



# Measuring Financial and Economic Risk with FRED®

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## GLOSSARY

**Coupon payment:** The monthly or annual interest payment that the bondholder receives from the bond's issue date until the bond matures.

**Default:** The failure to promptly pay interest or principal when due.

**Face value:** The value printed on the face of a stock, bond, or other financial instrument or document.

**Index:** A number used to represent the change in value of a magnitude (frequently a price level) between a base date and a different date. An index typically has a value of 100 on the base date.

**Maturity (of bonds):** The period during which a bond makes coupon payments. At maturity, the face value of the bond is paid. Maturity may be expressed as years, months, or weeks.

**Option:** A contract to buy or sell a specific financial product, known as the underlying instrument, at a pre-specified price.

**Recession:** A period of declining real income and rising unemployment; significant decline in general economic activity extending over a period of time.

**Spread:** The difference in value between two prices, interest rates, or yields.

**Stylized fact:** An economic phenomenon consistently described by data but not systematically defined by theory.

**Time series:** A collection of observations of data obtained through repeated measurements over time.

**Treasuries:** The collective name for the bills, bonds, and notes issued by the U.S. Treasury on behalf of the federal government.

**Unemployment rate:** The percentage of the labor force that is willing and able to work, does not currently have a job, and is actively looking for employment.

**Volatility:** Sudden or large change in the price of an asset.

**Yield:** The average return from owning a bond. Yield depends on the price paid for the bond, its coupon payments, and the time to maturity.

**Yield curve:** A graph that shows the yields of bonds with different maturity dates.

"In order to effectively monitor market developments and systemic risks, it is crucial that regulators across jurisdictions and countries share data on a consistent and regular basis."

—Janet L. Yellen<sup>1</sup>

## Description

FRED® (Federal Reserve Economic Data) provides access to a wide range of **time-series** data. Several of those series signal stress levels in financial markets and the probability of economic recession. This article describes indexes of financial and economic recession risk to new data users and can serve as a reference to advanced data users.

## Introduction

The data on economic and financial conditions accessible through FRED® come from many sources, for example, federal government departments such as the U.S. Treasury and private corporations such as Moody's Investors Service. FRED® presents the data produced by organizations and individuals "as is"—that is, exactly as provided by the source. The Federal Reserve Bank of St. Louis transforms some of those data into **indexes** and **spreads**. This article provides a description of several of these indicators of economic and financial conditions, their interpretation, and their construction.

