Monetary Trends

October 2010

# Deflation and the Fisher Equation

Irving Fisher (1867-1947), one of America's greatest monetary economists, is famous for many reasons. One of the most important is the Fisher equation, which states that the nominal interest rate is equal to the real interest rate plus the expected inflation rate. This is a statement about equilibrium in the market for bonds, not about the factors that determine these two components.

Depending on which market rate is used, the expected real return will include a premium for various sources of risk. For most of post-WWII U.S. history, estimates of this risk premium in the federal funds market have been small relative to estimates of the risk-free real interest rate and the expected inflation rate, so they are ignored in this essay.

The chart shows the Fed's policy rate—the federal funds rate—and the consumer price index (CPI) inflation trend. The trend is measured as a 25-month centered moving average. We use a 25-month window to filter out the noise or temporary deviations associated with temporary shocks and measurement error. The Blue Chip Consensus forecast is used as the inflation rate for the next 12 months to make the calculation current; that is, the last value in the chart is the monthly average of actual inflation from July 2009 through July 2010 and the Blue Chip Consensus monthly forecasts of CPI inflation through July 2011 (shown at an annual rate).

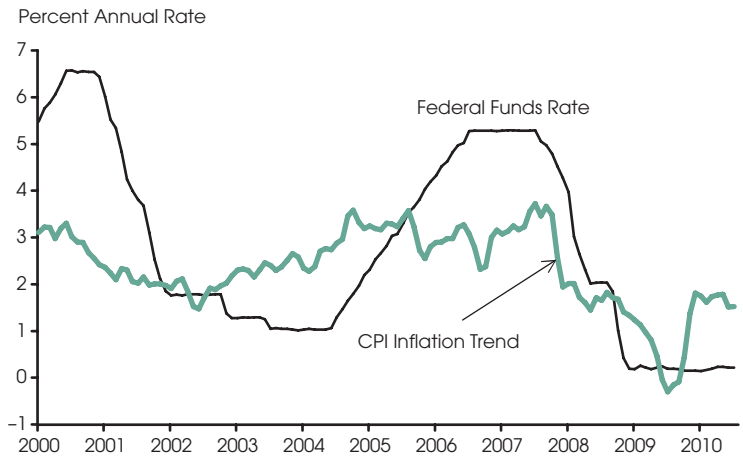
Since January 2000, the average federal funds rate has been 2.80 percent and the average CPI inflation rate has been 2.50 percent. The ex post real federal funds rate has been 0.30 percent. The low real interest rate is associated with a decade bracketed by two recessions and, consequently, relatively low economic growth. Looking back to the 1990s when real growth was surprisingly rapid, the average federal funds rate was 5.15 percent while the inflation rate averaged 2.97 percent. Yet, these values were low compared with the 1980s—the average federal funds rate was 9.97 percent and the average inflation rate was 5.36 percent. In the 1990s, the ex post real federal funds rate was 2.18 percent and, in the 1980s, it was a whopping 4.61 percent.

With the federal funds rate near zero since December 2008 and expected to remain there for the next year or two, the Fisher equation has important implications for the expected inflation rate. If the real economy is currently rebounding to a sustainable growth trend, the real interest rate will rise and the only outcomes possible will be either a higher nominal federal funds rate or a negative expected inflation rate.

The current consensus is that the Federal Open Market Committee cannot raise interest rates because the unemployment rate is so high. The unemployment rate, however, is a poor guide for setting the policy rate during a recovery because unemployment lags growth in gross domestic product. The high unemployment rate will persist even as the economy recovers and real interest rates rise. So, according to Irving Fisher, one reason to worry about deflation is that the federal funds rate is expected to be held near zero as the economy grows out of this recession.

—William T. Gavin

**CPI Inflation and the Federal Funds Rate**



# Contents



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

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


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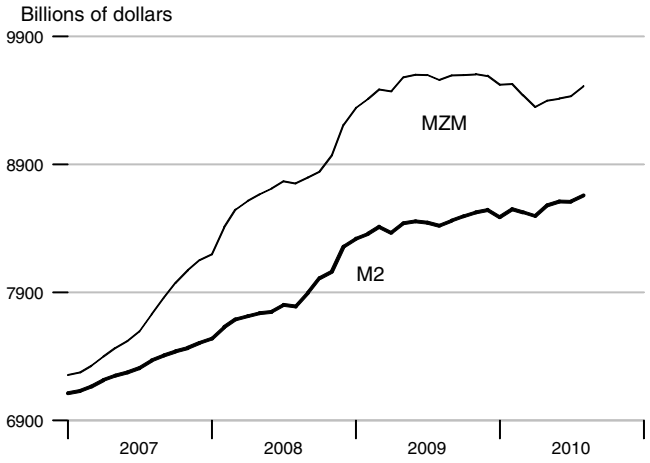
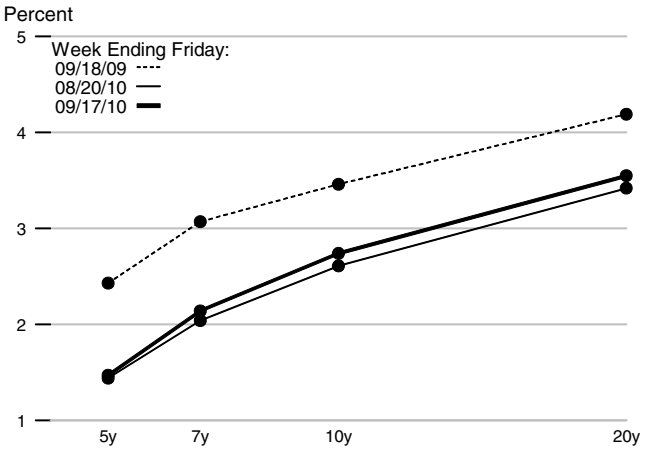
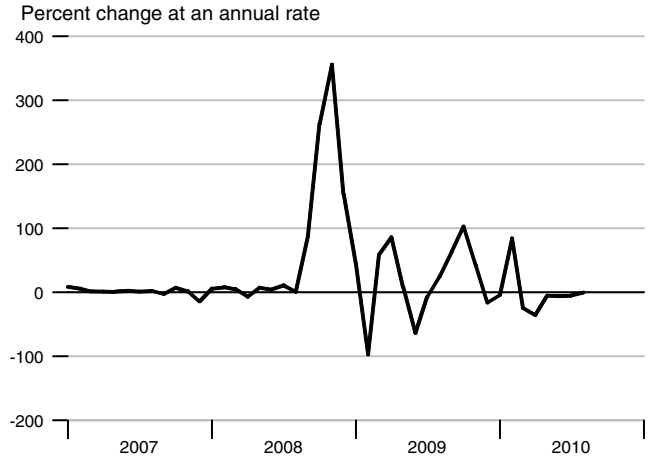
## M2 and MZM



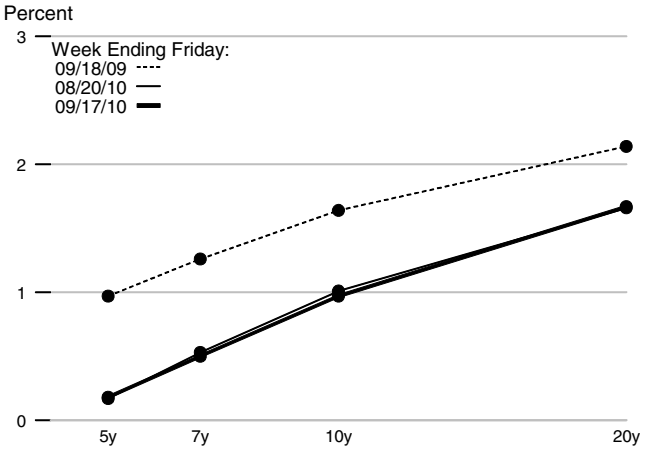

## Treasury Yield Curve



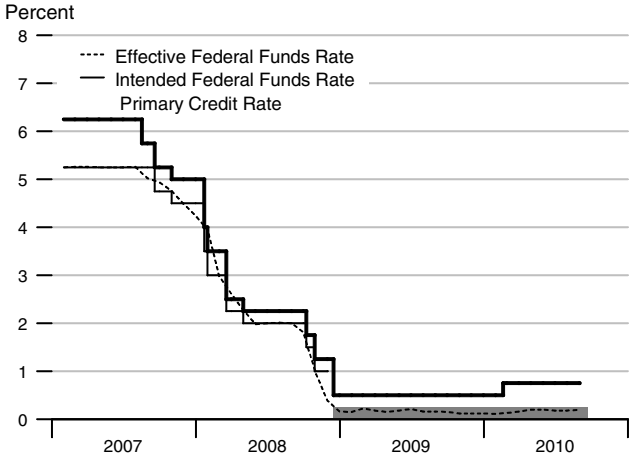

## Adjusted Monetary Base




## Real Treasury Yield Curve

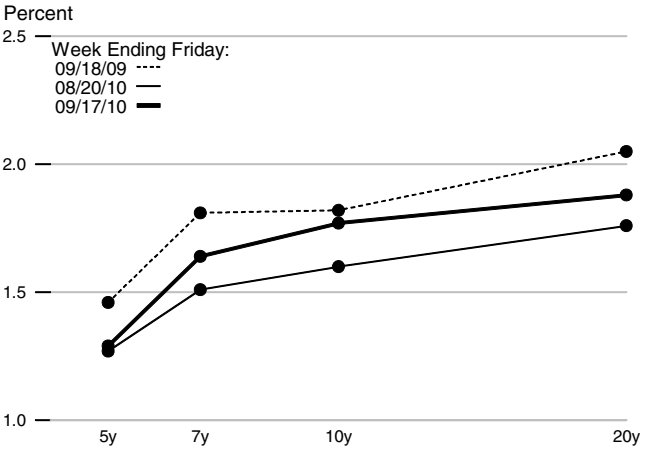



## Reserve Market Rates



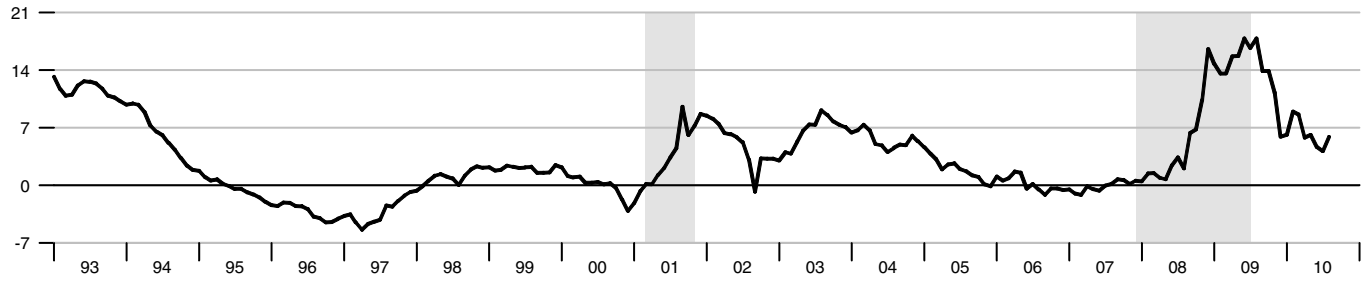

Note: Effective December 16, 2008, FOMC reports the intended Federal Funds Rate as a range.

