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The FRED® Blog

Constructing “ex ante” real interest rates on FRED

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FRED ECONOMIC DATA | ST. LOUIS FED

CPI **+3.2** % Chg. from Yr. Ago on Feb 2024

Civ. Unemploy. Rate **3.9** % on Feb 2024

10-Yr. Treas. Rate **4.22** % on 2024-03-22

Real GDP **+3.2** %, Comp. Annual Rate of Chg. on Q4 2023

IP **+0.1** % Chg. on Feb 2024

Payroll Employment **+275** Chg., Thous. of Persons on Feb 2024

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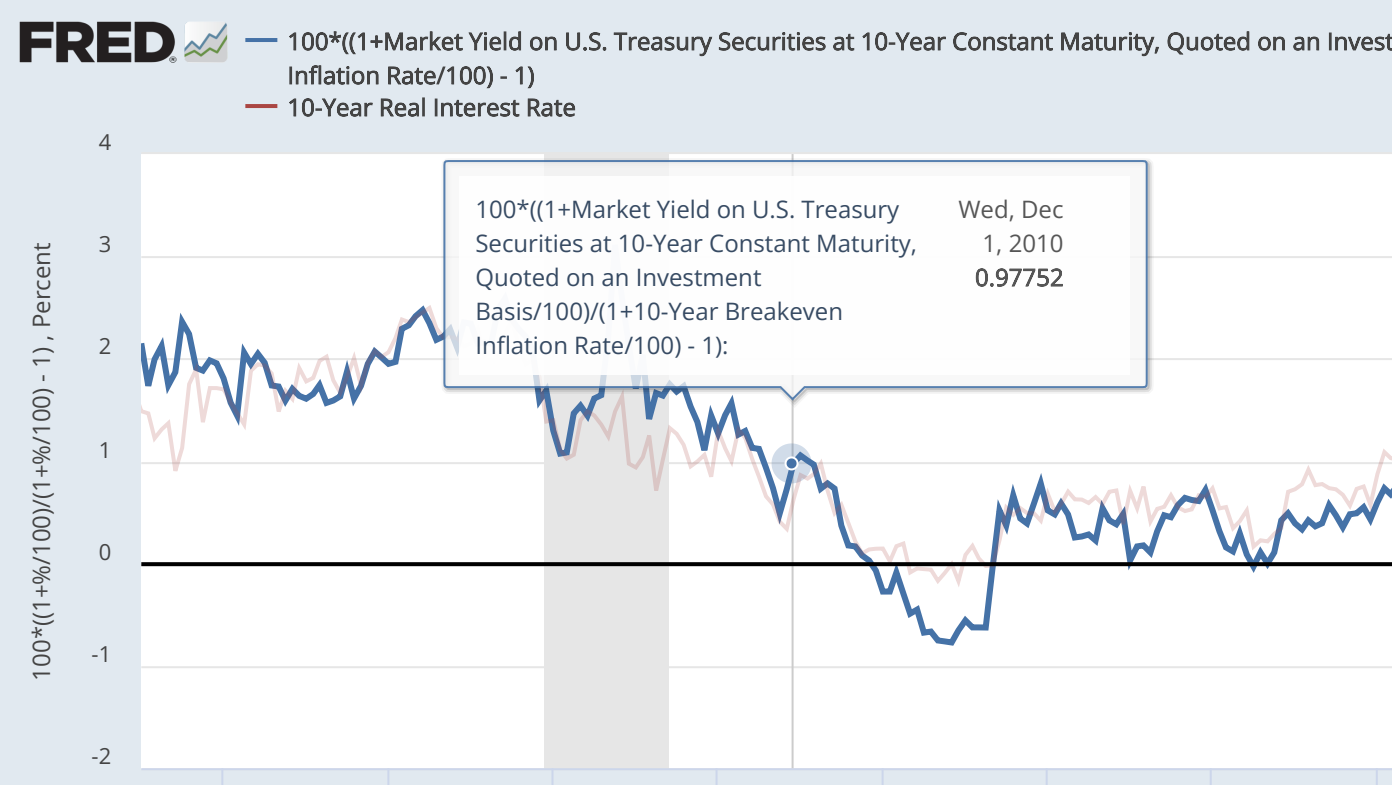

Interest rates are some of the most popular series on FRED. Almost all the interest rates on FRED are nominal interest rates, which reflect the annual cost of borrowing money. A nominal interest rate doesn’t account for the effects of inflation, though. For example, if a lender lends $100 for a year at 5% interest, the borrower repays the lender with $105 at the end of the year. But, if inflation has been 10% over that same year, the lender is actually able to buy less with the $105 repayment at the end of that year than they could have bought with the $100 originally loaned at the beginning of that year.

