

Bagehot on the Financial Crises of 1825...and 2008

Recently, several federal agencies, including the Federal Reserve, FDIC, and Treasury, have created numerous programs to support credit flows.¹ Some analysts have criticized these programs as “scattershot,” as lacking focus, or as desperate attempts to be perceived as “doing something.”² Others have argued that care must be taken so that these programs do not violate Walter Bagehot’s maxim that central banks must lend only against good collateral and at penalty rates (Thornton, 2008). Here, I argue that these programs are appropriate and consistent with lessons learned from two centuries of monetary history.

Macroeconomists continue to find use in Bagehot’s *Lombard Street* (1873), a book that prescribed behavioral rules for the Bank of England when Great Britain had no statutory central bank but the Bank held the nation’s gold reserve and special statutory authority to issue banknotes. Bagehot’s principal message was that the first task of a central bank during a financial panic is to end the panic—a message that remains true today. He defined a panic, in his day, as a period when the public wished to hold only gold coin, bullion, or Bank of England banknotes. Quelling a panic required satisfying the public’s demand for these risk-free liquid assets. It was the practice of the Bank to lend aggressively during panics, and several times before his writing the Bank had nearly exhausted its reserves. Further, lending could not always be against “good” collateral since the panic itself harmed the market value of assets. Bagehot advised a lending rate sufficiently high to avoid exhausting the Bank’s reserves and adequate collateral to ensure that the Bank, a private institution, would not itself become insolvent.³

The applicability of Bagehot’s advice is limited today. Modern central banks in fiat money economies do not face the constraints that concerned Bagehot—their right to issue high-powered money cannot be exhausted, nor can they become insolvent. Modern research suggests, instead, two pieces of advice. The first is that panics tend to follow periods of increasing *asymmetric information* between borrowers and lenders, leading to an underpricing of risk associated with new financial securities and instruments. During the panic, information becomes more uniform, asset prices change, and some lenders/investors become insolvent. The central bank’s role is to assist markets in this price discovery process by keeping them as orderly as possible. This mechanism has been explored by Kindleberger (1978), Mishkin (1991), Neal (1998), and others. The second piece of advice is that preserving the banking system through the panic is essential because banking firms, more so than other institutions, process private information and monitor borrowers. Sustaining the banking firms does *not* preclude imposing losses on the firms’ owners and debtors, but maintaining the firms may require lending on questionable collateral. Friedman and Schwartz (1963) argue that such efforts during the Great Depression were

inadequate, and they quote approvingly Bagehot’s summary of how the Bank of England halted history’s first modern financial panic (*Lombard Street*, pp. 51-52):

The way in which the panic of 1825 was stopped by advancing money has been described in so broad and graphic a way that the passage has become classical. “We lent it,” said Mr. Harman [a senior director] on behalf of the Bank of England, “by every possible means and in modes we have never adopted before; we took in stock on security, we purchased Exchequer bills, we made advances on Exchequer bills, we not only discounted outright, but we made advances on the deposit of bills of exchange to an immense amount, in short, by every possible means consistent with the safety of the Bank, and we were not on some occasions over-nice [to borrowers].”

It is clear in the historical record that the Federal Reserve’s founders expected all Fed lending to be repaid; doing otherwise would be to conduct fiscal rather than monetary policy. Further, Bagehot’s first advice to central banks remains: In a financial panic, quell the panic by every possible means, mindful that an effective monetary policy during a panic cannot be risk free.

—Richard G. Anderson

References

- Bagehot, Walter. *Lombard Street: A Description of the Money Market*. London: John Murray, 1873. Reprinted (with introduction by Hartley Withers). London: William Clowes and Sons, 1924.
- Friedman, Milton and Schwartz, Anna J. *A Monetary History of the United States, 1867–1960*. Princeton, NJ: Princeton University Press, 1963.
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- Neal, Larry. “The Financial Crisis of 1825 and the Restructuring of the British Financial System.” *Federal Reserve Bank of St. Louis Review*, May/June 1998, 80(3), pp. 53-78.
- Leonhardt, David. “Piling Up Monuments of Waste.” *New York Times*, November 18, 2008.
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- Zandi, Mark. “The Economic Outlook and Stimulus Options.” Written testimony before the U.S. Senate Budget Committee, November 19, 2008.

¹ A summary and timeline are available at <http://www.stlouisfed.org/timeline/>.

² Examples include Leonhardt (2008) and the testimony of Mark Zandi, chief economist of Moody’s Economy.com, before the U.S. Senate Budget Committee, November 19, 2008.

³ The Bank of England at this time was a private bank with shareholders and dividend payments.

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Conventions used in this publication:

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

We welcome your comments addressed to:

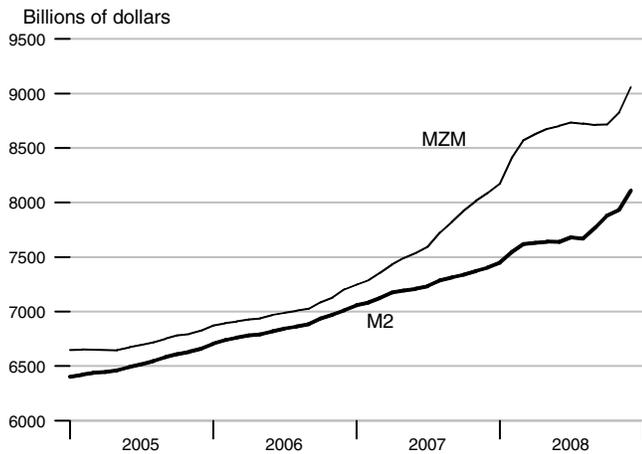
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St. Louis, MO 63166-0442

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.

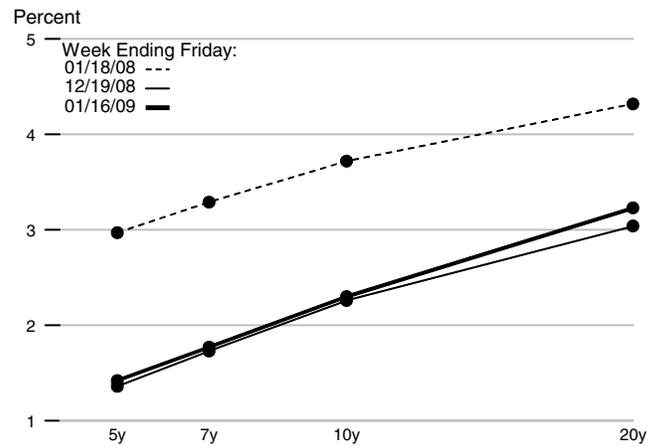
or to:

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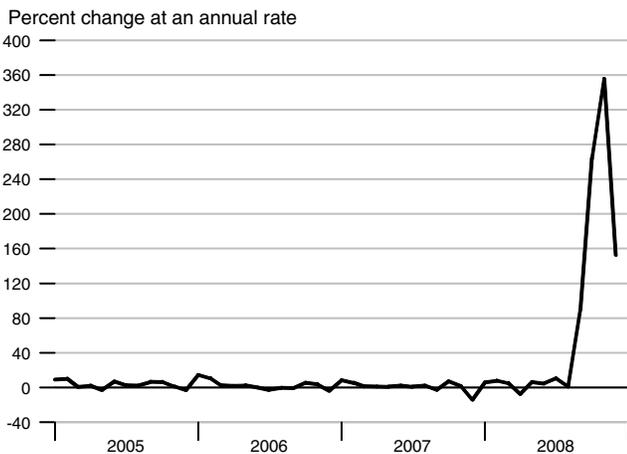
M2 and MZM



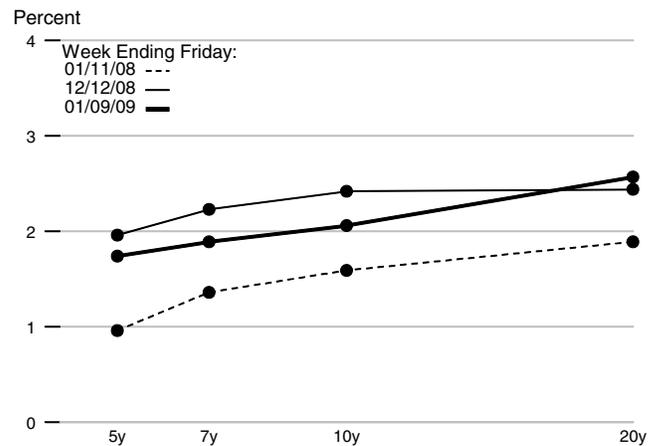
Treasury Yield Curve



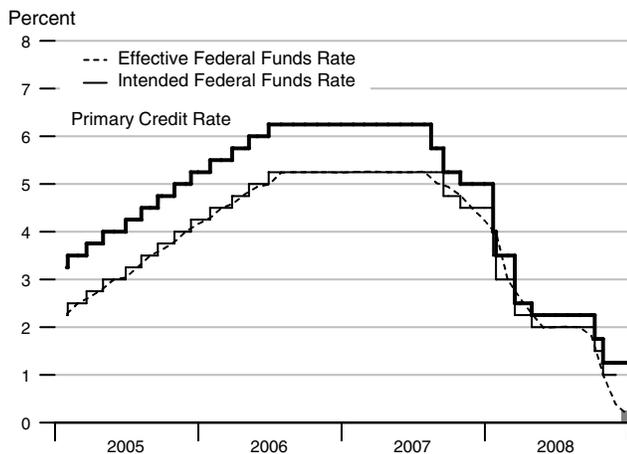
Adjusted Monetary Base



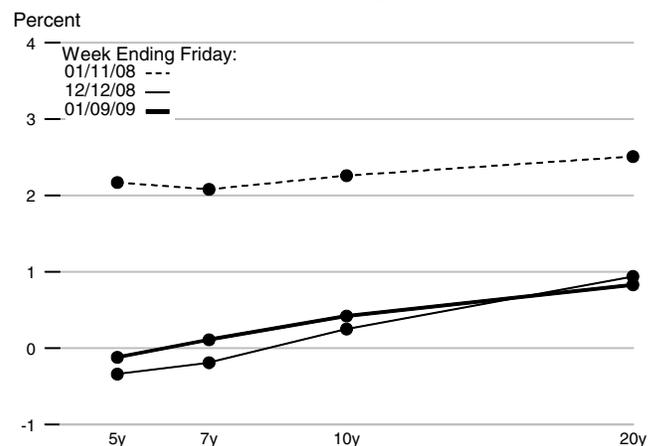
Real Treasury Yield Curve



Reserve Market Rates



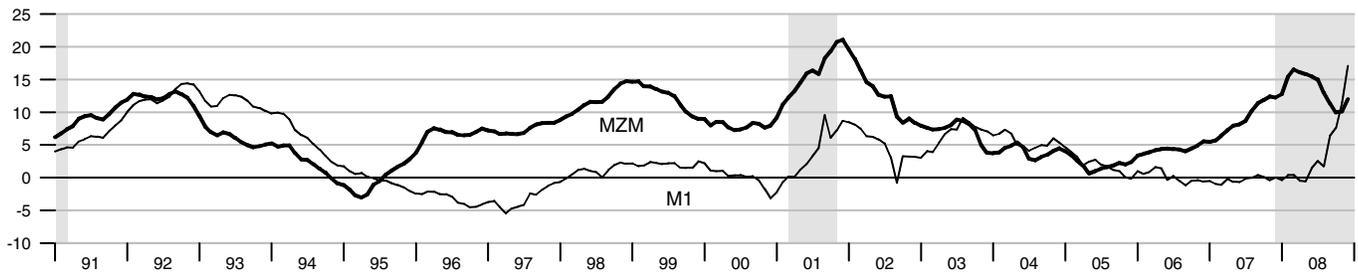
Inflation-Indexed Treasury Yield Spreads



