## Are Banks Vulnerable to a Housing Bust?

House prices in the United States have soared over the past five years. A common measure of the trend in house prices is the repeat sales index produced by the Office of Federal Housing Enterprise Oversight. According to this measure, between 2001:Q1 and 2005:Q3, U.S. house prices increased by an average of 40 percent in nominal terms and 29 percent relative to the consumer price index (excluding the shelter component of the index). This rapid appreciation has led some analysts to forecast a correction in real house pricespossibly even a decline in nominal prices.

A decline in house prices would reduce household wealth, which could restrain the growth of consumer expenditures and overall economic activity. Mortgage default rates could increase sharply if a decline in house prices were accompanied by slower growth of household income or rising interest rates. Furthermore, a decline in house prices would reduce the value of collateral behind the $\$ 8$ trillion residential mortgage debt market and would thereby increase the losses lenders experience on loan defaults. The popularity of nontraditional mortgage loans, such as interest-only loans and adjustable-rate loans that permit negative amortization ("option ARMS"), raises additional concern about default risk because such loans expose borrowers to more interest-rate and house-price risk than traditional fixed-rate, amortizing loans.

How exposed are banks to residential real estate? As a share of their total assets, commercial bank holdings of residential real estate loans and securities have risen markedly since the mid-1990s. For example, between 1999:Q1 and 2005:Q1, the sum of bank holdings of 1-to4 -family residential real estate loans and the market value of their holdings of mortgage-backed securities (excluding those issued or guaranteed by a government agency or government-sponsored enterprise, such as Fannie Mae and Freddie Mac) increased from about 15 percent of total bank assets to nearly 20 percent. More comprehensive measures that include all residential real estate loans show similar increases in exposure, as does the ratio of untapped home equity lines of credit to total bank assets.

These simple exposure measures provide little information, however, about whether banks today are more vulnerable to a decline in house prices than they were in the past. Although the share of bank assets consisting of residential real estate loans and securities has increased since 1999, so too has bank equity-capital relative to total bank assets. Between 1999:Q1 and 2005:Q1, equity-capital increased from 8.5 percent of total bank assets to 9.9 percent of total assets. Because capital serves as a cushion against loan and security losses, the increase in real estate loans and securities as a share of bank assets is less worrisome than it would have otherwise been.

The national averages, of course, mask considerable variation across banks in their holdings of residential real estate loans and securities and in their capital-to-assets ratios. One might assume that risks are greater for banks located in regions that have seen the most rapid house price appreciation. Loan-to-value ratios have tended to be lower in such regions, however, suggesting that the mortgage market may have adapted to a possibly higher risk of house price declines in those states. Further, the growth of the mortgagebacked securities market and proliferation of interstate branch banking may have reduced banks' exposure to local real estate shocks by facilitating greater geographic diversification of their real estate loan and securities portfolios. Finally, a portion of the residential real estate loans and securities held by banks are guaranteed by third parties, and many banks purchase only highly rated securities that have little credit risk. Thus, to get a complete picture of how vulnerable individual banks are to a decline in house prices, we need to know more about the composition of their real estate loan and securities portfolios.
——avid C. Wheelock

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## Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.
2. Shaded areas indicate recessions, as determined by the National Bureau of Economic Research.
3. Percent change at an annual rate is the simple, not compounded, monthly percent change multiplied by 12 . For example, using consecutive months, the percent change at an annual rate in x between month $t-1$ and the current month $t$ is: $\left[\left(x_{t} / x_{t-1}\right)-1\right] \times 1200$. 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: $\left[\left(x_{t} / x_{t-12}\right)-1\right] \times 100$.

