No Volatility, No Forecasting Power for the Term Spread

The recent disassociation between the term spread and the real growth rate can be explained in part by the finance fundamentals behind the concept of the term spread. The term spread, commonly defined as the difference between the yields on 10-year U.S. government bonds and 3-month Treasury bills, can be interpreted as a risk premium: the additional amount of compensation required to commit wealth to long-term investments in the face of unanticipated inflation shocks. The reasoning is simple: Should inflation accelerate unexpectedly, nominal interest rates are likely to promptly increase. While an investor buying Treasury bills could achieve higher yields quickly, an investor who has purchased bonds could not and will suffer a loss since the new nominal interest rates are higher than the bond’s rate. Because this loss may be substantial if the bond is far from maturity, bond investors require a reward in the form of a term spread.

We can quantify inflation risk by using the volatility of long-term bond yields. If there is substantial inflation risk, investors will tend to revise often their expectations of future inflation rates. This process affects long-term bond prices and causes volatility in their yields. If inflationary risks decline independently of business cycle conditions, long-term bond yields become less volatile and the quantity of risk declines; this causes the term spread to decrease as well. The table shows this has been true over the past 26 years. In the Volcker era, the average realized (compounded using daily interest rates), annualized volatility of 10-year government bonds had been 3.7 percent with a 2.6 percent term spread under Greenspan, the average realized volatility declines to 1.3 percent and the term spread declines to 1.7 percent.

However, the past two years have been characterized by a very low volatility in the bond market (0.7 percent) and virtually no term spread (0.04 percent). And the past decade has been characterized by less than half the risk formerly in the bond market, and at the same time the term spread has declined by approximately one-half. Low or negative term spreads are conventionally seen as an icon of deflationary recessions. Between January 2001 and December 2007, the term spread declined to an average of 0.35 percent per year. Surprisingly, over the same period, real GDP maintained a brisk pace of almost 5 percent per year. Is it surprising the U.S. term spread has stopped forecasting real economic growth? No, because the term spread is a risk premium; the prices will decline when risk disappears. For support, we have computed correlations between the term spread and the real GDP growth rate for two sub-samples: 1981-94 and 1995-2007. We find a high and statistically significant correlation in the first, high-volatility sub-sample, 0.36; with sufficient risk, the term spread is positive and varies to reflect anticipations of future business cycles. Over the second, low-volatility sub-sample the term spread has lost any association to real economic growth. The correlation is essentially zero (-0.03) and is not statistically significant. If the term spread mostly depends on inflationary risk and such risks disappear over time, poor forecasting performance is expected. It is ironic that the very success of Chairman Greenspan and Bernanke at fighting inflation and anchoring inflationary expectations may have led to a new era in which forecasters and policymakers struggle with the loss of the term spread’s predictive power. The business cycle remains difficult to forecast, although with stable inflation, the loss of a forecasting instrument seems a small price to pay.

—Massimo Guidolin and Allison K. Rodean

Sources

Eurodollar Futures: Chicago Mercantile Exchange; Eurodollar futures.
Congressional Budget Office: Potential real GDP.
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.

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

Page 12: The SMM (Monetary Trends) model is estimated using the Wisconsin Data Set, consisting of MZM and MZM Own Rates from the Federal Reserve Bank of St. Louis, two interest rate series, the Federal Reserve Bank of St. Louis, and the Wisconsin Data Set, consisting of MZM and MZM Own Rates from the Federal Reserve Bank of St. Louis, two interest rate 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 issued for and demand and other checkable deposits issued by financial institutions (except deposits due to the Treasury and depository institutions); minus cash in process of collection and Federal Reserve float.

M2: Money (money, zero maturity): M2 minus small-denomination time deposits, personal money market mutual funds (that are deposit accounts in M3 not excluded from M2). The label MS2 was coined by William Poole (1994); the aggregate itself was proposed earlier by Musgrave (1988).

M3: 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; Eurodollars, deposits specifically, dollar-denominated deposits due to nonbank U.S. addresses held at foreign bank 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 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 simple chain index; see Anderson and Rasche (1996, 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 chained index is numerically larger than the "true" of reserves, which includes 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 (1996, 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 Neumann (1997). Indices are shown for the assets included in M2, with additional data at research.stlouisfed.org/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 1.25. M2M, 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 1: Readers are cautioned that, since early 1994, the level and growth of M1 have been depressed by total swap programs that reclassified transactions deposits (demand deposits and other checkable deposits as savings deposits overnight, thereby reducing bank’s required reserve; see Anderson and Rasche (2003) and research.stlouisfed.org/gpi/indices.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 commodity maturity yields calculated by the U.S. Treasury for sections 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/gpi/data. See also Statistical Supplement to the Federal Reserve Bulletin, table 1.35. The 10-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 other time deposits. Time Deposits includes M1 and M2. Large Time Deposits are deposits of $100,000 or more. Retail and Institutional Non-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 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 1.35.