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

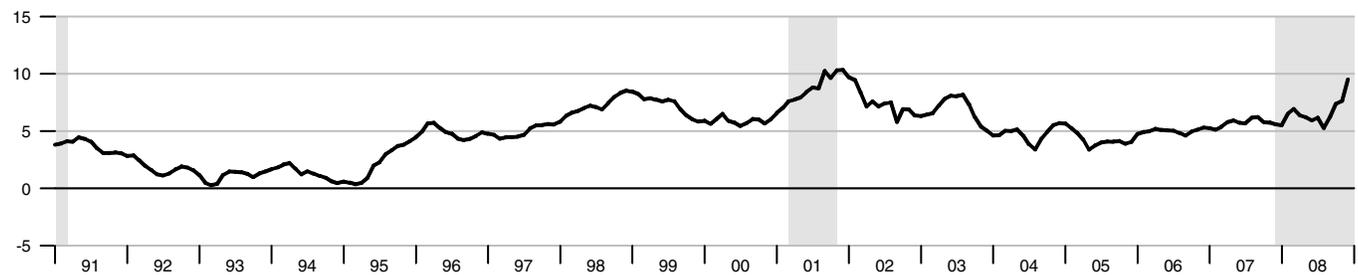
MZM and M1

Percent change from year ago



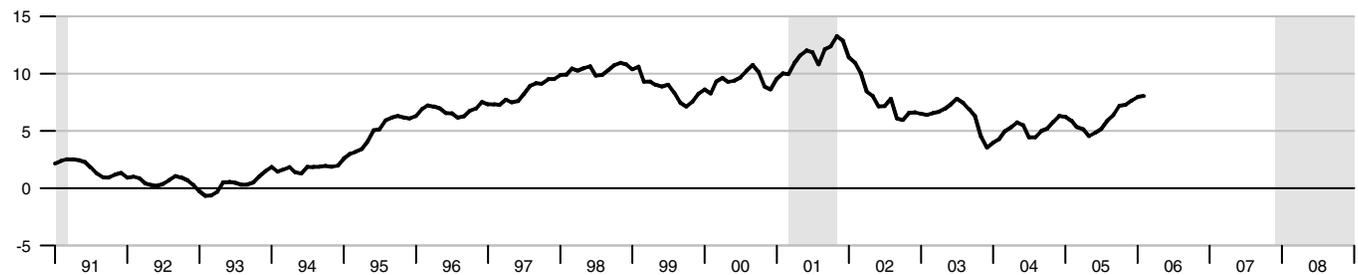
M2

Percent change from year ago



M3*

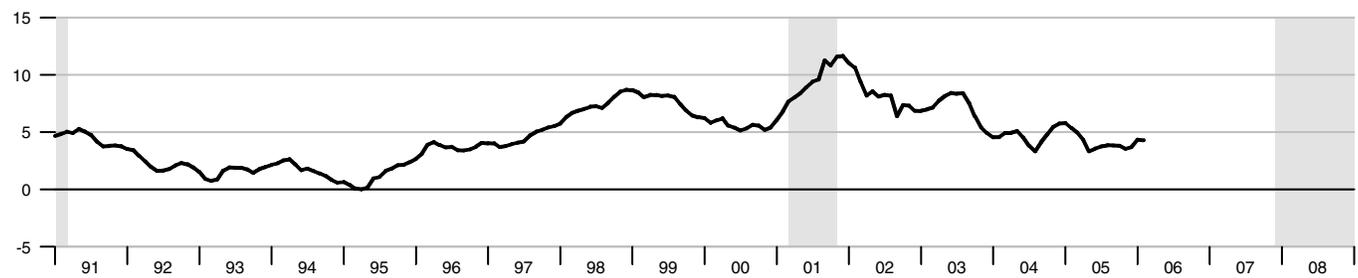
Percent change from year ago



*See table of contents for changes to the series.

Monetary Services Index - M2**

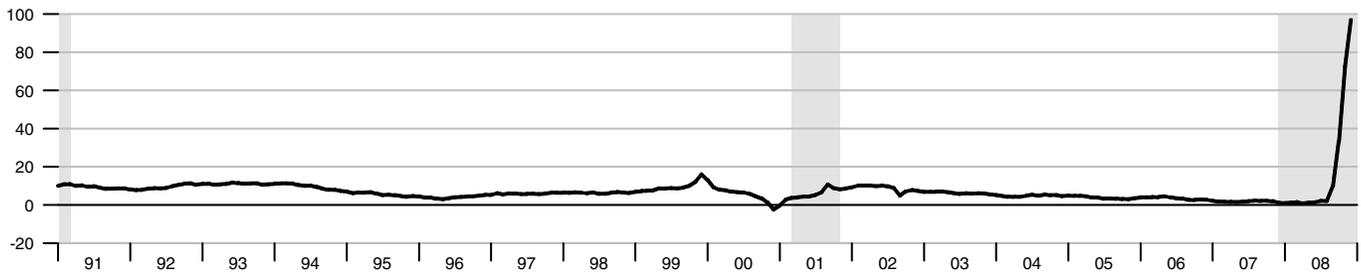
Percent change from year ago



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

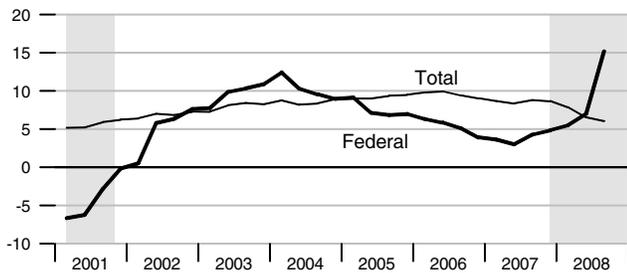
Adjusted Monetary Base

Percent change from year ago



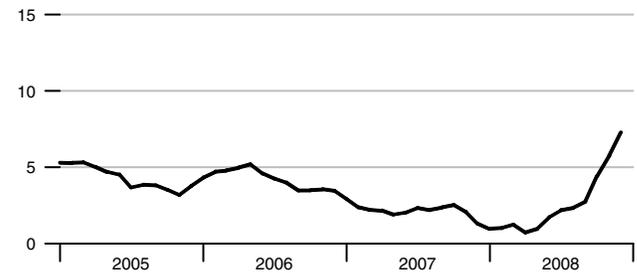
Domestic Nonfinancial Debt

Percent change from year ago



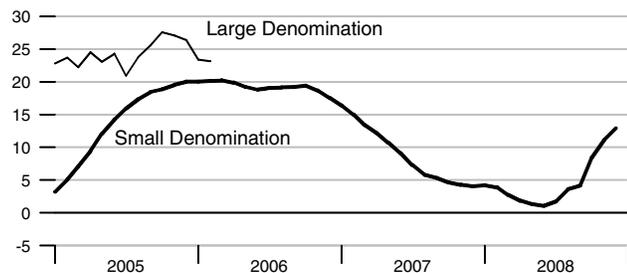
Currency Held by the Nonbank Public

Percent change from year ago



Time Deposits*

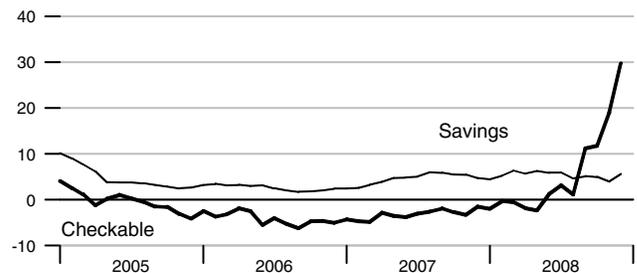
Percent change from year ago



*See table of contents for changes to the series.

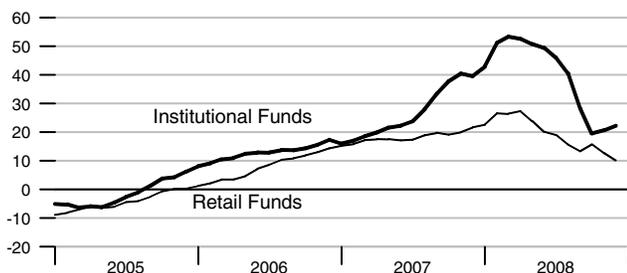
Checkable and Savings Deposits

Percent change from year ago



Money Market Mutual Fund Shares

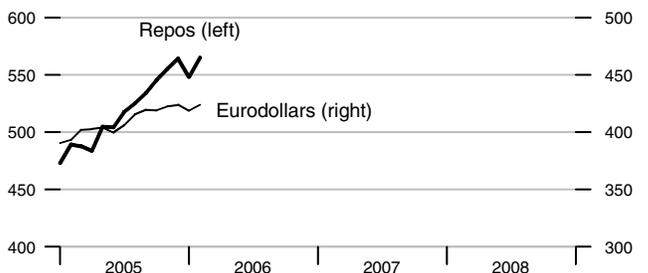
Percent change from year ago



Repurchase Agreements and Eurodollars*

Billions of dollars

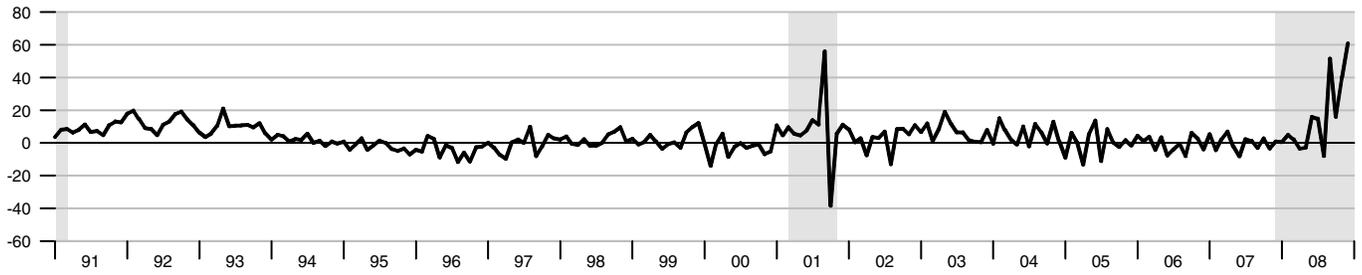
Billions of dollars



*See table of contents for changes to these series.