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
or to:
stlsFRED@stls.frb.org

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


Adjusted Monetary Base
Percent change at an annual rate


Reserve Market Rates


## Treasury Yield Curve

Percent


## Real Treasury Yield Curve

Percent


## Inflation-Indexed Treasury Yield Spreads

Percent


## MZM and M1

Percent change from year ago


## M2

Percent change from year ago


## M3

Percent change from year ago


## Monetary Services Index - M2

Percent change from year ago


## Adjusted Monetary Base

Percent change from year ago


Domestic Nonfinancial Debt
Percent change from year ago


## Time Deposits

Percent change from year ago


## Money Market Mutual Fund Shares

Percent change from year ago


Currency Held by the Nonbank Public
Percent change from year ago


## Checkable and Savings Deposits

Percent change from year ago


## Repurchase Agreements and Eurodollars

Billions of dollars
Billions of dollars


## M1

Percent change at an annual rate


## MZM

Percent change at an annual rate


## M2

Percent change at an annual rate


M3
Percent change at an annual rate



## Adjusted and Required Reserves

Billions of dollars


Total Borrowings, nsa


## Excess Reserves plus RCB Contracts

Billions of dollars


## Nonfinancial Commercial Paper

Percent change from year ago


## Consumer Credit

Percent change from year ago


## Inflation and 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. See notes on page 19.

## Treasury Security Yield Spreads

Yield to maturity


## Real Interest Rates

Percent, Real rate $=$ Nominal rate less CPI inflation


## Short-Term Interest Rates

Percent


## Long-Term Interest Rates



## Long-Term Interest Rates



## Short-Term Interest Rates

## Percent



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


## Federal Funds Rate and Inflation Targets

Percent


Calculated federal funds rate is based on Taylor's rule. See notes on page 19.

## Components of Taylor's Rule

## Actual and Potential Real GDP

Billions of chain-weighted 2000 dollars


PCE Inflation
Percent change from year ago


## Monetary Base Growth* and Inflation Targets

Percent

*Modified for the effects of sweeps programs on reserve demand.
Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago. See notes on page 19.

## Components of McCallum's Rule

Monetary Base Velocity Growth
Percent


## Real Output Growth

Percent


## Implied One-Year Forward Rates

Percent


Rates on Selected Federal Funds Futures Contracts
Percent, daily data
4.6 Mar 2006

## Inflation-Indexed Treasury Securities <br> Weekly data



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

## Inflation-Indexed <br> 10-Year Government Notes

Percent, weekly data


Rates on 3-Month Eurodollar Futures
Percent, daily data


## Rates on Federal Funds Futures on Selected Dates

Percent


## 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 Yield Spreads
Percent, weekly data



## Interest Rates



## MZM Velocity and Interest Rate Spread

Ratio Scale


## M2 Velocity and Interest Rate Spread



## 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


[^0]
## 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 |  |  |  |
|  | 2004Q4 | 2005Q1 | 2005Q2 | 2005Q3 | Sep05 | Oct05 | Nov05 | Dec05 |
| United States | 3.37 | 3.00 | 2.93 | 3.80 | 4.20 | 4.46 | 4.54 | 4.47 |
| Canada | 2.29 | 2.13 | 1.90 | 2.64 | 3.87 | 4.06 | 4.10 | . |
| France | 2.08 | 1.70 | 1.69 | 1.90 | 3.13 | 3.29 | . |  |
| Germany | 1.98 | 1.74 | 1.70 | 2.13 | 3.07 | 3.24 | 3.45 | . |
| Italy | 1.98 | 1.92 | 1.84 | 2.03 | 3.29 | 3.44 | 3.66 |  |
| Japan | 0.48 | -0.20 | -0.14 | -0.31 | 1.38 | 1.54 | 1.52 | 1.54 |
| United Kingdom | 3.41 | 3.17 | 3.01 | 2.78 | 4.24 | 4.37 |  |  |

