

## Why Do People Dislike Inflation?

Economists have often puzzled over the costs of inflation. Di Tella, MacCulloch, and Oswald (2001) present cross-country survey evidence that people's happiness or life satisfaction is adversely related to their country's inflation rate. Also, survey evidence presented by Shiller (1997) shows that people from all walks of life dislike inflation because they almost unanimously think that inflation erodes their standard of living.

Yet standard economic theory predicts that the costs of inflation are small. The argument is that nominal income can adjust for anticipated inflation, leaving people almost as well off as they would have been in the absence of inflation except for the opportunity cost of holding non-interest-bearing cash. Hence, economists commonly measure the cost of inflation as the area under the money demand function, which reflects the deadweight loss of holding cash instead of interest-bearing assets. By this measure, inflation has surprisingly small costs: about 0.1 to 0.8 percent of consumption when the inflation rate is 10 percent per year. The result is robust regardless of whether aggregate data or household data are used to estimate the demand function of money (see, e.g., Attanasio, Guiso, and Jappelli, 2002). If ordinary people have this cost of inflation in mind, they should not care much about moderate inflation. Yet Shiller (1997) found that the word "inflation" is the most common economic term among the general public, more common even than "unemployment."

Why do economists and ordinary people view the costs of inflation so differently? There are at least two plausible explanations. One is that standard economic measures may have failed to fully capture the costs of inflation. Another is that people are myopic and fail to see the connections between the costs and the benefits of inflation.

Wen (2010) argues that the standard economic measure of the costs of inflation does not take into account the insurance (buffer-stock) function of money. Since inflation destroys the value of money and reduces the demand for cash, it exposes people (especially low-income households) to more consumption variability than otherwise. Based on this concept, Wen finds that the cost of 10 percent annual inflation is equivalent to the loss of 8 to 12 percent of consumption (or income).

The second explanation is that ordinary people, unlike economists, do not connect the costs of inflation with its benefits. For example, Shiller (1997) believes that people realize how inflation erodes the purchasing power of a dollar but do not realize that inflation also raises their nominal income. As another example, people may fail to differentiate between inflation and

the causes of inflation. When a government finances spending by printing money, the general price level rises and people can buy less. That is, the government taxes people through inflation. Therefore, higher government spending is the true cause of the lowered living standard. However, when economists calculate the costs of inflation, they compare the cost of raising revenue through inflation to the cost of raising revenue with some alternative tax that does not distort the economy—called a "lump-sum" tax. Such a comparison isolates the net cost of inflation associated purely with the increase in the money stock. This comparison is equivalent to asking people "What would be the cost of inflation if the government prints and hands out money to people instead of spending the money itself?"

The reality, of course, is that the government never hands out money to people on the street when it increases the money supply. That is, inflation is seldom caused by lump-sum transfers but is often caused by higher government spending programs. For example, Calvo and Guidotti (1993, p. 683) conclude that "public finance considerations are major determinants of monetary policy as well as the proximate cause of inflation in many countries." In particular, using data from both developing and developed countries, they show that high-inflation countries carry higher government deficits.

Thus, according to the theory of myopic behavior, when trying to understand the costs of inflation, people may miss not only the connection between inflation and increases in nominal income but also the connection between inflation and the benefits gained from government spending programs. So, the reason why people dislike inflation is similar to why they dislike income taxation.

—Yi Wen

Attanasio, Orazio; Guiso, Luigi and Jappelli, Tullio. "The Demand for Money, Financial Innovation, and the Welfare Cost of Inflation: An Analysis with Household Data." *Journal of Political Economy*, April 2002, 110(2), pp. 317-51.

Calvo, Guillermo A. and Guidotti, Pablo E. "On the Flexibility of Monetary Policy: The Case of the Optimal Inflation Tax." *Review of Economic Studies*, July 1993, 60(3), pp. 667-87.

Di Tella, Rafael; MacCulloch, Robert J. and Oswald, Andrew J. "Preferences over Inflation and Unemployment: Evidence from Surveys of Happiness." *American Economic Review*, March 2001, 91(1), pp. 335-41.

Shiller, Robert J. "Why Do People Dislike Inflation?" in Christina D. Romer and David H. Romer, eds., *Reducing Inflation: Motivation and Strategy*. Chap. 1. Chicago: University of Chicago Press, 1997, pp. 13-65.

Wen, Yi. "Liquidity Demand and Welfare in a Heterogeneous-Agent Economy." Working Paper 2010-009A, Federal Reserve Bank of St. Louis, March 2010; <http://research.stlouisfed.org/wp/2010/2010-009.pdf>.

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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](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:  $[(x_t/x_{t-1})-1] \times 1200$ . Note that this differs from *National Economic Trends*. In that publication, monthly percent changes are compounded and expressed as annual growth rates.
4. The *percent change from year ago* refers to the percent change from the same period in the previous year. For example, the percent change from year ago in  $x$  between month  $t-12$  and the current month  $t$  is:  $[(x_t/x_{t-12})-1] \times 100$ .

We welcome your comments addressed to:

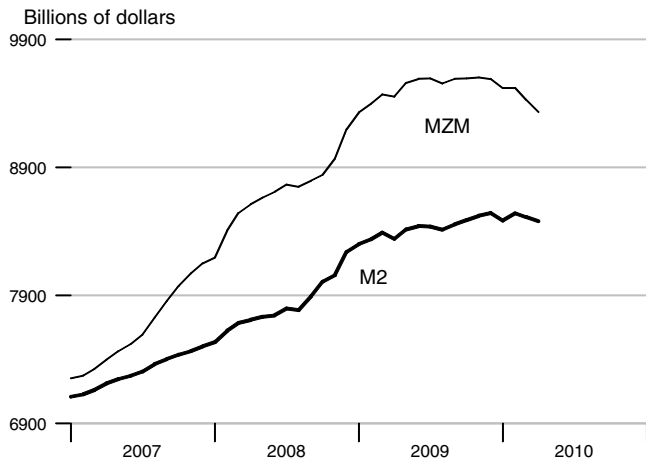
Editor, *Monetary Trends*  
Research Division  
Federal Reserve Bank of St. Louis  
P.O. Box 442  
St. Louis, MO 63166-0442

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.

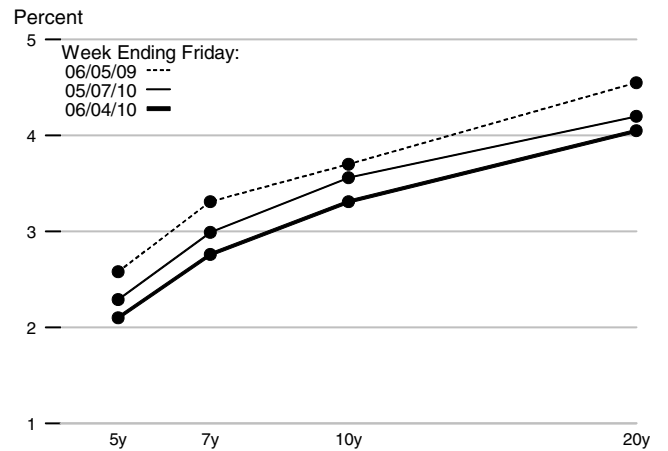
or to:

stlsFRED@stls.frb.org

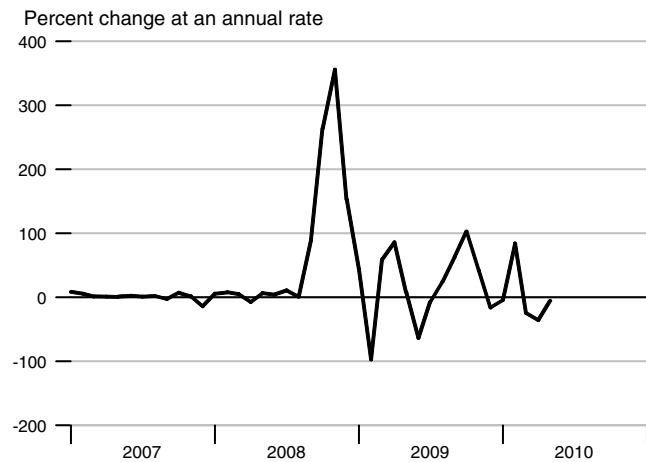
### M2 and MZM



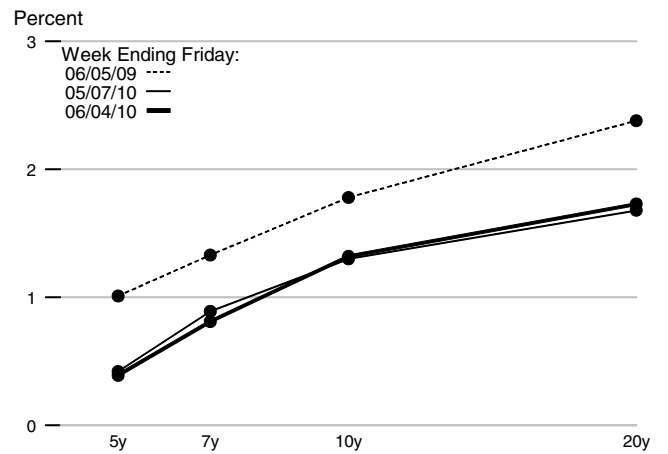
### Treasury Yield Curve



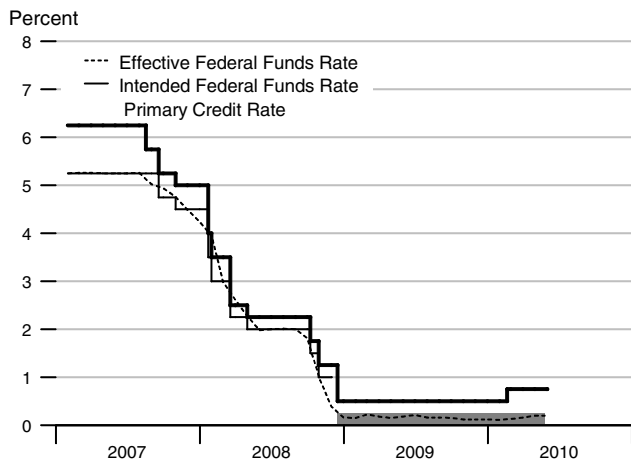
### Adjusted Monetary Base



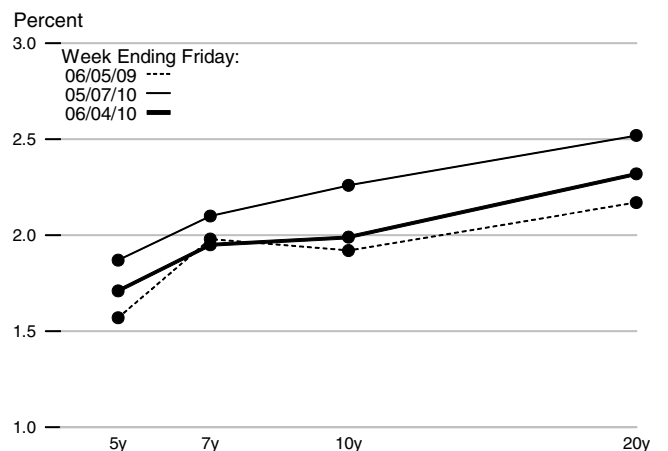
### Real Treasury Yield Curve



### Reserve Market Rates



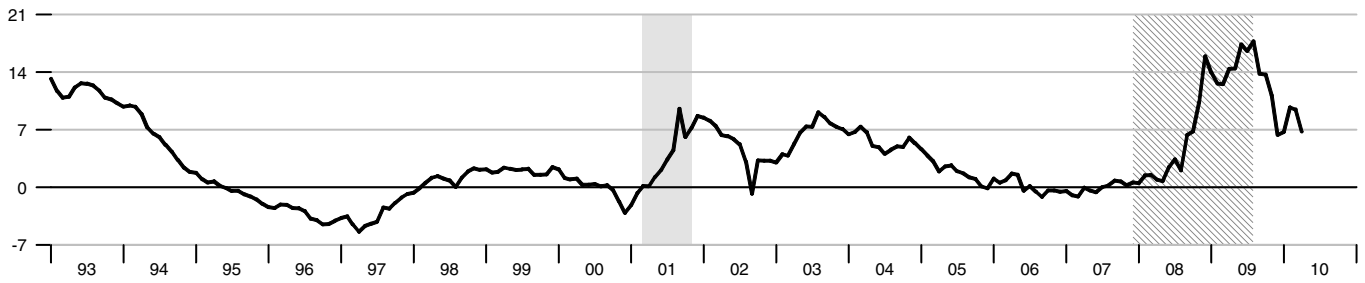
### Inflation-Indexed Treasury Yield Spreads



