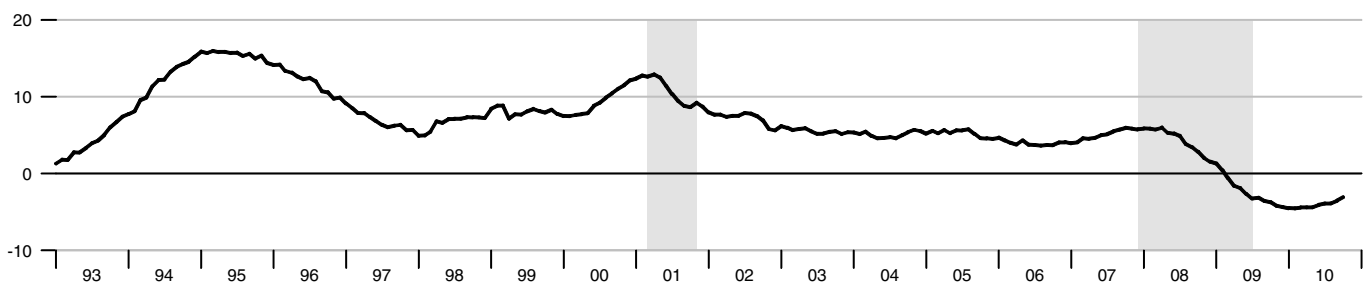
Percent change from year ago



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

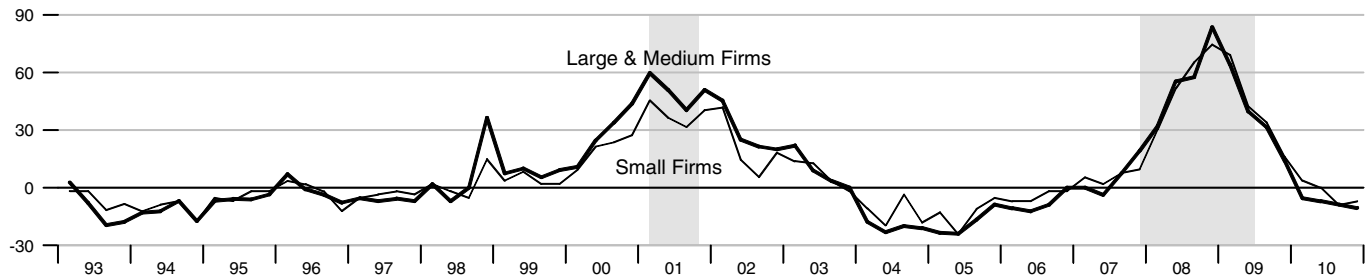
Consumer Credit

Percent change from year ago



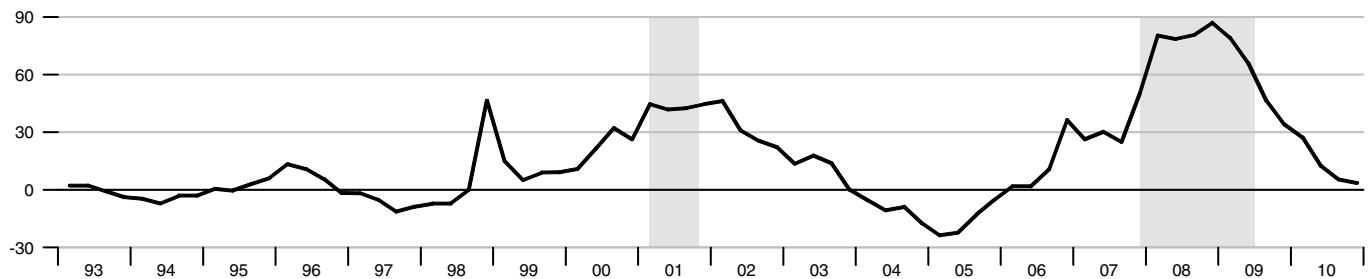
Net Percentage of Domestic Banks Tightening Standards for Commercial and Industrial Loans

Percentage



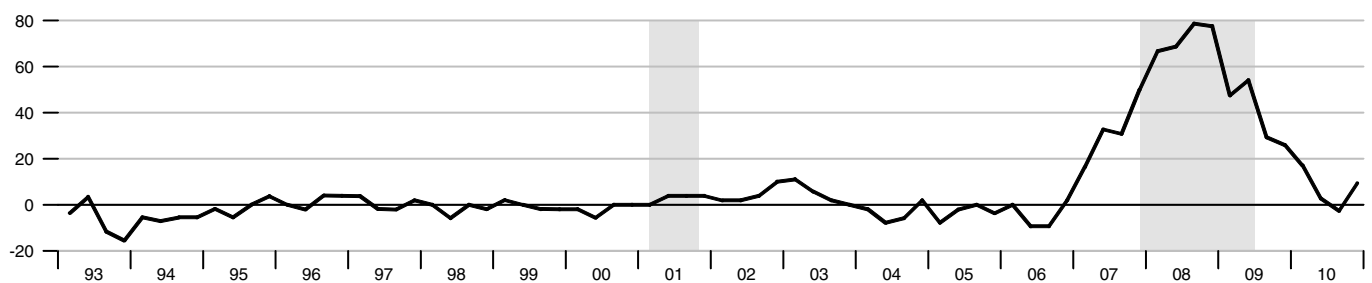
Net Percentage of Domestic Banks Tightening Standards for Commercial Real Estate Loans

Percentage



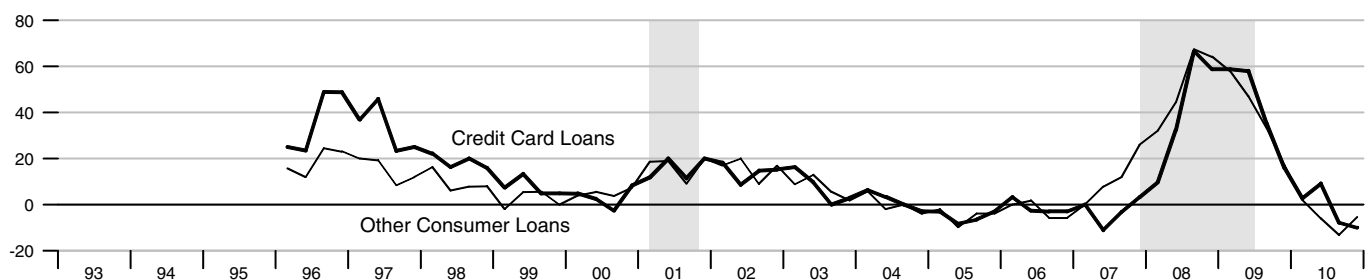
Net Percentage of Domestic Banks Tightening Standards for Residential Mortgage Loans