## Inflation and Long-Term Interest Rate Differentials



|  |  | Money Stock |  |  |  |  | Adjusted <br> Monetary Base | Reserves | MSI M2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | M1 | MZM | M2 | M3 | Credit |  |  |  |
|  | 2001 | 1140.215 | 5223.438 | 5219.902 | 7646.741 | 5344.001 | 641.167 | 86.172 | 271.439 |
|  | 2002 | 1196.344 | 5895.446 | 5615.409 | 8261.403 | 5596.950 | 697.092 | 88.158 | 294.191 |
|  | 2003 | 1273.946 | 6332.382 | 6004.606 | 8788.514 | 6120.442 | 740.926 | 93.308 | 315.219 |
|  | 2004 | 1344.897 | 6581.409 | 6277.338 | 9236.793 | 6597.516 | 776.704 | 96.061 | 329.910 |
|  | 2005 | 1368.637 | 6722.557 | 6543.006 | 9801.865 | 7239.205 | 806.308 | 96.357 | 343.599 |
| 2003 | 1 | 1235.469 | 6195.709 | 5866.596 | 8624.845 | 5954.725 | 726.940 | 91.196 | 307.910 |
|  | 2 | 1268.185 | 6279.599 | 5976.326 | 8735.938 | 6135.073 | 738.451 | 92.117 | 313.666 |
|  | 3 | 1292.370 | 6443.859 | 6091.199 | 8901.791 | 6187.761 | 744.331 | 95.163 | 319.766 |
|  | 4 | 1299.762 | 6410.361 | 6084.306 | 8891.481 | 6204.207 | 753.981 | 94.758 | 319.534 |
| 2004 | 1 | 1319.929 | 6449.505 | 6138.564 | 9010.315 | 6428.351 | 761.427 | 95.031 | 322.486 |
|  | 2 | 1339.324 | 6587.990 | 6257.514 | 9216.103 | 6560.282 | 771.146 | 96.600 | 328.774 |
|  | 3 | 1350.520 | 6621.038 | 6311.119 | 9313.488 | 6645.830 | 782.780 | 96.796 | 331.731 |
|  | 4 | 1369.815 | 6667.102 | 6402.156 | 9407.267 | 6755.599 | 791.464 | 95.817 | 336.649 |
| 2005 | 1 | 1371.380 | 6674.440 | 6465.918 | 9536.882 | 6992.253 | 798.241 | 96.656 | 339.987 |
|  | 2 | 1369.379 | 6666.370 | 6493.088 | 9677.109 | 7166.755 | 802.631 | 96.050 | 341.128 |
|  | 3 | 1362.911 | 6723.410 | 6555.819 | 9877.278 | 7350.225 | 808.399 | 96.508 | 344.200 |
|  | 4 | 1370.880 | 6826.008 | 6657.198 | 10116.19 | 7447.587 | 815.960 | 96.214 | 349.079 |
| 2003 | Dec | 1305.081 | 6396.868 | 6085.195 | 8885.301 | 6251.311 | 752.952 | 92.971 | 319.634 |
| 2004 | Jan | 1303.448 | 6410.822 | 6098.708 | 8942.455 | 6321.751 | 756.790 | 93.206 | 320.482 |
|  | Feb | 1321.799 | 6444.242 | 6139.032 | 9006.604 | 6442.661 | 763.195 | 95.937 | 322.499 |
|  | Mar | 1334.540 | 6493.452 | 6177.951 | 9081.885 | 6520.641 | 764.295 | 95.950 | 324.478 |
|  | Apr | 1334.317 | 6541.332 | 6215.194 | 9144.307 | 6540.998 | 767.951 | 97.095 | 326.515 |
|  | May | 1338.617 | 6606.287 | 6273.248 | 9233.171 | 6549.961 | 770.211 | 95.779 | 329.610 |
|  | Jun | 1345.039 | 6616.350 | 6284.101 | 9270.830 | 6589.886 | 775.275 | 96.927 | 330.197 |
|  | Jul | 1337.428 | 6602.798 | 6285.668 | 9273.163 | 6602.291 | 780.464 | 95.691 | 330.486 |
|  | Aug | 1355.047 | 6616.533 | 6306.493 | 9308.479 | 6632.671 | 781.527 | 96.023 | 331.433 |
|  | Sep | 1359.084 | 6643.783 | 6341.195 | 9358.822 | 6702.529 | 786.349 | 98.674 | 333.274 |
|  | Oct | 1360.163 | 6644.202 | 6369.273 | 9369.946 | 6713.832 | 792.248 | 97.558 | 334.886 |
|  | Nov | 1375.791 | 6669.000 | 6406.537 | 9401.368 | 6759.506 | 793.878 | 96.828 | 336.880 |
|  | Dec | 1373.491 | 6688.104 | 6430.657 | 9450.486 | 6793.460 | 788.267 | 93.065 | 338.181 |
| 2005 | Jan | 1364.258 | 6683.116 | 6449.132 | 9502.881 | 6892.662 | 793.540 | 95.087 | 339.216 |
|  | Feb | 1371.622 | 6668.727 | 6464.333 | 9538.993 | 6999.367 | 800.277 | 97.805 | 339.882 |
|  | Mar | 1378.259 | 6671.476 | 6484.290 | 9568.773 | 7084.731 | 800.906 | 97.076 | 340.864 |
|  | Apr | 1360.574 | 6668.027 | 6481.126 | 9620.515 | 7112.411 | 802.312 | 97.440 | 340.777 |
|  | May | 1373.235 | 6648.732 | 6482.584 | 9662.669 | 7166.646 | 800.580 | 94.556 | 340.497 |
|  | Jun | 1374.327 | 6682.350 | 6515.553 | 9748.143 | 7221.207 | 805.002 | 96.155 | 342.109 |
|  | Jul | 1354.354 | 6687.408 | 6525.125 | 9776.768 | 7281.201 | 805.964 | 95.584 | 342.723 |
|  | Aug | 1370.998 | 6717.509 | 6554.403 | 9878.795 | 7360.533 | 807.389 | 95.815 | 344.072 |
|  | Sep | 1363.381 | 6765.314 | 6587.930 | 9976.270 | 7408.941 | 811.844 | 98.126 | 345.805 |
|  | Oct | 1367.635 | 6802.769 | 6627.211 | 10058.20 | 7419.862 | 816.108 | 97.757 | 347.587 |
|  | Nov | 1372.690 | 6813.052 | 6652.876 | 10098.96 | 7438.453 | 816.789 | 97.141 | 348.787 |
|  | Dec | 1372.315 | 6862.202 | 6691.507 | 10191.41 | 7484.447 | 814.982 | 93.744 | 350.864 |