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

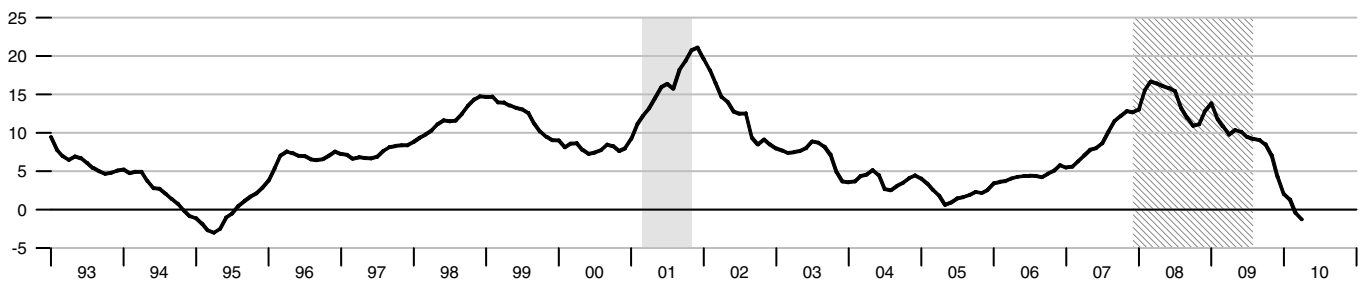
**M1**

Percent change from year ago



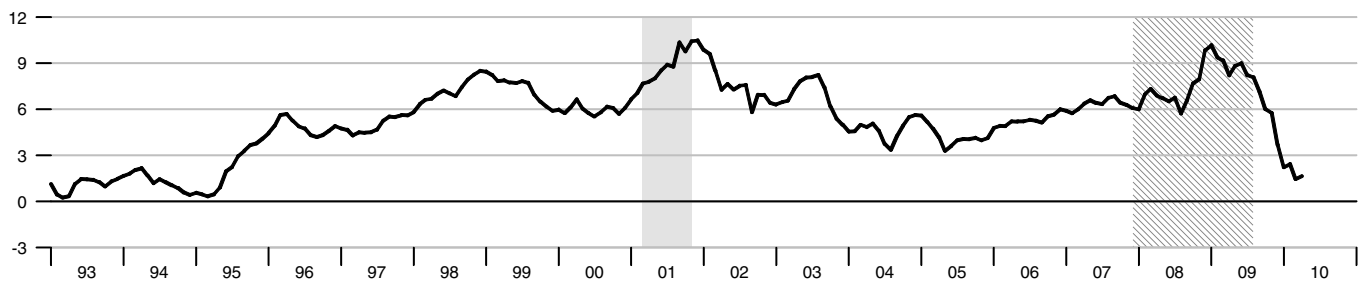
**M2M**

Percent change from year ago



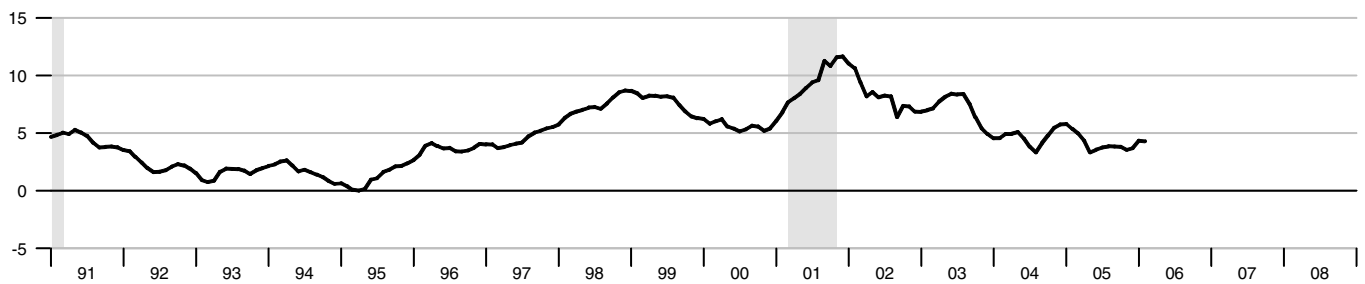
**M2**

Percent change from year ago



**Monetary Services Index - M2\*\***

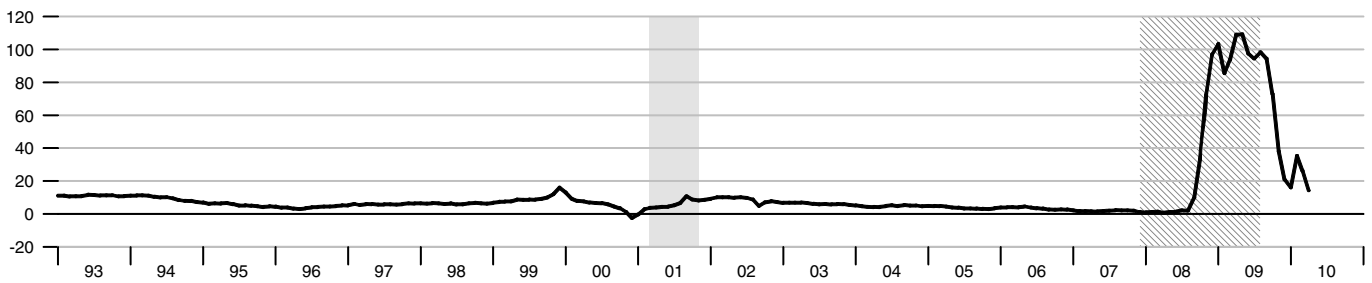
Percent change from year ago



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

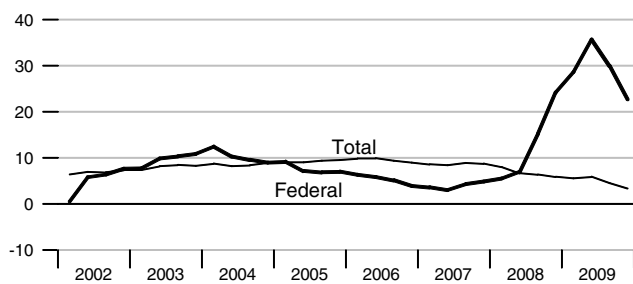
### Adjusted Monetary Base

Percent change from year ago



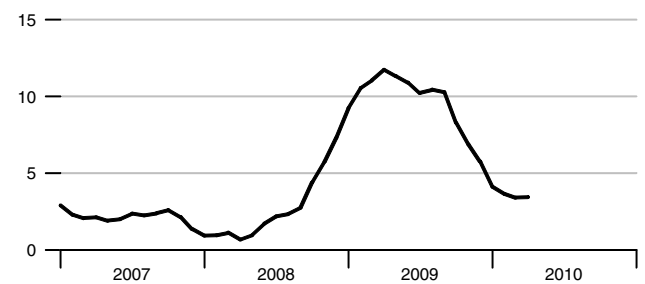
### Domestic Nonfinancial Debt

Percent change from year ago



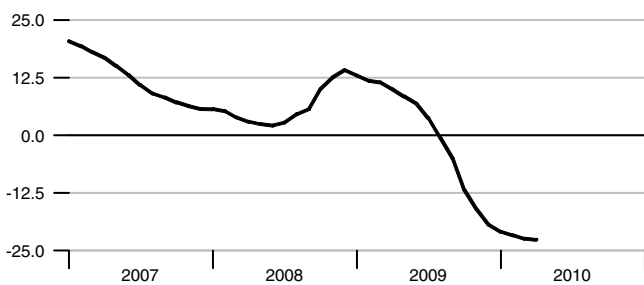
### Currency Held by the Nonbank Public

Percent change from year ago



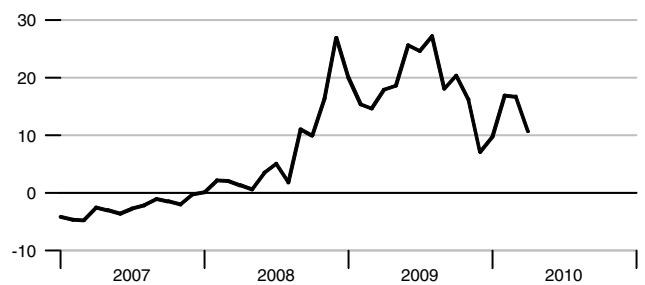
### Small Denomination Time Deposits\*

Percent change from year ago



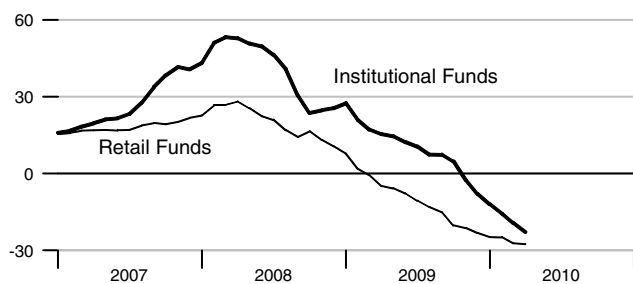
### Checkable Deposits

Percent change from year ago



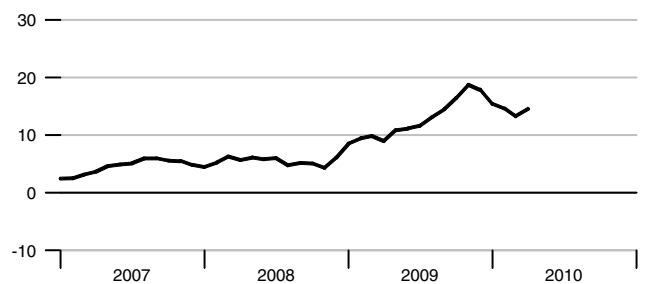
### Money Market Mutual Fund Shares

Percent change from year ago