Percentage

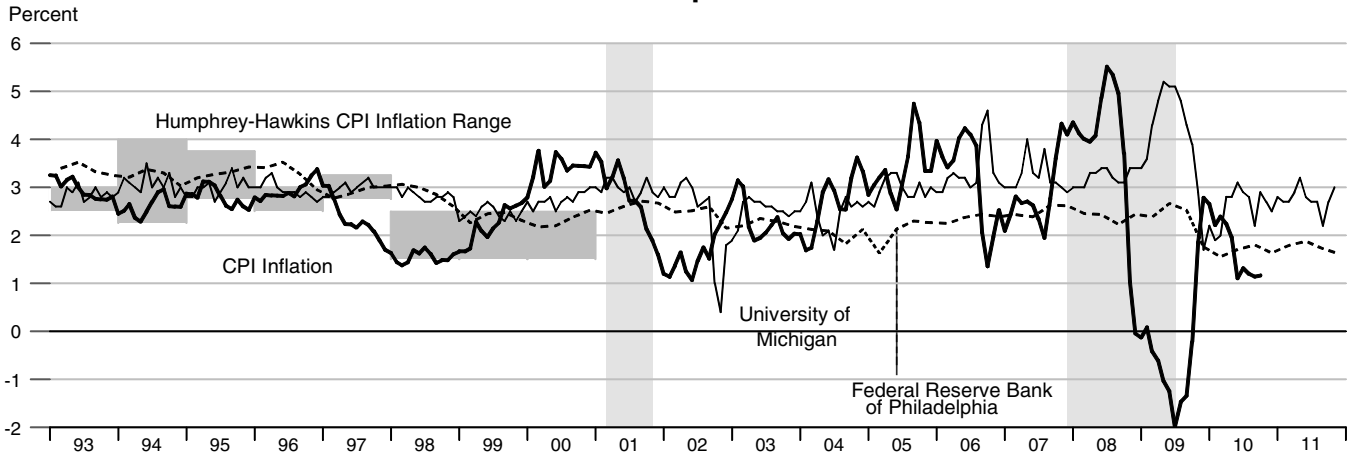


Net Percentage of Domestic Banks Tightening Standards for Consumer Loans

Percentage

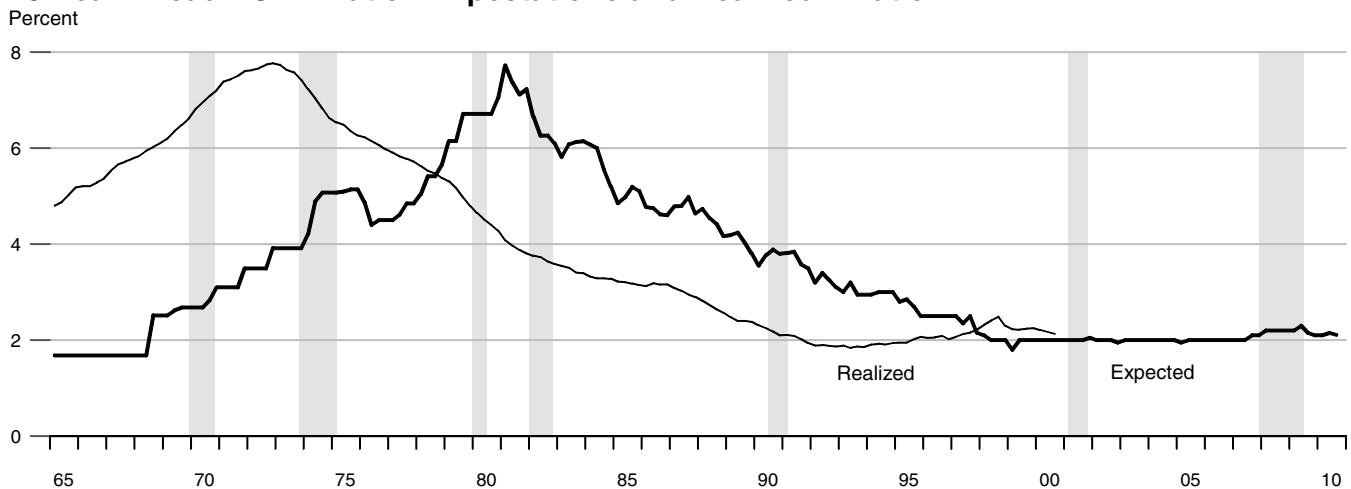


CPI Inflation and 1-Year-Ahead CPI Inflation Expectations



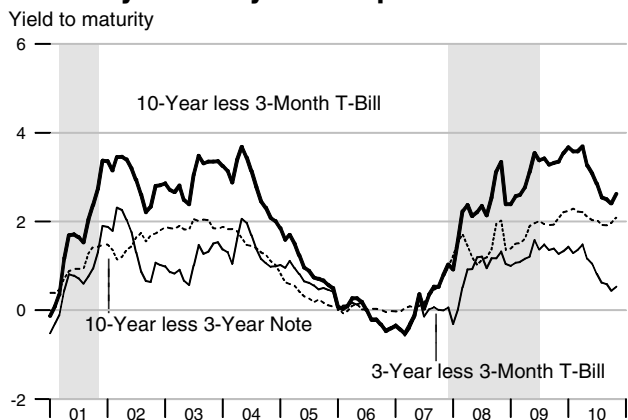
The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph.

10-Year Ahead PCE Inflation Expectations and Realized Inflation

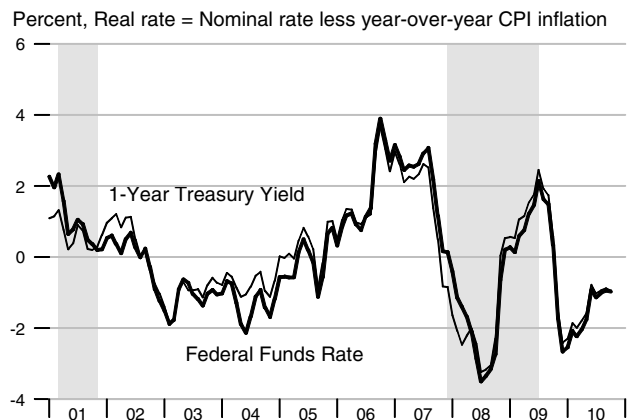


See the notes section for an explanation of the chart.