[^1]|  |  | Federa Funds | Primary Credit Rate | Prime <br> Rate | 3-mo <br> CDs | Treasury Yields |  |  | Corporate Aaa Bonds | S \& L <br> Aaa Bonds | Conventional <br> Mortgage |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3-mo |  |  |  | 3-yr | 10-yr |  |  |  |
|  | 2001 |  | 3.89 |  | 6.92 | 3.69 | 3.47 | 4.08 | 5.02 | 7.08 | 5.01 | 6.97 |
|  | 2002 | 1.67 |  | 4.68 | 1.73 | 1.63 | 3.10 | 4.61 | 6.49 | 4.87 | 6.54 |
|  | 2003 | 1.13 | 2.11 | 4.12 | 1.15 | 1.03 | 2.11 | 4.02 | 5.67 | 4.52 | 5.82 |
|  | 2004 | 1.35 | 2.34 | 4.34 | 1.56 | 1.40 | 2.78 | 4.27 | 5.63 | 4.50 | 5.84 |
|  | 2005 | 3.21 | 4.19 | 6.19 | 3.51 | 3.21 | 3.93 | 4.29 | 5.23 | 4.28 | 5.86 |
| 2003 | 1 | 1.25 | 2.25 | 4.25 | 1.26 | 1.18 | 2.07 | 3.92 | 6.00 | 4.60 | 5.83 |
|  | 2 | 1.25 | 2.23 | 4.24 | 1.17 | 1.06 | 1.77 | 3.62 | 5.31 | 4.28 | 5.51 |
|  | 3 | 1.02 | 2.00 | 4.00 | 1.07 | 0.95 | 2.20 | 4.23 | 5.70 | 4.68 | 6.01 |
|  | 4 | 1.00 | 2.00 | 4.00 | 1.10 | 0.93 | 2.38 | 4.29 | 5.66 | 4.52 | 5.92 |
| 2004 | 1 | 1.00 | 2.00 | 4.00 | 1.05 | 0.93 | 2.17 | 4.02 | 5.45 | 4.26 | 5.61 |
|  | 2 | 1.01 | 2.00 | 4.00 | 1.25 | 1.10 | 2.98 | 4.60 | 5.93 | 4.82 | 6.13 |
|  | 3 | 1.43 | 2.42 | 4.42 | 1.70 | 1.51 | 2.92 | 4.30 | 5.64 | 4.54 | 5.89 |
|  | 4 | 1.95 | 2.94 | 4.94 | 2.25 | 2.04 | 3.05 | 4.17 | 5.48 | 4.39 | 5.73 |
| 2005 | 1 | 2.47 | 3.44 | 5.44 | 2.78 | 2.58 | 3.61 | 4.30 | 5.32 | 4.23 | 5.76 |
|  | 2 | 2.94 | 3.91 | 5.91 | 3.23 | 2.93 | 3.73 | 4.16 | 5.15 | 4.15 | 5.72 |
|  | 3 | 3.46 | 4.43 | 6.43 | 3.74 | 3.43 | 3.98 | 4.21 | 5.09 | 4.28 | 5.76 |
|  | 4 | 3.98 | 4.97 | 6.97 | 4.30 | 3.91 | 4.37 | 4.49 | 5.38 | 4.45 | 6.22 |
| 2003 | Dec | 0.98 | 2.00 | 4.00 | 1.10 | 0.91 | 2.44 | 4.27 | 5.62 | 4.41 | 5.88 |
| 2004 |  | 1.00 | 2.00 | 4.00 | 1.06 | 0.90 | 2.27 | 4.15 | 5.54 | 4.42 | 5.74 |