## Inflation-Indexed Treasury Yield Spreads



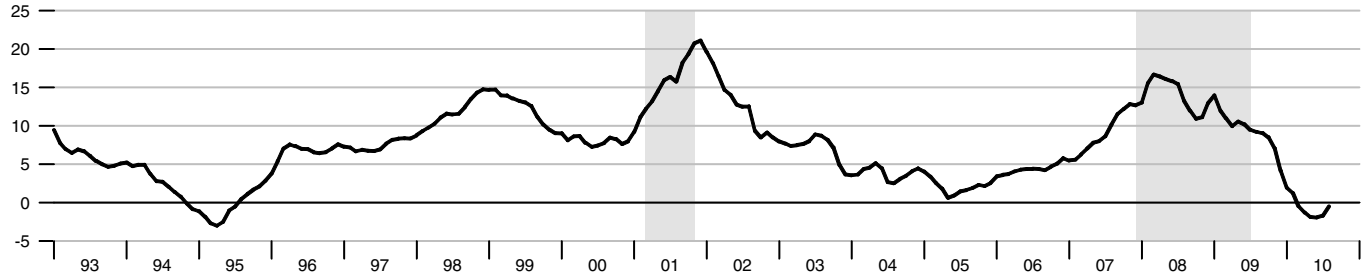
## M1

Percent change from year ago



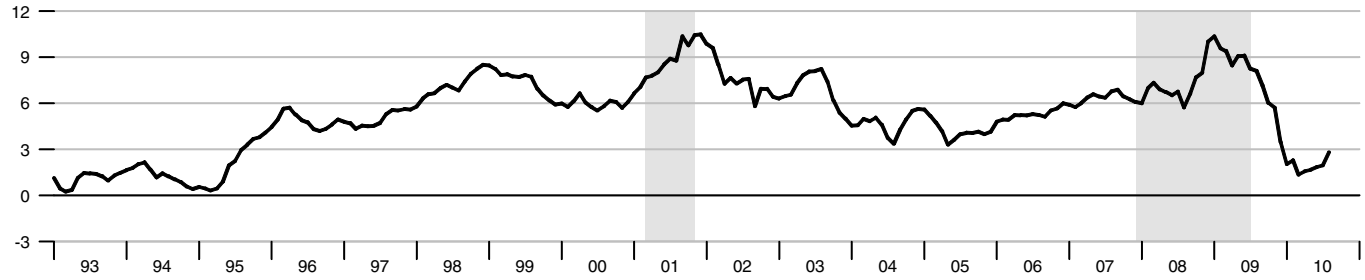

## MZM

Percent change from year ago



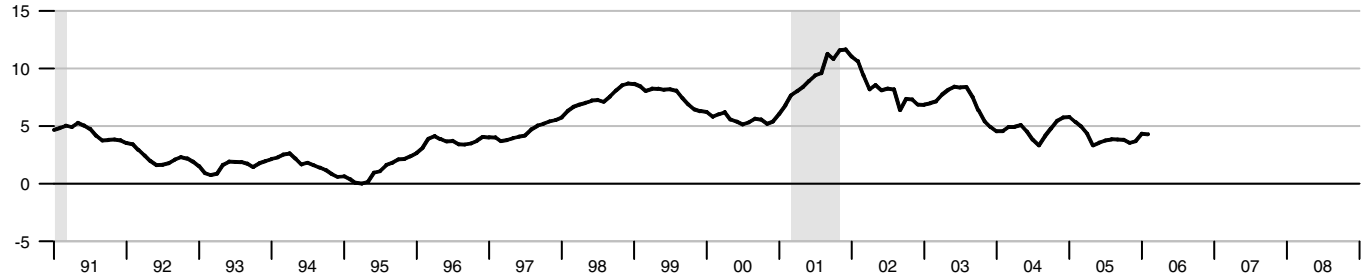

## M2

Percent change from year ago




## Monetary Services Index - M2**

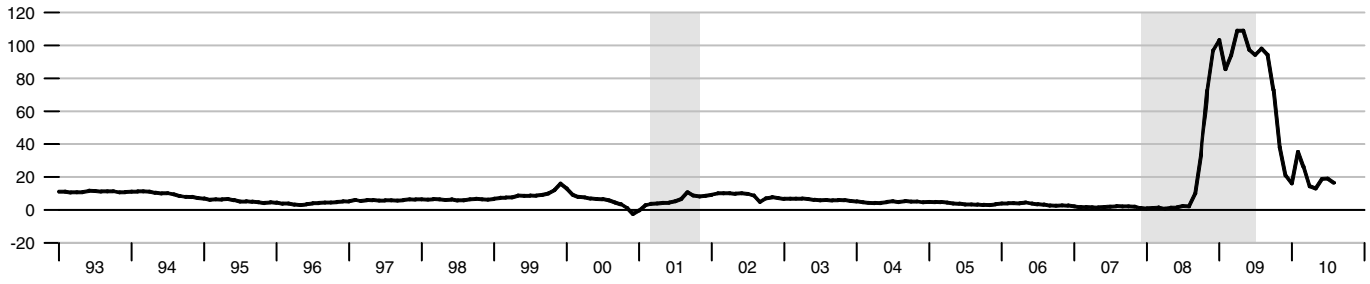
Percent change from year ago




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

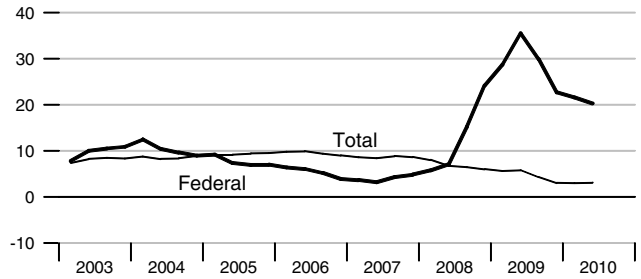
## Adjusted Monetary Base

Percent change from year ago



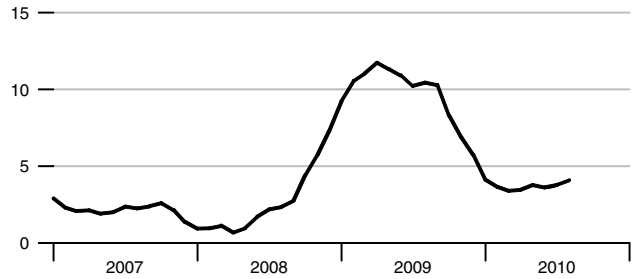

## Domestic Nonfinancial Debt

Percent change from year ago



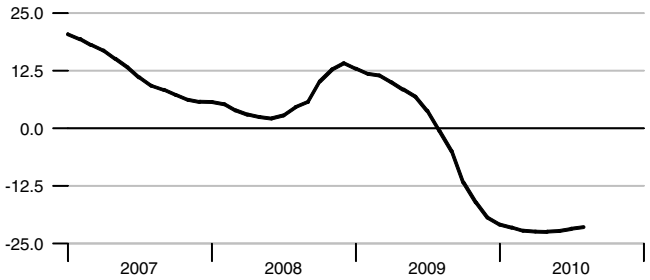

## Currency Held by the Nonbank Public

Percent change from year ago



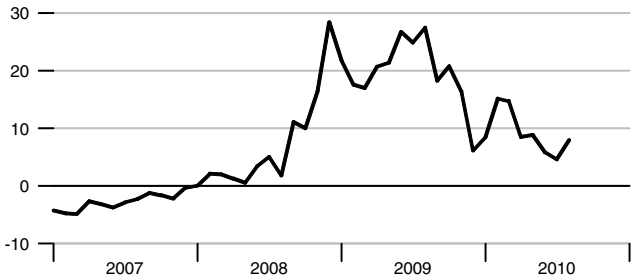

## Small Denomination Time Deposits*

Percent change from year ago



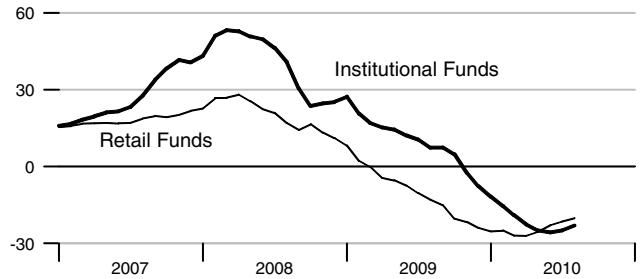

