Business Cycle Measures

At the time this cover page was written, the National Bureau of Economic Research (NBER) had not yet announced the official end of the recession. Many economists, however, believe that it ended in mid-2009. We discuss two business cycle measures that provide some statistical evidence of a trough long before an NBER announcement, which could help policymakers decide when to exit quantitative easing.

The Philadelphia Fed publishes the Aruoba-Diebold-Scotti business conditions index (ADS index), which is constructed using data measured at mixed frequencies: gross domestic product (measured quarterly); employment, industrial production, personal income less transfer payments, and manufacturing and trade sales (measured monthly); and initial jobless claims (measured weekly). Ironically, the ADS index is a daily time series that contains no daily data—the authors of the index note in their published paper that including a daily interest rate spread (term spread, or the difference between the 10-year T-bond and 3-month T-bill yields) did not improve the index’s performance. The index is revised whenever any series is updated.¹

Economist Michael Dueker at Russell Investments introduced a business cycle index (Russell BCI) that is updated around the 15th of each month. Dueker uses both macroeconomic and financial data to assess the current state of the economy and make predictions for the upcoming three years. His estimation uses employment, inflation excluding food and energy, the term spread, the difference between Aaa and Baa corporate bond yields, and the difference between commercial paper and T-bill yields.²

The chart shows the ADS index vintage from June 17, 2010 (which includes values through June 12) and the Russell BCI vintage from June 2010 (which includes values through May). With the ADS index, values above zero indicate the degree to which business conditions are better than average, whereas the opposite holds true for values below zero. Russell BCI values are expressed as the number of standard deviations from zero; larger positive (negative) values indicate that conditions are farther from a business cycle peak (trough).

Both measures show August 2009 as the first full month with positive values since the recession began, which indicates that the recession ended last July. Even though the ADS index has dipped below zero briefly since then, the authors of the index still classify July 2009 as the trough. Since early February 2010, the ADS index has generally shown steady improvement in business conditions. Additionally, the Russell BCI forecasts show a slight decline in conditions with the release of June data but then fairly steady conditions through mid-2013.

Both the ADS index and Russell BCI had already pinpointed July 2009 as the end of the recession in vintages released in mid-September of 2009. Although the recession’s end date is not official, these measures provide some idea about the overall state of the economy.

—Kristie M. Engemann and Michael T. Owyang


Conventions used in this publication:

1. Unless otherwise indicated, data are monthly.

2. Except where otherwise noted, solid shading indicates recessions, as determined by the National Bureau of Economic Research. The NBER has not yet determined the end of the recession that began in December 2007; however, the hatched shading shows that the recession ended in July 2009. We made this determination based on a statistical model for dating business cycle turning points developed by Marcelle Chauvet and Jeremy Piger (“A Comparison of the Real-Time Performance of Business Cycle Dating Methods,” Journal of Business and Economic Statistics, 2008, 26, 42-49). For more information, see http://www.uoregon.edu/~jpiger/us_recession_probs.htm.

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: \( \frac{(x_t / x_{t-1}) - 1}{12} \times 100 \). 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: \( \frac{(x_t / x_{t-12}) - 1}{100} \).

We welcome your comments addressed to:

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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.
Monetary Trends

M2 and MZM

Billions of dollars

Adjusted Monetary Base

Percent change at an annual rate

Real Treasury Yield Curve

Percent

Reserve Market Rates

Percent

Inflation-Indexed Treasury Yield Spreads

Percent

Note: Effective December 16, 2008, FOMC reports the intended Federal Funds Rate as a range.
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 accommodate the discontinuation of M3.
**Monetary Trends**

*Adjusted and Required Reserves*
- Billions of dollars

*Total Borrowings, nsa*
- Billions of dollars

*Excess Reserves plus RCB Contracts*
- Billions of dollars

*Nonfinancial Commercial Paper*
- Percent change from year ago

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

Percent, Real rate = Nominal rate less year-over-year CPI inflation
Federal Funds Rate and Inflation Targets

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

Components of Taylor's Rule

Components of McCallum's Rule

Monetary Base Velocity Growth

Real Output Growth

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.
### Monetary Trends

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

- **MZM**
- **M2**

#### Interest Rates
Percent

- 3-Month T-Bill
- M2 Own
- MZM Own

#### MZM Velocity and Interest Rate Spread
Ratio Scale

- 1974Q1 to 1999Q4
- 1994Q1 to present

#### M2 Velocity and Interest Rate Spread
Ratio Scale

- 1974Q1 to 1999Q4
- 1994Q1 to present

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**Interest Rate Spread** = 3-Month T-Bill less MZM Own Rate

**Interest Rate Spread** = 3-Month T-Bill less M2 Own Rate
Monetary Trends

Gross Domestic Product
Percent change from year ago

Real Gross Domestic Product
Percent change from year ago

Gross Domestic Product Price Index
Percent change from year ago

M2
Percent change from year ago

Dashed lines indicate 10-year moving averages.
Recent Inflation and Long-Term Interest Rates

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<th>Consumer Price Inflation Rates</th>
<th>Long-Term Government Bond Rates</th>
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Inflation and Long-Term Interest Rate Differentials
## Money Stock

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<th>M2</th>
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<th>Bank Credit</th>
<th>Adjusted Monetary Base</th>
<th>Reserves</th>
<th>MSI M2**</th>
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### Monthly Data for Selected Years

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**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.
<table>
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<th>Year</th>
<th>Federal Funds</th>
<th>Primary Credit Rate</th>
<th>Prime Rate</th>
<th>3-mo CDs</th>
<th>3-mo Treasury Yields</th>
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Note: All values are given as a percent at an annual rate.
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*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, traveler’s 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 is a spliced chain index; see Anderson and Rasche (1996a, 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/aggregs/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

\[
\pi_t^* = 2.5 + \pi_{t-1}^* + (\pi_{t-1}^* - \pi_t^*)/2 + 100 \times (y_{t-1} - y_{t-1}^*)/2
\]

to five alternative target inflation rates, \(\pi = 0, 1, 2, 3, 4\) percent, where \(\pi_t^*\) 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 \(y_{t-1}^*\) 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

\[
\Delta b_t = \Delta b_t^* - \Delta y_t^* + a (\Delta y_t - \Delta y_{t-1}),
\]
\[
\Delta y_t^* = \pi_t^* + \Delta y_t^*
\]

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, $\Delta v^p_t$ is the average base velocity growth (calculated recursively), $\Delta v_{t-1}$ 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 $m = 1, \ldots, 10$ 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),

$$R(m) = \alpha_0 + (\alpha_1 + \alpha_2)(1 - e^{-m/50})/(m/50) - \alpha_3 \times e^{-m/50},$$

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. M2 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:**


**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**


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