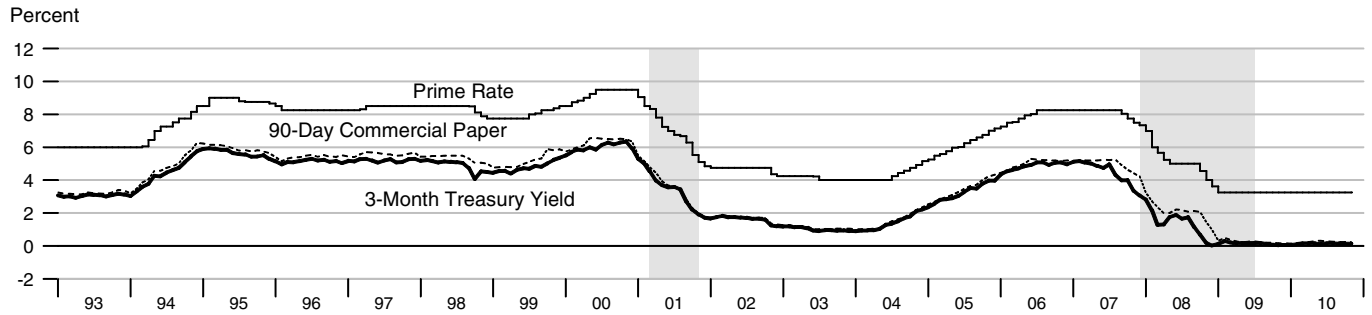
Treasury Security Yield Spreads



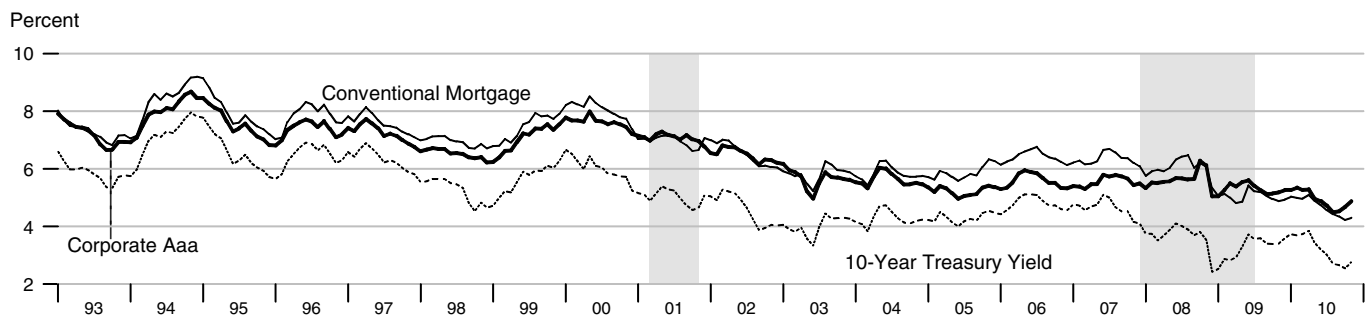
Real Interest Rates



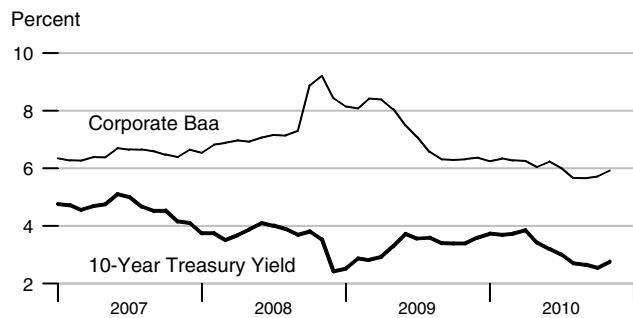
Short-Term Interest Rates



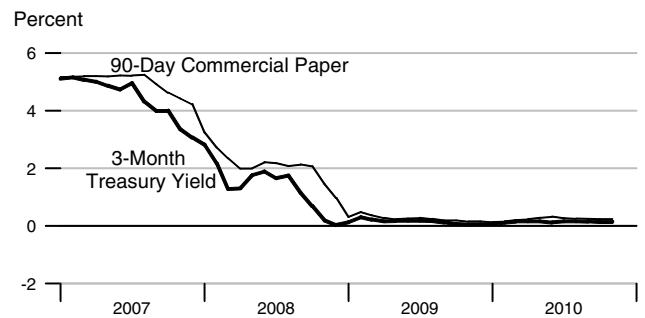
Long-Term Interest Rates



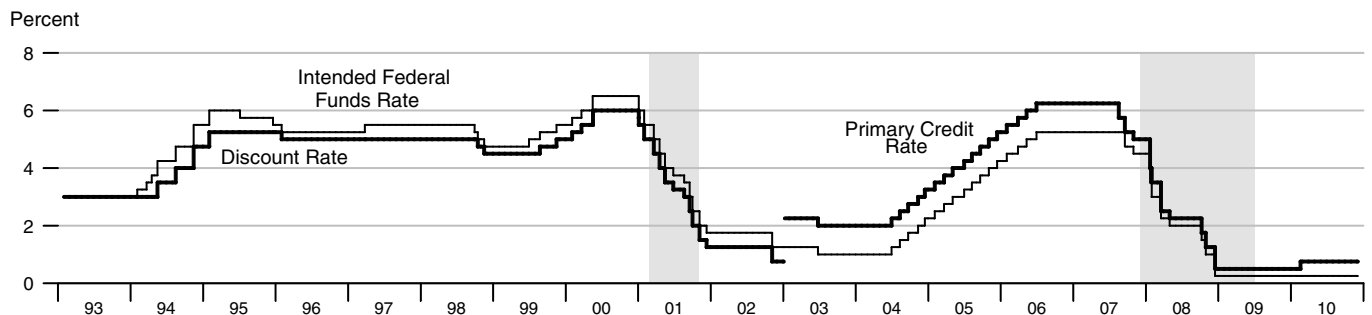
Long-Term Interest Rates



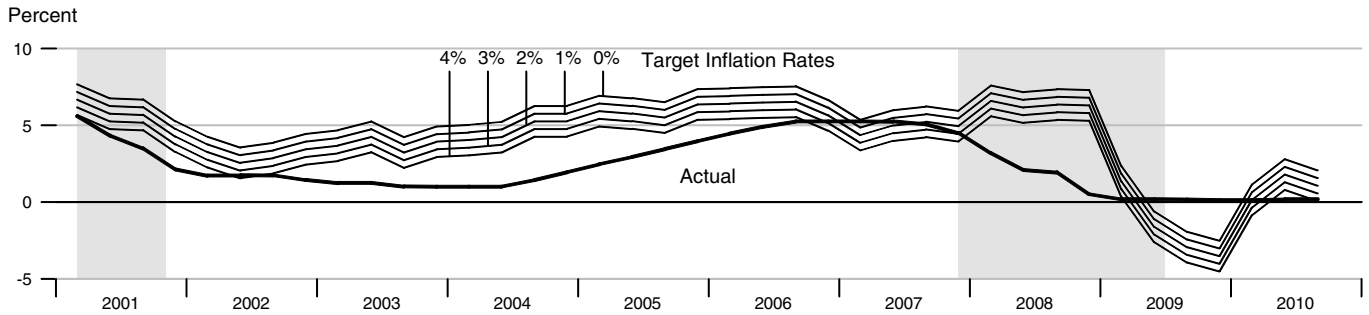
Short-Term Interest Rates



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



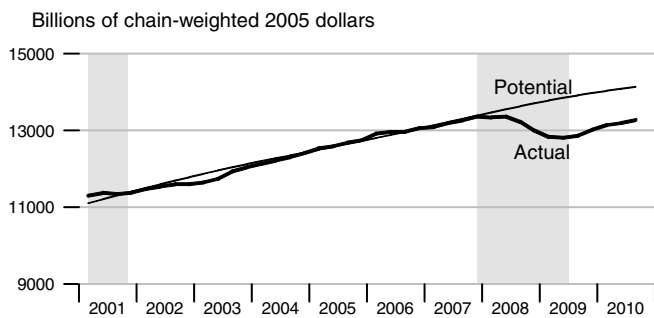
Federal Funds Rate and Inflation Targets



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

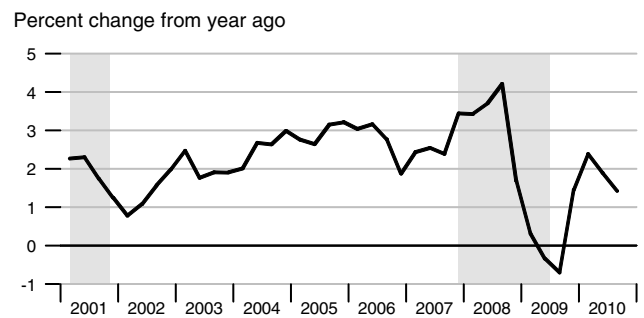
Components of Taylor's Rule

Actual and Potential Real GDP

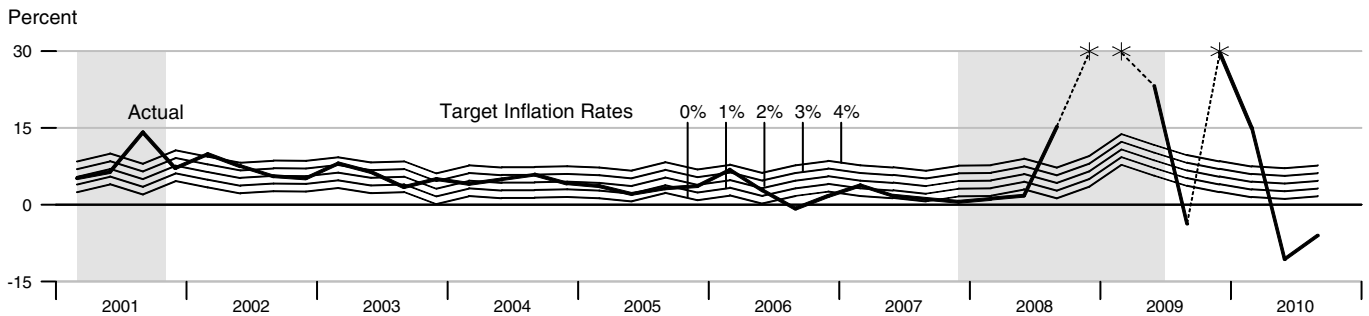


See notes section for further explanation.