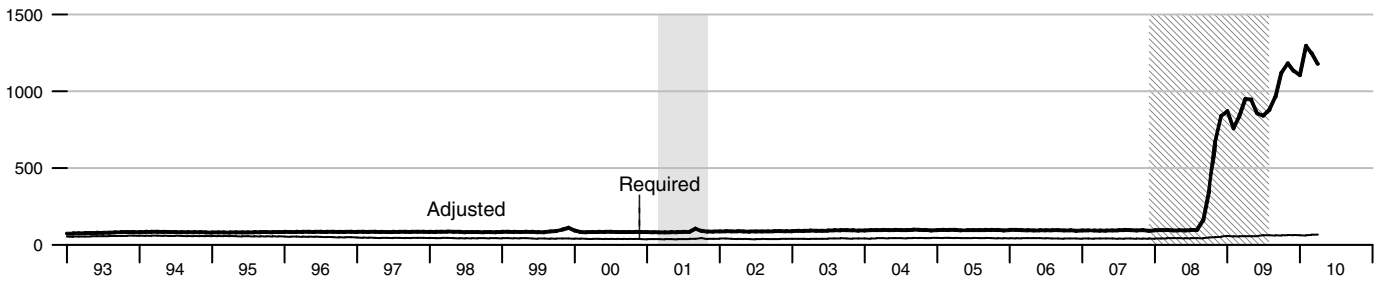
### Savings Deposits

Percent change from year ago



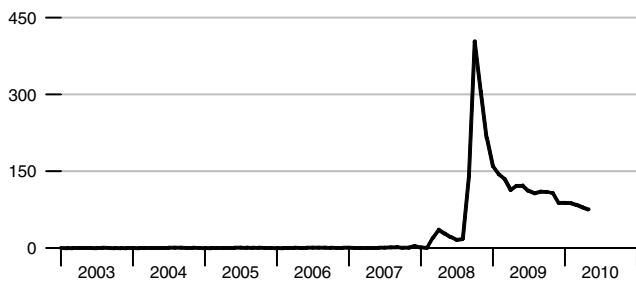
### Adjusted and Required Reserves

Billions of dollars



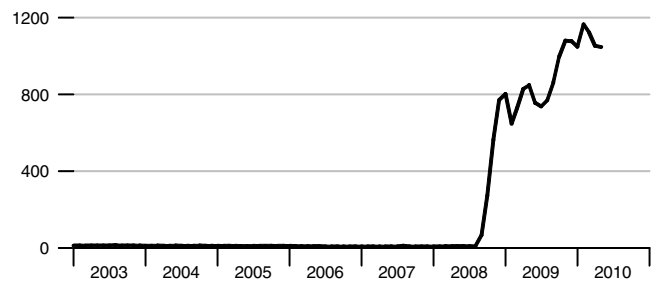
### Total Borrowings, nsa

Billions of dollars



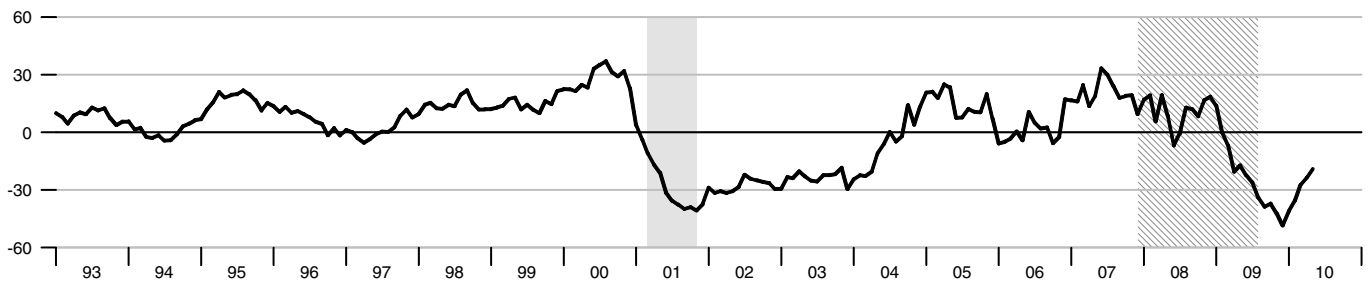
### Excess Reserves plus RCB Contracts

Billions of dollars



### Nonfinancial Commercial Paper

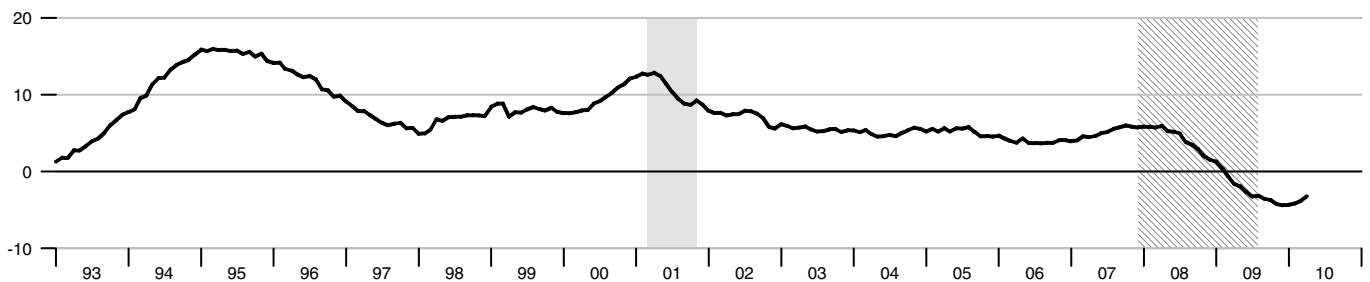
Percent change from year ago



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>.

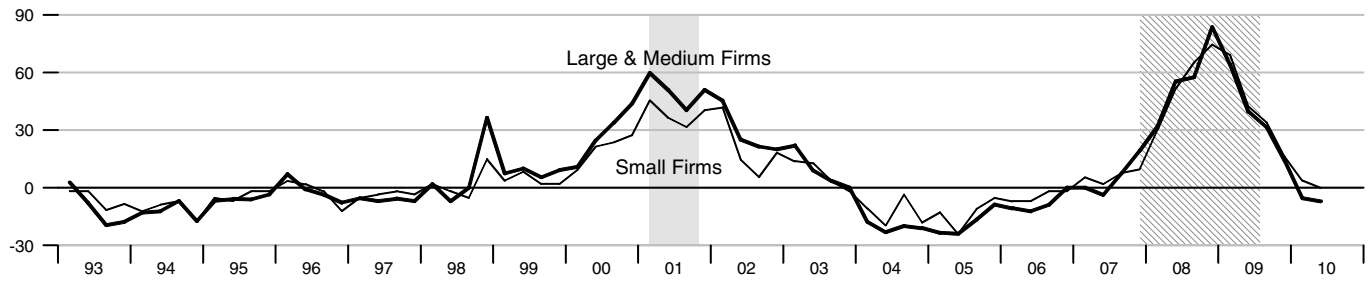
### Consumer Credit

Percent change from year ago



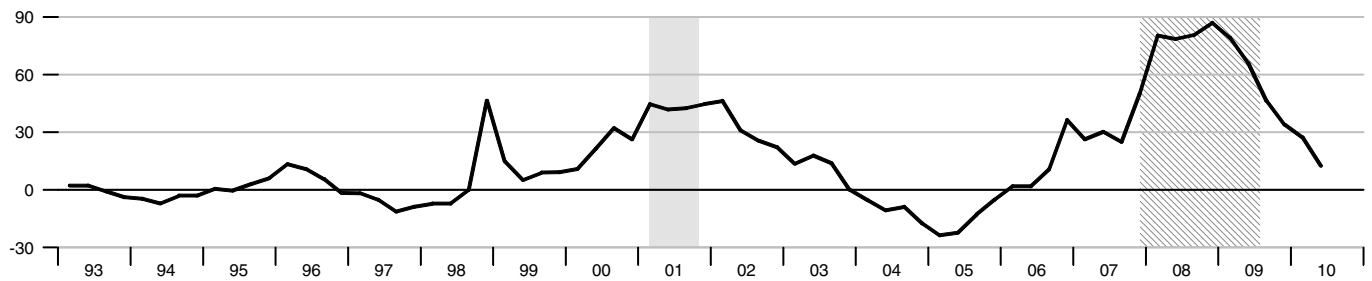
**Net Percentage of Domestic Banks Tightening Standards for Commercial and Industrial Loans**

Percentage



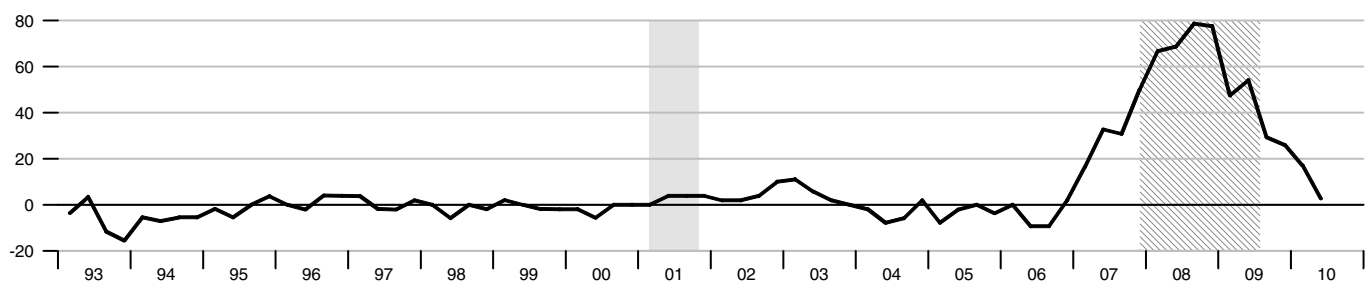
**Net Percentage of Domestic Banks Tightening Standards for Commercial Real Estate Loans**

Percentage



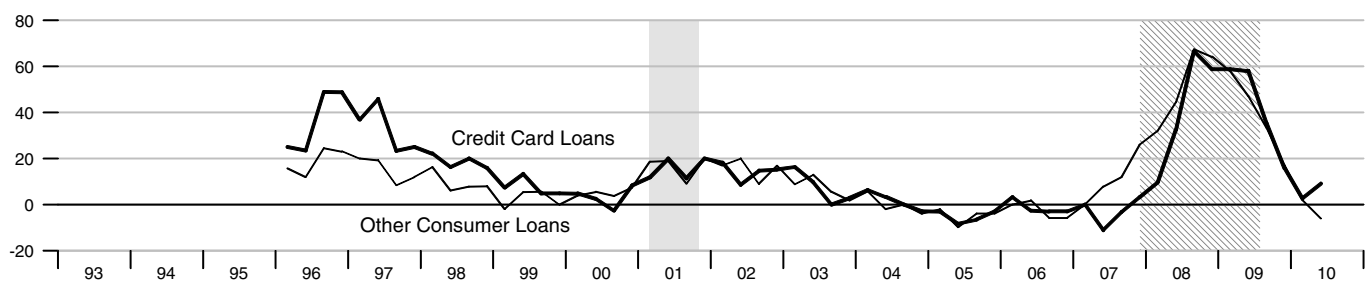
**Net Percentage of Domestic Banks Tightening Standards for Residential Mortgage Loans**