## Checkable Deposits

Percent change from year ago



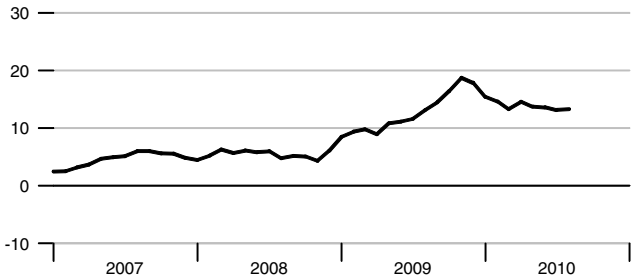

## Money Market Mutual Fund Shares

Percent change from year ago



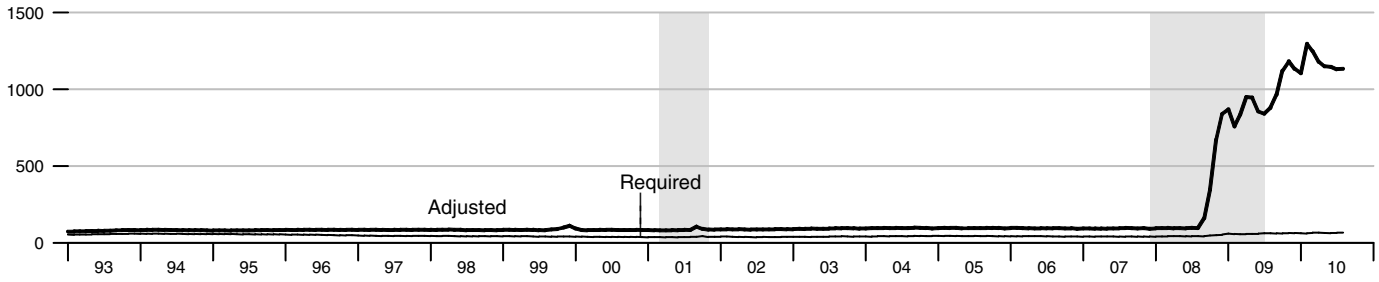

## Savings Deposits

Percent change from year ago



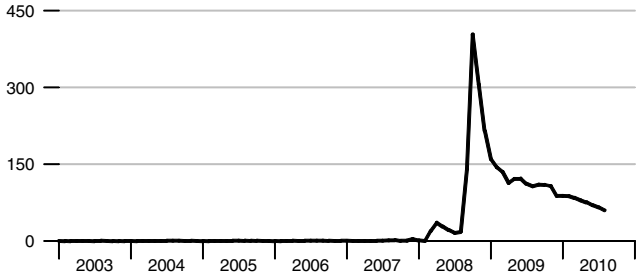
## Adjusted and Required Reserves

Billions of dollars




## Total Borrowings, nsa

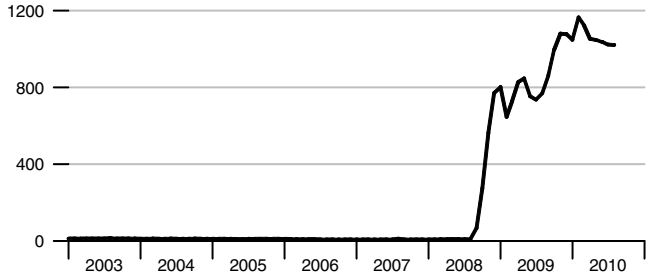
Billions of dollars




* Data exclude term auction credit

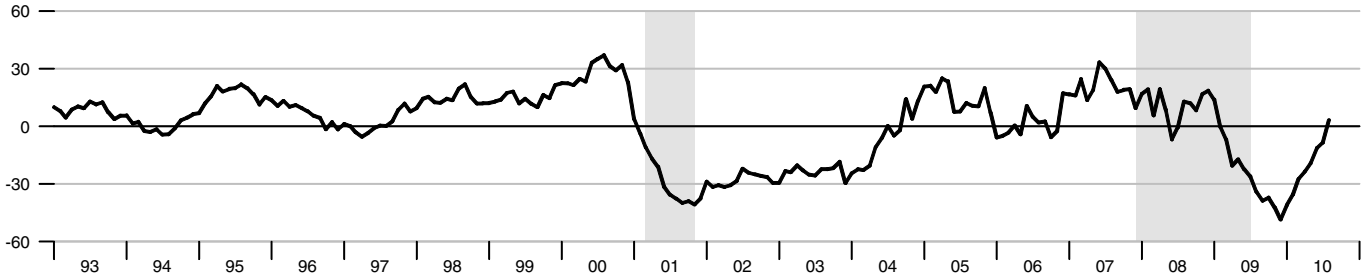
## Excess Reserves plus RCB Contracts

Billions of dollars




## Nonfinancial Commercial Paper

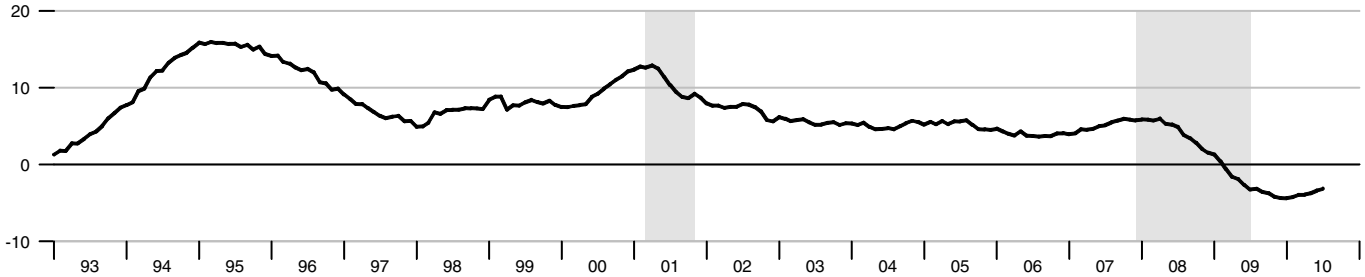
Percent change from year ago




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

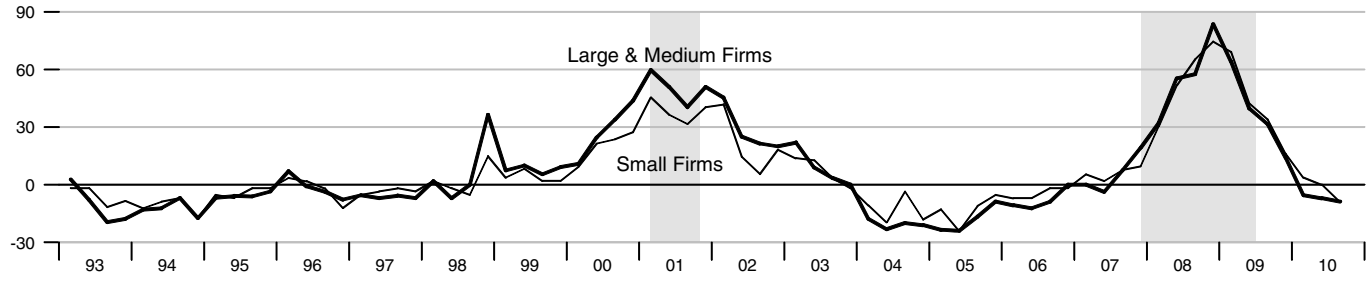
## Consumer Credit

Percent change from year ago



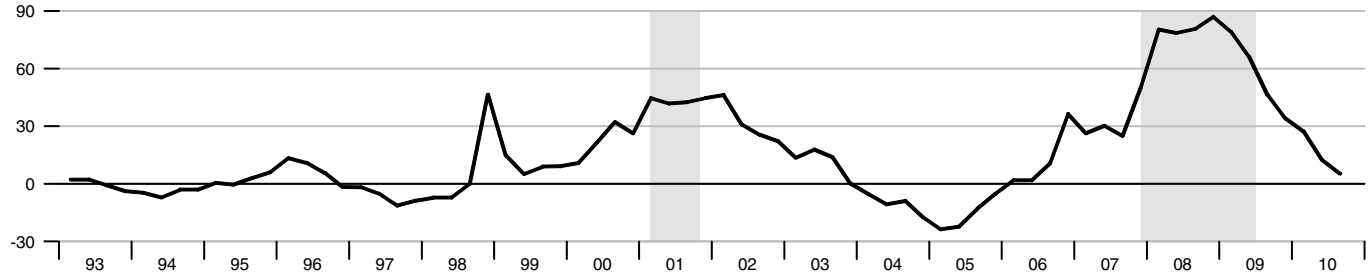
## Net Percentage of Domestic Banks Tightening Standards for Commercial and Industrial Loans