PCE Inflation



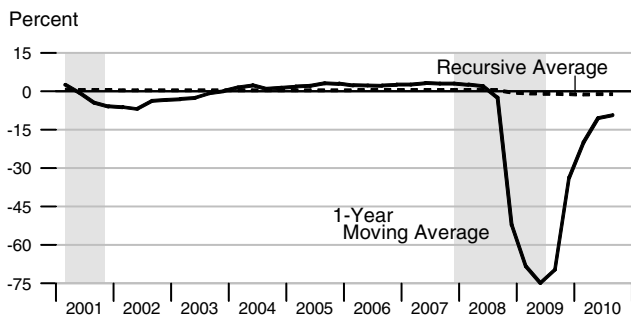
Monetary Base Growth and Inflation Targets



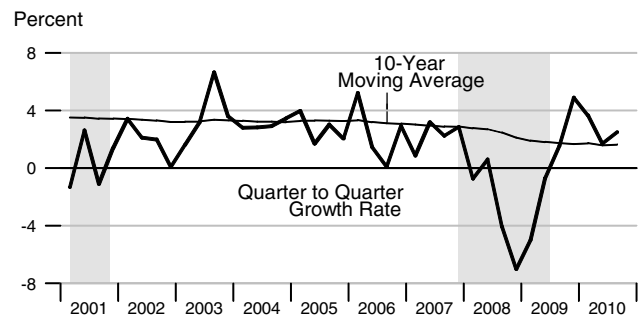
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter.
*Actual values for 2008:Q4, 2009:Q1, and 2009:Q4 are 188.38 percent, 60.77 percent, and 56.51, respectively.

Components of McCallum's Rule

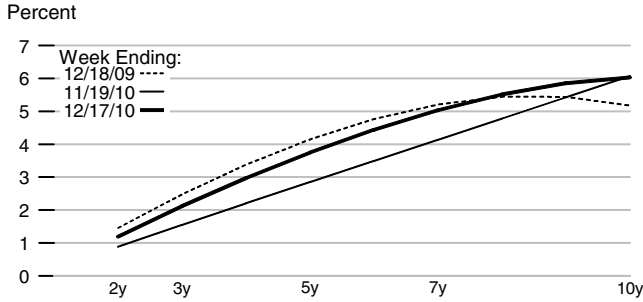
Monetary Base Velocity Growth



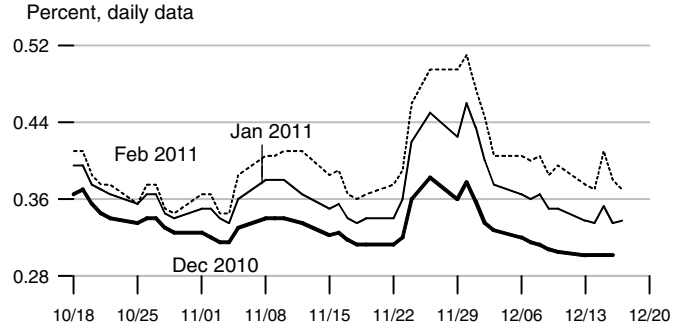
Real Output Growth



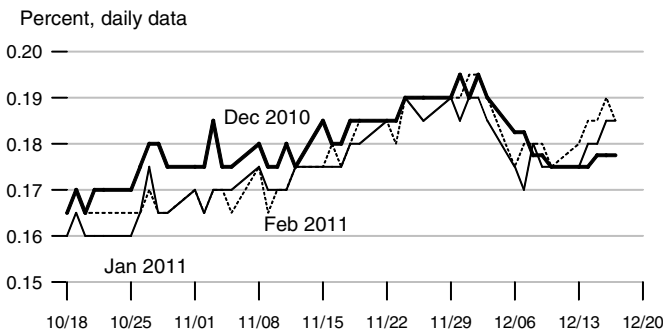
Implied One-Year Forward Rates



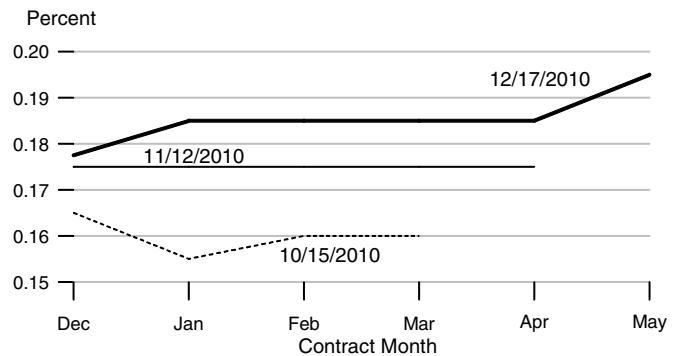
Rates on 3-Month Eurodollar Futures



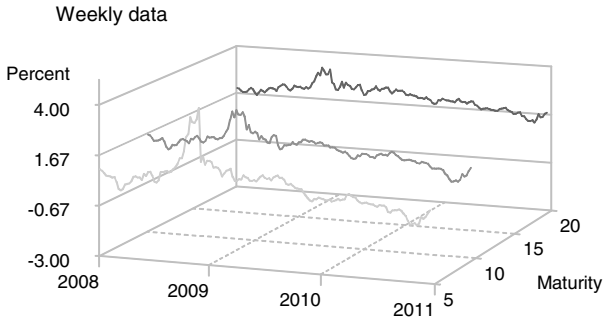
Rates on Selected Federal Funds Futures Contracts



Rates on Federal Funds Futures on Selected Dates



Inflation-Indexed Treasury Securities



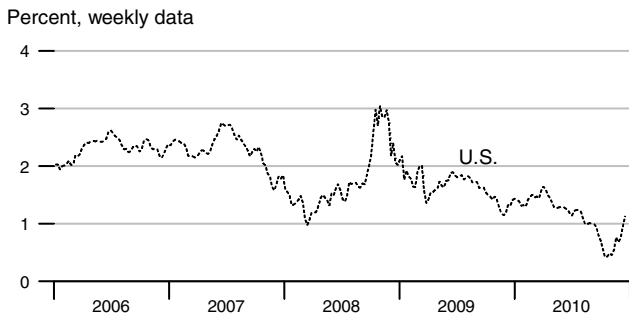
Note: Yields are inflation-indexed constant maturity U.S. Treasury securities

Inflation-Indexed Treasury Yield Spreads



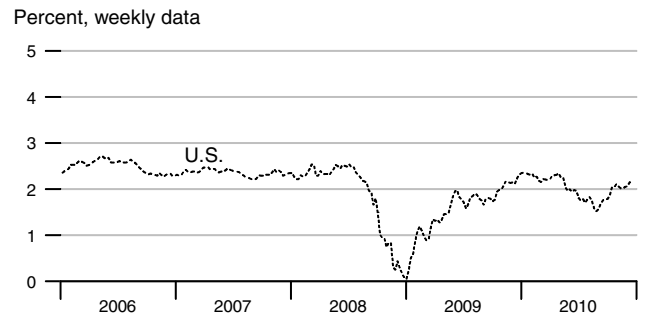
Note: Yield spread is between nominal and inflation-indexed constant maturity U.S. Treasury securities.