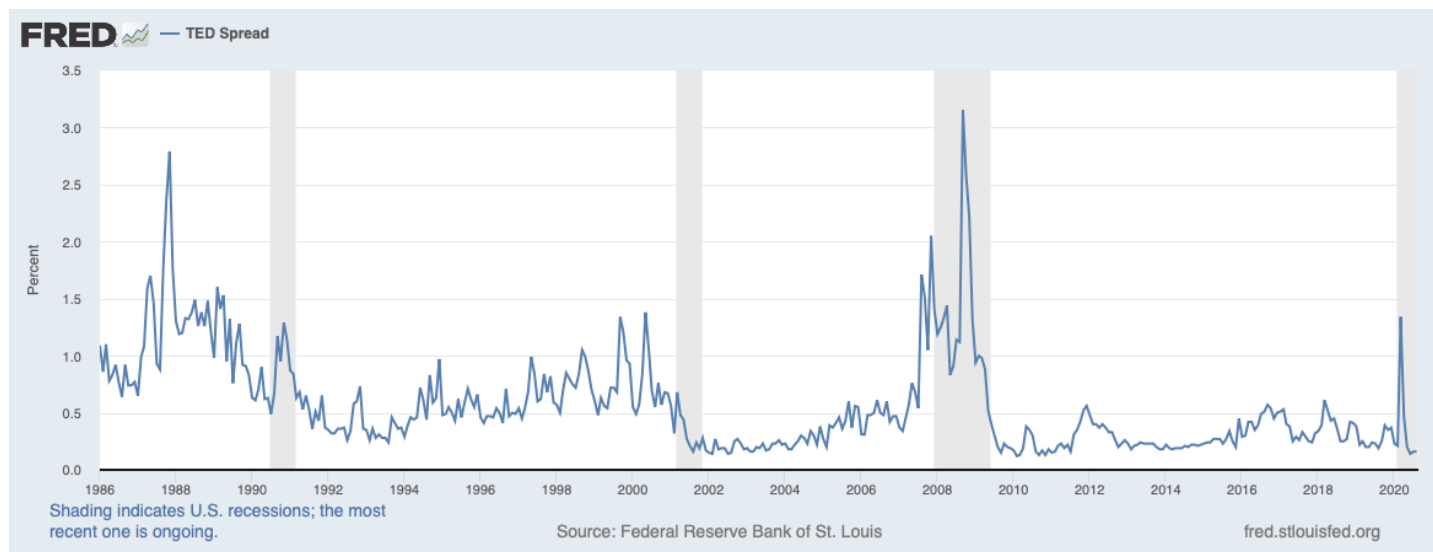
## Financial Risk

All buyers of bonds are exposed to some degree of **default** risk. Default is the failure to promptly pay interest or principal on a bond when due. There are several ways to measure market participants' subjective assessment of default risk.

### *Financial Risk Measured as a Difference Between Yields*

The difference between the **yields** of bonds with different risk characteristics—a risk spread—varies with the perceived default risk of each bond. A bond's yield, or return to **maturity**, depends on its price, **coupon payments**, and time to maturity. Bonds are bought and sold at different prices after they are issued. Because a bond's maturity, coupon payments, and **face**

Figure 1  
The TED Spread



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=nYa5>, accessed May 29, 2020.

**value** are fixed, the price and yield are inversely related. When demand for a bond is high, the price rises and the yield falls.

The U.S. Treasury issues bonds on behalf of the federal government, and these bonds are also known as **Treasuries**. Treasuries are considered to have extremely low risk of default and tend to attract risk-averse investors.

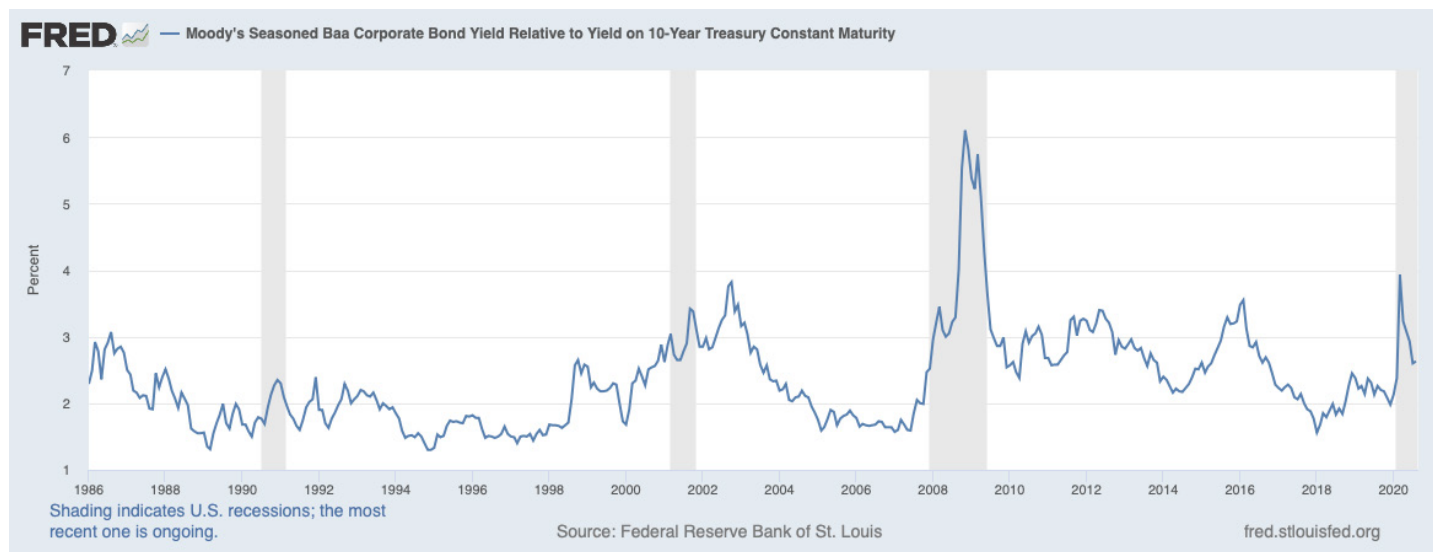
The FRED® graph in Figure 1 shows the “TED spread,” that is, the spread between the 3-month London Interbank Offered Rate (LIBOR) and the yield on the 3-month Treasury bill. The 3-month LIBOR is the interest rate at which major banks lend to each other in the London market for a period of three months. A Treasury bill is a Treasury bond maturing in three months.