|  | Feb | 1.01 | 2.00 | 4.00 | 1.05 | 0.94 | 2.25 | 4.08 | 5.50 | 4.26 | 5.64 |
|  | Mar | 1.00 | 2.00 | 4.00 | 1.05 | 0.95 | 2.00 | 3.83 | 5.33 | 4.11 | 5.45 |
|  | Apr | 1.00 | 2.00 | 4.00 | 1.08 | 0.96 | 2.57 | 4.35 | 5.73 | 4.69 | 5.83 |
|  | May | 1.00 | 2.00 | 4.00 | 1.20 | 1.04 | 3.10 | 4.72 | 6.04 | 4.93 | 6.27 |
|  | Jun | 1.03 | 2.01 | 4.01 | 1.46 | 1.29 | 3.26 | 4.73 | 6.01 | 4.85 | 6.29 |
|  | Jul | 1.26 | 2.25 | 4.25 | 1.57 | 1.36 | 3.05 | 4.50 | 5.82 | 4.71 | 6.06 |
|  | Aug | 1.43 | 2.43 | 4.43 | 1.68 | 1.50 | 2.88 | 4.28 | 5.65 | 4.52 | 5.87 |
|  | Sep | 1.61 | 2.58 | 4.58 | 1.86 | 1.68 | 2.83 | 4.13 | 5.46 | 4.40 | 5.75 |
|  | Oct | 1.76 | 2.75 | 4.75 | 2.04 | 1.79 | 2.85 | 4.10 | 5.47 | 4.38 | 5.72 |
|  | Nov | 1.93 | 2.93 | 4.93 | 2.26 | 2.11 | 3.09 | 4.19 | 5.52 | 4.45 | 5.73 |
|  | Dec | 2.16 | 3.15 | 5.15 | 2.45 | 2.22 | 3.21 | 4.23 | 5.47 | 4.35 | 5.75 |
| 2005 | Jan | 2.28 | 3.25 | 5.25 | 2.61 | 2.37 | 3.39 | 4.22 | 5.36 | 4.24 | 5.71 |
|  | Feb | 2.50 | 3.49 | 5.49 | 2.77 | 2.58 | 3.54 | 4.17 | 5.20 | 4.16 | 5.63 |
|  | Mar | 2.63 | 3.58 | 5.58 | 2.97 | 2.80 | 3.91 | 4.50 | 5.40 | 4.29 | 5.93 |
|  | Apr | 2.79 | 3.75 | 5.75 | 3.09 | 2.84 | 3.79 | 4.34 | 5.33 | 4.18 | 5.86 |
|  | May | 3.00 | 3.98 | 5.98 | 3.22 | 2.90 | 3.72 | 4.14 | 5.15 | 4.20 | 5.72 |
|  | Jun | 3.04 | 4.01 | 6.01 | 3.38 | 3.04 | 3.69 | 4.00 | 4.96 | 4.08 | 5.58 |
|  | Jul | 3.26 | 4.25 | 6.25 | 3.57 | 3.29 | 3.91 | 4.18 | 5.06 | 4.18 | 5.70 |
|  | Aug | 3.50 | 4.44 | 6.44 | 3.77 | 3.52 | 4.08 | 4.26 | 5.09 | 4.33 | 5.82 |
|  | Sep | 3.62 | 4.59 | 6.59 | 3.87 | 3.49 | 3.96 | 4.20 | 5.13 | 4.34 | 5.77 |
|  | Oct | 3.78 | 4.75 | 6.75 | 4.13 | 3.79 | 4.29 | 4.46 | 5.35 | 4.49 | 6.07 |
|  | Nov | 4.00 | 5.00 | 7.00 | 4.31 | 3.97 | 4.43 | 4.54 | 5.42 | 4.42 | 6.33 |
|  | Dec | 4.16 | 5.15 | 7.15 | 4.45 | 3.97 | 4.39 | 4.47 | 5.37 | 4.46 | 6.27 |