Percentage

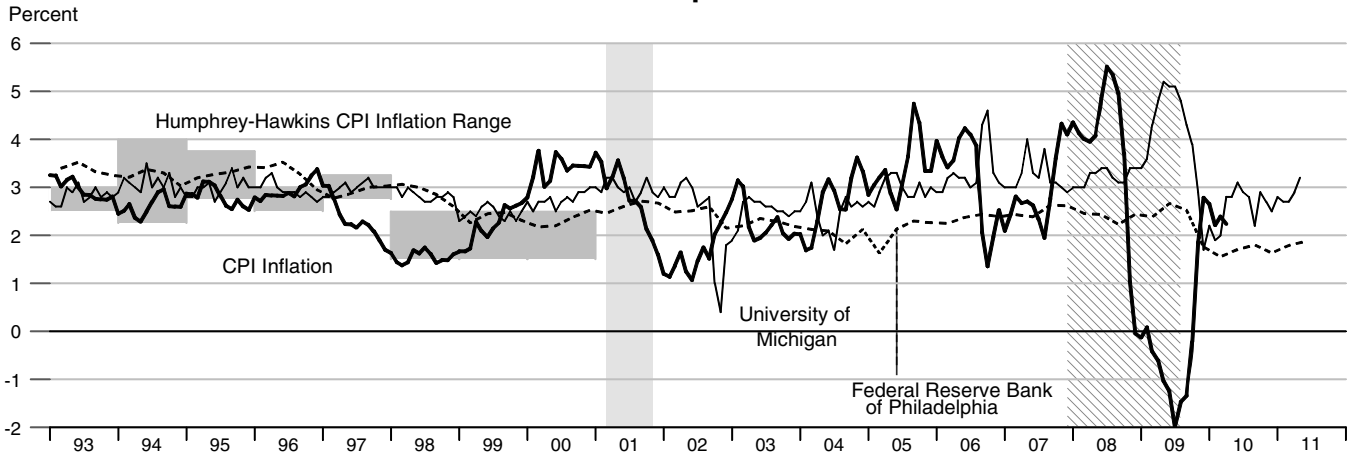


**Net Percentage of Domestic Banks Tightening Standards for Consumer Loans**

Percentage

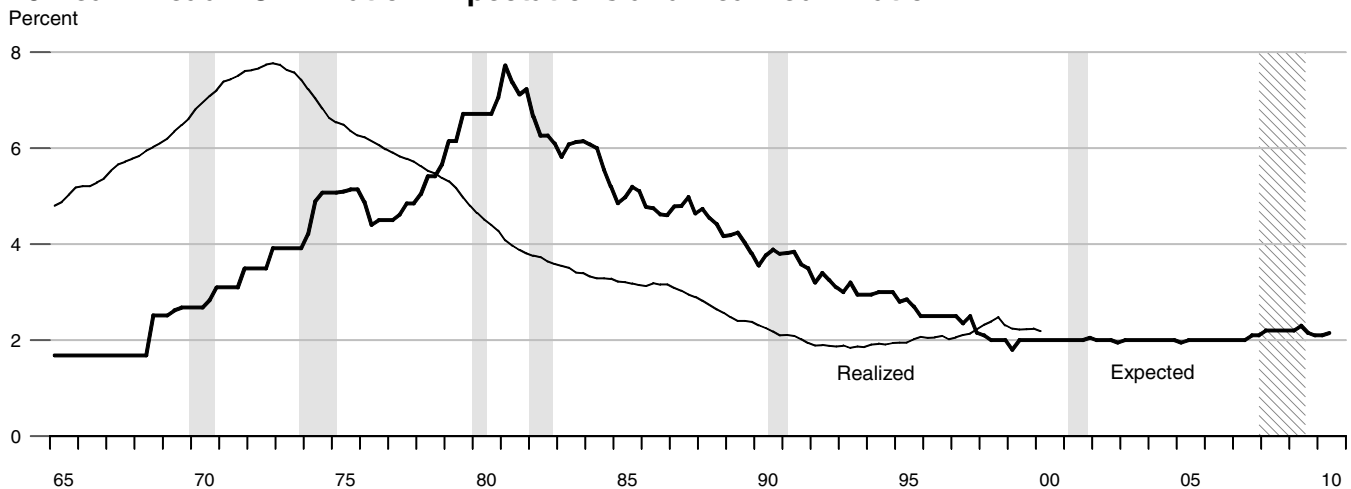


### CPI Inflation and 1-Year-Ahead CPI Inflation Expectations



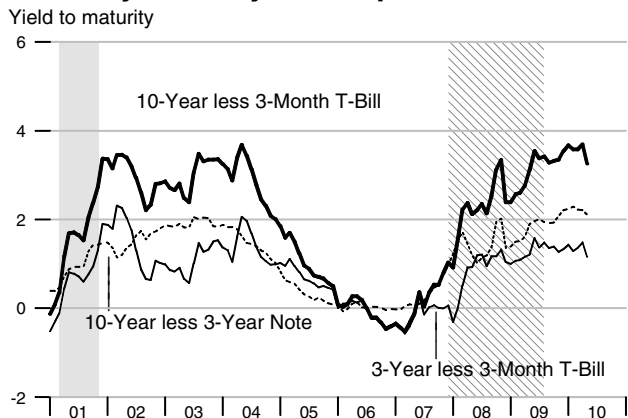
The shaded region shows the Humphrey-Hawkins inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph.

### 10-Year Ahead PCE Inflation Expectations and Realized Inflation

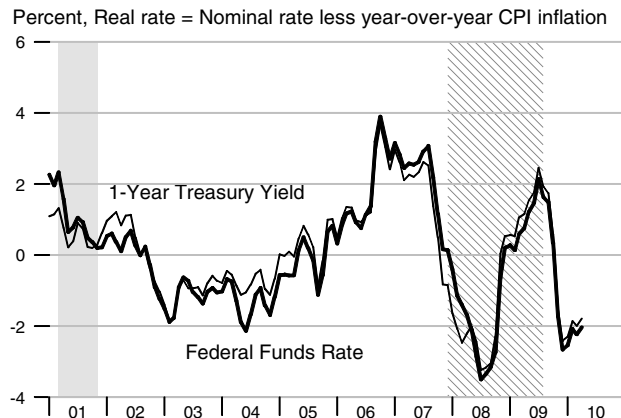


See the notes section for an explanation of the chart.