The TED spread has always been positive because banks are riskier borrowers than the U.S. Treasury. A change in that perception is unlikely to occur. Note that the latest value of the series accessible in FRED® is not up to date, because the LIBOR data are released with a one-week delay due to an agreement with the source.

The Federal Reserve Bank of St. Louis creates the TED spread series from data reported by ICE (Intercontinental Exchange) Benchmark Administration Limited (IBA) and the U.S. Treasury.

**Learn more:** “TED on FRED®”; <https://fredblog.stlouisfed.org/2016/07/ted-on-fred/> (Federal Reserve Bank of St. Louis *FRED® Blog*, July 7, 2016).

Figure 2  
**Moody’s Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity**



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=nnkl>, accessed May 29, 2020.

Figure 3  
**ICE BofA U.S. High-Yield Index Option-Adjusted Spread**



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=qGTw>, accessed May 29, 2020.

The FRED® graphs in Figure 2 and Figure 3 show the difference in yield between corporate bonds with some default risk and Treasury bonds of comparable maturities.

Figure 2 shows the Baa-Treasury spread; that is, the spread on Moody’s Seasoned Baa Corporate Bonds and 10-Year Treasury constant maturity bonds. Baa is a rating

assigned by Moody’s Investors Service to bonds with moderate default risk.

The Federal Reserve Bank of St. Louis creates the Baa-Treasury spread series from data on these bonds reported by Moody’s Investors Service and the U.S. Treasury, respectively.

Figure 3 shows the **options-adjusted** “high-yield” Treasury spread; that is, the spread on an options-adjusted spread index of high-yield bonds and Treasury bond yields. An option-adjusted spread index is the measurement of the difference in yield between a corporate bond that includes an option and a Treasury bond. An option is a contract to buy or sell a specific financial product, known as the underlying instrument, at a pre-specified price. “High-yield” is a rating assigned by ICE BofA (Bank of America) to bonds with high default risk (and thus relatively lower ratings).

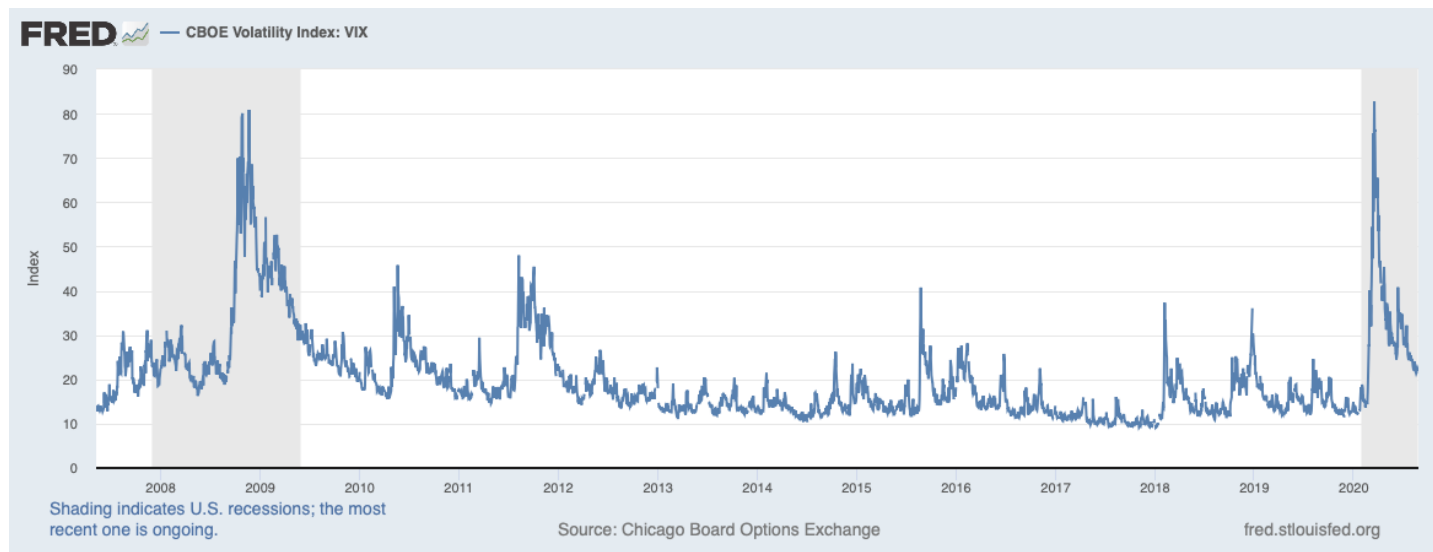
Figure 2 and Figure 3 illustrate that default risk tends to rise before and during **recessions**. At those times, slower economic growth and weaker growth of earnings by