Percentage



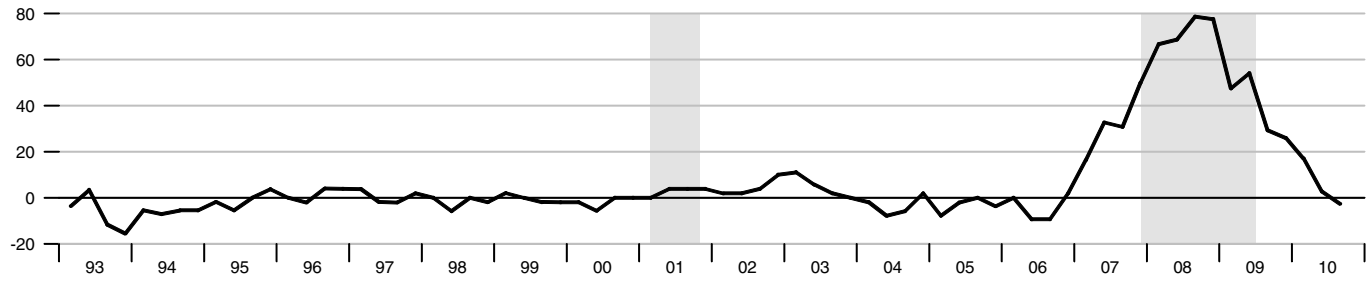

## Net Percentage of Domestic Banks Tightening Standards for Commercial Real Estate Loans

Percentage



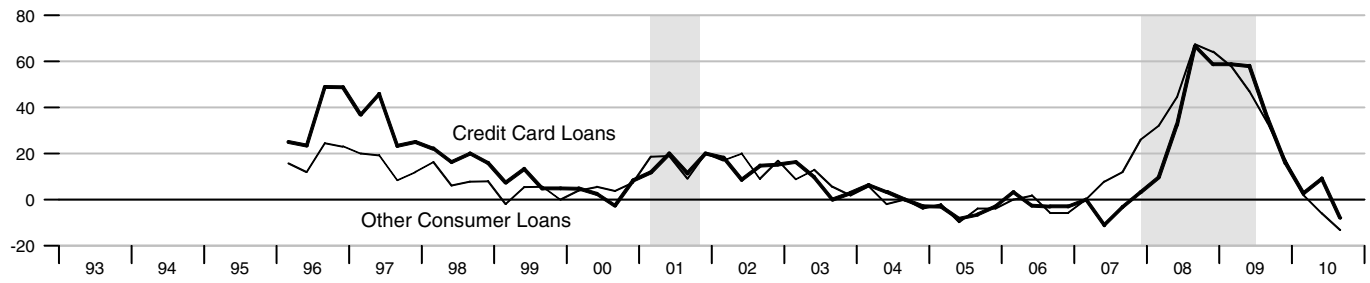

## Net Percentage of Domestic Banks Tightening Standards for Residential Mortgage Loans

Percentage



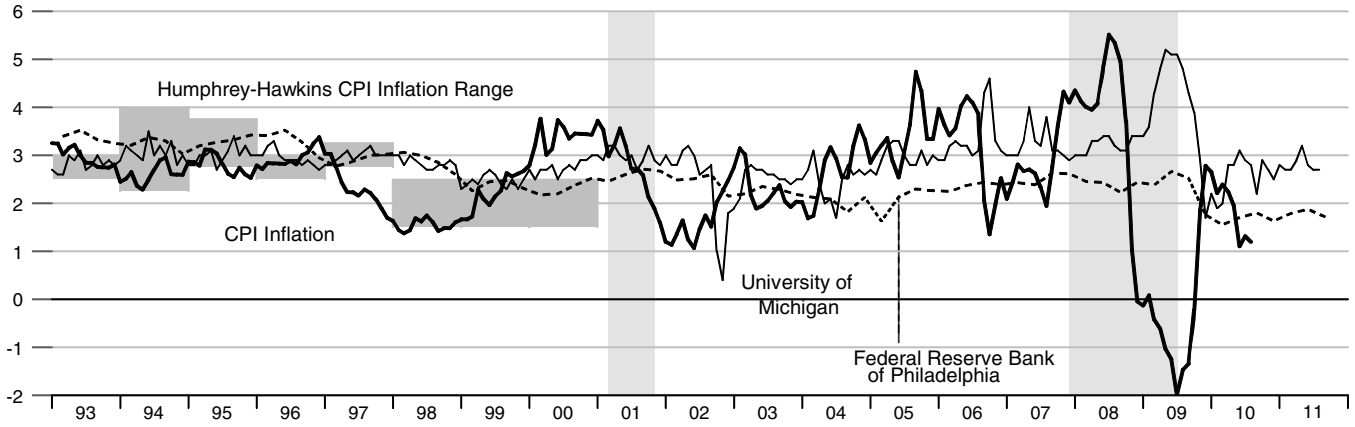

## Net Percentage of Domestic Banks Tightening Standards for Consumer Loans

Percentage



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

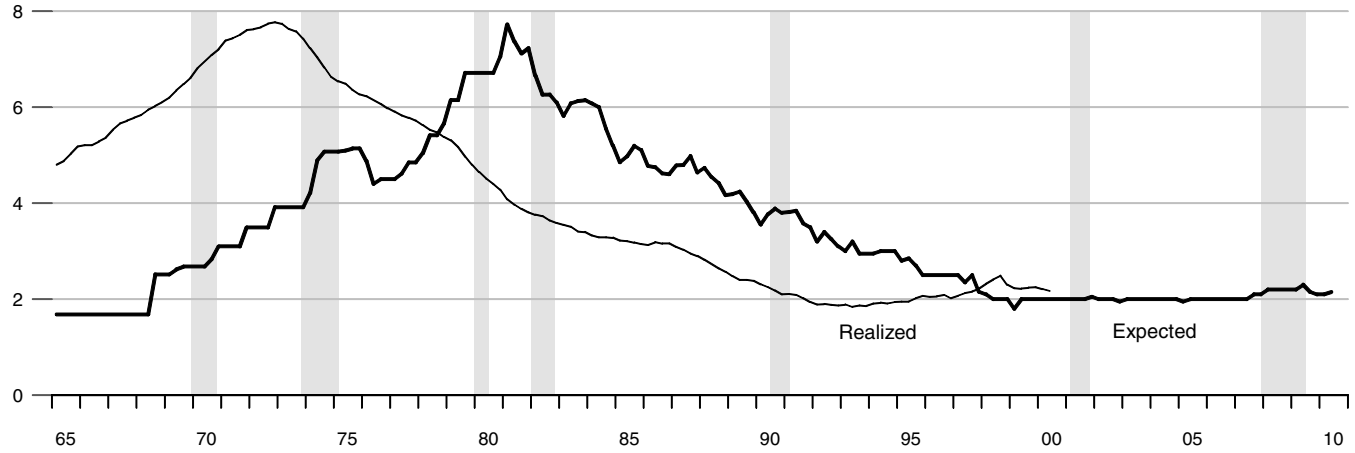
Percent




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

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

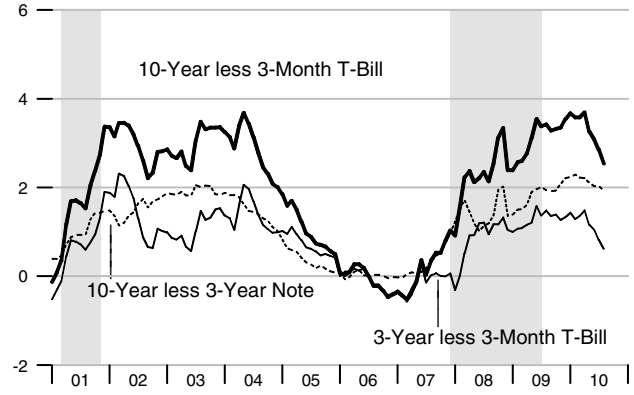
Percent




See the notes section for an explanation of the chart.

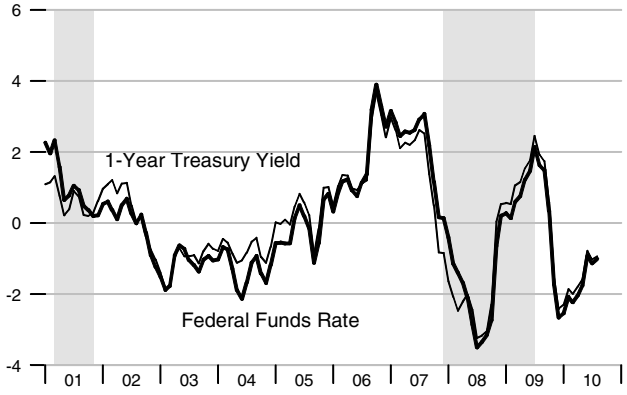
## Treasury Security Yield Spreads

Yield to maturity

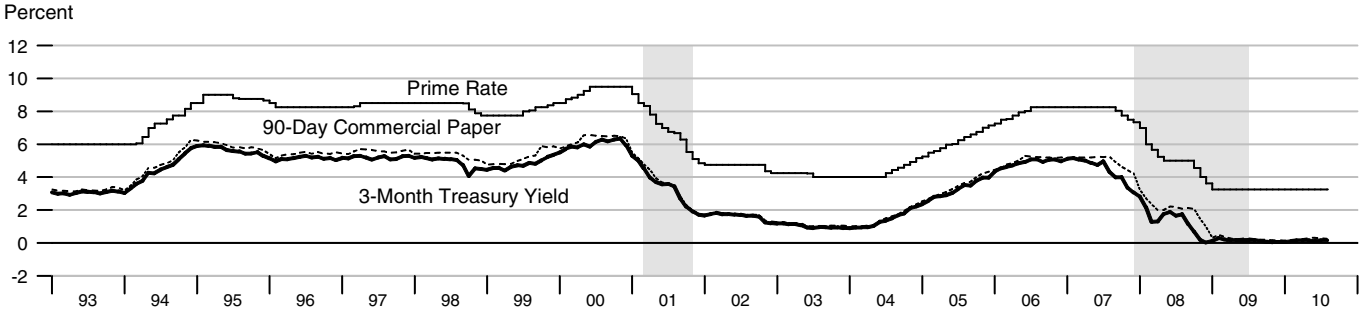



## Real Interest Rates

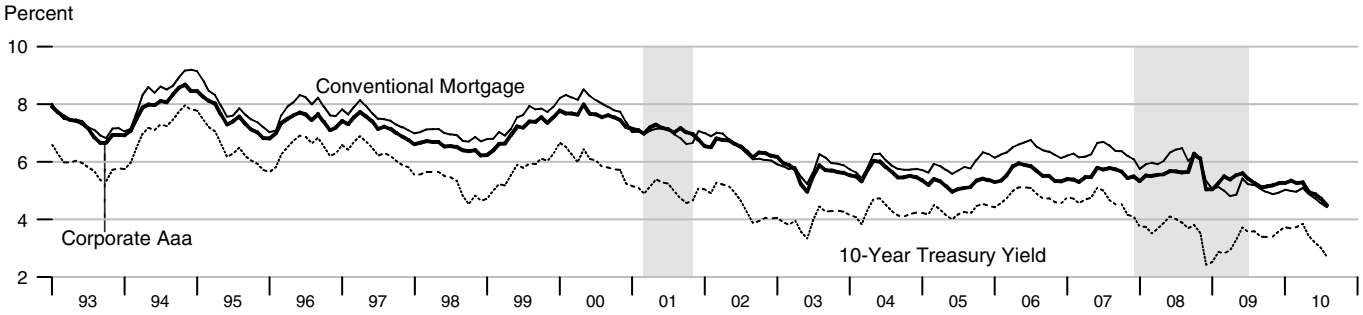
Percent, Real rate = Nominal rate less year-over-year CPI inflation



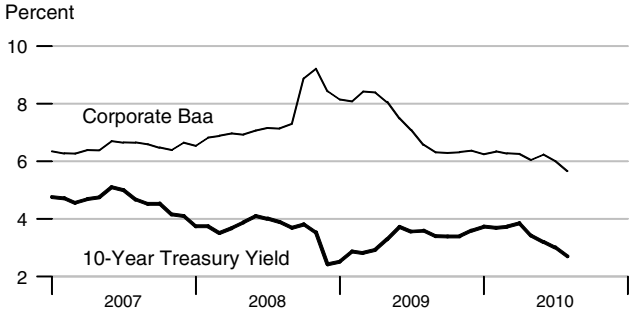
## Short-Term Interest Rates



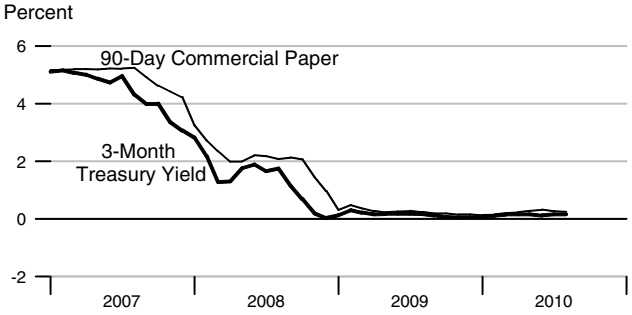

## Long-Term Interest Rates



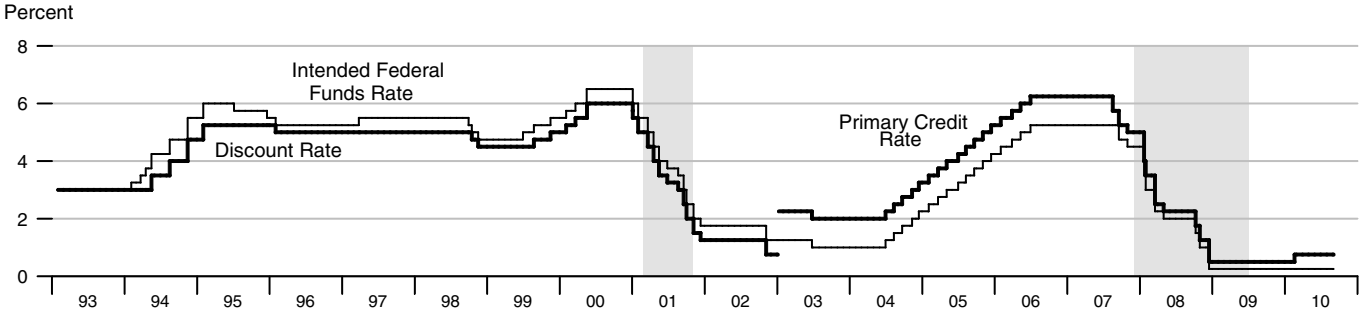

## Long-Term Interest Rates



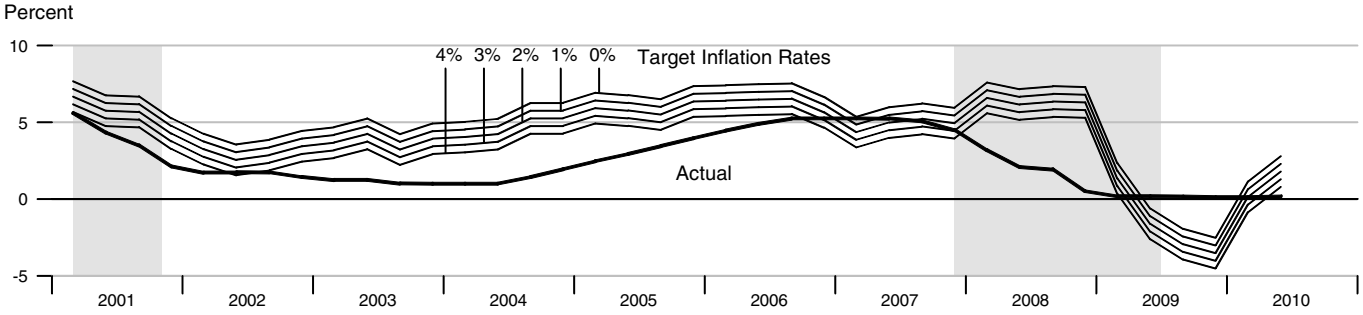

## Short-Term Interest Rates




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



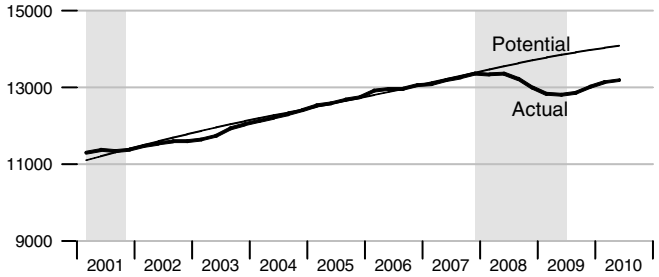
## Federal Funds Rate and Inflation Targets