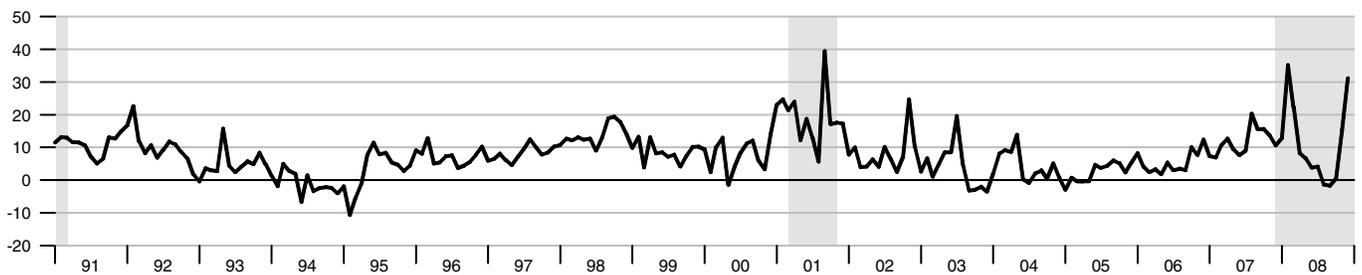
M1

Percent change at an annual rate



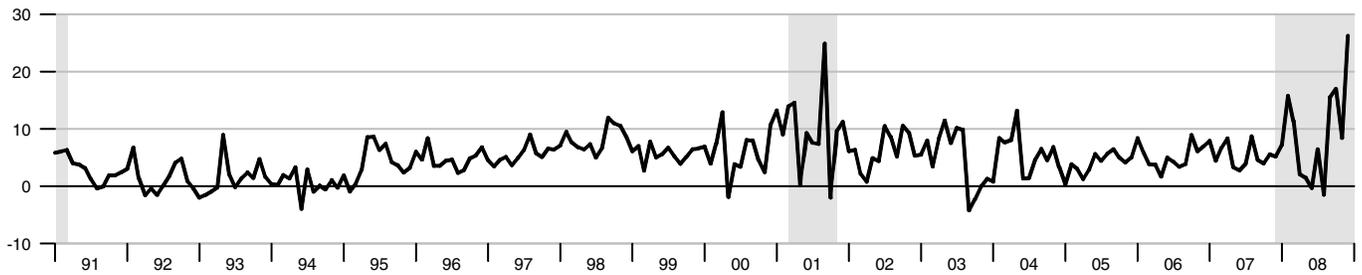
M2M

Percent change at an annual rate



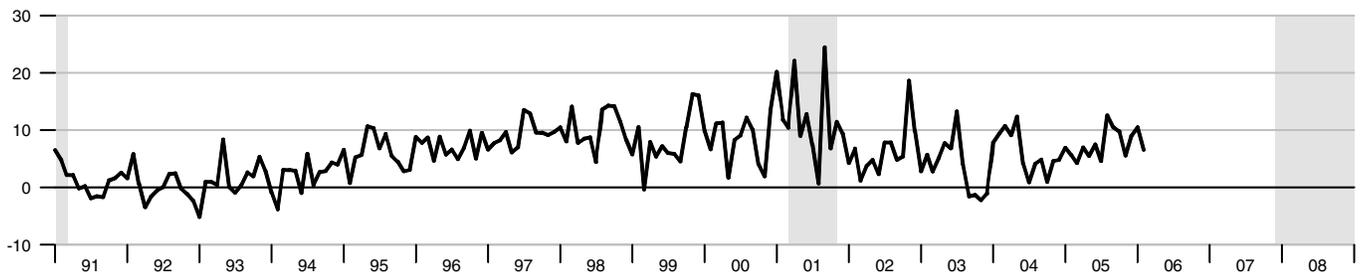
M2

Percent change at an annual rate



M3*

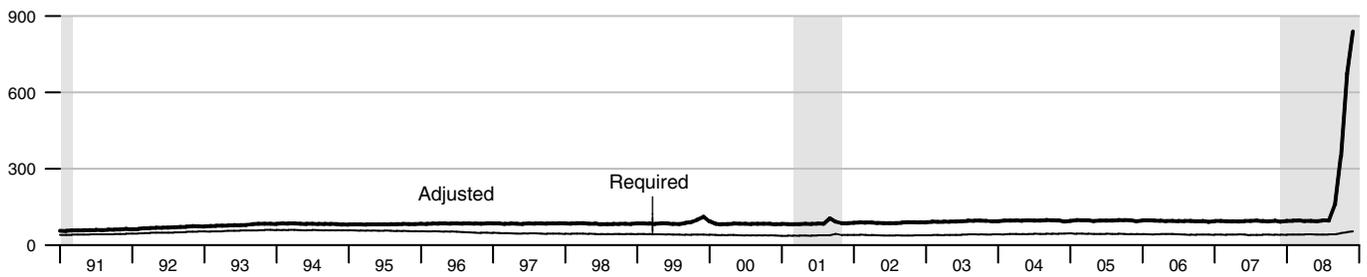
Percent change at an annual rate



*See table of contents for changes to the series.

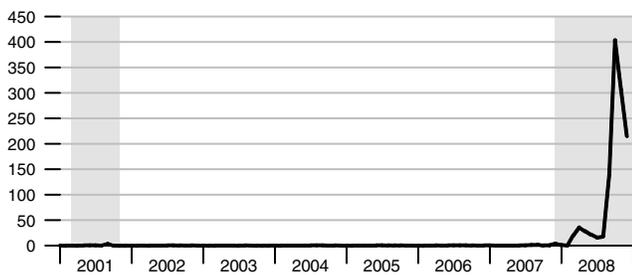
Adjusted and Required Reserves

Billions of dollars



Total Borrowings, nsa

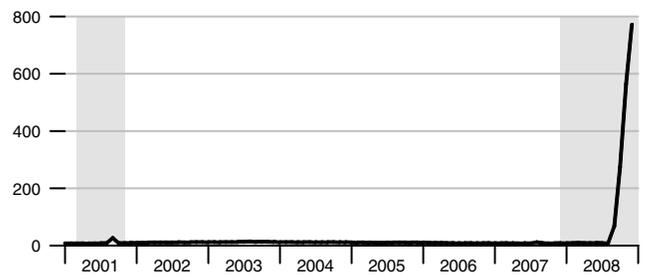
Billions of dollars



* Data exclude term auction credit

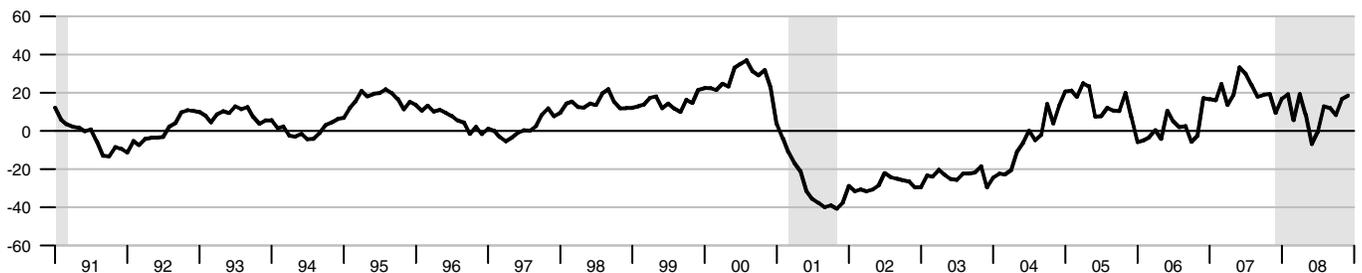
Excess Reserves plus RCB Contracts

Billions of dollars



Nonfinancial Commercial Paper

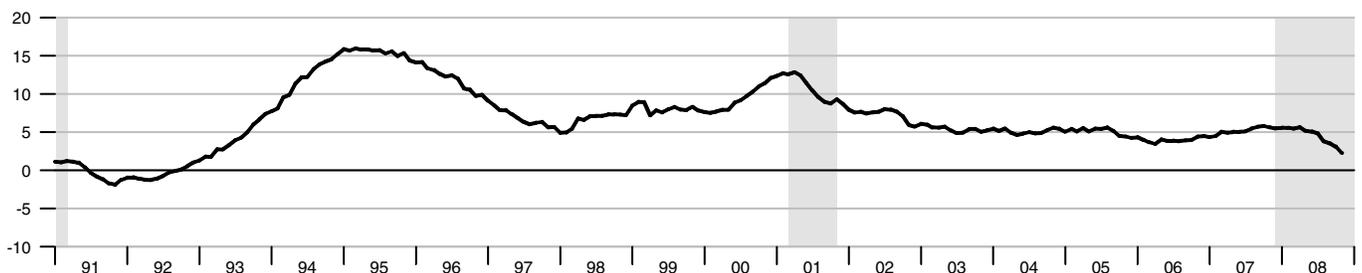
Percent change from year ago



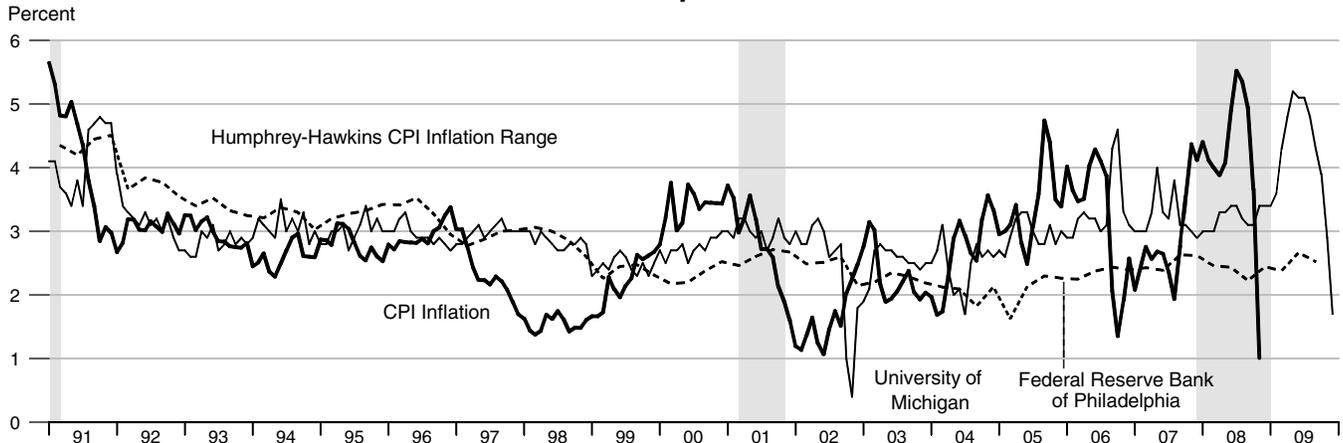
As of April 10, 2006, the Federal Reserve Board made major changes to its commercial paper calculations. For more information, please refer to <http://www.federalreserve.gov/releases/cp/about.htm>.