bond issuers imply a higher probability that some firms may fail to make interest payments on their debt. Not surprisingly, because lower-rated bonds offer higher yields, their spreads tend to be larger.

ICE Data Indices creates the ICE BofA U.S. High-Yield Index Option-Adjusted Spread with data from multiple sources and the U.S. Treasury.

**Learn more:** “The Corporate Bond Credit Spread Puzzle”; <https://www.frbsf.org/economic-research/publications/economic-letter/2008/march/corporate-bond-credit-spread/> (Christensen, Jens. Federal Reserve Bank of San Francisco *Economic Letter*, March 14, 2008).

Figure 4  
The VIX



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=qGU1>, accessed May 29, 2020.

**Financial Risk Measured as an Index**

Another way to measure financial risk is through an index that summarizes market conditions such as price **volatility**, investors’ uncertainty, or indicators of default risk.

The FRED® graph in Figure 4 shows the Chicago Board Options Exchange Volatility Index® (VIX). This popular index uses S&P 500® index option prices to measure market expectations of near-term volatility.

Rising values signify increasing financial market stress, while falling values signify declining financial market stress. The Chicago Board Options Exchange produces the VIX with a formula based on stock option prices.

**Learn more:** “Financial Conditions Indexes”; <https://research.stlouisfed.org/publications/economic-synopses/2017/11/03/financial-conditions-indexes/> (Reinbold, Brian and Restrepo-Echavarria, Paulina. Federal Reserve Bank of St. Louis *Economic Synopses*, 2017, No. 17).

Figure 5  
St. Louis Fed Financial Stress Index



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=qBma>, accessed May 29, 2020.