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

|  |  | M1 | MZM | M2 | M3 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Percent change at an annual rate |  |  |  |  |  |
|  | 2001 | 3.33 | 15.88 | 8.77 | 11.47 |
|  | 2002 | 4.92 | 12.87 | 7.58 | 8.04 |
|  | 2003 | 6.49 | 7.41 | 6.93 | 6.38 |
|  | 2004 | 5.57 | 3.93 | 4.54 | 5.10 |
|  | 2005 | 1.77 | 2.14 | 4.23 | 6.12 |
| 2003 | 1 | 8.38 | 7.85 | 6.90 | 6.69 |
|  | 2 | 10.59 | 5.42 | 7.48 | 5.15 |
|  | 3 | 7.63 | 10.46 | 7.69 | 7.59 |
|  | 4 | 2.29 | -2.08 | -0.45 | -0.46 |
| 2004 | 1 | 6.21 | 2.44 | 3.57 | 5.35 |
|  | 2 | 5.88 | 8.59 | 7.75 | 9.14 |
|  | 3 | 3.34 | 2.01 | 3.43 | 4.23 |
|  | 4 | 5.71 | 2.78 | 5.77 | 4.03 |
| 2005 | 1 | 0.46 | 0.44 | 3.98 | 5.51 |
|  | 2 | -0.58 | -0.48 | 1.68 | 5.88 |
|  | 3 | -1.89 | 3.42 | 3.86 | 8.27 |
|  | 4 | 2.34 | 6.10 | 6.19 | 9.68 |
| 2003 | Dec | 6.72 | -1.96 | 0.72 | 0.04 |
| 2004 | Jan | -1.50 | 2.62 | 2.66 | 7.72 |
|  | Feb | 16.89 | 6.26 | 7.93 | 8.61 |
|  | Mar | 11.57 | 9.16 | 7.61 | 10.03 |
|  | Apr | -0.20 | 8.85 | 7.23 | 8.25 |
|  | May | 3.87 | 11.92 | 11.21 | 11.66 |
|  | Jun | 5.76 | 1.83 | 2.08 | 4.89 |
|  | Jul | -6.79 | -2.46 | 0.30 | 0.30 |
|  | Aug | 15.81 | 2.50 | 3.98 | 4.57 |
|  | Sep | 3.58 | 4.94 | 6.60 | 6.49 |
|  | Oct | 0.95 | 0.08 | 5.31 | 1.43 |
|  | Nov | 13.79 | 4.48 | 7.02 | 4.02 |
|  | Dec | -2.01 | 3.44 | 4.52 | 6.27 |
| 2005 | Jan | -8.07 | -0.89 | 3.45 | 6.65 |
|  | Feb | 6.48 | -2.58 | 2.83 | 4.56 |
|  | Mar | 5.81 | 0.49 | 3.70 | 3.75 |
|  | Apr | -15.40 | -0.62 | -0.59 | 6.49 |
|  | May | 11.17 | -3.47 | 0.27 | 5.26 |
|  | Jun | 0.95 | 6.07 | 6.10 | 10.61 |
|  | Jul | -17.44 | 0.91 | 1.76 | 3.52 |
|  | Aug | 14.75 | 5.40 | 5.38 | 12.52 |
|  | Sep | -6.67 | 8.54 | 6.14 | 11.84 |
|  | Oct | 3.74 | 6.64 | 7.16 | 9.86 |
|  | Nov | 4.44 | 1.81 | 4.65 | 4.86 |
|  | Dec | -0.33 | 8.66 | 6.97 | 10.99 |