Consumer Credit

Percent change from year ago



CPI Inflation and 1-Year-Ahead CPI Inflation Expectations



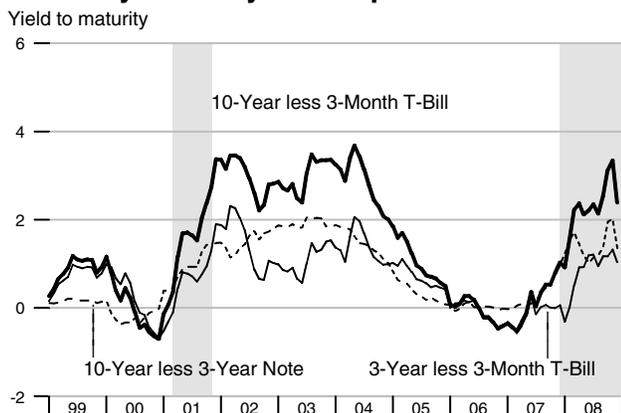
The shaded region shows the Humphrey-Hawkins CPI inflation range. Beginning in January 2000, the Humphrey-Hawkins inflation range was reported using the PCE price index and therefore is not shown on this graph.

10-Year Ahead PCE Inflation Expectations and Realized Inflation

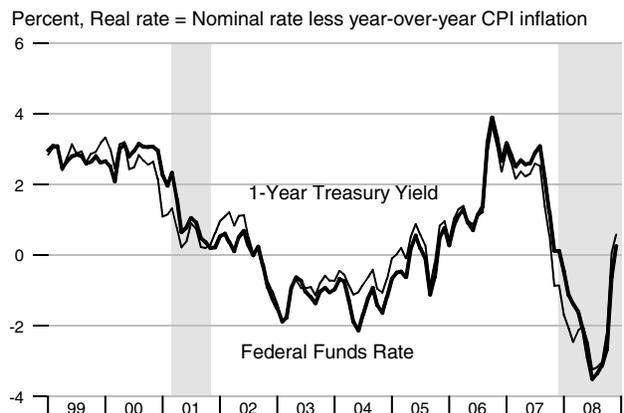


See the notes section for an explanation of the chart.

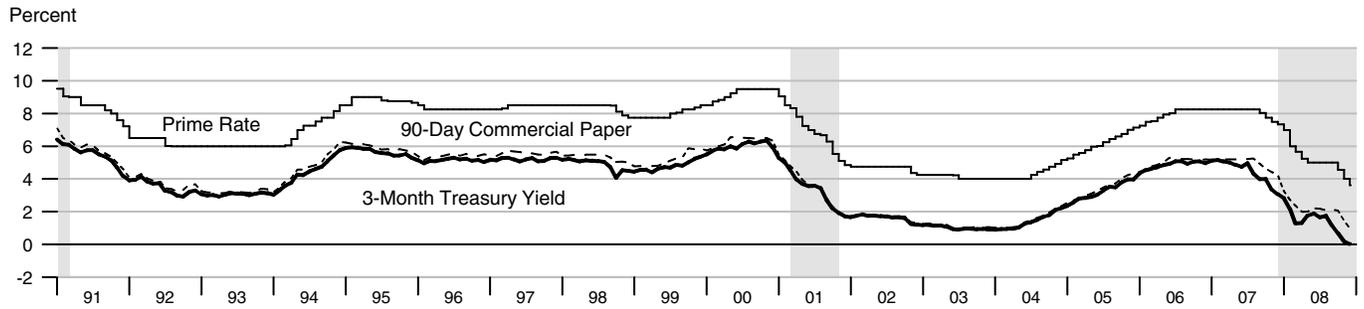
Treasury Security Yield Spreads



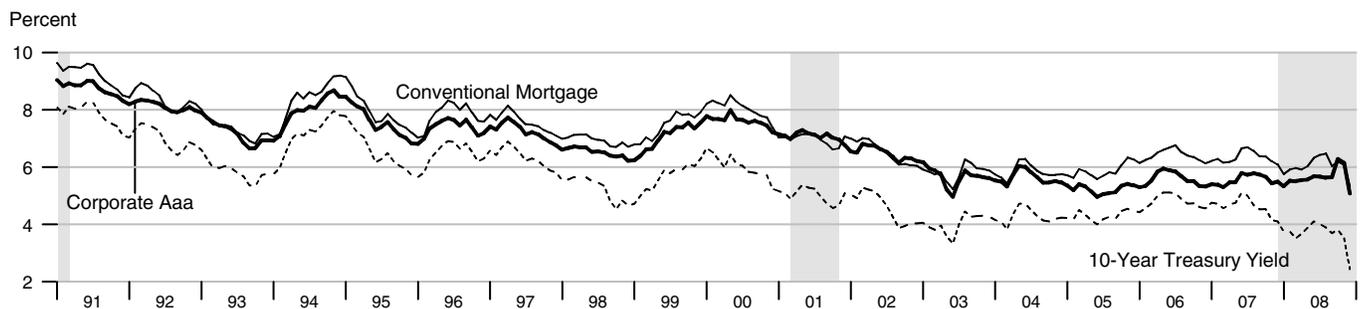
Real Interest Rates



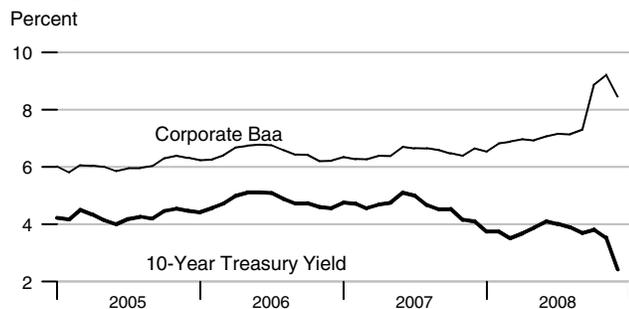
Short-Term Interest Rates



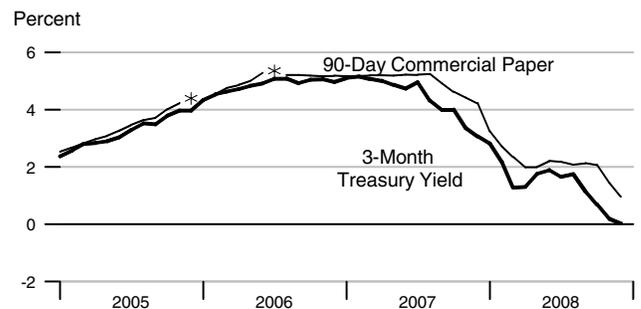
Long-Term Interest Rates



Long-Term Interest Rates

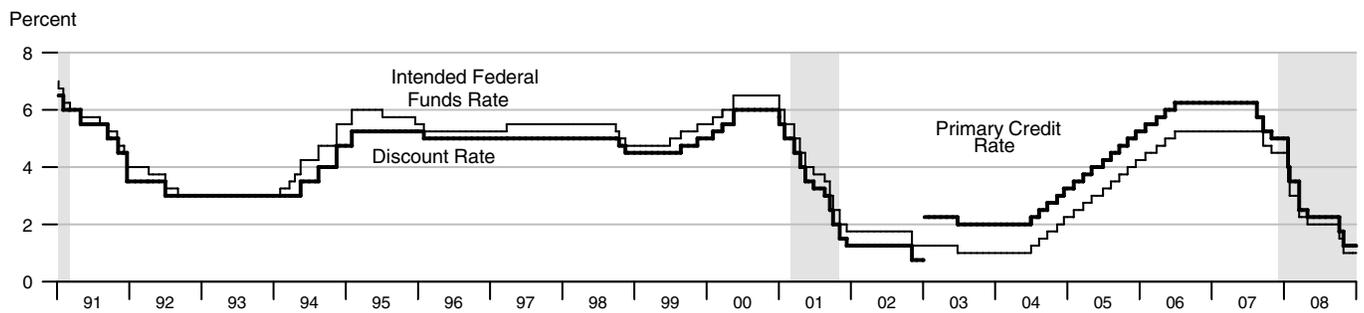


Short-Term Interest Rates



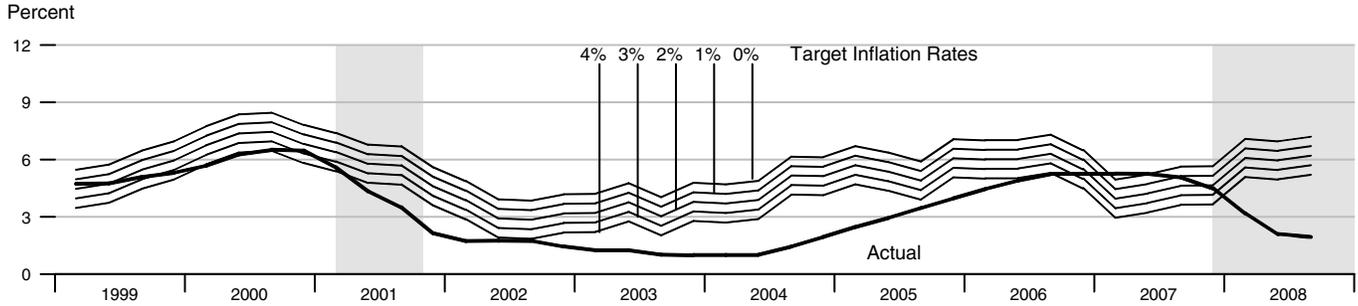
*90-Day Commercial Paper data are not available for December 2005, January 2006, and July 2006.

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



Data available as of December 2008.

Federal Funds Rate and Inflation Targets

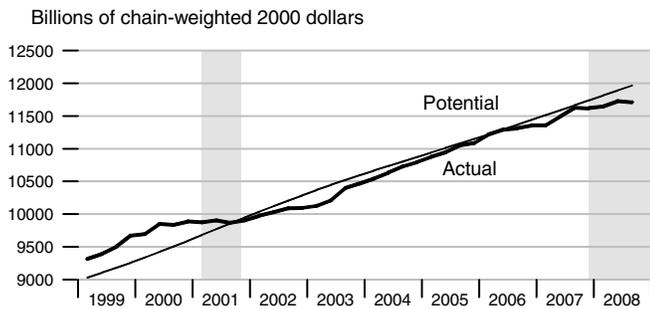


Calculated federal funds rate is based on Taylor's rule.