Inflation-Indexed 10-Year Government Notes



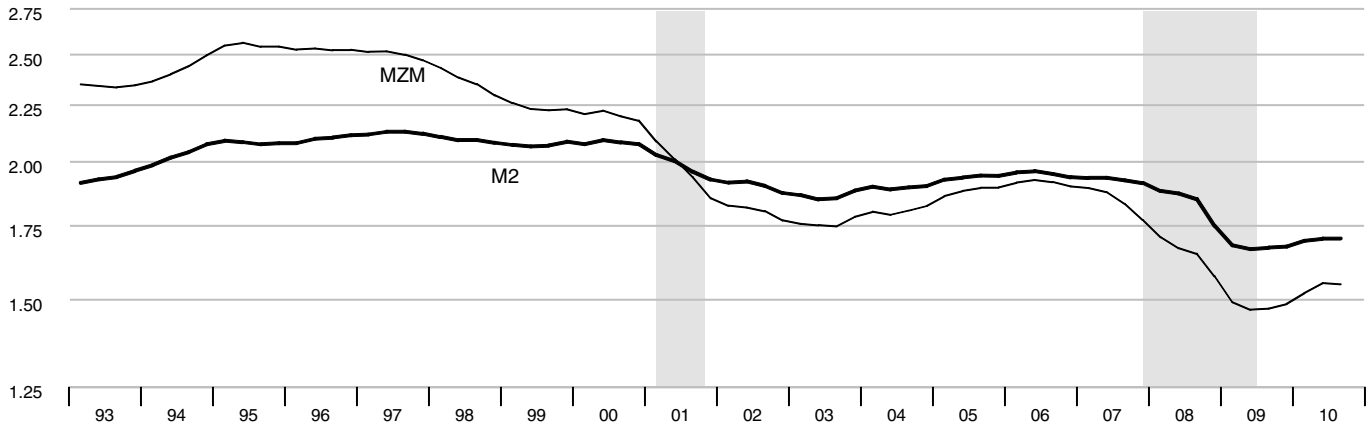
Note: Data is temporarily unavailable for the French and U.K. 10-Year Notes and Government Yield Spreads.

Inflation-Indexed 10-Year Government Yield Spreads



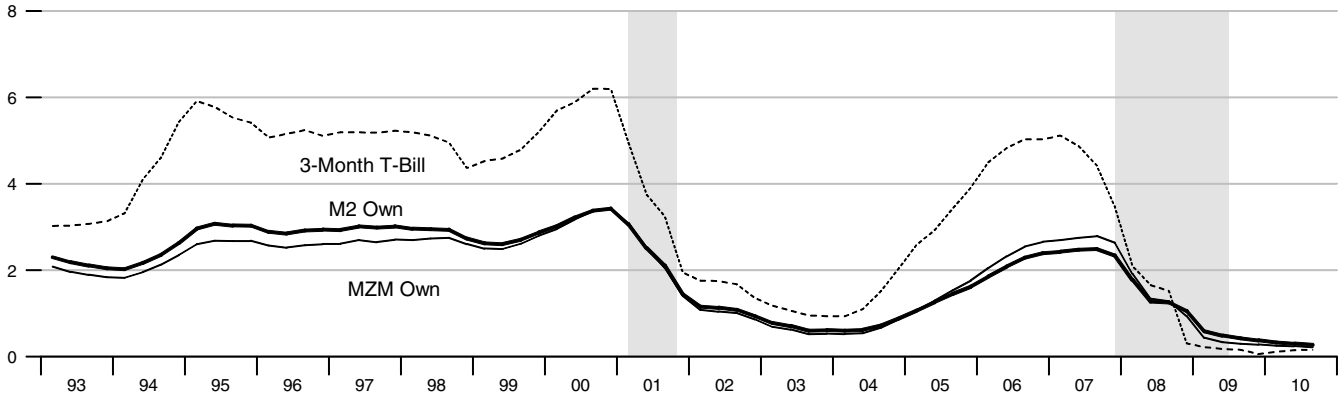
Velocity

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



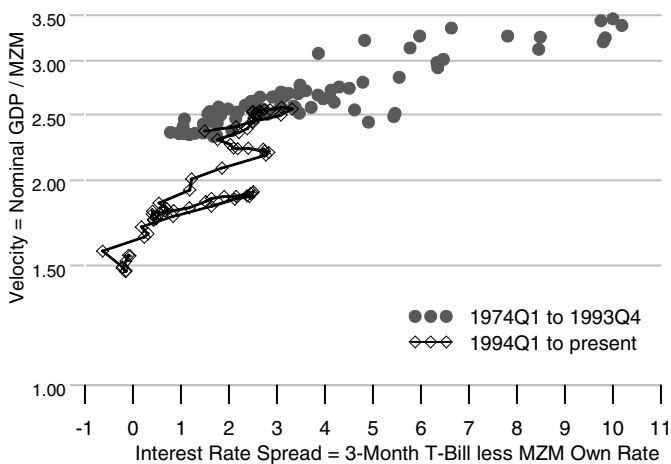
Interest Rates

Percent



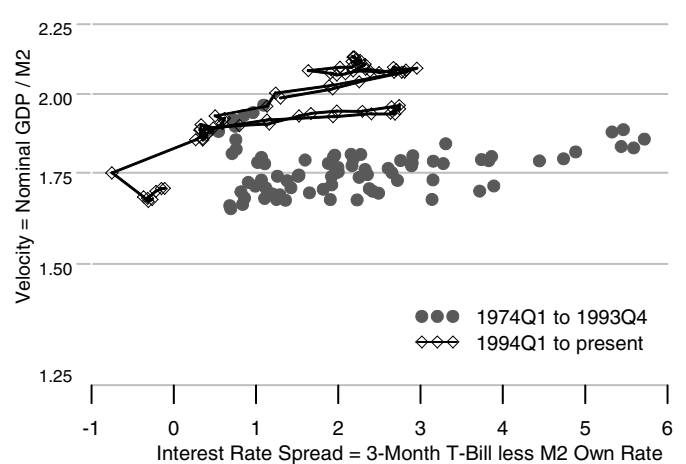
MZM Velocity and Interest Rate Spread

Ratio Scale



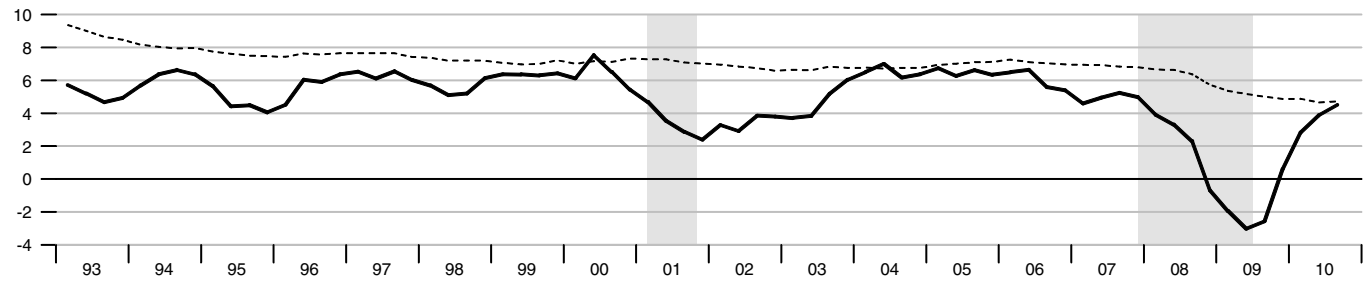
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

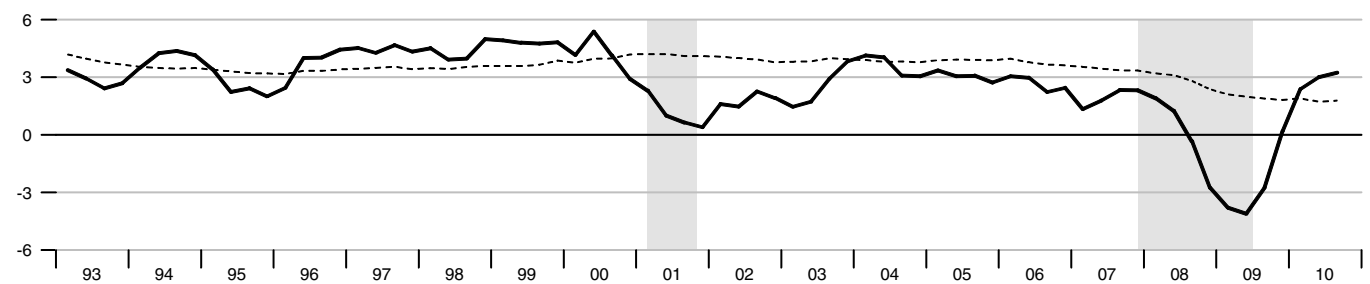
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