Page 8: Inflation Expectations measures include the quarterly Federal Reserve Bank of Philadelphia Survey of Professional Forecasters, monthly University of Michigan Survey Research Center’s Survey 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 expenditure (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. Generally, neither are shown on this graph. CPI inflation is measured by the price index to report in inflation range; the FOMC expected to be consistent with the degree of reserve 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 show the observed federal funds rate, quarterly, and the level of the funds rate implied by applying Taylor’s (1993) equation:

\[
\frac{\pi^*}{\pi} = 2.5 + \beta_1 + (\beta_2 - \pi^*) + 2\beta_4 \pi + \beta_5 \pi^*(\beta_2 - \pi^*),
\]

to five alternative target inflation rates: \(\pi^* = 1, 2, 3, 4, 5\) percent, where \(\pi^*\) is the implied federal funds rate, \(\pi_1^*\) is the level of the previous period’s level of real gross domestic product (GDP), and \(\beta_4\) in the log of an estimate of the previous period’s level of potential output. Potential GDP is estimated by the Congressional Budget Office.

Monetary Base Growth and Inflation Targets show the quarterly growth of the adjusted monetary base (modified to include an estimate of the offset of swap programs) implied by applying McCulley’s (1984, 1993) equation:

\[
\frac{\Delta M}{M} = \pi^* (10-year moving average growth rate of real GDP)
\]

-5 to 0, 0.5, 1, 2, 3, 4 percent, where \(\Delta M\) is the implied growth rate of the adjusted monetary base, the 10-year moving average growth rate 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:

\[
(\pi_1^* - \pi^*) \times 400 + 400,\quad \pi^* \text{ is the log of real GDP};
\]

-5 to 0, 0.5, 1, 2, 3, 4 percent, where \(\pi^*\) is the level 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 swap 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, but at best, 25 basis point. The Swap program data are found at research.stlouisfed.org/gpi/indices.html.

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

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### Monetary Trends

#### Percent change at an annual rate

<table>
<thead>
<tr>
<th>Year</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>6.46</td>
<td>6.98</td>
<td>6.40</td>
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<tr>
<td>2004</td>
<td>5.57</td>
<td>4.71</td>
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<tr>
<td>2005</td>
<td>2.03</td>
<td>4.44</td>
<td>5.97</td>
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<tr>
<td>2006</td>
<td>0.21</td>
<td>4.80</td>
<td>4.95</td>
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<tr>
<td>2007</td>
<td>0.40</td>
<td>5.93</td>
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</tr>
</tbody>
</table>

#### Treasury Yield Curve

- **Percent change at an annual rate**

#### Adjusted Monetary Base

- **Percent change at an annual rate**

#### Real Treasury Yield Curve

- **Percent change at an annual rate**

#### Reserve Market Rates

- **Percent**

#### Inflation-Indexed Treasury Yield Spreads

- **Percent**

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*See table of contents for changes to this series.*
### Money Stock

<table>
<thead>
<tr>
<th>Year</th>
<th>M1</th>
<th>M2M</th>
<th>M2</th>
<th>M3</th>
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<tbody>
<tr>
<td>2003</td>
<td>1273.483</td>
<td>6327.286</td>
<td>5867.639</td>
<td>6757.321</td>
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<tr>
<td>2004</td>
<td>1341.420</td>
<td>6579.700</td>
<td>6299.297</td>
<td>7034.719</td>
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<td>2005</td>
<td>1317.194</td>
<td>6725.613</td>
<td>6547.741</td>
<td>7987.497</td>
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<td>2006</td>
<td>1374.716</td>
<td>6999.837</td>
<td>6881.928</td>
<td>10207.704</td>
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<td>2007</td>
<td>1369.219</td>
<td>7637.467</td>
<td>7265.988</td>
<td>9670.599</td>
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</table>

### Bank Credit

<table>
<thead>
<tr>
<th>Year</th>
<th>Adjusted Monetary Base</th>
<th>Reserves</th>
<th>MSI M2**</th>
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<tr>
<td>2003</td>
<td>611.784</td>
<td>740.859</td>
<td>93.325</td>
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<tr>
<td>2004</td>
<td>6603.358</td>
<td>775.786</td>
<td>96.129</td>
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<td>2005</td>
<td>7249.102</td>
<td>806.027</td>
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<td>2006</td>
<td>7694.545</td>
<td>835.013</td>
<td>94.887</td>
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<tr>
<td>2007</td>
<td>8574.181</td>
<td>850.800</td>
<td>94.165</td>
</tr>
</tbody>
</table>

### 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

### 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

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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 M3 series until we revise the code to accommodate the discontinuation of M3.

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*See table of contents for changes to the series.*
Monetary Trends

Inflation and 1-Year-Ahead 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. See notes on page 19.

Treasury Security Yield Spreads

Yield to maturity

10-Year less 3-Month T-Bill
10-Year less 3-Year Note
3-Year less 3-Month T-Bill

Real Interest Rates

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

1-Year Treasury Yield
Federal Funds Rate

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.