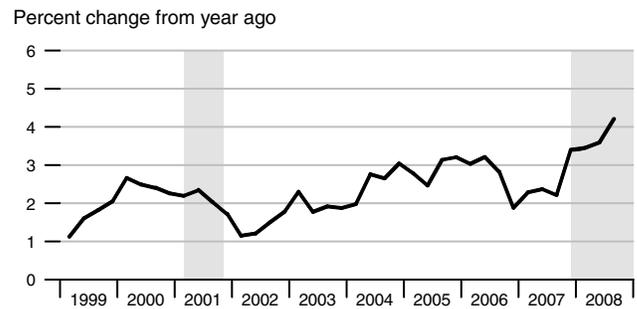
See notes on page 19.

Components of Taylor's Rule

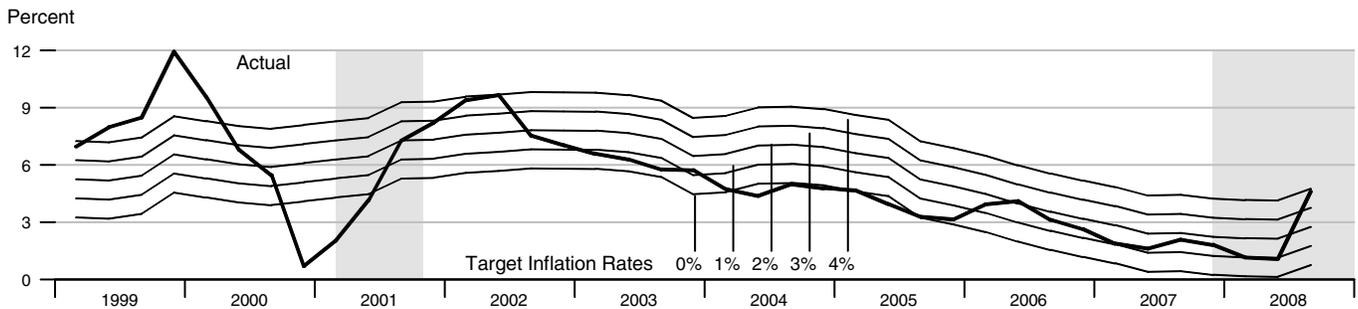
Actual and Potential Real GDP



PCE Inflation



Monetary Base Growth* and Inflation Targets

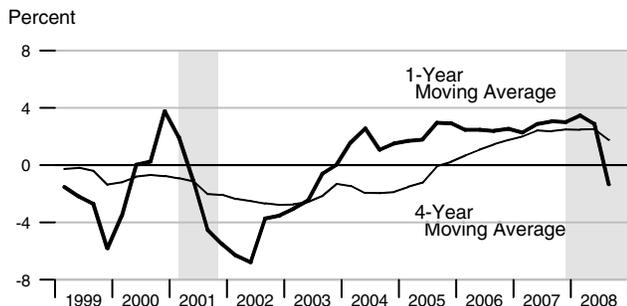


*Modified for the effects of sweeps programs on reserve demand. Calculated base growth is based on McCallum's rule. Actual base growth is percent change from year ago.

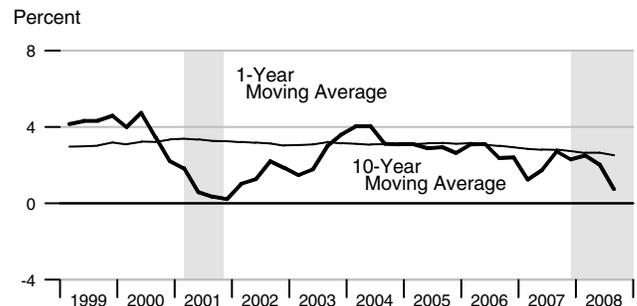
See notes on page 19.

Components of McCallum's Rule

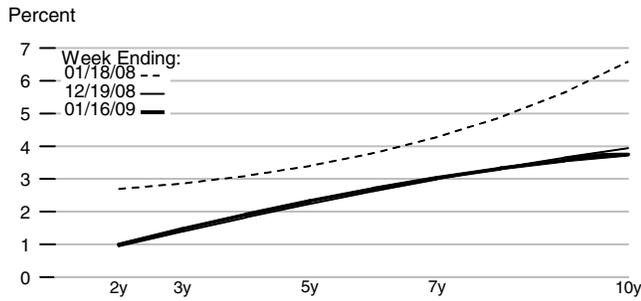
Monetary Base Velocity Growth



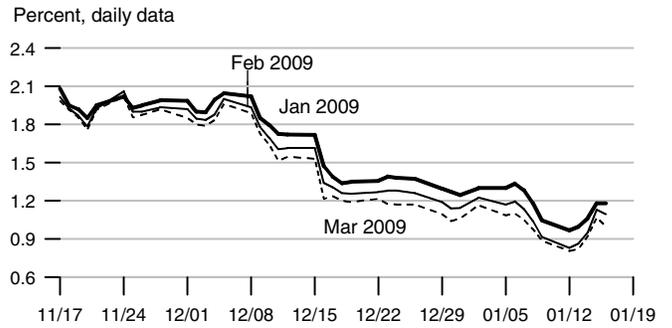
Real Output Growth



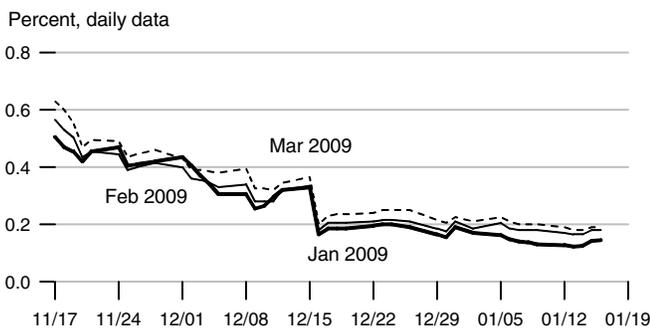
Implied One-Year Forward Rates



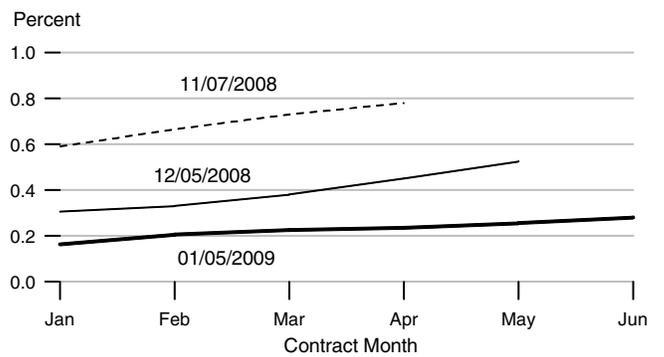
Rates on 3-Month Eurodollar Futures



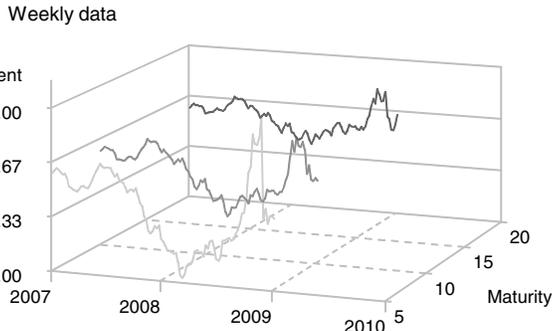
Rates on Selected Federal Funds Futures Contracts



Rates on Federal Funds Futures on Selected Dates

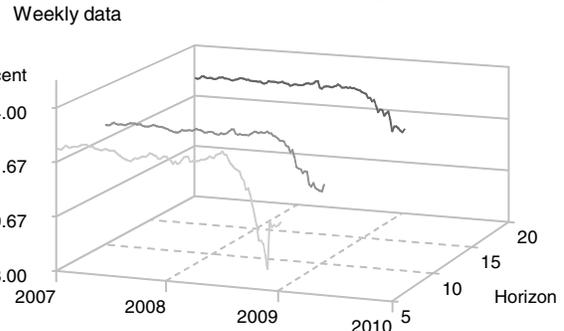


Inflation-Indexed Treasury Securities



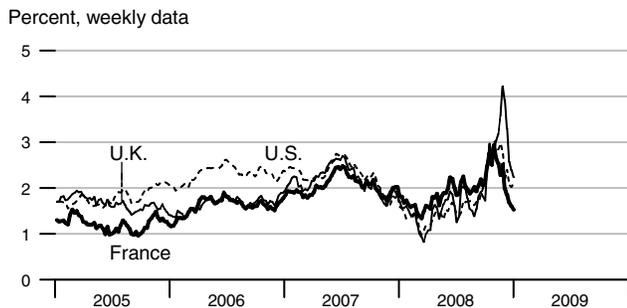
Note: Yields are inflation-indexed constant maturity U.S. Treasury securities

Inflation-Indexed Treasury Yield Spreads

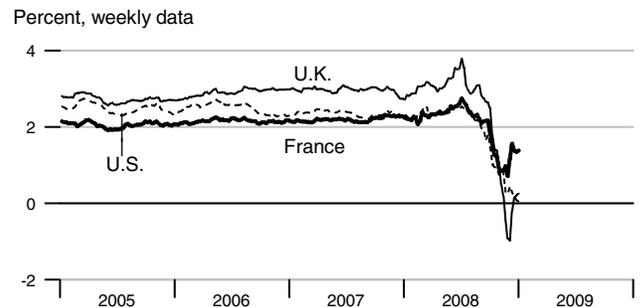


Note: Yield spread is between nominal and inflation-indexed constant maturity U.S. Treasury securities.