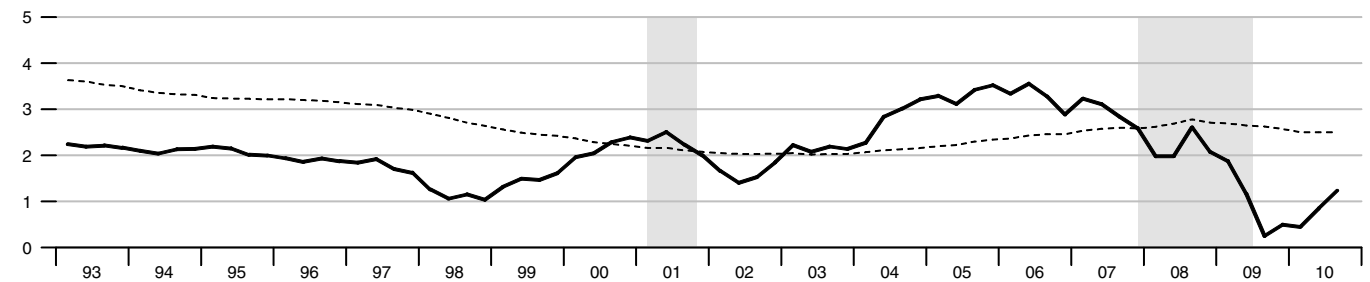
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

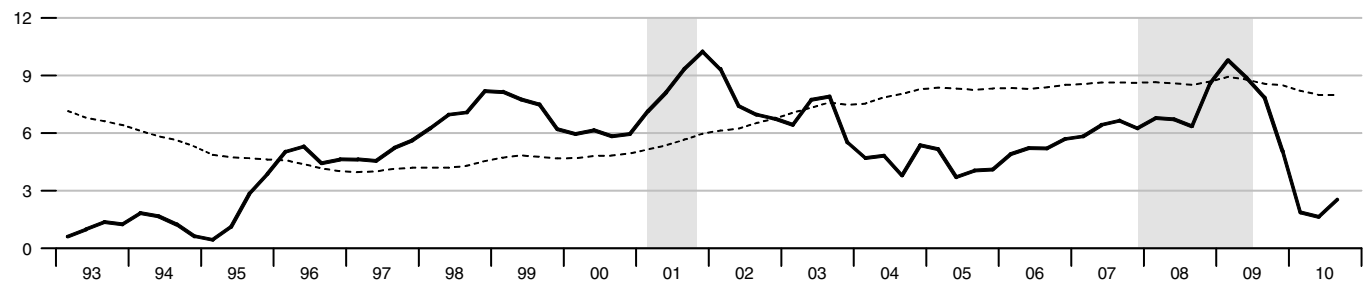
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

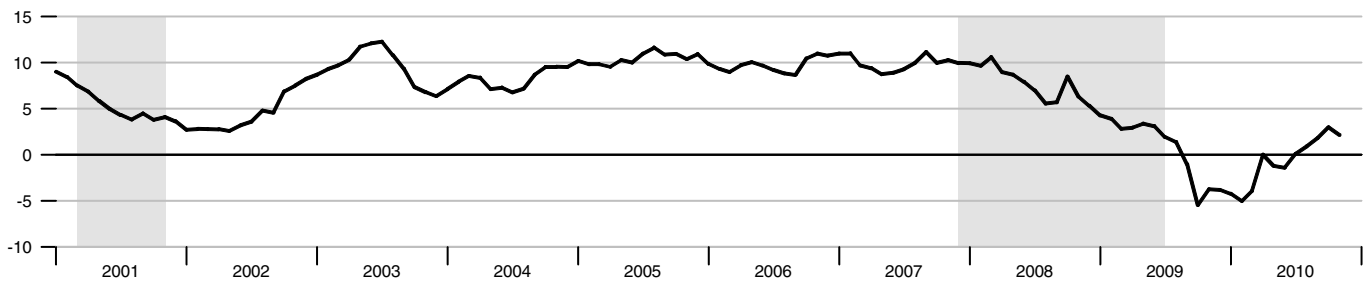
Percent change from year ago



Dashed lines indicate 10-year moving averages.

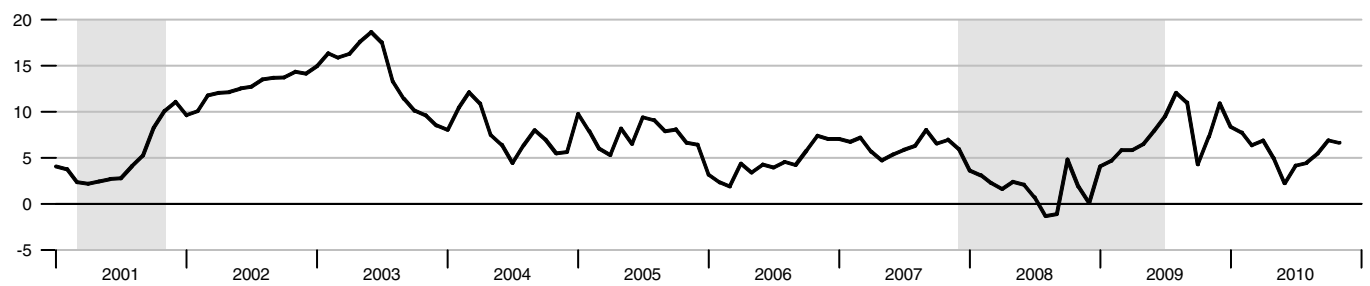
Bank Credit

Percent change from year ago



Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



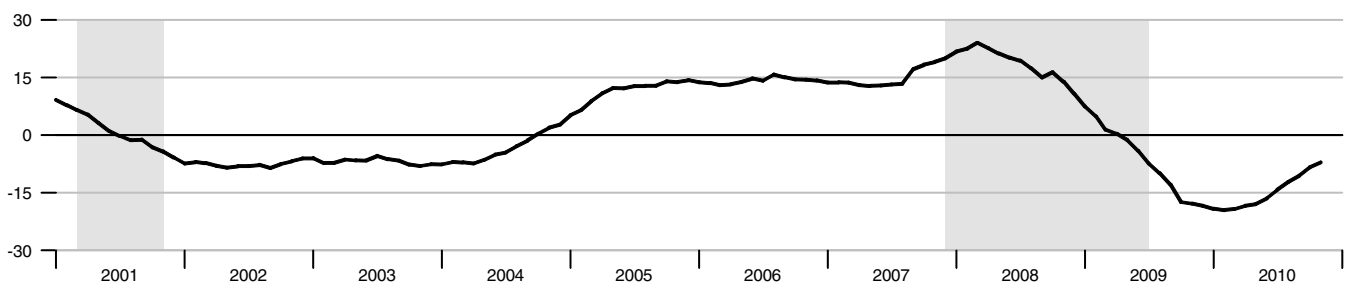
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