## 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 30year constant maturity series was discontinued by the Treasury as of February 18, 2002.

Page 5: Checkable Deposits is the sum of demand and other checkable deposits. Savings Deposits is the sum of money market deposit accounts and passbook and statement savings. Time Deposits have a minimum initial maturity of 7 days. Large Time Deposits are deposits of $\$ 100,000$ or more. Retail and Institutional Money Market Mutual Funds are as included in M2 and the non-M2 component of M3, respectively.

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

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

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

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

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 as estimated by the Congressional Budget Office.

Monetary Base Growth and Inflation Targets shows the quarterly growth of the adjusted monetary base (modified to include an estimate of the effect of sweep programs) implied by applying McCallum's $(1988,1993)$ equation
$\Delta M B_{t}^{*}=\pi^{*}+(10$-year moving average growth of real GDP $)$

- (4-year moving average of base velocity growth)
to five alternative target inflation rates, $\pi^{*}=0,1,2,3,4$ percent, where $\Delta M B_{t}{ }^{*}$ is the implied growth rate of the adjusted monetary base. The 10 -year moving average growth of real GDP for a quarter $t$ is calculated as the average quarterly growth during the previous 40 quarters, at an annual rate, by the formula $\left(\left(y_{t}-y_{t-40}\right) / 40\right) \times 400$, where $y_{t}$ is the log of real GDP. The 4 -year moving average of base velocity growth is calculated similarly. To adjust the monetary base for the effect of retail-deposit sweep programs, we add to the monetary base an amount equal to 10 percent of the total amount swept, as estimated by the Federal Reserve Board staff. These estimates are imprecise, at best. Sweep program data are found at research.stlouisfed.org/aggreg/swdata.html.

Page 11: Implied One-Year Forward Rates are calculated by this Bank from Treasury constant maturity yields. Yields to maturity, $R(m)$, for securities with $m=1, \ldots, 10$ years to maturity are obtained by linear interpolation between reported yields. These yields are smoothed by fitting the regression suggested by Nelson and Siegel (1987),

$$
R(m)=\mathrm{a}_{0}+\left(\mathrm{a}_{1}+\mathrm{a}_{2}\right)\left(1-\mathrm{e}^{-m / 50}\right) /(m / 50)-\mathrm{a}_{2} \times \mathrm{e}^{-m / 50}
$$

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 $D(m)=\left(1-e^{-R(m) \times m}\right) / R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). Rates on 3-Month Eurodollar Futures and Rates on Selected Federal Funds Futures Contracts trace through time the yield on three specific contracts. Rates on Federal Funds Futures on Selected Dates displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. Inflation-Indexed Treasury Securities and Yield Spreads are those plotted on page 3. Inflation-Indexed 10-Year Government Notes shows the yield of an inflation-indexed note that is scheduled to mature in approximately (but not greater than) 10 years. The current French note has a maturity date of $7 / 25 / 2015$, the current U.K. note has a maturity date of $8 / 16 / 2013$, and the current U.S. note has a maturity date of 7/15/2015. Inflation-Indexed Treasury Yield Spreads and InflationIndexed 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 2000 dollars.