Inflation-Indexed 10-Year Government Notes

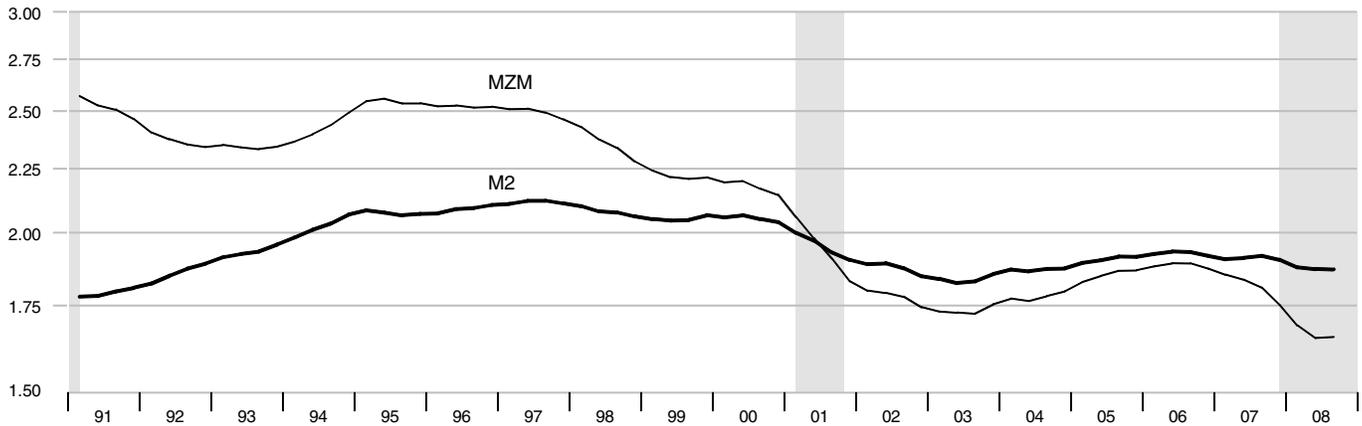


Inflation-Indexed 10-Year Government Yield Spreads



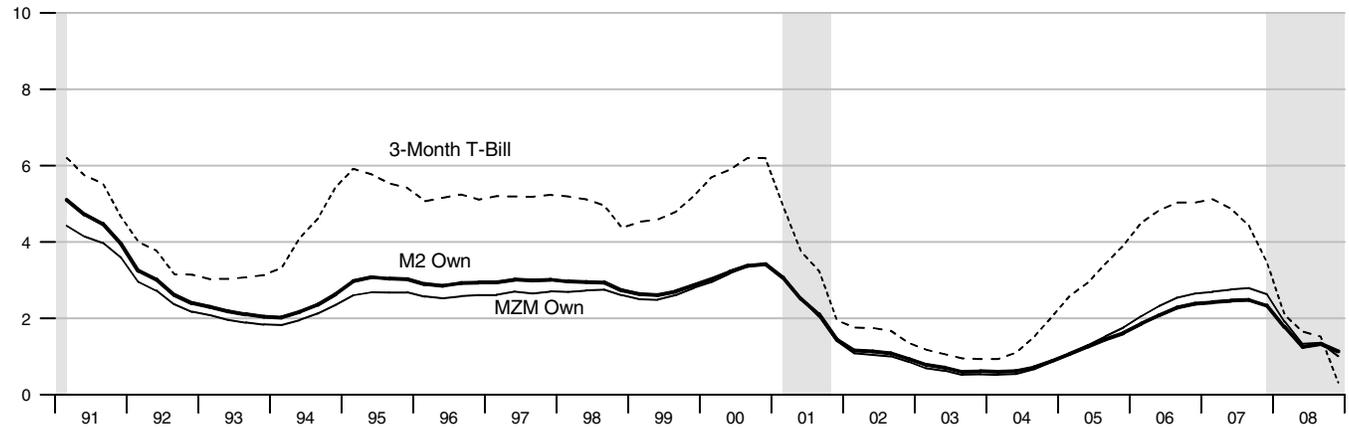
Velocity

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



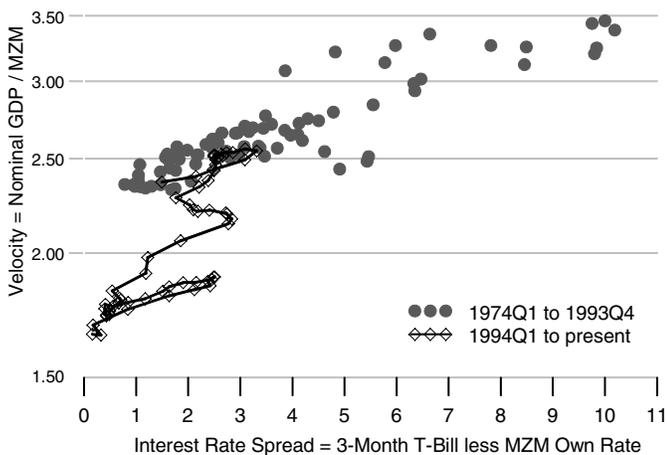
Interest Rates

Percent



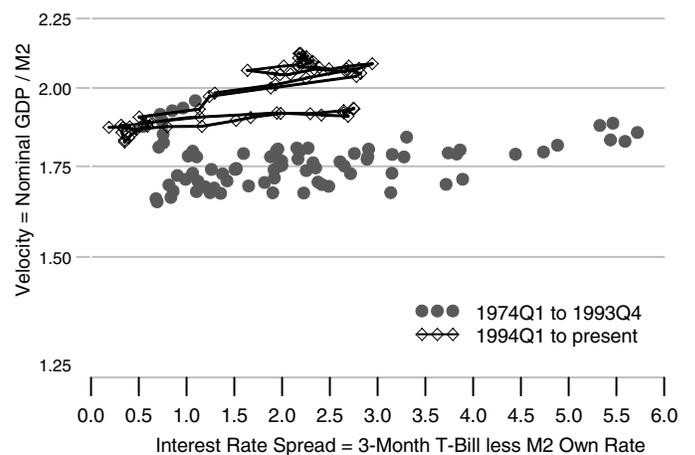
MZM Velocity and Interest Rate Spread

Ratio Scale



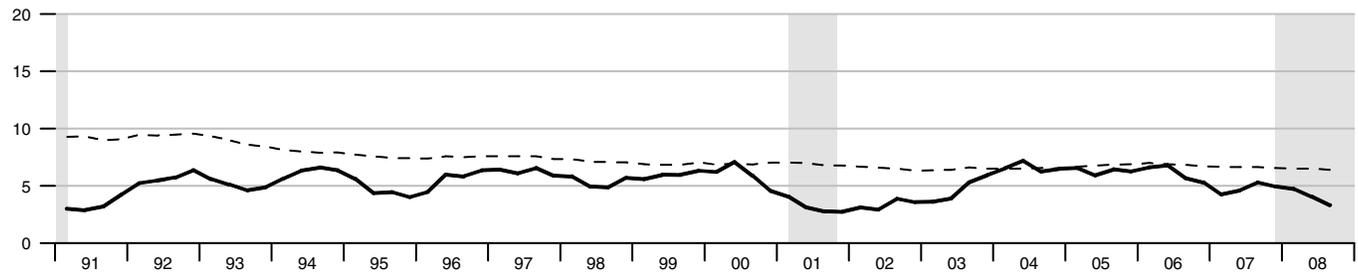
M2 Velocity and Interest Rate Spread

Ratio Scale



Gross Domestic Product

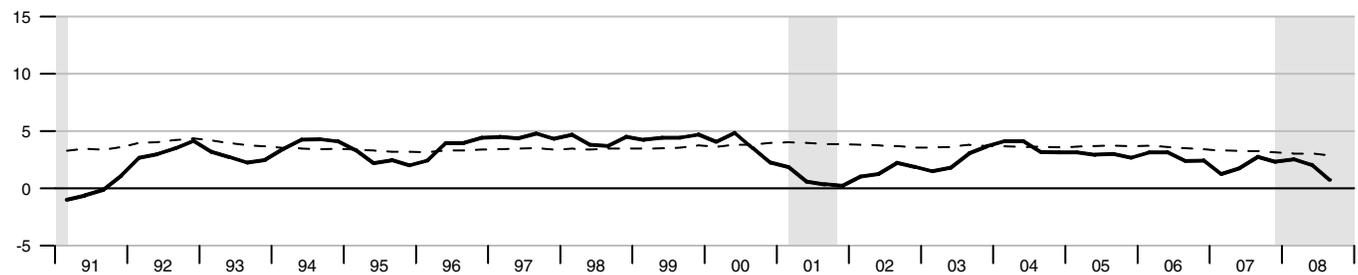
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Real Gross Domestic Product

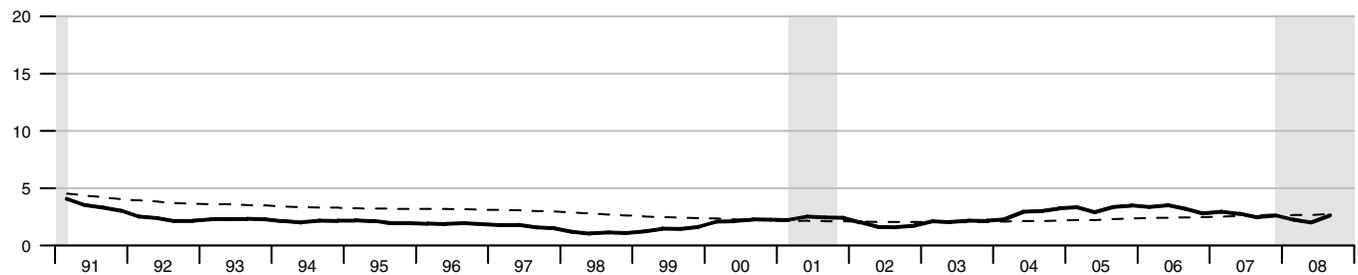
Percent change from year ago



Dashed lines indicate 10-year moving averages.

Gross Domestic Product Price Index

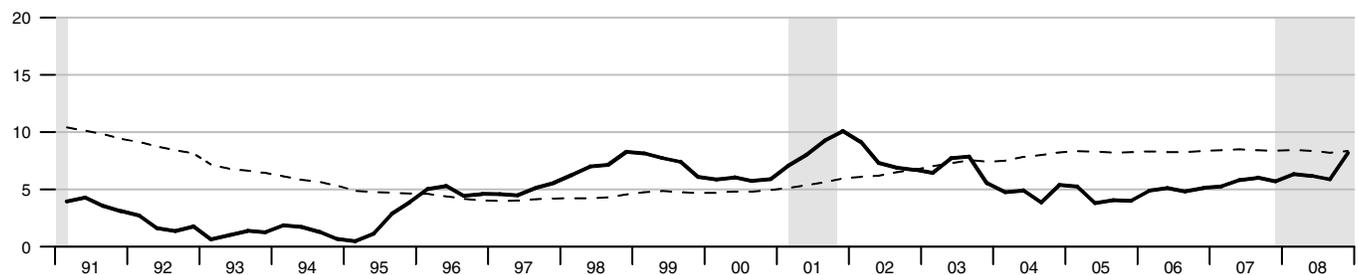
Percent change from year ago



Dashed lines indicate 10-year moving averages.

M2

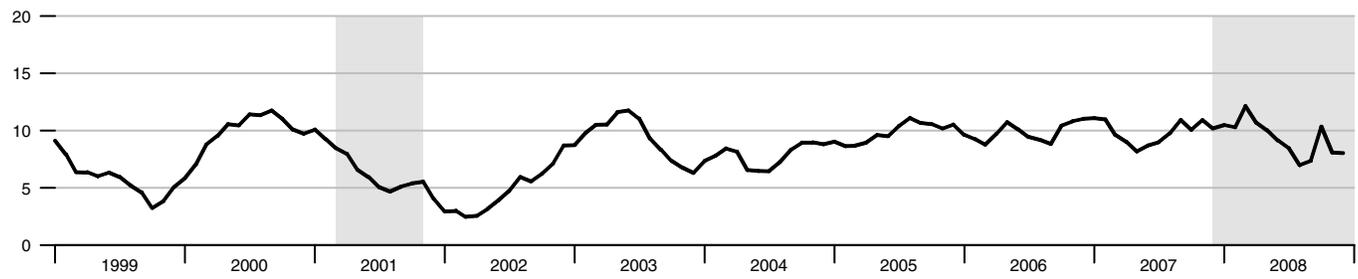
Percent change from year ago



Dashed lines indicate 10-year moving averages.