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

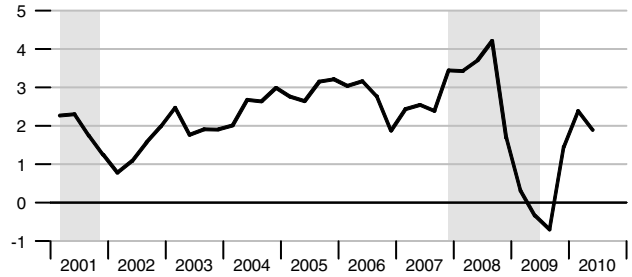
## Components of Taylor's Rule

### Actual and Potential Real GDP

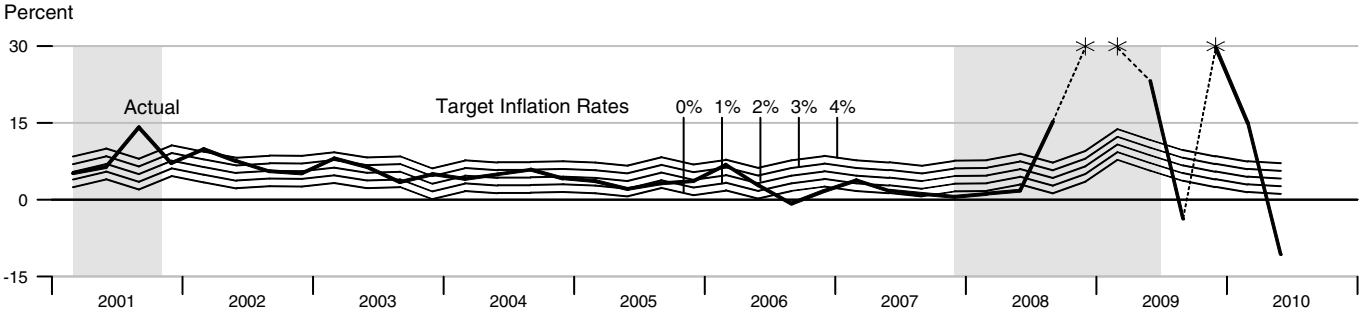



See notes section for further explanation.

### PCE Inflation



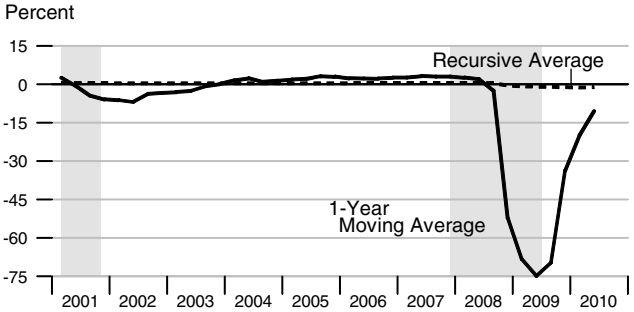

## Monetary Base Growth and Inflation Targets



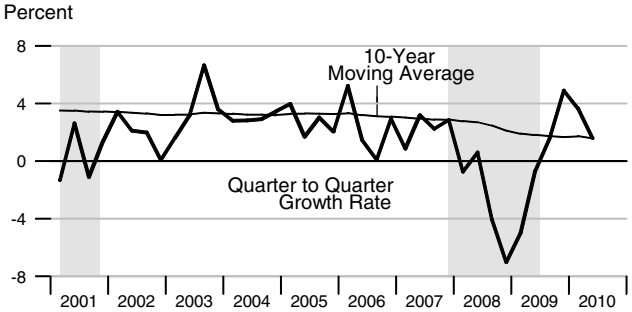

Calculated base growth is based on McCallum's rule. Actual base growth is percent change from the previous quarter.
*Actual values for 2008:Q4, 2009:Q1, and 2009:Q4 are 188.38 percent, 60.77 percent, and 56.51, respectively.

## Components of McCallum's Rule

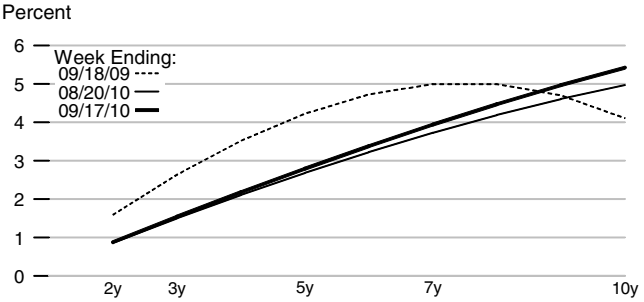
### Monetary Base Velocity Growth



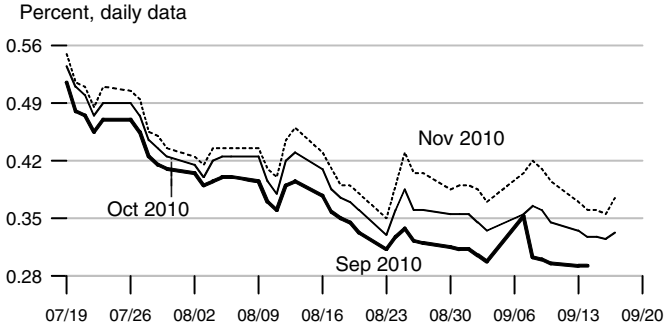

### Real Output Growth



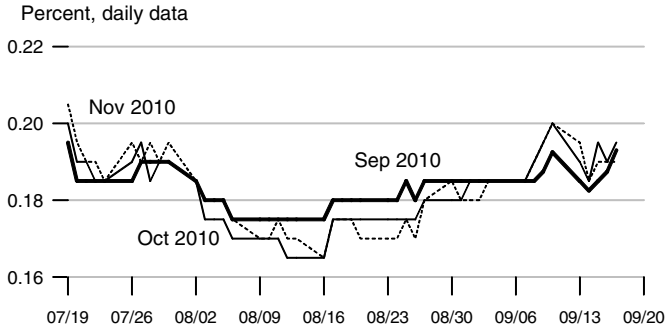
## Implied One-Year Forward Rates



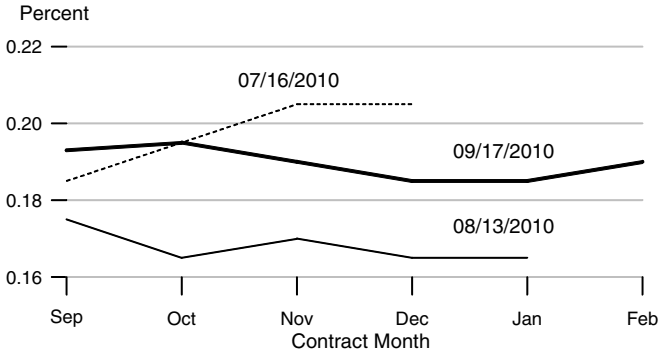

## Rates on 3-Month Eurodollar Futures




## Rates on Selected Federal Funds Futures Contracts

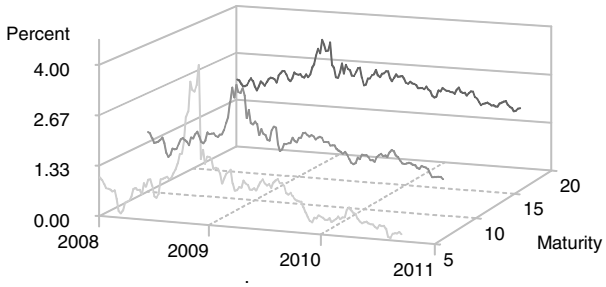



## Rates on Federal Funds Futures on Selected Dates




## Inflation-Indexed Treasury Securities

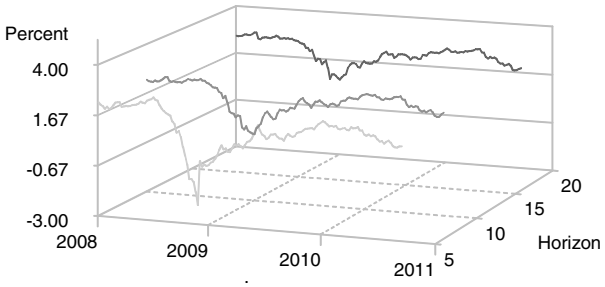
Weekly data




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

## Inflation-Indexed Treasury Yield Spreads

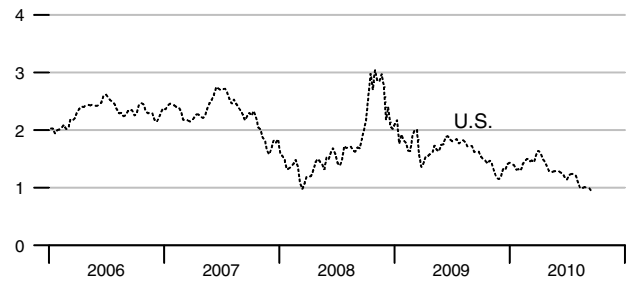
Weekly data




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

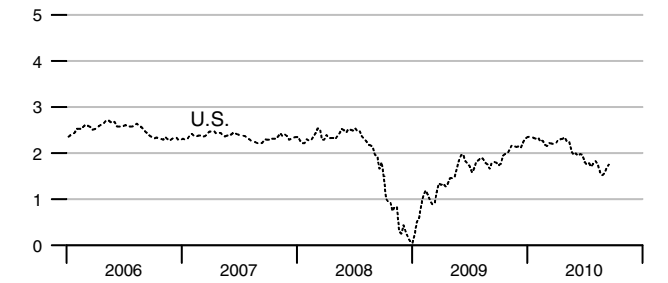
## Inflation-Indexed 10-Year Government Notes