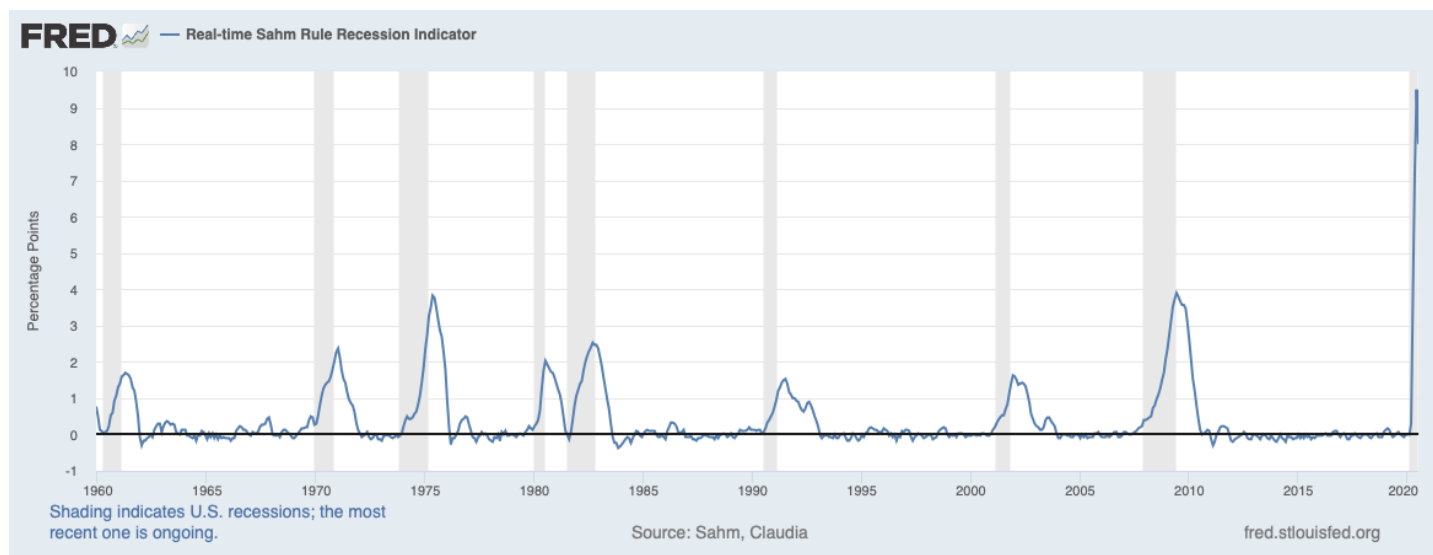
The FRED® graph in Figure 5 shows the St. Louis Fed Financial Stress Index. This index measures the degree of financial stress in the markets and is constructed from 18 weekly data series: seven interest rate series, six yield spreads, and five other indicators. Each of these variables captures some aspect of financial stress. Accordingly, as the level of financial stress in the economy changes, these data series are likely to move together.

The index is constructed so that its average value is zero, which represents normal financial market conditions. Values below zero suggest below-average financial

market stress, while values above zero suggest above-average financial market stress. The Federal Reserve Bank of St. Louis calculates the index using data reported by multiple organizations.

**Learn more:** “Disentangling Diverse Measures: A Survey of Financial Stress Indexes”; <https://research.stlouisfed.org/publications/review/2012/09/04/disentangling-diverse-measures-a-survey-of-financial-stress-indexes> (Kliesen, Kevin; Owyang, Michael T. and Vermann, E. Katarina. Federal Reserve Bank of St. Louis *Review*, September/October 2012, 94(5), pp. 369-97).

Figure 6  
Real-Time Sahm Rule Recession Indicator



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=pnfb>, accessed May 29, 2020.

### Economic Recession Risk

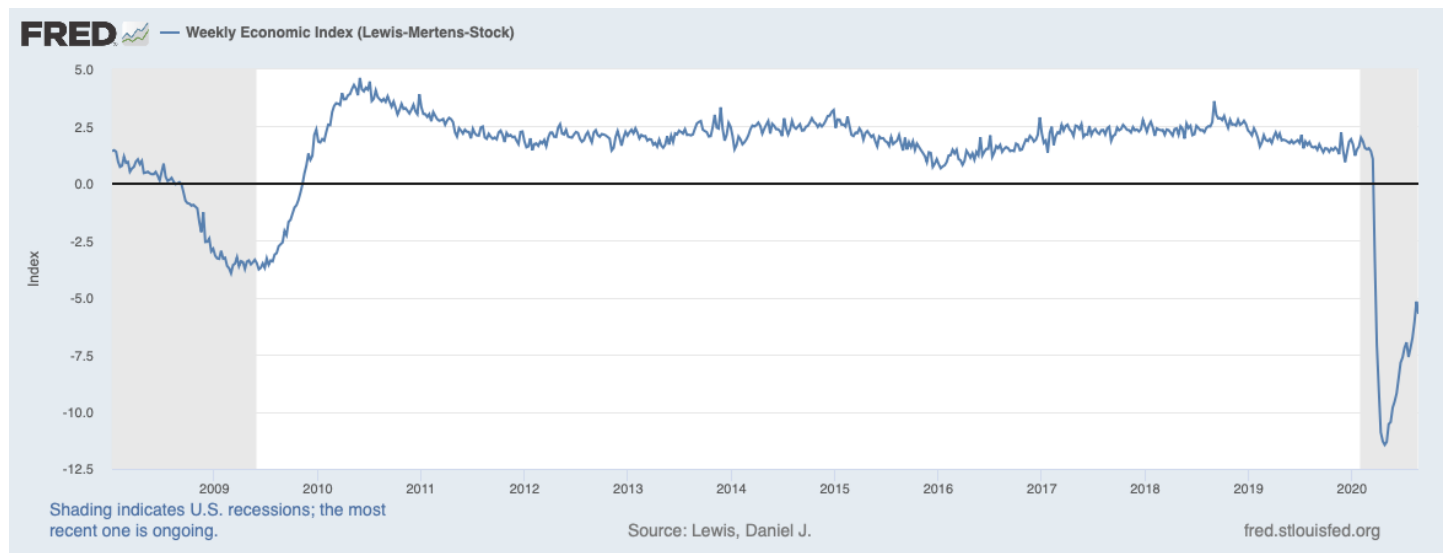
Economic activity undergoes periodic but irregular business cycles. The alternating periods of economic expansion and contraction impact the production of goods and services, employment, and price levels. Contractions in economic activity are called recessions. Economic researchers have proposed several indexes to identify the start of a recession.