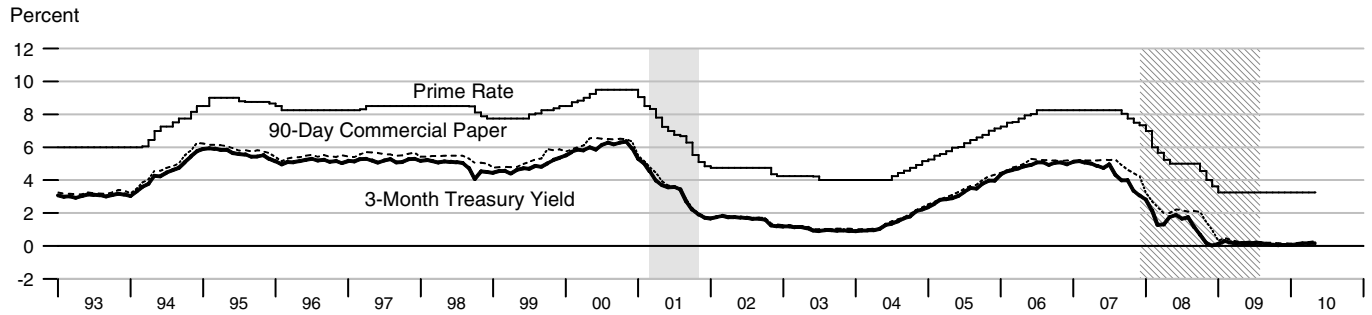
### Treasury Security Yield Spreads



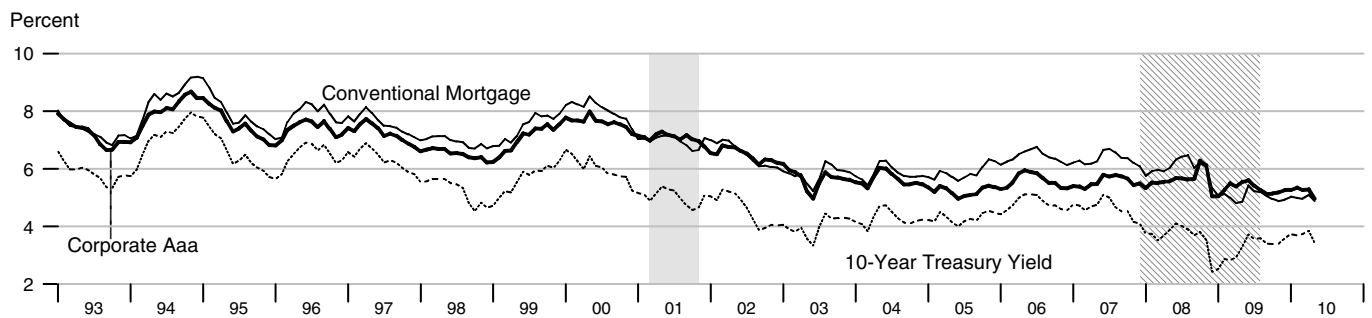
### Real Interest Rates



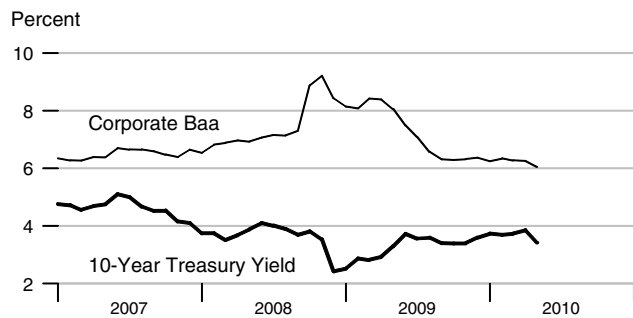
### Short-Term Interest Rates



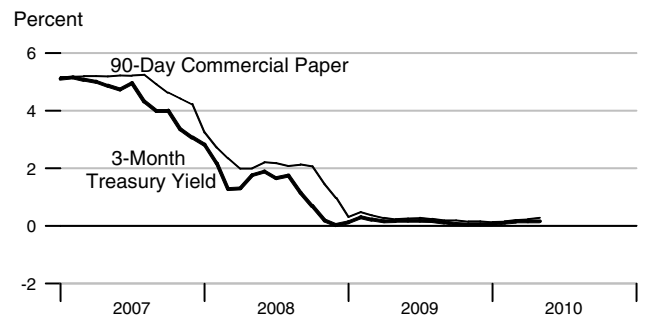
### Long-Term Interest Rates



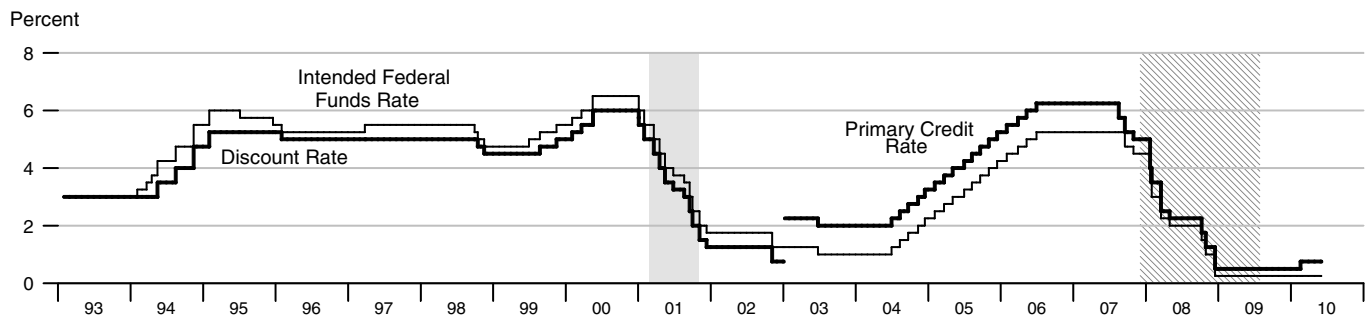
### Long-Term Interest Rates



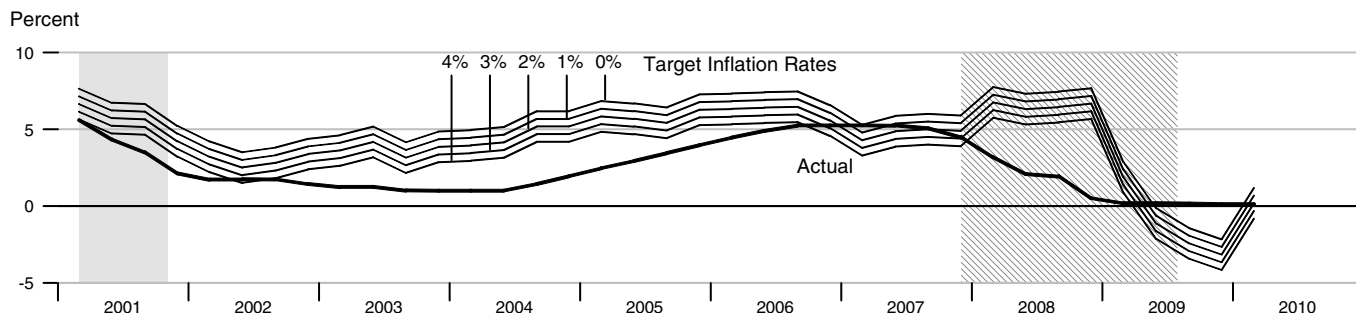
### Short-Term Interest Rates



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



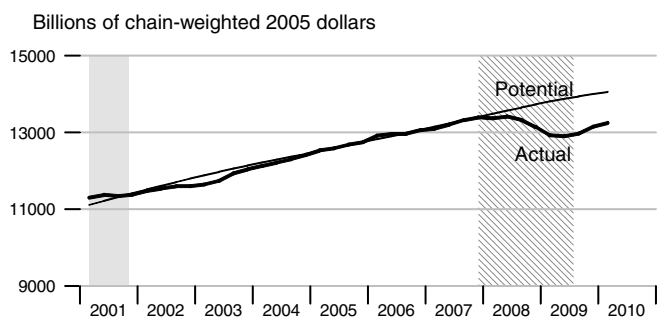
### Federal Funds Rate and Inflation Targets



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

### Components of Taylor's Rule

#### Actual and Potential Real GDP

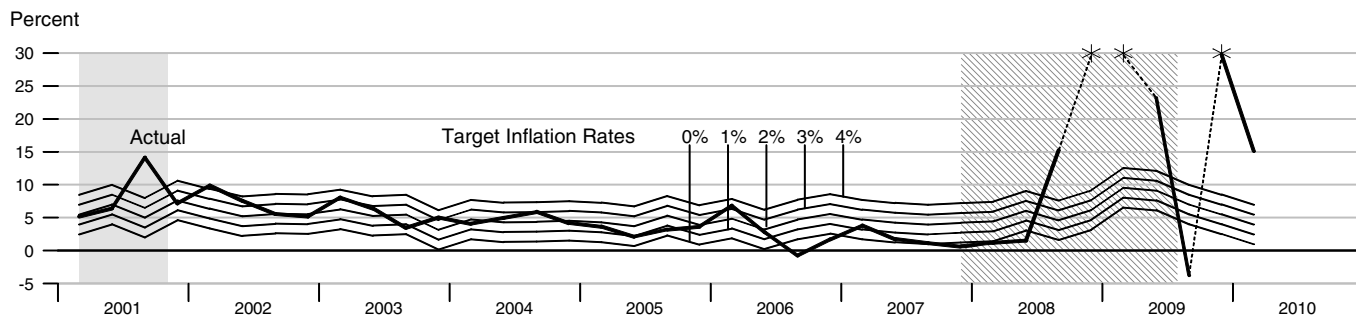


See notes section for further explanation.

#### PCE Inflation



### Monetary Base Growth and Inflation Targets

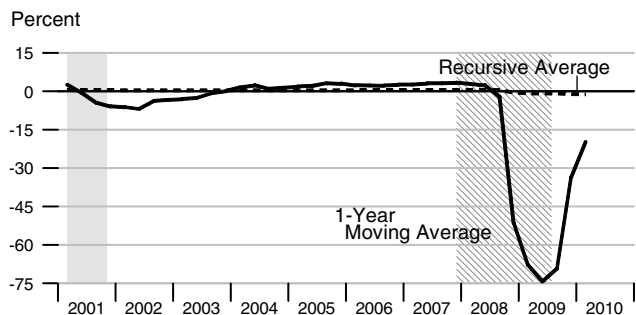


Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter.

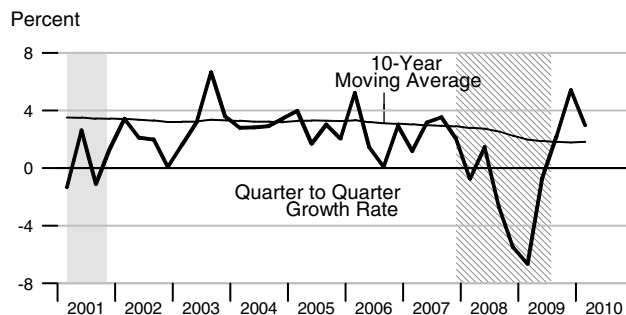
\*Actual values for 2008:Q4, 2009:Q1, and 2009:Q4 are 188.38 percent, 60.77 percent, and 56.51, respectively.

### Components of McCallum's Rule

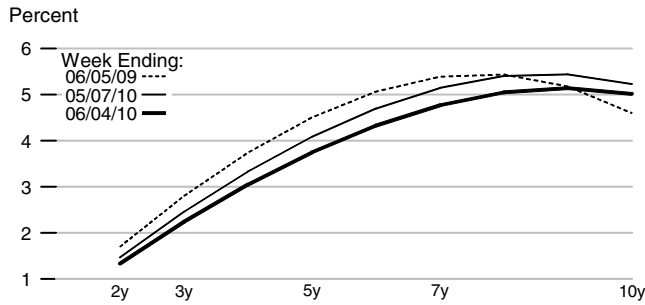
#### Monetary Base Velocity Growth



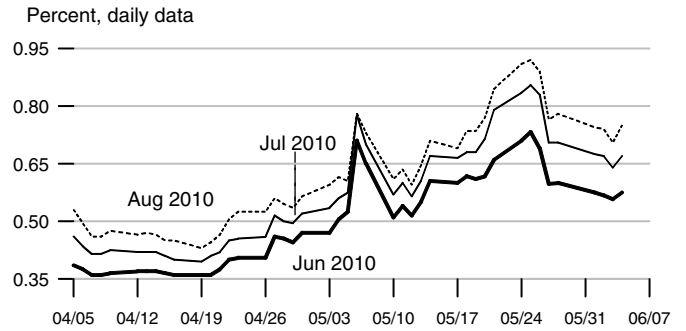
#### Real Output Growth



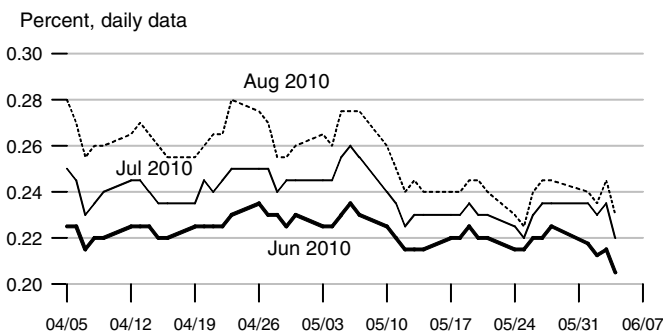
### Implied One-Year Forward Rates



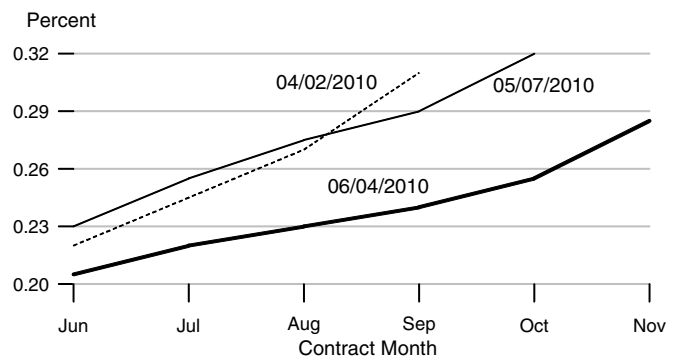
### Rates on 3-Month Eurodollar Futures



### Rates on Selected Federal Funds Futures Contracts

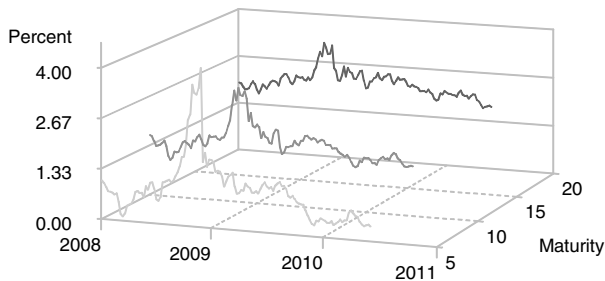


### Rates on Federal Funds Futures on Selected Dates



### Inflation-Indexed Treasury Securities

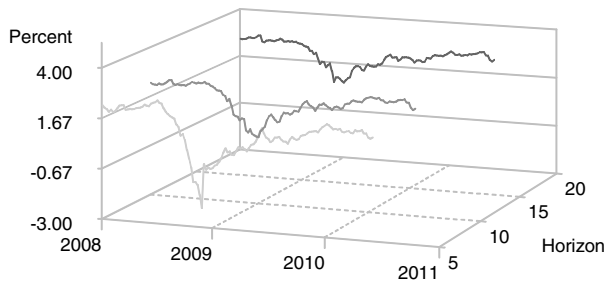
Weekly data



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

### Inflation-Indexed Treasury Yield Spreads

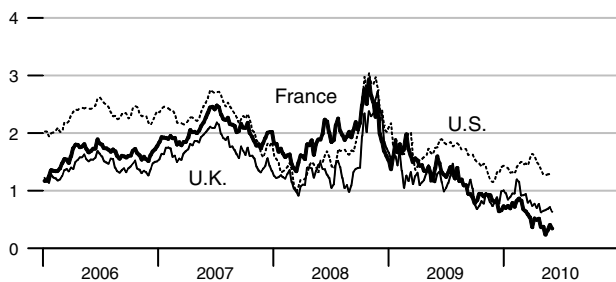
Weekly data



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

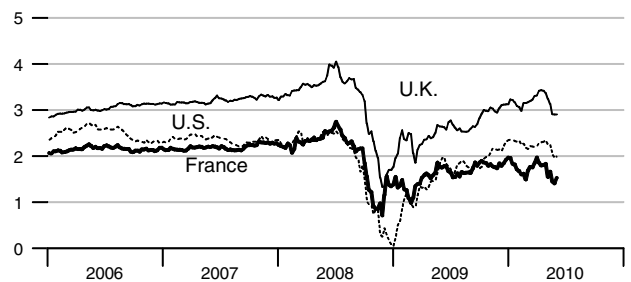
### Inflation-Indexed 10-Year Government Notes