Percent, weekly data




## Inflation-Indexed 10-Year Government Yield Spreads

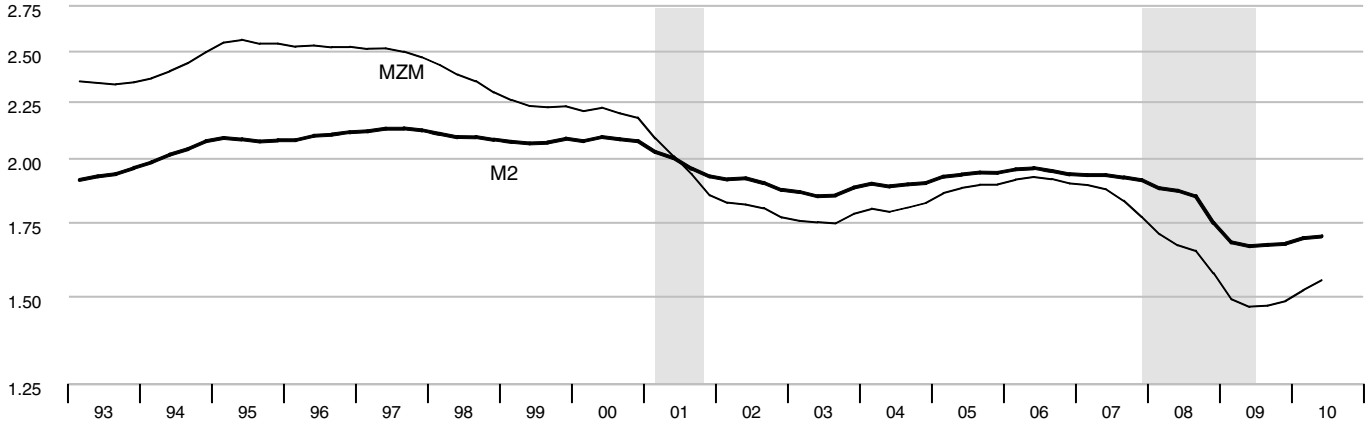
Percent, weekly data




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

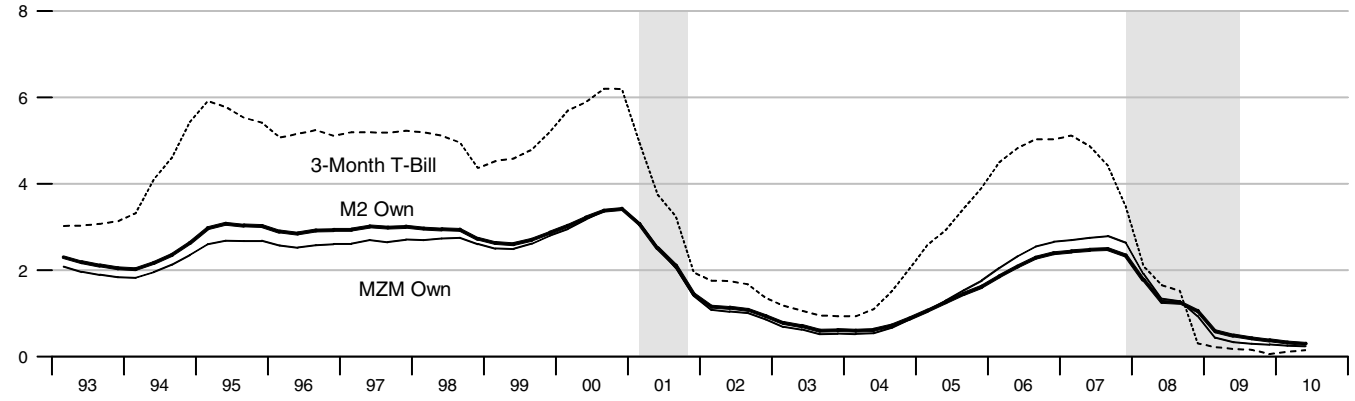
## Velocity

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



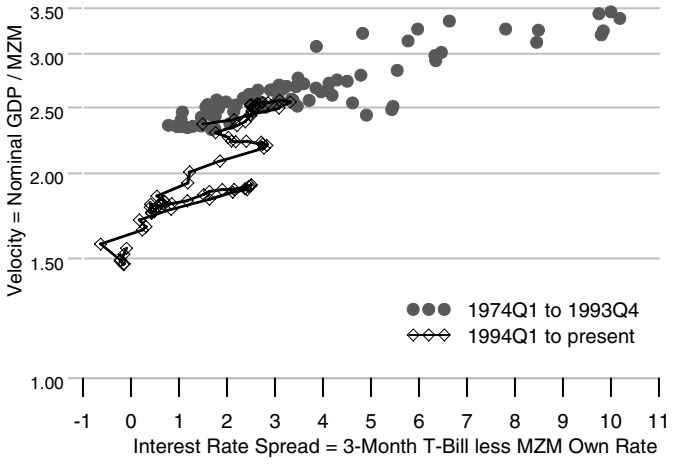

## Interest Rates

Percent



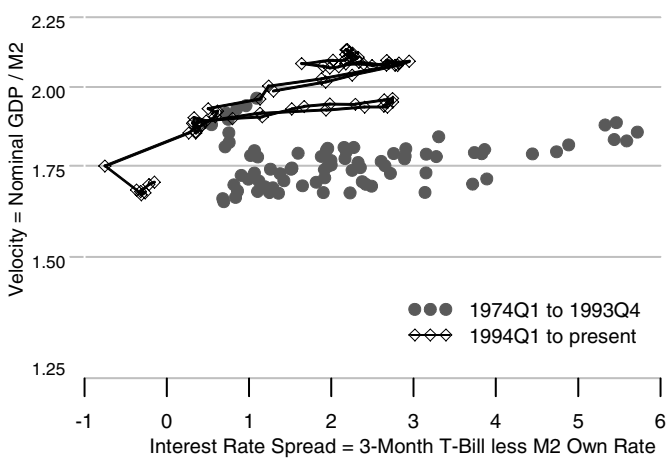

## MZM Velocity and Interest Rate Spread

Ratio Scale



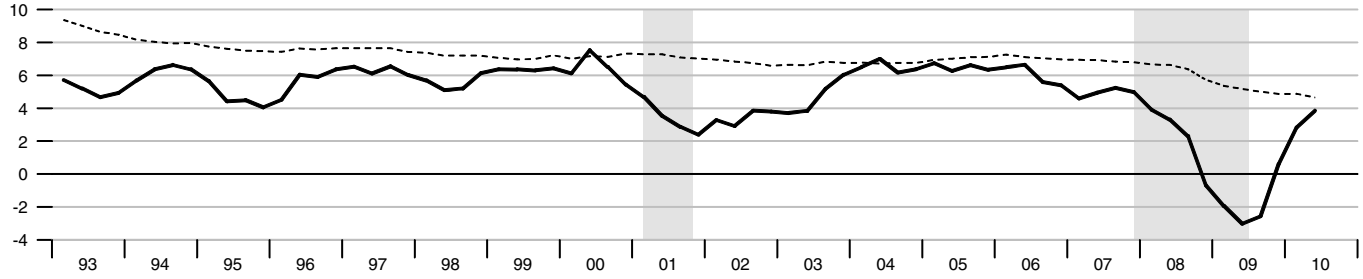

## M2 Velocity and Interest Rate Spread

Ratio Scale



## Gross Domestic Product

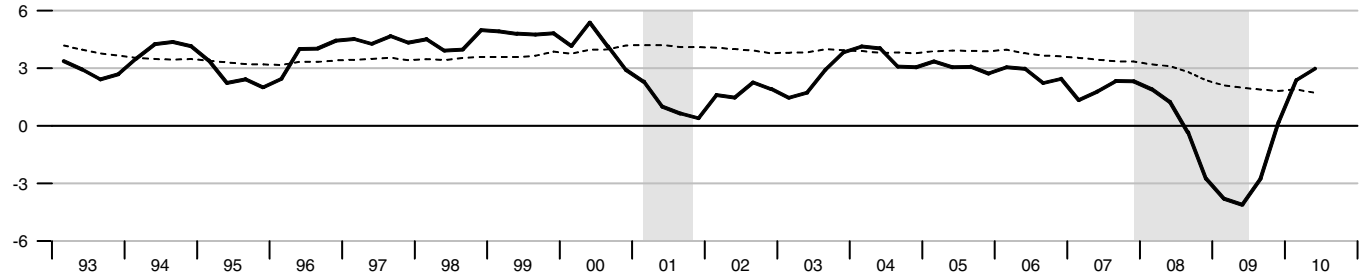
Percent change from year ago




Dashed lines indicate 10-year moving averages.

## Real Gross Domestic Product

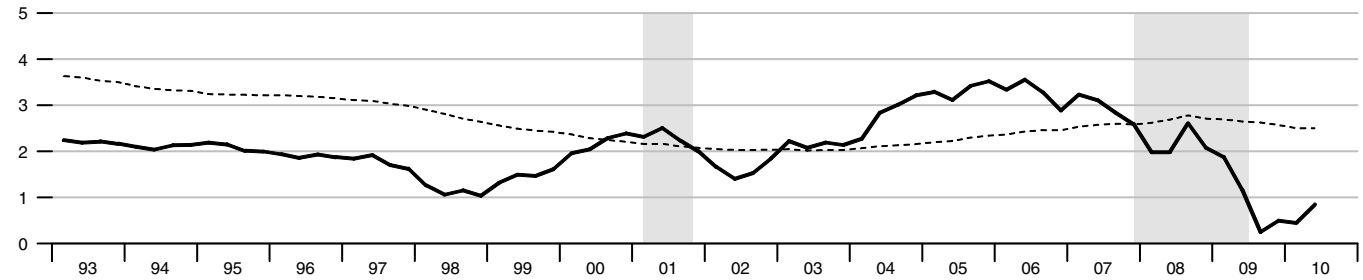
Percent change from year ago




Dashed lines indicate 10-year moving averages.

## Gross Domestic Product Price Index

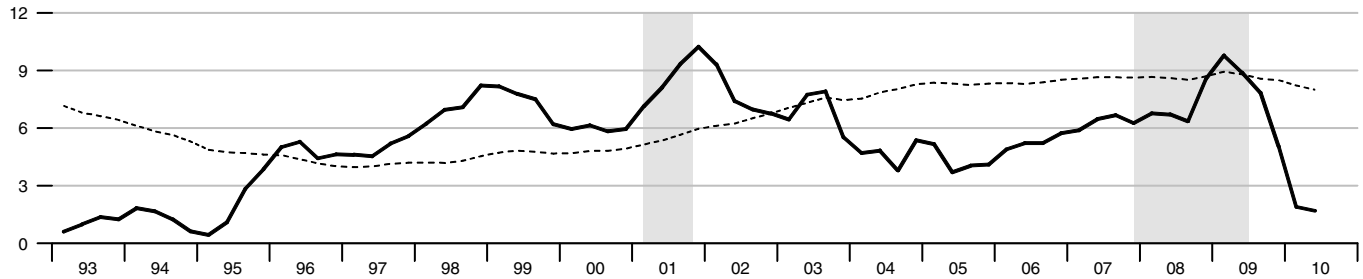
Percent change from year ago




Dashed lines indicate 10-year moving averages.