The FRED® graph in Figure 6 shows the Sahm Rule Recession Indicator. This index has signaled the start of a recession when the three-month moving average of the national **unemployment rate** reported by the Bureau of Labor statistics (BLS) has risen by 0.50 percentage points or more relative to its low during the previous 12 months.

This indicator is based on “real-time” data, that is, the unemployment rate (and the recent history of unemployment rates) available in a given month. The BLS regularly reports the monthly unemployment rate a week after the month is over. The source of the Sahm Rule Recession Indicator is the economist Claudia Sahm, who creates the index using BLS data.

**Learn more:** “FRED® Adds Sahm Rule Recession Indicators”; <https://research.stlouisfed.org/publications/research-news/fred-adds-sahm-rule-recession-indicators> (Federal Reserve Bank of St. Louis *Research News*, n.d.).

Figure 7  
The WEI



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=r5B7>, accessed May 29, 2020.

The FRED® graph in Figure 7 shows the Weekly Economic Index (WEI), which is composed of 10 weekly economic indicators: Redbook same-store sales; the Rasmussen Consumer Index; new claims for unemployment insurance; continued claims for unemployment insurance; adjusted income/employment tax withholdings (from Booth Financial Consulting); railroad traffic originated (from the Association of American Railroads); the American Staffing Association Staffing Index; steel production; wholesale sales of gasoline, diesel, and jet fuel; and the weekly average U.S. electricity load (with remaining data supplied by Haver Analytics). The year-over-year percentage changes in these series are combined into a single index of weekly economic activity—the WEI.

The WEI is scaled to a four-quarter GDP (gross domestic product) growth rate: For example, if the WEI reads  $-2$  percent for an entire quarter, one would expect GDP that quarter to be 2 percent lower than a year ago. The economists Daniel J. Lewis, Karel Mertens, and James H. Stock produce the series from data reported by multiple organizations.

**Learn more:** “FRED® Adds Weekly Economic Index from Daniel Lewis, Karel Mertens, and James Stock”; <https://news.research.stlouisfed.org/2020/04/fred-adds-weekly-economic-index-from-daniel-lewis-karel-mertens-and-james-stock/> (Federal Reserve Bank of St. Louis *Research News*, April 20, 2020).



Figure 8  
Yield on 10-Year Treasury Constant Maturity Minus Yield on 2-Year Treasury Constant Maturity



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=IFt2>, accessed May 29, 2020.

Figure 9  
Yield on 10-Year Treasury Constant Maturity Minus Yield on 3-Month Treasury Constant Maturity



SOURCE: FRED®, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/graph/?g=r5tl>, accessed May 29, 2020.