Percent, weekly data



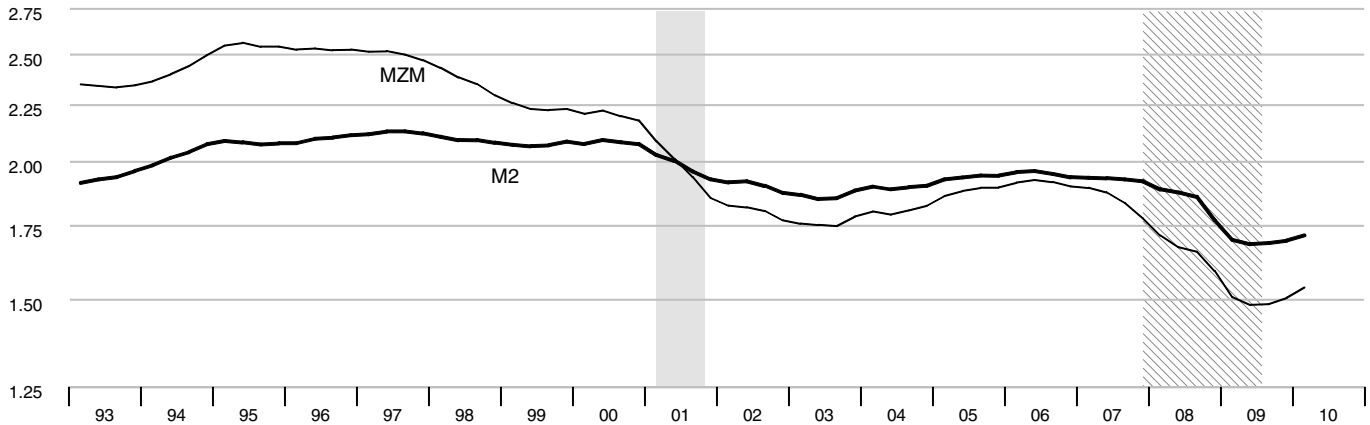
### Inflation-Indexed 10-Year Government Yield Spreads

Percent, weekly data



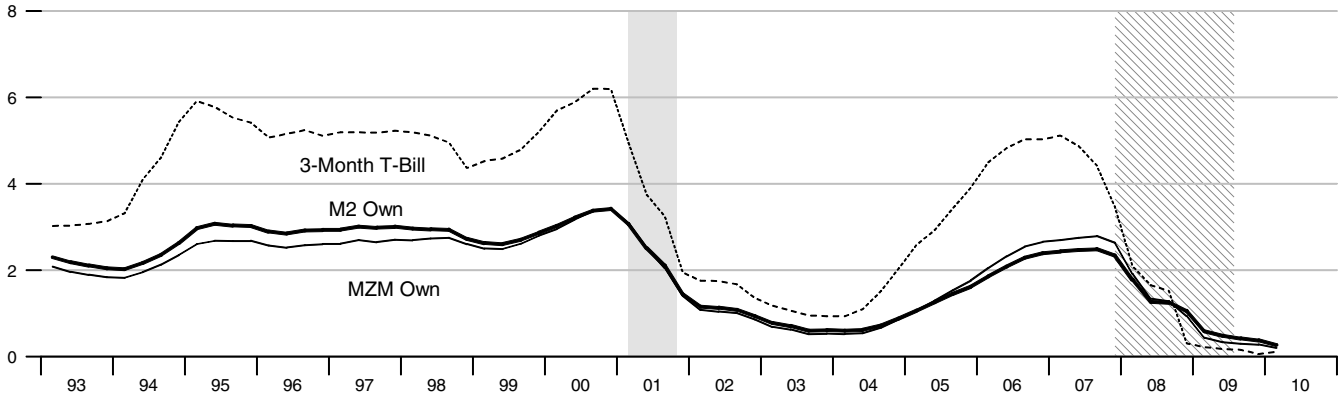
Velocity

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



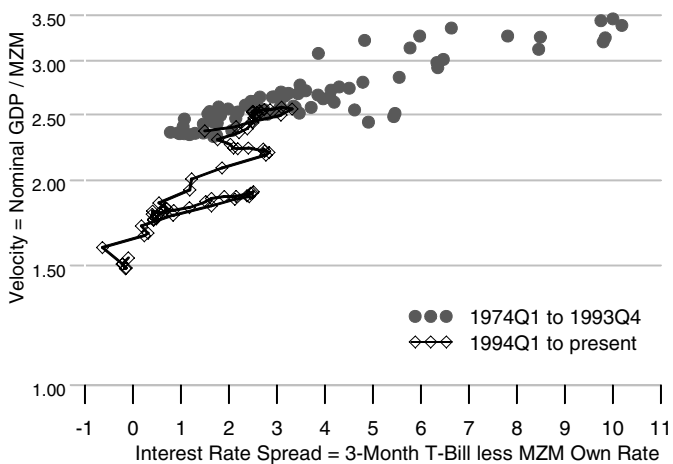
Interest Rates

Percent



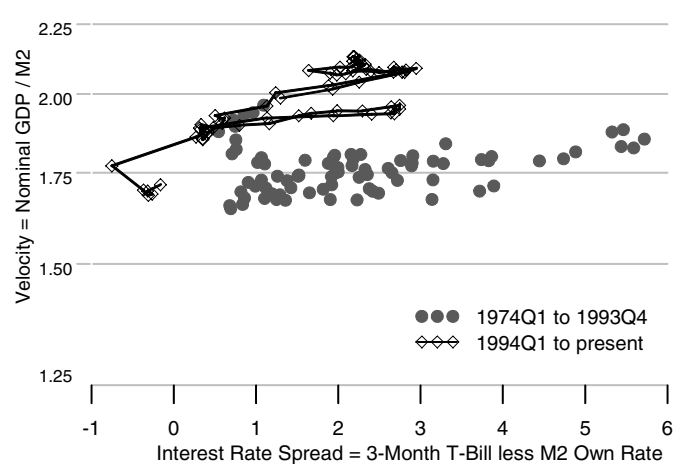
MZM Velocity and Interest Rate Spread

Ratio Scale



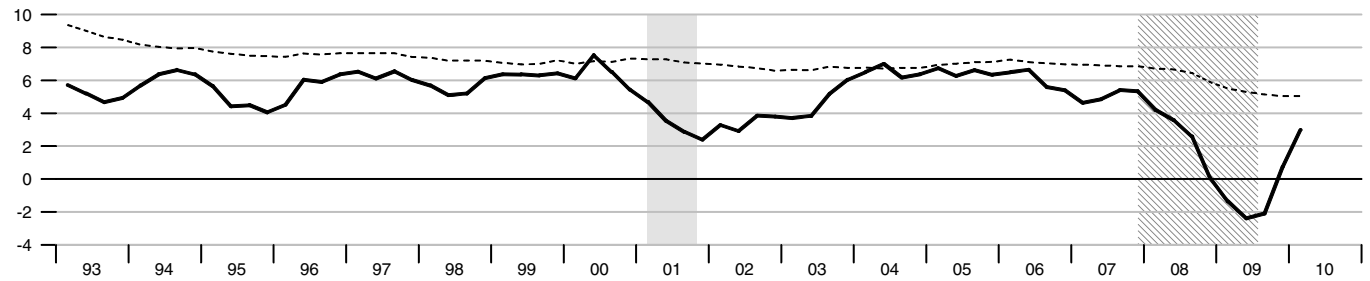
M2 Velocity and Interest Rate Spread

Ratio Scale



### Gross Domestic Product

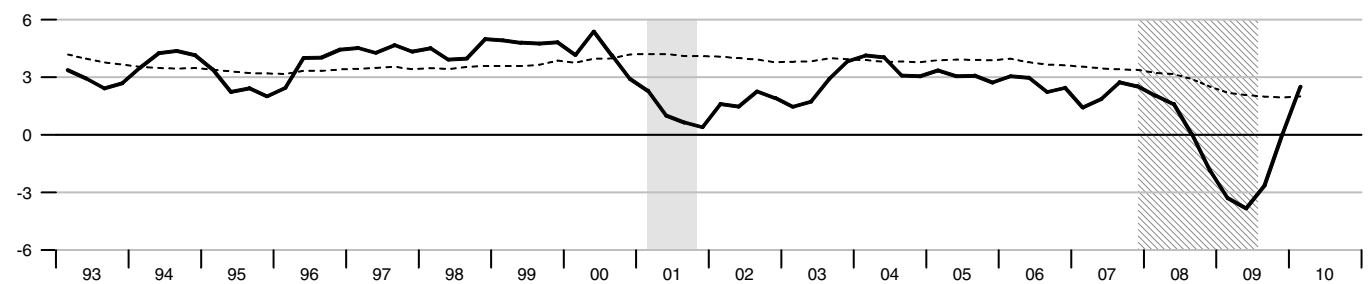
Percent change from year ago



Dashed lines indicate 10-year moving averages.

### Real Gross Domestic Product

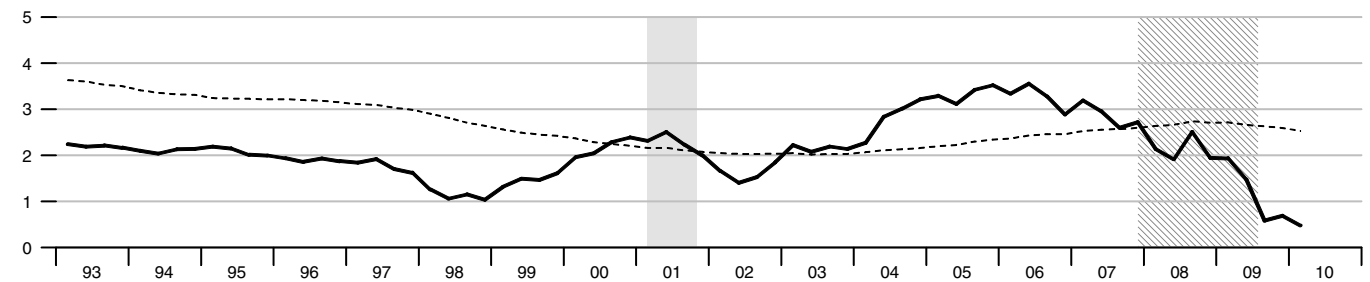
Percent change from year ago



Dashed lines indicate 10-year moving averages.