## M2

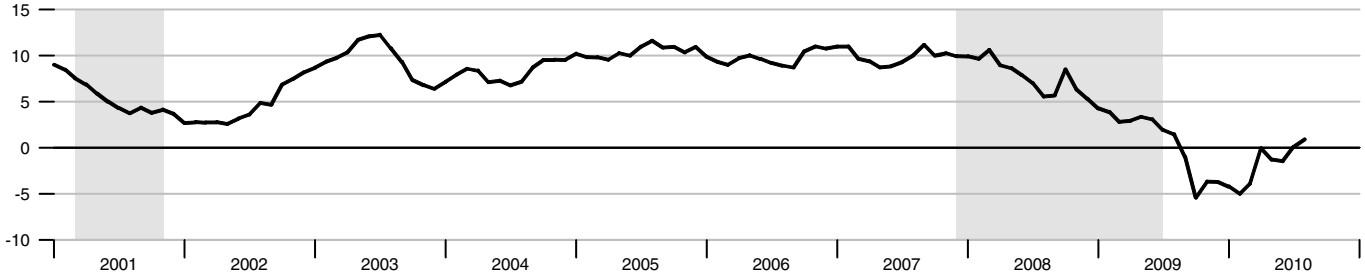
Percent change from year ago




Dashed lines indicate 10-year moving averages.

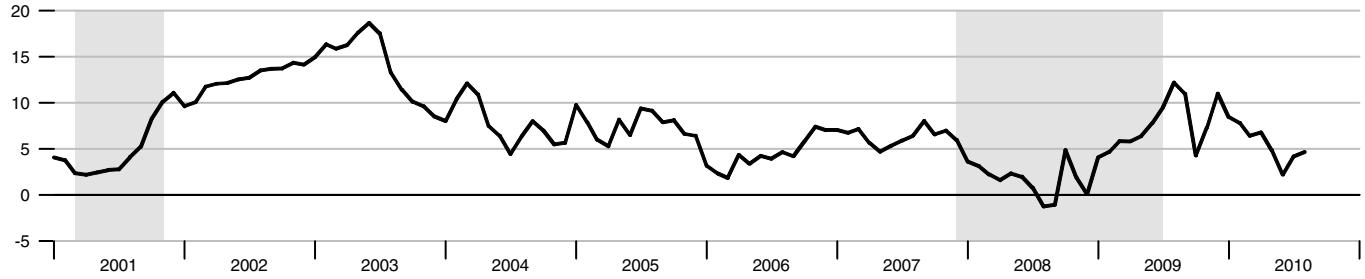
## Bank Credit

Percent change from year ago



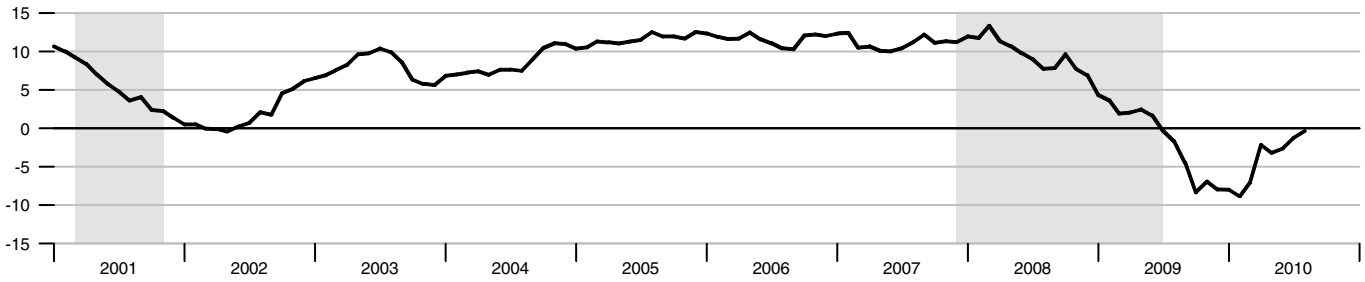

## Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



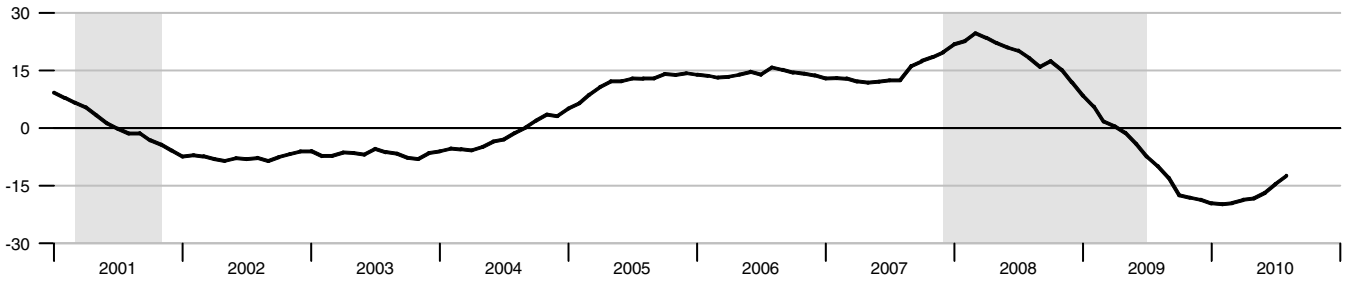

## Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

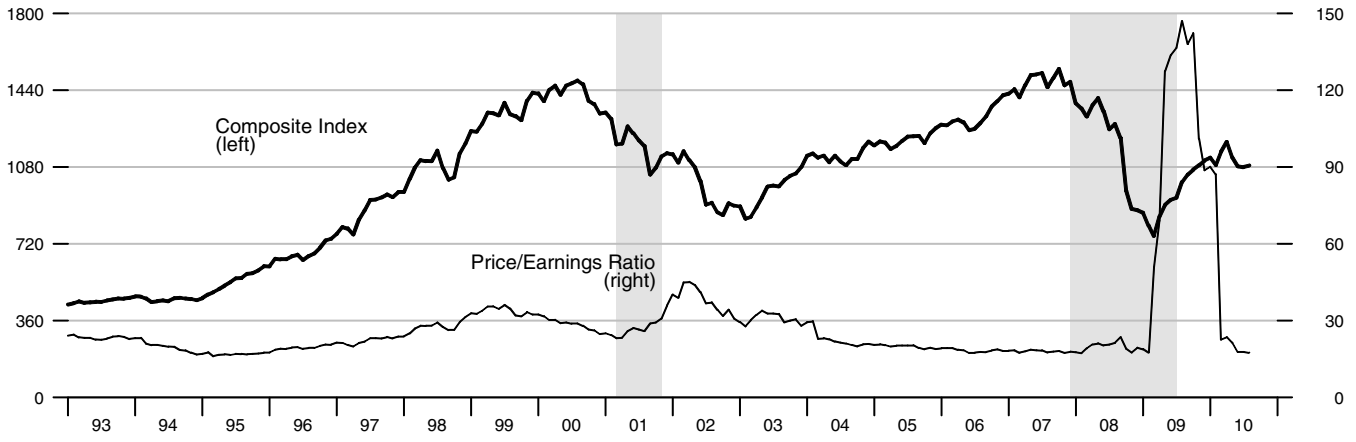



## Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



## Standard & Poor's 500

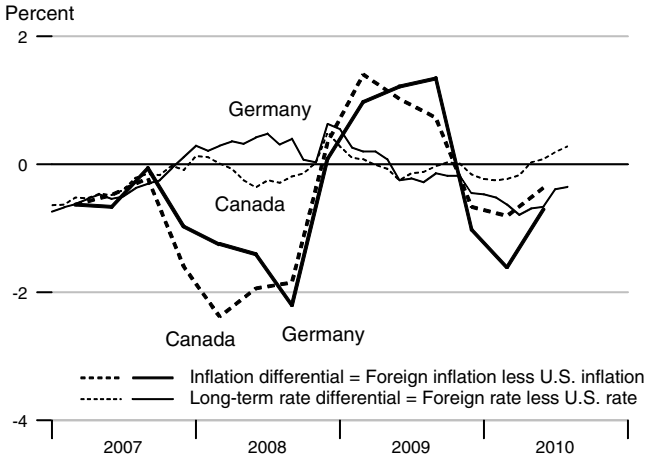


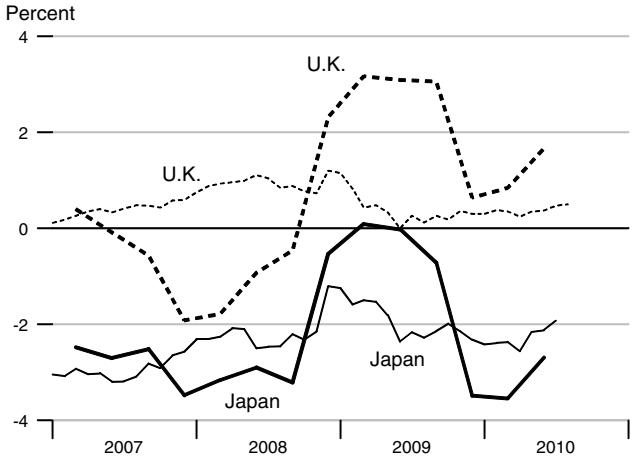

## Recent Inflation and Long-Term Interest Rates

| | Consumer Price Inflation Rates | | | | Long-Term Government Bond Rates | | | |
|---|---|---|---|---|---|---|---|---|
| | Percent change from year ago | | | | Percent | | | |
| | 2009Q3 | 2009Q4 | 2010Q1 | 2010Q2 | May10 | Jun10 | Jul10 | Aug10 |
| United States | -1.60 | 1.46 | 2.42 | 1.77 | 3.42 | 3.20 | 3.01 | 2.70 |
| Canada | -0.87 | 0.79 | 1.61 | 1.40 | 3.45 | 3.28 | 3.20 | 2.98 |
| France | -0.42 | 0.36 | 1.32 | 1.61 | 3.08 | 3.07 | . | . |
| Germany | -0.25 | 0.44 | 0.81 | 1.06 | 2.73 | 2.54 | 2.62 | 2.35 |
| Italy | 0.12 | 0.65 | 1.29 | 1.41 | 3.99 | 4.10 | 4.03 | 3.80 |
| Japan | -2.31 | -2.03 | -1.12 | -0.93 | 1.26 | 1.08 | 1.08 | . |
| United Kingdom | 1.46 | 2.09 | 3.26 | 3.44 | 3.77 | 3.57 | 3.48 | 3.20 |