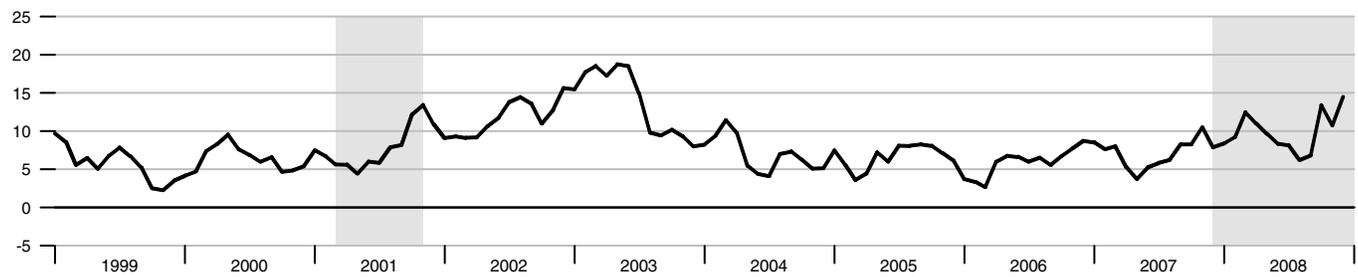
Bank Credit

Percent change from year ago



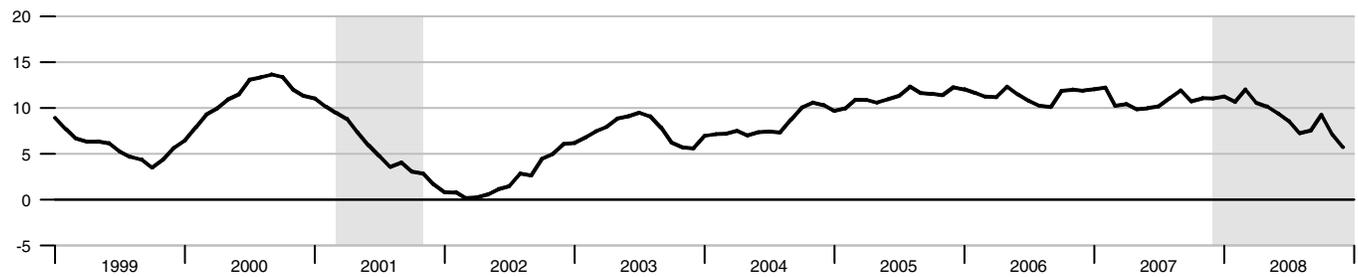
Investment Securities in Bank Credit at Commercial Banks

Percent change from year ago



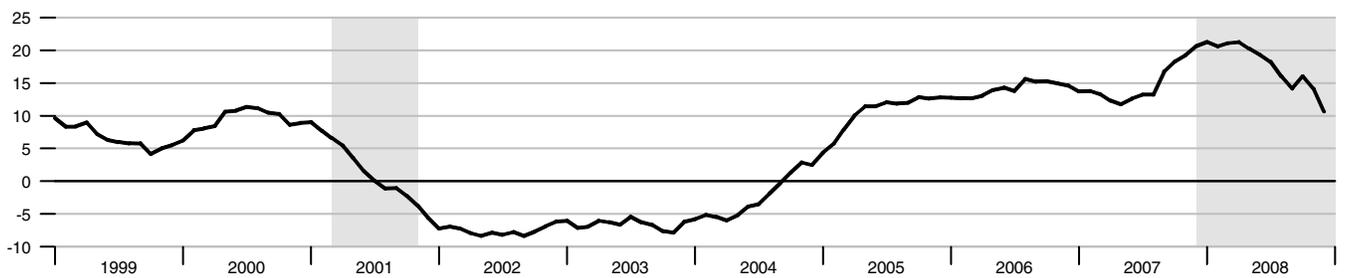
Total Loans and Leases in Bank Credit at Commercial Banks

Percent change from year ago

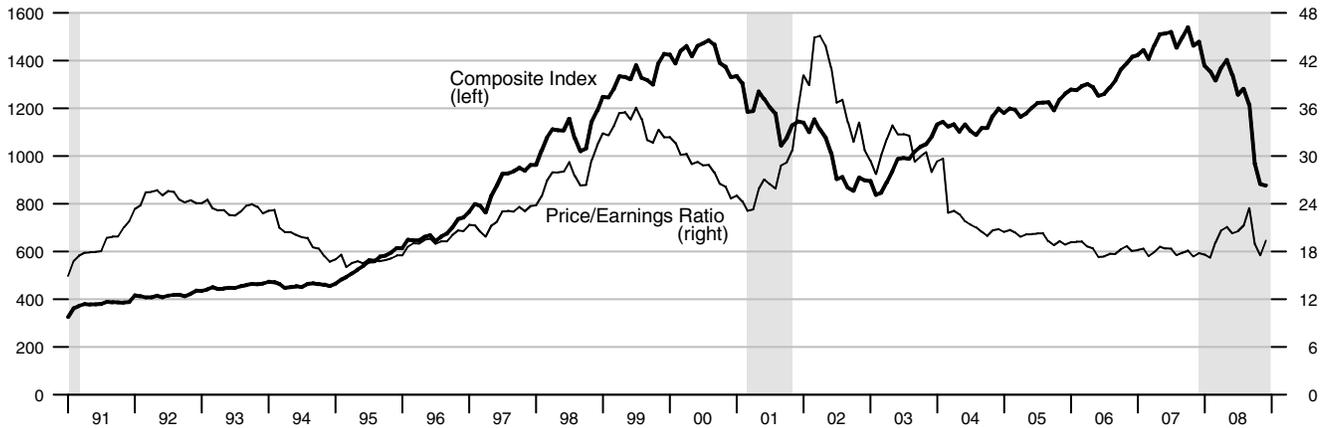


Commercial and Industrial Loans at Commercial Banks

Percent change from year ago



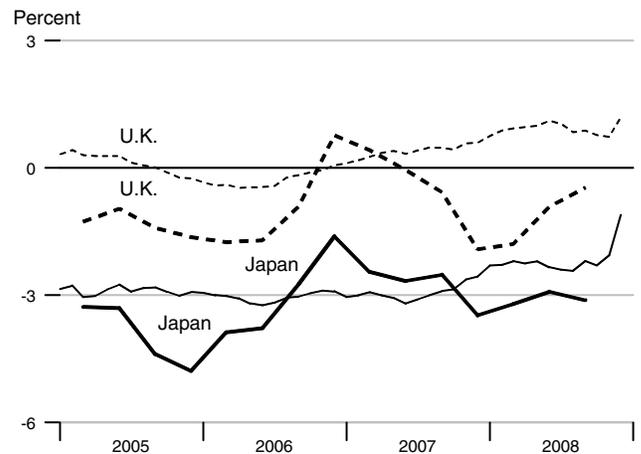
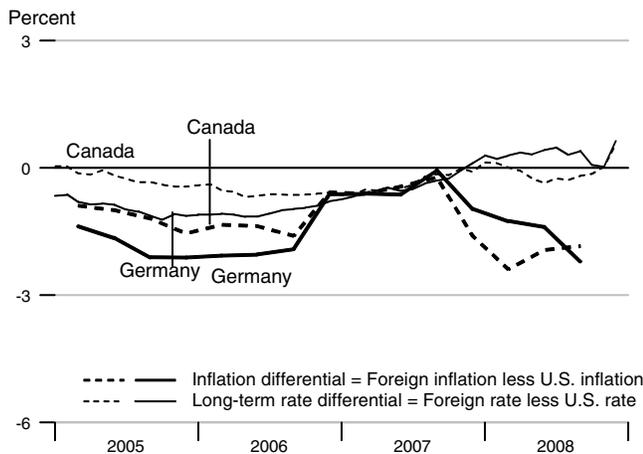
Standard & Poor's 500



Recent Inflation and Long-Term Interest Rates

	Consumer Price Inflation Rates				Long-Term Government Bond Rates			
	Percent change from year ago				Percent			
	2008Q1	2008Q2	2008Q3	2008Q4	Sep08	Oct08	Nov08	Dec08
United States	4.17	4.29	5.27	1.52	3.69	3.81	3.53	2.42
Canada	1.78	2.35	3.43	.	3.50	3.67	3.56	2.98
France	2.95	3.30	3.25	.	4.36	4.18	3.98	.
Germany	2.92	2.90	3.07	.	4.09	3.88	3.56	3.05
Italy	3.06	3.57	3.97	2.80	4.80	4.78	4.74	.
Japan	0.96	1.37	2.16	.	1.49	1.51	1.47	1.31
United Kingdom	2.38	3.37	4.81	.	4.57	4.58	4.26	3.62