### The Inverted Yield Curve

An economic phenomenon consistently described by data but not systematically defined by theory is called a “stylized fact.” Historically, the values of some financial indicators have reliably predicted changes in broad economic conditions. One of those indicators is known

as the “slope of the **yield curve.**” The yield curve is a graph that shows the yields of bonds with different maturity dates. The value of that slope can be approximated by calculating the “term premium” between bonds with different maturity dates, that is, the difference in yield between bonds of different maturities.



The FRED® graph in Figure 8 shows the difference in yield between Treasuries maturing in 10 years and Treasuries maturing in 2 years. Because longer-maturity bonds usually offer higher yields than shorter-maturity bonds, the line is usually above the horizontal axis at zero. When the yield curve inverts, the 2-year yield is greater than the 10-year yield and the term premium becomes negative. Historically, such an inversion has predicted a recession in about a year. The graph also illustrates the correlation between the inverted yield curve and the onset of economic recessions (the shaded areas) in the United States.

The FRED® graph in Figure 9 shows a similar phenomenon by comparing the difference between Treasuries maturing in 10 years and 3 months.

The Federal Reserve Bank of St. Louis calculates the differences in these bond yields based on data reported by the U.S. Treasury.

**Learn more:** “Should We Fear the Inverted Yield Curve”; <https://research.stlouisfed.org/publications/page1-econ/2019/11/29/should-we-fear-the-inverted-yield-curve> (Mendez-Carbajo, Diego. Federal Reserve Bank of St. Louis *Page One Economics*®, December 2019).

## Summary

Several FRED® time series signal stress levels in financial markets and probabilities of economic recession. This article has described those series, their interpretations, and their sources. ■

**Learn more:** Check the latest values of the time series described above in the following FRED® Dashboard: <https://research.stlouisfed.org/dashboard/53656>.

## Note

<sup>1</sup> Yellen, Janet. “Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications.” Speech at the American Economic Association/American Finance Association Joint Luncheon, San Diego, CA, January 4, 2013; <https://www.federalreserve.gov/newsevents/speech/yellen20130104a.htm>.

## Additional Resources

Famiglietti, Matthew, and Garriga, Carlos. “Predicting the Yield Curve Inversions that Predict Recessions: Part 1.” Federal Reserve Bank of St. Louis *Economic Synopses*, 2019, No. 9; <https://research.stlouisfed.org/publications/economic-synopses/2019/04/12/predicting-the-yield-curve-inversions-that-predict-recessions-part-1>.

Guidolin, Massimo, and Tam, Yu Man. “Is the Financial Crisis Over? A Yield Spread Perspective.” Federal Reserve Bank of St. Louis *Economic Synopses*, 2009, No. 40; <https://research.stlouisfed.org/publications/economic-synopses/2009/09/21/is-the-financial-crisis-over-a-yield-spread-perspective/>.

Martin, Fernando. “Economic Realities and Consequences of the COVID-19 Pandemic—Part I: Financial Markets and Monetary Policy.” Federal Reserve Bank of St. Louis *Economic Synopses*, 2020, No. 10; <https://research.stlouisfed.org/publications/economic-synopses/2020/03/30/economic-realities-and-consequences-of-the-covid-19-pandemicpart-i-financial-markets-and-monetary-policy>.

Mizrach, Bruce, and Neely, Christopher J. “Secondary Market Corporate Credit Facility Supports Main Street.” Federal Reserve Bank of St. Louis *Economic Synopses*, 2020, No. 17; <https://research.stlouisfed.org/publications/economic-synopses/2020/04/13/secondary-market-corporate-credit-facility-supports-main-street>.

Mizrach, Bruce, and Neely, Christopher J. “Fed Intervention in the To-Be-Announced Market for Mortgage-Backed Securities.” Federal Reserve Bank of St. Louis *Economic Synopses*, 2020, No. 19; <https://research.stlouisfed.org/publications/economic-synopses/2020/04/15/fed-intervention-in-the-to-be-announced-market-for-mortgage-backed-securities>.

Neely, Christopher J. “Using Implied Volatility to Measure Uncertainty About Interest Rates.” Federal Reserve Bank of St. Louis *Review*, May/June 2005, 87(3), pp. 407-25; <https://research.stlouisfed.org/publications/review/2005/05/01/using-implied-volatility-to-measure-uncertainty-about-interest-rates>.

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