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

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

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

## Sources

Agence France Trésor: French note yields.
Bank of Canada: Canadian note yields.
Bank of England: U.K. note yields.
Board of Governors of the Federal Reserve System:
Monetary aggregates and components: H. 6 release. Bank credit and components: H. 8 release. Consumer credit: G. 19 release. Required reserves, excess reserves, clearing balance contracts, and discount window borrowing: H.4.1 and H. 3 releases. Interest rates: H. 15 release. Nonfinancial commercial paper: Board of Governors website. Nonfinancial debt: Z. 1 release. M2 own rate.

Bureau of Economic Analysis: GDP.
Bureau of Labor Statistics: CPI.
Chicago Board of Trade: Federal funds futures contract.

Chicago Mercantile Exchange: Eurodollar futures.
Congressional Budget Office : Potential real GDP.
Federal Reserve Bank of Philadelphia: Survey of Professional Forecasters inflation expectations.
Federal Reserve Bank of St. Louis: Adjusted monetary base and adjusted reserves, monetary services index, MZM own rate, one-year forward rates.
Organization for Economic Cooperation and Development: International interest and inflation rates.
Standard \& Poor's: Stock price-earnings ratio, stock price composite index.
University of Michigan Survey Research Center: Median expected price change.
U.S. Department of the Treasury: U.S. security yields.

## References

Anderson, Richard G. and Robert H. Rasche (1996a). "A Revised Measure of the St. Louis Adjusted Monetary Base," Federal Reserve Bank of St. Louis Review, March/April, 78(2), pp. 3-13.*
$\qquad$ (1996b). "Measuring the Adjusted Monetary Base in an Era of Financial Change," Federal Reserve Bank of St. Louis Review, November/ December, 78(6), pp. 3-37.*
and ___ (2001). "Retail Sweep Programs and Bank Reserves, 19941999," Federal Reserve Bank of St. Louis Review, January/February, 83(1), pp. 51-72.*
___ and $\qquad$ , with Jeffrey Loesel (2003). "A Reconstruction of the Federal Reserve Bank of St. Louis Adjusted Monetary Base and Reserves," Federal Reserve Bank of St. Louis Review, September/October, 85(5), pp. 39-70.*
_ Barry E. Jones and Travis D. Nesmith (1997). "Special Report: The Monetary Services Indexes Project of the Federal Reserve Bank of St. Louis," Federal Reserve Bank of St. Louis Review, January/February, 79(1), pp. 31-82.*
McCallum, Bennett T. (1988). "Robustness Properties of a Monetary Policy Rule," Carnegie-Rochester Conference Series on Public Policy, vol. 29, pp. 173-204.
_(1993). "Specification and Analysis of a Monetary Policy Rule for Japan," Bank of Japan Monetary and Economic Studies, November, pp. 1-45.

Motley, Brian (1988). "Should M2 Be Redefined?" Federal Reserve Bank of San Francisco Economic Review, Winter, pp. 33-51.

Nelson, Charles R. and Andrew F. Siegel (1987). "Parsimonious Modeling of Yield Curves," Journal of Business, October, pp. 473-89.

Poole, William (1991). Statement before the Subcommittee on Domestic Monetary Policy of the Committee on Banking, Finance and Urban Affairs, U.S. House of Representatives, November 6, 1991. Government Printing Office, Serial No. 102-82.

Sharpe, William F. (1997). Macro-Investment Analysis, on-line textbook available at www.stanford.edu/ $\sim$ wfsharpe $/ \mathrm{mia} / \mathrm{mia} . h t \mathrm{~m}$.

Shiller, Robert (1990). "The Term Structure of Interest Rates," Handbook of Monetary Economics, vol. 1, B. Friedman and F. Hahn, eds., pp. 627-722.

Taylor, John B. (1993). "Discretion versus Policy Rules in Practice," CarnegieRochester Conference Series on Public Policy, vol. 39, pp. 195-214.

Note: *Available on the Internet at research.stlouisfed.org/publications/review/.


[^0]:    Dashed lines indicate 10-year moving averages.

[^1]:    *All values are given in billions of dollars.