Inflation and Long-Term Interest Rate Differentials



		Money Stock				Bank	Adjusted		MSI M2**
		M1	MZM	M2	M3*	Credit	Monetary Base	Reserves	
2004		1344.422	6569.804	6249.938	9234.718	6595.613	776.768	96.129	329.873
2005		1371.780	6706.774	6517.356	9786.477	7247.387	806.628	96.560	343.539
2006		1374.386	6995.516	6842.574	10270.74	7958.705	835.040	94.913	
2007		1369.603	7626.162	7232.850		8742.795	850.579	94.200	
2008		1423.937	8660.971	7713.886		9556.251	1009.761	232.050	
2006	1	1381.850	6891.629	6735.147		7626.312	830.534	96.495	
	2	1379.956	6945.088	6797.397		7885.208	836.387	95.082	
	3	1367.253	7006.517	6864.172		8037.708	834.610	94.829	
	4	1368.486	7138.831	6973.582		8285.589	838.627	93.247	
2007	1	1369.946	7296.282	7089.234		8427.239	846.309	94.122	
	2	1372.969	7486.247	7192.676		8564.617	849.919	93.558	
	3	1368.271	7713.138	7277.898		8832.887	852.267	95.428	
	4	1367.227	8008.981	7371.592		9146.435	853.820	93.691	
2008	1	1371.769	8385.197	7537.922		9352.317	856.319	96.177	
	2	1375.147	8669.479	7636.972		9416.333	859.325	94.389	
	3	1417.003	8723.365	7706.460		9503.986	892.683	117.644	
	4	1531.827	8865.842	7974.191		9952.368	1430.716	619.991	
2006	Dec	1366.533	7202.966	7012.339		8353.552	837.690	91.097	
2007	Jan	1372.533	7246.756	7058.625		8394.084	843.494	94.186	
	Feb	1367.496	7288.538	7084.824		8460.554	847.258	94.424	
	Mar	1369.809	7353.552	7124.254		8427.080	848.174	93.757	
	Apr	1377.704	7431.242	7173.881		8506.991	848.961	93.602	
	May	1375.280	7489.817	7193.761		8564.795	849.615	92.772	
	Jun	1365.924	7537.682	7210.385		8622.066	851.181	94.299	
	Jul	1368.498	7593.947	7233.660		8703.768	851.858	94.605	
	Aug	1369.928	7722.440	7286.098		8840.743	853.438	96.648	
	Sep	1366.388	7823.027	7313.937		8954.151	851.505	95.031	
	Oct	1369.502	7925.050	7338.264		9055.653	856.459	93.524	
	Nov	1365.636	8015.346	7372.260		9179.014	857.515	95.757	
	Dec	1366.542	8086.547	7404.252		9204.638	847.487	91.793	
2008	Jan	1367.201	8173.321	7448.859		9276.102	851.441	95.083	
	Feb	1372.811	8412.755	7546.780		9331.342	856.944	96.197	
	Mar	1375.296	8569.515	7618.126		9449.506	860.571	97.250	
	Apr	1371.281	8628.195	7631.353		9415.390	855.241	94.378	
	May	1368.027	8676.205	7640.776		9423.936	859.685	94.935	
	Jun	1386.132	8704.037	7638.786		9409.673	863.050	93.853	
	Jul	1403.295	8734.154	7679.688		9441.096	870.540	96.796	
	Aug	1393.954	8724.141	7670.215		9458.173	871.333	96.423	
	Sep	1453.761	8711.801	7769.477		9612.688	936.176	159.713	
	Oct	1473.148	8714.952	7879.409		9992.092	1142.217	347.358	
	Nov	1522.537	8826.627	7934.716		9921.129	1480.746	673.633	
	Dec	1599.797	9055.948	8108.449		9943.883	1669.185	838.981	

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			
2004		1.35	2.34	4.34	1.56	1.40	2.78	4.27	5.63	4.50	5.84
2005		3.21	4.19	6.19	3.51	3.21	3.93	4.29	5.23	4.28	5.86
2006		4.96	5.96	7.96	5.15	4.85	4.77	4.79	5.59	4.15	6.41
2007		5.02	5.86	8.05	5.27	4.47	4.34	4.63	5.56	4.13	6.34
2008		1.93	2.39	5.09	2.97	1.39	2.24	3.67	5.64	4.58	6.04
2006	1	4.46	5.43	7.43	4.72	4.50	4.58	4.57	5.39	4.29	6.24
	2	4.91	5.90	7.90	5.18	4.83	4.98	5.07	5.89	4.36	6.60
	3	5.25	6.25	8.25	5.39	5.03	4.87	4.90	5.68	4.13	6.56
	4	5.25	6.25	8.25	5.32	5.03	4.65	4.63	5.39	3.82	6.24
2007	1	5.26	6.25	8.25	5.31	5.12	4.68	4.68	5.36	3.91	6.22
	2	5.25	6.25	8.25	5.32	4.87	4.76	4.85	5.58	4.13	6.37
	3	5.07	5.93	8.18	5.42	4.42	4.41	4.73	5.75	4.27	6.55
	4	4.50	5.02	7.52	5.02	3.47	3.50	4.26	5.53	4.24	6.23
2008	1	3.18	3.67	6.21	3.23	2.09	2.17	3.66	5.46	4.39	5.88
	2	2.09	2.33	5.08	2.76	1.65	2.67	3.89	5.60	4.43	6.09
	3	1.94	2.25	5.00	3.06	1.52	2.63	3.86	5.65	4.50	6.31
	4	0.51	1.31	4.06	2.82	0.30	1.48	3.25	5.84	5.02	5.87
2006	Dec	5.24	6.25	8.25	5.32	4.97	4.58	4.56	5.32	3.76	6.14
2007	Jan	5.25	6.25	8.25	5.32	5.11	4.79	4.76	5.40	3.89	6.22
	Feb	5.26	6.25	8.25	5.31	5.16	4.75	4.72	5.39	3.95	6.29
	Mar	5.26	6.25	8.25	5.30	5.08	4.51	4.56	5.30	3.88	6.16
	Apr	5.25	6.25	8.25	5.31	5.01	4.60	4.69	5.47	3.99	6.18
	May	5.25	6.25	8.25	5.31	4.87	4.69	4.75	5.47	4.04	6.26
	Jun	5.25	6.25	8.25	5.33	4.74	5.00	5.10	5.79	4.36	6.66
	Jul	5.26	6.25	8.25	5.32	4.96	4.82	5.00	5.73	4.24	6.70
	Aug	5.02	6.01	8.25	5.49	4.32	4.34	4.67	5.79	4.30	6.57
	Sep	4.94	5.53	8.03	5.46	3.99	4.06	4.52	5.74	4.26	6.38
	Oct	4.76	5.24	7.74	5.08	4.00	4.01	4.53	5.66	4.20	6.38
	Nov	4.49	5.00	7.50	4.97	3.35	3.35	4.15	5.44	4.26	6.21
	Dec	4.24	4.83	7.33	5.02	3.07	3.13	4.10	5.49	4.25	6.10
2008	Jan	3.94	4.48	6.98	3.84	2.82	2.51	3.74	5.33	4.13	5.76
	Feb	2.98	3.50	6.00	3.06	2.17	2.19	3.74	5.53	4.42	5.92
	Mar	2.61	3.04	5.66	2.79	1.28	1.80	3.51	5.51	4.63	5.97
	Apr	2.28	2.49	5.24	2.85	1.31	2.23	3.68	5.55	4.45	5.92
	May	1.98	2.25	5.00	2.66	1.76	2.69	3.88	5.57	4.34	6.04
	Jun	2.00	2.25	5.00	2.76	1.89	3.08	4.10	5.68	4.50	6.32
	Jul	2.01	2.25	5.00	2.79	1.66	2.87	4.01	5.67	4.44	6.43
	Aug	2.00	2.25	5.00	2.79	1.75	2.70	3.89	5.64	4.44	6.48
	Sep	1.81	2.25	5.00	3.59	1.15	2.32	3.69	5.65	4.61	6.04
	Oct	0.97	1.81	4.56	4.32	0.69	1.86	3.81	6.28	5.05	6.20
	Nov	0.39	1.25	4.00	2.36	0.19	1.51	3.53	6.15	4.83	6.09
	Dec	0.16	0.86	3.61	1.77	0.03	1.07	2.42	5.08	5.17	5.33

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

		M1	MZM	M2	M3*
Percent change at an annual rate					
	2004	5.57	3.98	4.73	5.09
	2005	2.03	2.08	4.28	5.97
	2006	0.19	4.31	4.99	4.95
	2007	-0.35	9.01	5.70	
	2008	3.97	13.57	6.65	
2006	1	1.98	5.38	6.12	
	2	-0.55	3.10	3.70	
	3	-3.68	3.54	3.93	
	4	0.36	7.55	6.38	
2007	1	0.43	8.82	6.63	
	2	0.88	10.41	5.84	
	3	-1.37	12.12	4.74	
	4	-0.31	15.34	5.15	
2008	1	1.33	18.79	9.03	
	2	0.98	13.56	5.26	
	3	12.18	2.49	3.64	
	4	32.41	6.53	13.90	
2006	Dec	-3.91	12.38	6.97	
2007	Jan	5.27	7.30	7.92	
	Feb	-4.40	6.92	4.45	
	Mar	2.03	10.70	6.68	
	Apr	6.92	12.68	8.36	
	May	-2.11	9.46	3.33	
	Jun	-8.16	7.67	2.77	
	Jul	2.26	8.96	3.87	
	Aug	1.25	20.30	8.70	
	Sep	-3.10	15.63	4.59	
	Oct	2.73	15.65	3.99	
	Nov	-3.39	13.67	5.56	
	Dec	0.80	10.66	5.21	
2008	Jan	0.58	12.88	7.23	
	Feb	4.92	35.15	15.77	
	Mar	2.17	22.36	11.34	
	Apr	-3.50	8.22	2.08	
	May	-2.85	6.68	1.48	
	Jun	15.88	3.85	-0.31	
	Jul	14.86	4.15	6.43	
	Aug	-7.99	-1.38	-1.48	
	Sep	51.49	-1.70	15.53	
	Oct	16.00	0.43	16.98	
	Nov	40.23	15.38	8.42	
	Dec	60.89	31.18	26.27	

*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 nomi-

nal constant maturity yield less the real constant maturity yield. Daily data and descriptions are available at research.stlouisfed.org/fred2/. See also *Statistical Supplement to the Federal Reserve Bulletin*, table 1.35. The 30-year constant maturity series was discontinued by the Treasury as of February 18, 2002.

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

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

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

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

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

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

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

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where f_t^* is the implied federal funds rate, π_{t-1} is the previous period's inflation rate (PCE) measured on a year-over-year basis, y_{t-1} is the log of the previous period's level of real gross domestic product (GDP), and y_{t-1}^P is the log of an estimate of the previous period's level of potential output. **Potential Real GDP** is 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

$$\begin{aligned} \Delta MB_t^* &= \pi^* + (10\text{-year moving average growth of real GDP}) \\ &\quad - (4\text{-year moving average of base velocity growth}) \end{aligned}$$

to five alternative target inflation rates, $\pi^* = 0, 1, 2, 3, 4$ percent, where ΔMB_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

$(y_t - y_{t-40})/40) \times 400$, 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 $m = 1, \dots, 10$ 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),

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

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 $D(m) = (1 - e^{-R(m) \cdot m})/R(m)$. These rates are linear approximations to the true instantaneous forward rates; see Shiller (1990). For a discussion of the use of forward rates as indicators of inflation expectations, see Sharpe (1997). **Rates on 3-Month Eurodollar Futures** and **Rates on Selected Federal Funds Futures Contracts** trace through time the yield on three specific contracts. **Rates on Federal Funds Futures on Selected Dates** displays a single day's snapshot of yields for contracts expiring in the months shown on the horizontal axis. **Inflation-Indexed Treasury Securities and Yield Spreads** are those plotted on page 3. **Inflation-Indexed 10-Year Government Notes** shows the yield of an inflation-indexed note that is scheduled to mature in approximately (but not greater than) 10 years. The current French note has a maturity date of 7/25/2015, the current U.K. note has a maturity date of 8/16/2013, and the current U.S. note has a maturity date of 1/15/2018. **Inflation-Indexed Treasury Yield Spreads** and **Inflation-Indexed 10-Year Government Yield Spreads** equal the difference between the yields on the most recently issued inflation-indexed securities and the unadjusted security yields of similar maturity.

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

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

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