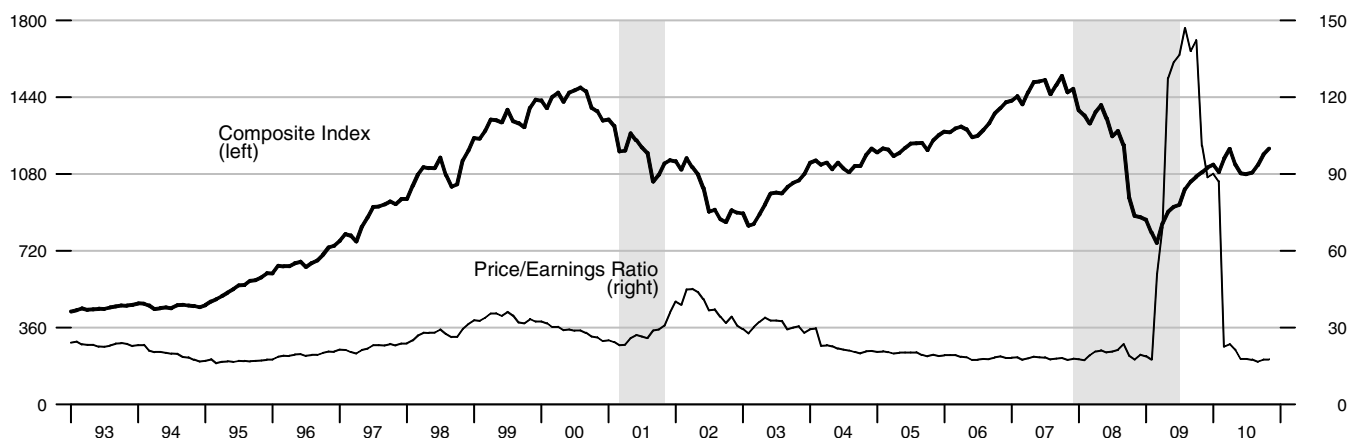


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



Standard & Poor's 500

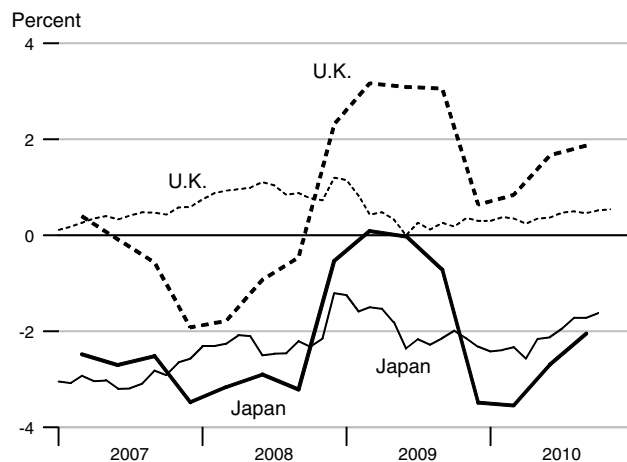
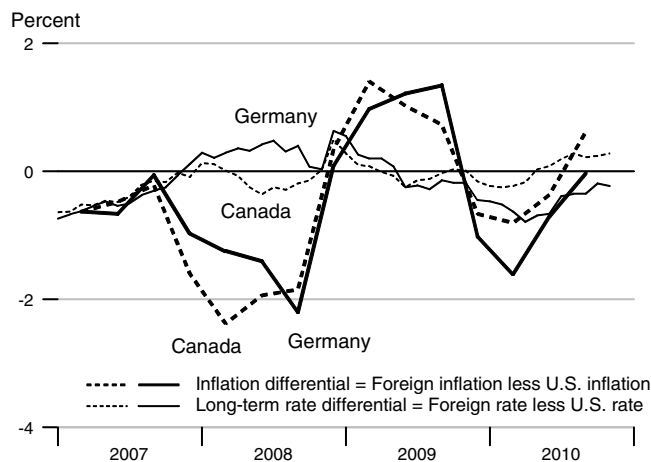


Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2009Q4	2010Q1	2010Q2	2010Q3	Aug10	Sep10	Oct10	Nov10
United States	1.46	2.42	1.77	1.22	2.70	2.65	2.54	2.76
Canada	0.79	1.61	1.40	1.83	2.98	2.87	2.78	3.04
France	0.36	1.32	1.61	1.53	2.68	2.68	.	.
Germany	0.44	0.81	1.06	1.18	2.35	2.30	2.35	2.53
Italy	0.65	1.29	1.41	1.62	3.80	3.86	3.80	4.18
Japan	-2.03	-1.12	-0.93	-0.83	0.98	0.93	0.92	.
United Kingdom	2.09	3.26	3.44	3.09	3.20	3.11	3.06	3.30

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Inflation and Long-Term Interest Rate Differentials



		Money Stock				Bank	Adjusted		MSI M2**
		M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	
2005		1371.536	6709.741	6525.151	9786.477	7015.091	806.622	96.554	343.539
2006		1374.163	7000.945	6868.146	10270.74	7697.040	835.035	94.908	
2007		1372.079	7635.149	7300.241		8462.623	850.529	94.145	
2008		1432.773	8708.061	7820.320		9122.749	1010.130	232.534	
2009		1634.793	9538.280	8434.798		9190.798	1796.550	944.772	
2008	1	1384.588	8384.447	7615.259		8999.867	856.338	96.192	
	2	1392.554	8664.431	7730.396		9011.612	860.033	95.081	
	3	1423.716	8773.390	7826.426		9068.211	893.439	118.518	
	4	1530.235	9009.974	8109.200		9411.306	1430.709	620.346	
2009	1	1578.270	9414.578	8361.120		9329.186	1662.925	820.597	
	2	1621.077	9552.027	8417.984		9294.851	1763.628	917.017	
	3	1653.063	9586.193	8440.664		9136.651	1747.186	895.441	
	4	1686.761	9600.321	8519.425		9002.503	2012.460	1146.032	
2010	1	1702.865	9497.685	8517.189		8919.104	2089.180	1217.002	
	2	1709.636	9389.559	8556.052		9214.328	2034.276	1158.344	
	3	1741.646	9522.252	8653.937		9222.011	2003.657	1117.931	
2008	Nov	1516.919	8972.642	8062.465		9385.134	1480.740	674.070	
	Dec	1602.055	9211.248	8255.292		9355.466	1669.236	839.363	
2009	Jan	1583.473	9343.138	8316.718		9332.244	1730.151	869.931	
	Feb	1573.980	9413.828	8356.720		9348.492	1590.149	758.576	
	Mar	1577.358	9486.769	8409.921		9306.821	1668.474	833.284	
	Apr	1608.533	9473.300	8364.291		9264.930	1787.690	949.281	
	May	1608.536	9580.607	8436.668		9322.693	1799.205	946.080	
	Jun	1646.162	9602.174	8452.994		9296.929	1703.989	855.691	
	Jul	1649.944	9600.506	8442.977		9202.656	1693.712	841.475	
	Aug	1648.424	9561.480	8419.718		9143.923	1728.112	879.587	
	Sep	1660.820	9596.594	8459.298		9063.375	1819.734	965.262	
	Oct	1676.190	9599.932	8492.133		8974.661	1975.378	1122.194	
	Nov	1687.506	9607.092	8523.343		9033.627	2044.689	1182.377	
	Dec	1696.588	9593.940	8542.798		8999.221	2017.312	1133.526	
2010	Jan	1680.736	9523.959	8486.026		8936.817	2010.109	1105.435	
	Feb	1714.782	9529.017	8545.671		8878.969	2150.910	1296.160	
	Mar	1713.078	9440.078	8519.870		8941.525	2106.522	1249.412	
	Apr	1701.383	9349.043	8490.568		9264.847	2044.296	1178.993	
	May	1706.046	9400.692	8573.009		9210.519	2034.541	1149.754	
	Jun	1721.479	9418.943	8604.578		9167.619	2023.991	1146.284	
	Jul	1716.452	9437.111	8603.319		9211.350	2015.187	1131.072	
	Aug	1742.831	9514.679	8649.422		9226.962	2014.639	1133.728	
	Sep	1765.655	9614.966	8709.070		9227.722	1981.144	1088.992	
	Oct	1779.586	9695.794	8767.034		9241.698	1998.494	1099.710	
	Nov	1831.938	9757.384	8804.205		9227.580	1991.151	1076.447	