### Gross Domestic Product Price Index

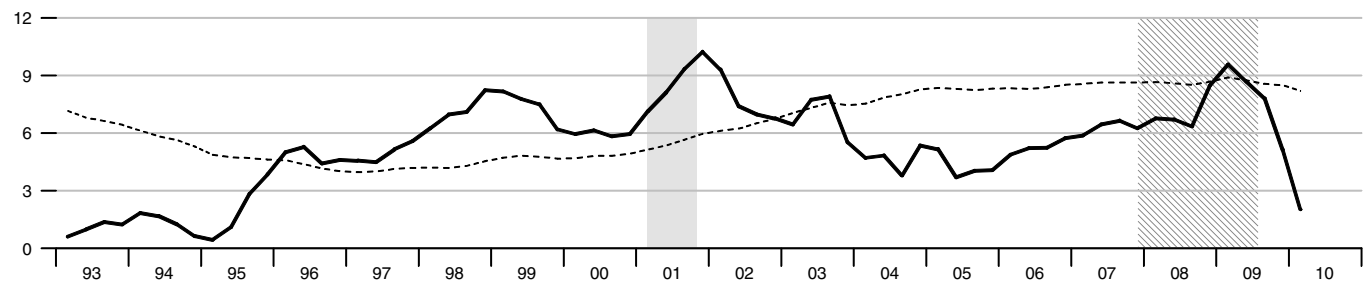
Percent change from year ago



Dashed lines indicate 10-year moving averages.

### M2

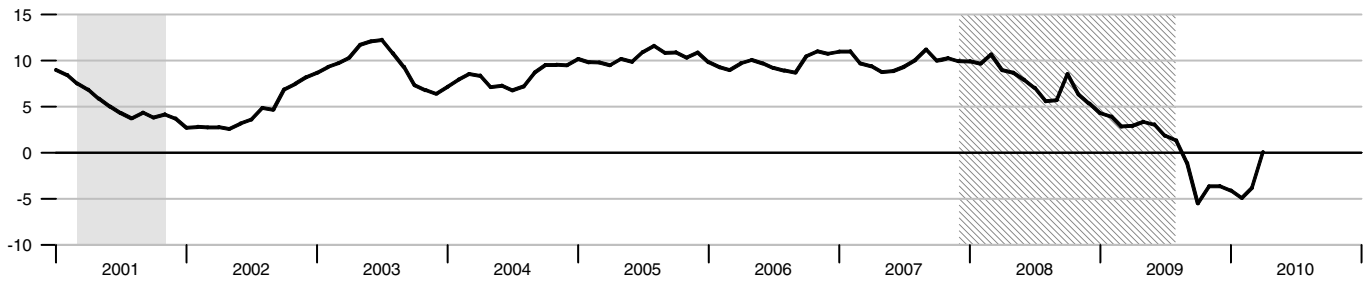
Percent change from year ago



Dashed lines indicate 10-year moving averages.

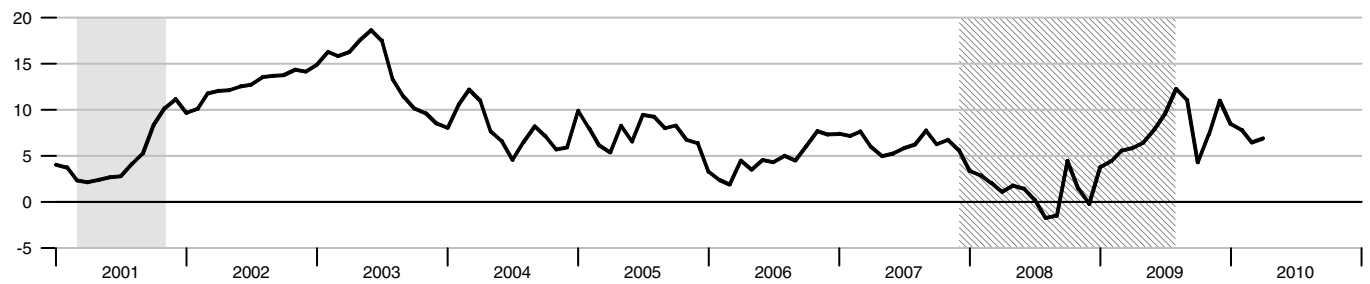
**Bank Credit**

Percent change from year ago



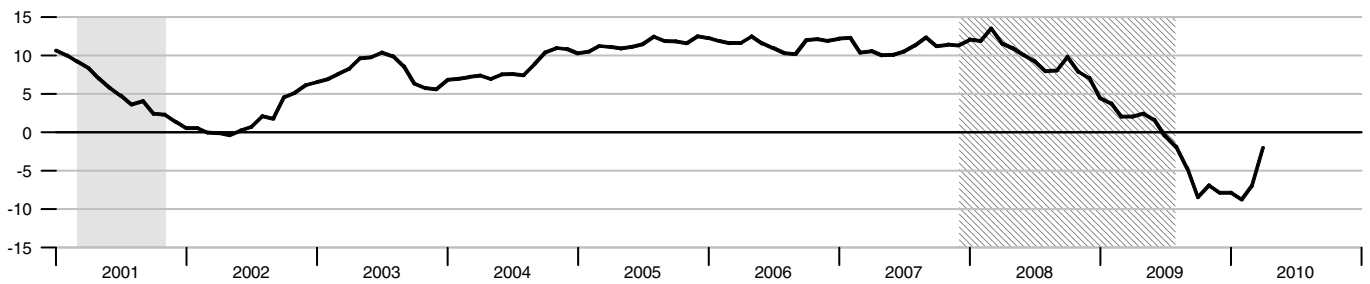
**Investment Securities in Bank Credit at Commercial Banks**

Percent change from year ago



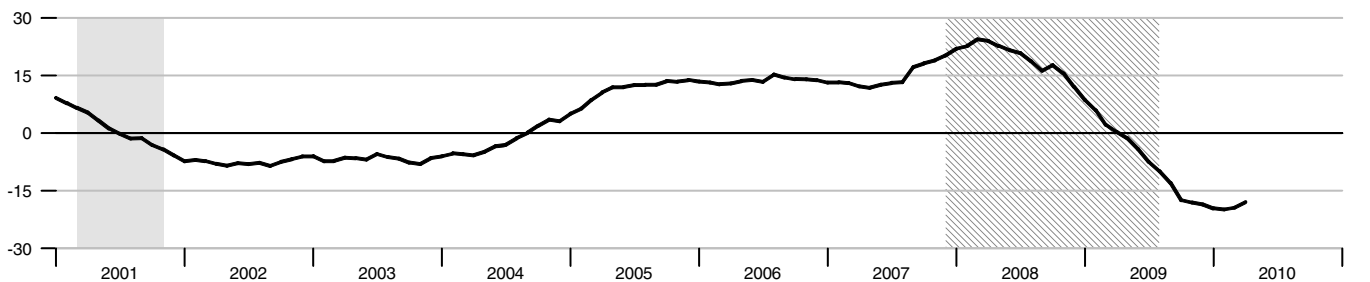
**Total Loans and Leases in Bank Credit at Commercial Banks**

Percent change from year ago

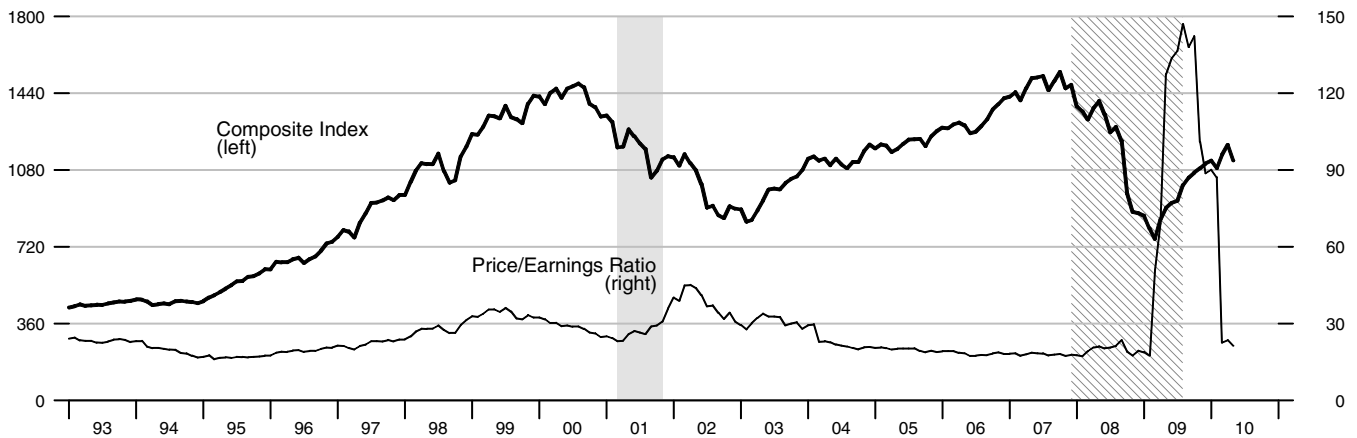


**Commercial and Industrial Loans at Commercial Banks**

Percent change from year ago



### Standard & Poor's 500

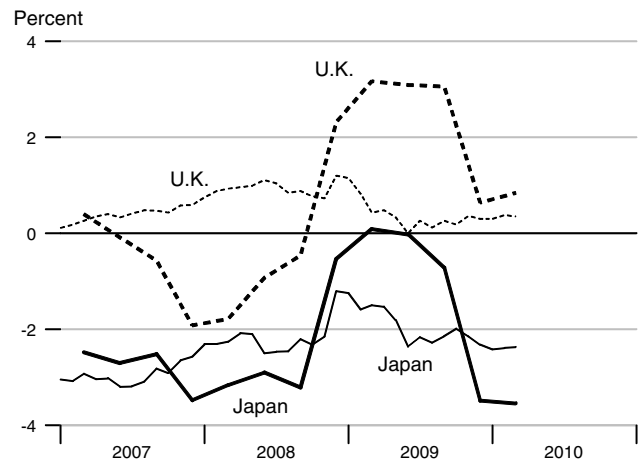
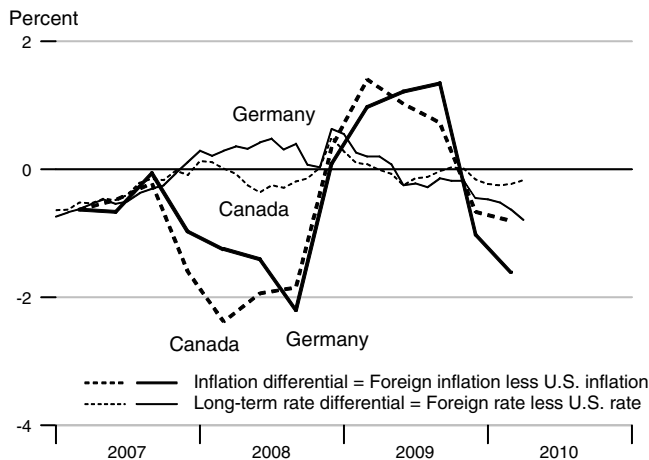


### Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2009Q2	2009Q3	2009Q4	2010Q1	Feb10	Mar10	Apr10	May10
United States	-0.97	-1.60	1.46	2.42	3.69	3.73	3.85	3.42
Canada	0.06	-0.87	0.79	1.61	3.44	3.50	3.68	.
France	-0.21	-0.42	0.36	1.32	3.50	3.44	.	.
Germany	0.25	-0.25	0.44	0.81	3.17	3.10	3.06	.
Italy	0.85	0.12	0.65	1.29	4.05	3.94	4.00	.
Japan	-0.98	-2.31	-2.03	-1.12	1.30	1.36	.	.
United Kingdom	2.12	1.46	2.09	3.26	4.07	4.08	.	.