## Inflation and Long-Term Interest Rate Differentials



| | | Money Stock | | | | Bank | Adjusted | | |
|---|---|---|---|---|---|---|---|---|---|
| | | M1 | MZM | M2 | M3* | Credit | Monetary Base | Reserves | MSI M2** |
| 2005 | | 1371.536 | 6709.684 | 6524.832 | 9786.477 | 7015.642 | 806.623 | 96.555 | 343.539 |
| 2006 | | 1374.163 | 7000.882 | 6868.752 | 10270.74 | 7698.030 | 835.036 | 94.909 | |
| 2007 | | 1372.079 | 7635.008 | 7303.199 | | 8463.337 | 850.544 | 94.159 | |
| 2008 | | 1432.775 | 8707.694 | 7823.088 | | 9123.482 | 1009.767 | 232.170 | |
| 2009 | | 1634.804 | 9537.118 | 8436.940 | | 9193.247 | 1796.572 | 944.793 | |
| 2008 | 1 | 1384.590 | 8384.246 | 7618.254 | | 9001.155 | 856.263 | 96.115 | |
| | 2 | 1392.557 | 8664.175 | 7733.424 | | 9004.581 | 859.333 | 94.378 | |
| | 3 | 1423.718 | 8773.061 | 7829.293 | | 9072.266 | 892.762 | 117.838 | |
| | 4 | 1530.237 | 9009.295 | 8111.382 | | 9415.925 | 1430.712 | 620.349 | |
| 2009 | 1 | 1578.272 | 9413.546 | 8363.350 | | 9330.060 | 1663.022 | 820.691 | |
| | 2 | 1621.078 | 9550.893 | 8420.406 | | 9285.616 | 1763.719 | 917.109 | |
| | 3 | 1653.103 | 9585.002 | 8442.804 | | 9144.193 | 1747.153 | 895.408 | |
| | 4 | 1686.765 | 9599.029 | 8521.200 | | 9013.121 | 2012.393 | 1145.965 | |
| 2010 | 1 | 1702.912 | 9497.220 | 8521.489 | | 8922.226 | 2089.181 | 1216.986 | |
| | 2 | 1710.363 | 9387.769 | 8563.048 | | 9199.405 | 2034.267 | 1158.289 | |
| 2008 | Jul | 1413.845 | 8768.068 | 7801.390 | | 9027.693 | 870.707 | 97.012 | |
| | Aug | 1398.847 | 8752.714 | 7789.624 | | 9028.065 | 871.469 | 96.673 | |
| | Sep | 1458.462 | 8798.402 | 7896.864 | | 9161.040 | 936.110 | 159.830 | |
| | Oct | 1471.733 | 8845.564 | 8012.064 | | 9498.832 | 1142.155 | 347.607 | |
| | Nov | 1516.921 | 8971.958 | 8064.557 | | 9389.721 | 1480.742 | 674.073 | |
| | Dec | 1602.056 | 9210.362 | 8257.526 | | 9359.223 | 1669.239 | 839.367 | |
| 2009 | Jan | 1583.474 | 9342.150 | 8318.930 | | 9334.898 | 1730.414 | 870.183 | |
| | Feb | 1573.982 | 9412.811 | 8358.887 | | 9350.707 | 1590.201 | 758.628 | |
| | Mar | 1577.360 | 9485.677 | 8412.234 | | 9304.574 | 1668.452 | 833.261 | |
| | Apr | 1608.534 | 9472.155 | 8366.764 | | 9261.193 | 1787.758 | 949.349 | |
| | May | 1608.536 | 9579.490 | 8439.162 | | 9313.723 | 1799.320 | 946.195 | |
| | Jun | 1646.163 | 9601.034 | 8455.293 | | 9281.932 | 1704.080 | 855.782 | |
| | Jul | 1649.971 | 9599.330 | 8445.331 | | 9202.625 | 1693.690 | 841.454 | |
| | Aug | 1648.483 | 9560.317 | 8421.966 | | 9159.403 | 1728.096 | 879.570 | |
| | Sep | 1660.854 | 9595.358 | 8461.114 | | 9070.552 | 1819.673 | 965.200 | |
| | Oct | 1676.188 | 9598.647 | 8493.987 | | 8984.716 | 1975.377 | 1122.191 | |
| | Nov | 1687.511 | 9605.793 | 8525.219 | | 9043.586 | 2044.519 | 1182.207 | |
| | Dec | 1696.597 | 9592.648 | 8544.394 | | 9011.060 | 2017.284 | 1133.497 | |
| 2010 | Jan | 1680.757 | 9522.816 | 8488.470 | | 8942.069 | 2010.112 | 1105.430 | |
| | Feb | 1714.827 | 9528.544 | 8549.933 | | 8883.944 | 2150.910 | 1296.143 | |
| | Mar | 1713.151 | 9440.299 | 8526.064 | | 8940.664 | 2106.522 | 1249.385 | |
| | Apr | 1701.691 | 9349.126 | 8498.054 | | 9255.630 | 2044.296 | 1178.953 | |
| | May | 1706.769 | 9398.968 | 8579.979 | | 9194.380 | 2034.542 | 1149.699 | |
| | Jun | 1722.630 | 9415.214 | 8611.111 | | 9148.204 | 2023.962 | 1146.215 | |
| | Jul | 1718.488 | 9433.686 | 8610.356 | | 9211.634 | 2015.148 | 1131.017 | |

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

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

| | | Federal Funds | Primary Credit Rate | Prime Rate | 3-mo CDs | Treasury Yields 3-mo | 3-yr | 10-yr | Corporate Aaa Bonds | Municipal Aaa Bonds | Conventional Mortgage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | 3.21 | 4.19 | 6.19 | 3.51 | 3.21 | 3.93 | 4.29 | 5.23 | 4.28 | 5.86 |
| 2006 | | 4.96 | 5.96 | 7.96 | 5.15 | 4.85 | 4.77 | 4.79 | 5.59 | 4.15 | 6.41 |
| 2007 | | 5.02 | 5.86 | 8.05 | 5.27 | 4.47 | 4.34 | 4.63 | 5.56 | 4.13 | 6.34 |
| 2008 | | 1.93 | 2.39 | 5.09 | 2.97 | 1.39 | 2.24 | 3.67 | 5.63 | 4.58 | 6.04 |
| 2009 | | 0.16 | 0.50 | 3.25 | 0.56 | 0.15 | 1.43 | 3.26 | 5.31 | 4.27 | 5.04 |
| 2008 | 1 | 3.18 | 3.67 | 6.21 | 3.23 | 2.09 | 2.17 | 3.66 | 5.46 | 4.39 | 5.88 |
| | 2 | 2.09 | 2.33 | 5.08 | 2.76 | 1.65 | 2.67 | 3.89 | 5.60 | 4.43 | 6.09 |
| | 3 | 1.94 | 2.25 | 5.00 | 3.06 | 1.52 | 2.63 | 3.86 | 5.65 | 4.50 | 6.31 |
| | 4 | 0.51 | 1.31 | 4.06 | 2.82 | 0.30 | 1.48 | 3.25 | 5.82 | 5.02 | 5.87 |
| 2009 | 1 | 0.18 | 0.50 | 3.25 | 1.08 | 0.22 | 1.27 | 2.74 | 5.27 | 4.64 | 5.06 |
| | 2 | 0.18 | 0.50 | 3.25 | 0.62 | 0.17 | 1.49 | 3.31 | 5.51 | 4.43 | 5.03 |
| | 3 | 0.16 | 0.50 | 3.25 | 0.30 | 0.16 | 1.56 | 3.52 | 5.27 | 4.11 | 5.16 |
| | 4 | 0.12 | 0.50 | 3.25 | 0.22 | 0.06 | 1.39 | 3.46 | 5.20 | 3.91 | 4.92 |
| 2010 | 1 | 0.13 | 0.61 | 3.25 | 0.21 | 0.11 | 1.47 | 3.72 | 5.29 | 3.93 | 5.00 |
| | 2 | 0.19 | 0.75 | 3.25 | 0.42 | 0.15 | 1.38 | 3.49 | 5.04 | 3.83 | 4.91 |
| 2008 | 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 |
| | 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 |

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 | 5.27 | 4.95 |
| | 2007 | -0.15 | 9.06 | 6.32 | |
| | 2008 | 4.42 | 14.05 | 7.12 | |
| | 2009 | 14.10 | 9.53 | 7.85 | |
| 2008 | 1 | 2.63 | 15.73 | 7.90 | |
| | 2 | 2.30 | 13.35 | 6.05 | |
| | 3 | 8.95 | 5.03 | 4.96 | |
| | 4 | 29.93 | 10.77 | 14.41 | |
| 2009 | 1 | 12.56 | 17.95 | 12.43 | |
| | 2 | 10.85 | 5.84 | 2.73 | |
| | 3 | 7.90 | 1.43 | 1.06 | |
| | 4 | 8.15 | 0.59 | 3.71 | |
| 2010 | 1 | 3.83 | -4.24 | 0.01 | |
| | 2 | 1.75 | -4.61 | 1.95 | |
| 2008 | Jul | 14.61 | 7.74 | 8.03 | |
| | Aug | -12.73 | -2.10 | -1.81 | |
| | Sep | 51.14 | 6.26 | 16.52 | |
| | Oct | 10.92 | 6.43 | 17.51 | |
| | Nov | 36.84 | 17.15 | 7.86 | |
| | Dec | 67.35 | 31.89 | 28.71 | |
| 2009 | Jan | -13.92 | 17.17 | 8.92 | |
| | Feb | -7.19 | 9.08 | 5.76 | |
| | Mar | 2.58 | 9.29 | 7.66 | |
| | Apr | 23.72 | -1.71 | -6.49 | |
| | May | 0.00 | 13.60 | 10.38 | |
| | Jun | 28.07 | 2.70 | 2.29 | |
| | Jul | 2.78 | -0.21 | -1.41 | |
| | Aug | -1.08 | -4.88 | -3.32 | |
| | Sep | 9.01 | 4.40 | 5.58 | |
| | Oct | 11.08 | 0.41 | 4.66 | |
| | Nov | 8.11 | 0.89 | 4.41 | |
| | Dec | 6.46 | -1.64 | 2.70 | |
| 2010 | Jan | -11.20 | -8.74 | -7.85 | |
| | Feb | 24.32 | 0.72 | 8.69 | |
| | Mar | -1.17 | -11.11 | -3.35 | |
| | Apr | -8.03 | -11.59 | -3.94 | |
| | May | 3.58 | 6.40 | 11.57 | |
| | Jun | 11.15 | 2.07 | 4.35 | |
| | Jul | -2.89 | 2.35 | -0.11 | |

*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, $\pi_{t-1}$ 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 $m = 1,...,$ 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/.