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

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

		Federal Funds	Primary Credit Rate	Prime Rate	3-mo CDs	Treasury Yields			Corporate Aaa Bonds	Municipal Aaa Bonds	Conventional Mortgage
						3-mo	3-yr	10-yr			
2005		3.21	4.19	6.19	3.51	3.21	3.93	4.29	5.23	4.28	5.86
2006		4.96	5.96	7.96	5.15	4.85	4.77	4.79	5.59	4.15	6.41
2007		5.02	5.86	8.05	5.27	4.47	4.34	4.63	5.56	4.13	6.34
2008		1.93	2.39	5.09	2.97	1.39	2.24	3.67	5.63	4.58	6.04
2009		0.16	0.50	3.25	0.56	0.15	1.43	3.26	5.31	4.27	5.04
2008	1	3.18	3.67	6.21	3.23	2.09	2.17	3.66	5.46	4.39	5.88
	2	2.09	2.33	5.08	2.76	1.65	2.67	3.89	5.60	4.43	6.09
	3	1.94	2.25	5.00	3.06	1.52	2.63	3.86	5.65	4.50	6.31
	4	0.51	1.31	4.06	2.82	0.30	1.48	3.25	5.82	5.02	5.87
2009	1	0.18	0.50	3.25	1.08	0.22	1.27	2.74	5.27	4.64	5.06
	2	0.18	0.50	3.25	0.62	0.17	1.49	3.31	5.51	4.43	5.03
	3	0.16	0.50	3.25	0.30	0.16	1.56	3.52	5.27	4.11	5.16
	4	0.12	0.50	3.25	0.22	0.06	1.39	3.46	5.20	3.91	4.92
2010	1	0.13	0.61	3.25	0.21	0.11	1.47	3.72	5.29	3.93	5.00
	2	0.19	0.75	3.25	0.42	0.15	1.38	3.49	5.04	3.83	4.91
	3	0.19	0.75	3.25	0.34	0.16	0.83	2.79	4.58	3.58	4.45
2008 Nov		0.39	1.25	4.00	2.36	0.19	1.51	3.53	6.12	4.83	6.09
Dec		0.16	0.86	3.61	1.77	0.03	1.07	2.42	5.05	5.17	5.33
2009	Jan	0.15	0.50	3.25	1.02	0.13	1.13	2.52	5.05	4.64	5.06
	Feb	0.22	0.50	3.25	1.16	0.30	1.37	2.87	5.27	4.56	5.13
	Mar	0.18	0.50	3.25	1.07	0.22	1.31	2.82	5.50	4.74	5.00
	Apr	0.15	0.50	3.25	0.89	0.16	1.32	2.93	5.39	4.48	4.81
	May	0.18	0.50	3.25	0.57	0.18	1.39	3.29	5.54	4.26	4.86
	Jun	0.21	0.50	3.25	0.39	0.18	1.76	3.72	5.61	4.56	5.42
	Jul	0.16	0.50	3.25	0.35	0.18	1.55	3.56	5.41	4.36	5.22
	Aug	0.16	0.50	3.25	0.30	0.17	1.65	3.59	5.26	4.17	5.19
	Sep	0.15	0.50	3.25	0.25	0.12	1.48	3.40	5.13	3.81	5.06
	Oct	0.12	0.50	3.25	0.24	0.07	1.46	3.39	5.15	3.85	4.95
	Nov	0.12	0.50	3.25	0.21	0.05	1.32	3.40	5.19	3.99	4.88
	Dec	0.12	0.50	3.25	0.22	0.05	1.38	3.59	5.26	3.89	4.93
2010	Jan	0.11	0.50	3.25	0.20	0.06	1.49	3.73	5.26	3.96	5.03
	Feb	0.13	0.59	3.25	0.19	0.11	1.40	3.69	5.35	3.91	4.99
	Mar	0.16	0.75	3.25	0.23	0.15	1.51	3.73	5.27	3.91	4.97
	Apr	0.20	0.75	3.25	0.30	0.16	1.64	3.85	5.29	3.95	5.10
	May	0.20	0.75	3.25	0.45	0.16	1.32	3.42	4.96	3.75	4.89
	Jun	0.18	0.75	3.25	0.52	0.12	1.17	3.20	4.88	3.81	4.74
	Jul	0.18	0.75	3.25	0.41	0.16	0.98	3.01	4.72	3.69	4.56
	Aug	0.19	0.75	3.25	0.32	0.16	0.78	2.70	4.49	3.44	4.43
	Sep	0.19	0.75	3.25	0.28	0.15	0.74	2.65	4.53	3.63	4.35
	Oct	0.19	0.75	3.25	0.27	0.13	0.57	2.54	4.68	3.62	4.23
	Nov	0.19	0.75	3.25	0.27	0.14	0.67	2.76	4.87		4.30

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

		M1	MZM	M2	M3*
Percent change at an annual rate					
2005		2.04	2.11	4.25	5.97
2006		0.19	4.34	5.26	4.95
2007		-0.15	9.06	6.29	
2008		4.42	14.05	7.12	
2009		14.10	9.53	7.86	
<hr/>					
2008	1	2.63	15.74	7.90	
	2	2.30	13.36	6.05	
	3	8.95	5.03	4.97	
	4	29.93	10.79	14.45	
2009	1	12.56	17.96	12.43	
	2	10.85	5.84	2.72	
	3	7.89	1.43	1.08	
	4	8.15	0.59	3.73	
2010	1	3.82	-4.28	-0.10	
	2	1.59	-4.55	1.83	
	3	7.49	5.65	4.58	
<hr/>					
2008	Nov	36.84	17.18	7.88	
	Dec	67.35	31.91	28.70	
<hr/>					
2009	Jan	-13.92	17.18	8.93	
	Feb	-7.19	9.08	5.77	
	Mar	2.58	9.30	7.64	
	Apr	23.72	-1.70	-6.51	
	May	0.00	13.59	10.38	
	Jun	28.07	2.70	2.32	
	Jul	2.76	-0.21	-1.42	
	Aug	-1.11	-4.88	-3.31	
	Sep	9.02	4.41	5.64	
	Oct	11.11	0.42	4.66	
	Nov	8.10	0.90	4.41	
	Dec	6.46	-1.64	2.74	
<hr/>					
2010	Jan	-11.21	-8.75	-7.97	
	Feb	24.31	0.64	8.43	
	Mar	-1.19	-11.20	-3.62	
	Apr	-8.19	-11.57	-4.13	
	May	3.29	6.63	11.65	
	Jun	10.86	2.33	4.42	
	Jul	-3.50	2.31	-0.18	
	Aug	18.44	9.86	6.43	
	Sep	15.72	12.65	8.28	
	Oct	9.47	10.09	7.99	
	Nov	35.30	7.62	5.09	

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

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

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

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

where duration is approximated as $D(m) = (1 - e^{-R(m) \times m})/R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). **Rates on 3-Month Eurodollar Futures and Rates on Selected Federal Funds Futures Contracts** trace through time the yield on three specific contracts. **Rates on Federal Funds Futures on Selected Dates** displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. **Inflation-Indexed Treasury Securities and Yield Spreads** are those plotted on page 3. **Inflation-Indexed 10-Year Government Notes** shows the yield of an inflation-indexed note that is scheduled to mature in approximately (but not greater than) 10 years. The current French note has a maturity date of 7/25/2015, the current U.K. note has a maturity date of 4/16/2020, and the current U.S. note has a maturity date of 5/15/2020. **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/.