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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		1371.763	6708.425	6522.507	9786.477	7012.652	806.628	96.560	343.539
2006		1374.373	6999.309	6866.220	10270.74	7694.938	835.039	94.913	
2007		1373.157	7633.169	7299.638		8460.781	850.567	94.184	
2008		1433.316	8704.724	7817.420		9123.269	1009.796	232.198	
2009		1628.703	9528.546	8424.286		9191.346	1796.608	944.860	
2008	1	1385.940	8382.125	7614.067		9000.092	856.293	96.144	
	2	1393.903	8661.973	7729.096		9003.683	859.364	94.409	
	3	1424.884	8770.769	7824.651		9075.594	892.790	117.867	
	4	1528.539	9004.027	8101.864		9413.706	1430.736	620.373	
2009	1	1566.702	9399.705	8343.187		9331.745	1663.090	820.776	
	2	1608.877	9536.079	8400.003		9284.243	1763.779	917.211	
	3	1653.038	9581.461	8435.811		9137.324	1747.162	895.468	
	4	1686.194	9596.940	8518.144		9012.073	2012.399	1145.986	
2010	1	1701.898	9489.561	8512.874		8933.624	2089.181	1216.980	
2008	Apr	1392.088	8612.347	7709.266		8995.764	855.200	94.327	
	May	1391.475	8663.838	7732.773		9012.850	859.886	95.107	
	Jun	1398.147	8709.733	7745.249		9002.435	863.006	93.792	
	Jul	1415.119	8765.882	7796.971		9028.665	870.737	97.042	
	Aug	1400.022	8750.445	7784.956		9032.806	871.497	96.702	
	Sep	1459.511	8795.979	7892.027		9165.311	936.136	159.856	
	Oct	1472.747	8843.102	8007.148		9499.135	1142.178	347.630	
	Nov	1518.123	8969.579	8058.746		9389.305	1480.765	674.096	
	Dec	1594.746	9199.401	8239.699		9352.677	1669.266	839.392	
2009	Jan	1573.816	9330.237	8300.717		9331.390	1730.476	870.242	
	Feb	1562.047	9398.629	8338.448		9352.089	1590.273	758.700	
	Mar	1564.244	9470.250	8390.396		9311.757	1668.522	833.385	
	Apr	1592.662	9453.862	8342.549		9258.241	1787.815	949.455	
	May	1592.981	9561.252	8415.364		9315.180	1799.382	946.297	
	Jun	1640.988	9593.124	8442.097		9279.307	1704.141	855.882	
	Jul	1649.869	9595.753	8437.718		9195.555	1693.710	841.504	
	Aug	1648.335	9556.551	8414.485		9153.588	1728.095	879.620	
	Sep	1660.911	9592.078	8455.231		9062.830	1819.680	965.281	
	Oct	1674.599	9595.379	8487.847		8977.340	1975.382	1122.271	
	Nov	1687.570	9603.646	8522.724		9045.562	2044.532	1182.223	
	Dec	1696.412	9591.795	8543.860		9013.318	2017.282	1133.464	
2010	Jan	1679.828	9519.370	8485.513		8949.238	2010.118	1105.423	
	Feb	1713.674	9520.843	8541.047		8893.953	2150.905	1296.124	
	Mar	1712.192	9428.471	8512.061		8957.682	2106.521	1249.393	
	Apr	1700.695	9333.580	8479.750		9264.242	2044.014	1178.963	

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	
2008	May	1.98	2.25	5.00	2.66	1.76	2.69	3.88	5.57	4.34	6.04	
	Jun	2.00	2.25	5.00	2.76	1.89	3.08	4.10	5.68	4.50	6.32	
	Jul	2.01	2.25	5.00	2.79	1.66	2.87	4.01	5.67	4.44	6.43	
	Aug	2.00	2.25	5.00	2.79	1.75	2.70	3.89	5.64	4.44	6.48	
	Sep	1.81	2.25	5.00	3.59	1.15	2.32	3.69	5.65	4.61	6.04	
	Oct	0.97	1.81	4.56	4.32	0.69	1.86	3.81	6.28	5.05	6.20	
	Nov	0.39	1.25	4.00	2.36	0.19	1.51	3.53	6.12	4.83	6.09	
	Dec	0.16	0.86	3.61	1.77	0.03	1.07	2.42	5.05	5.17	5.33	
	2009	Jan	0.15	0.50	3.25	1.02	0.13	1.13	2.52	5.05	4.64	5.06
		Feb	0.22	0.50	3.25	1.16	0.30	1.37	2.87	5.27	4.56	5.13
		Mar	0.18	0.50	3.25	1.07	0.22	1.31	2.82	5.50	4.74	5.00
		Apr	0.15	0.50	3.25	0.89	0.16	1.32	2.93	5.39	4.48	4.81
May		0.18	0.50	3.25	0.57	0.18	1.39	3.29	5.54	4.26	4.86	
Jun		0.21	0.50	3.25	0.39	0.18	1.76	3.72	5.61	4.56	5.42	
Jul		0.16	0.50	3.25	0.35	0.18	1.55	3.56	5.41	4.36	5.22	
Aug		0.16	0.50	3.25	0.30	0.17	1.65	3.59	5.26	4.17	5.19	
Sep		0.15	0.50	3.25	0.25	0.12	1.48	3.40	5.13	3.81	5.06	
Oct		0.12	0.50	3.25	0.24	0.07	1.46	3.39	5.15	3.85	4.95	
Nov		0.12	0.50	3.25	0.21	0.05	1.32	3.40	5.19	3.99	4.88	
Dec		0.12	0.50	3.25	0.22	0.05	1.38	3.59	5.26	3.89	4.93	
2010	Jan	0.11	0.50	3.25	0.20	0.06	1.49	3.73	5.26	3.96	5.03	
	Feb	0.13	0.59	3.25	0.19	0.11	1.40	3.69	5.35	3.91	4.99	
	Mar	0.16	0.75	3.25	0.23	0.15	1.51	3.73	5.27	3.91	4.97	
	Apr	0.20	0.75	3.25	0.30	0.16	1.64	3.85	5.29	3.95	5.10	
	May	0.20	0.75	3.25	0.45	0.16	1.32	3.42	4.96	3.75	4.89	

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

		M1	MZM	M2	M3*	
<b>Percent change at an annual rate</b>						
2005		2.03	2.11	4.24	5.97	
2006		0.19	4.34	5.27	4.95	
2007		-0.09	9.06	6.31		
2008		4.38	14.04	7.09		
2009		13.63	9.46	7.76		
<hr/>						
2008	1	2.67	15.73	7.86		
	2	2.30	13.35	6.04		
	3	8.89	5.02	4.95		
	4	29.10	10.64	14.17		
2009	1	9.99	17.58	11.91		
	2	10.77	5.80	2.72		
	3	10.98	1.90	1.71		
	4	8.02	0.65	3.90		
2010	1	3.73	-4.48	-0.25		
<hr/>						
2008	Apr	2.08	9.56	3.90		
	May	-0.53	7.17	3.66		
	Jun	5.75	6.36	1.94		
	Jul	14.57	7.74	8.01		
	Aug	-12.80	-2.11	-1.85		
	Sep	50.99	6.24	16.50		
	Oct	10.88	6.43	17.50		
	Nov	36.97	17.16	7.73		
	Dec	60.57	30.75	26.95		
	2009	Jan	-15.75	17.07	8.89	
		Feb	-8.97	8.80	5.45	
		Mar	1.69	9.14	7.48	
Apr		21.80	-2.08	-6.84		
May		0.24	13.63	10.47		
Jun		36.16	4.00	3.81		
Jul		6.49	0.33	-0.62		
Aug		-1.12	-4.90	-3.30		
Sep		9.16	4.46	5.81		
Oct		9.89	0.41	4.63		
Nov		9.29	1.03	4.93		
Dec		6.29	-1.48	2.98		
2010	Jan	-11.73	-9.06	-8.19		
	Feb	24.18	0.19	7.85		
	Mar	-1.04	-11.64	-4.07		
	Apr	-8.06	-12.08	-4.56		

\*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](http://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](http://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/](http://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,  $\pi_{t-1}$  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  $\Delta b_t$  is the implied growth rate of the adjusted monetary base,  $\Delta y_t^*$  is the 10-year

moving average growth in real GDP,  $\Delta v_t^\alpha$  is the average base velocity growth (calculated recursively),  $\Delta x_{t-1}$  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 11/15/2019. **Inflation-Indexed Treasury Yield Spreads and Inflation-Indexed 10-Year Government Yield Spreads** equal the difference between the yields on the most recently issued inflation-indexed securities and the unadjusted security yields of similar maturity.

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

**Page 13: Real Gross Domestic Product** is GDP as measured in chained 2000 dollars. The **Gross Domestic Product Price Index** is the implicit price deflator for GDP, which is defined by the Bureau of Economic Analysis, U.S. Department of Commerce, as the ratio of GDP measured in current dollars to GDP measured in chained 2005 dollars.

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

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

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

## Sources

*Agence France Trésor*: French note yields.

*Bank of Canada*: Canadian note yields.

*Bank of England*: U.K. note yields.

*Board of Governors of the Federal Reserve System*:

Monetary aggregates and components: H.6 release. Bank credit and components: H.8 release. Consumer credit: G.19 release. Required reserves, excess reserves, clearing balance contracts, and discount window borrowing: H.4.1 and H.3 releases. Interest rates: H.15 release. Nonfinancial commercial paper: Board of Governors website. Nonfinancial debt: Z.1 release. M2 own rate. Senior Loan Officer Opinion Survey on Bank Lending Practices.

*Bureau of Economic Analysis*: GDP.

*Bureau of Labor Statistics*: CPI.

*Chicago Board of Trade*: Federal funds futures contract.

*Chicago Mercantile Exchange*: Eurodollar futures.

*Congressional Budget Office*: Potential real GDP.

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

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

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

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

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

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

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- Note:** \*Available on the Internet at [research.stlouisfed.org/publications/review/](http://research.stlouisfed.org/publications/review/).