A *real* interest rate is an inflation-adjusted interest rate. You might think of a real interest rate as the price of borrowing in goods, not money. Because people and firms make decisions based on real quantities, not nominal quantities, real interest rates are more useful than nominal interest rates. For example, real interest rates are much more informative than nominal interest rates about the stance of monetary policy.

- By the Generations: Location Patterns of Different Cohorts
- Accounting for the Effects of Fiscal Policy Shocks on Exchange Rates through Markup Dynamics

Archives

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Technically, a gross real interest rate ($1+r$) is calculated as the ratio of gross nominal rates ($1+i$) to the gross inflation rate ($1+\pi$):

$$(1+r) = (1+i) / (1+\pi)$$

Suppose that candy bars cost $1 on January 1, 2022. The lender could use the $100 to buy 100 candy bars, but forgoes the purchase to make a loan of $100 instead. When the borrower repays the loan at 5% interest on January 1, 2023, the lender receives $105 dollars. If inflation has raised the price of candy bars by 10% by January 1, 2023, then each candy bar costs $1.10 and the lender can buy only 95 candy bars: $105/1.1 = 95.4545$. The gross real rate of return equals the real goods one can buy with the payoff from the loan (95.4545 candy bars) over the initial real value of the loan (100 candy bars). So, the gross real rate of interest is $95.4545/100 = 1.05/1.10 = (1+i)/(1+\pi)$.

This is often approximated as the interest rate minus the inflation rate.

$$r \cong i - \pi$$

This approximation is generally useful for relatively low rates of interest and inflation. With the example above, it would be $-5\% = 5\% - 10\%$. And yes, real interest rates can be negative.

To calculate historical real interest rates, one can either use a forecast of inflation or the average rate of inflation that actually occurred over the period of the loan/bond. When one uses a forecast of inflation to construct a real rate, that measure is called an “ex ante” real rate, while using realized inflation produces “ex post” real rates. Because forecasts of inflation will generally differ from each other and from the average rate of inflation realized over a period, estimates of real interest rates for the same date and same horizon can differ from each other.

Despite the usefulness of real interest rates, FRED only has a few real interest rates: 1-month, 1-year, and 10-year real rates, all at the monthly frequency, constructed by the Cleveland Fed with a variety of data to estimate the expected rate of inflation.

FRED users can also construct daily historical series for real rates of interest with market-implied forecasts of inflation, called “breakeven” inflation rates derived from options prices. There are breakeven inflation rates on FRED for 5-, 7-, 10-, 20-, and 30-year horizons.

- September 2021
- August 2021
- July 2021
- June 2021
- May 2021
- April 2021
- March 2021
- February 2021
- January 2021
- December 2020
- November 2020
- October 2020
- September 2020
- August 2020
- July 2020
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- June 2019
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- March 2019
- February 2019
- January 2019
- December 2018
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- October 2018
- September 2018
- August 2018
- July 2018

The FRED graph at the top compares the monthly Cleveland Fed 10-year real interest rate with a daily 10-year real rate derived from breakeven inflation. The two series track each other reasonably well for most of the sample, but diverge at times when the breakeven inflation rate is particularly volatile, such as during the Financial Crisis of 2008 and the COVID-19 pandemic of 2020-2021.

Using the methods to construct the above graph, FRED users can investigate real interest rates in several ways.

- It would be easy to compare the exact formula for a real interest rate $r = ((1+i)/(1+\pi)-1)$ with the approximation $(r \cong i - \pi)$ by using the “add line” and “formula” functions to create another series. You will see that the lines are difficult to distinguish.
- One could also compare the 10-year real interest rate above with the implied 5-year real interest rate from the 5-year constant maturity Treasury yield and 5-year breakeven inflation rate.
- One could download yield and inflation data to construct “ex post” real interest rates in Excel or another application.

How this graph was created: Search for and select “10-year constant maturity Treasury yield” and choose “Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity (DGS10).” From the “Edit Graph” panel, use the “Customize data” field to search for “10-year” and select “10-year breakeven inflation rate.” The 10-year yield (i.e., nominal interest rate) will be series “a” and the 10-year break-even inflation rate will be series “b”. From the formula bar, type in the following formula for a real interest rate: $100*((1+a/100)/(1+b/100) - 1)$ and click “Apply.” To compare this series with the Cleveland Fed 10-year real rate, use the “Add Line” tab at the top of the editing box to search for and select “10-year real interest rate” and click “Add data series.” The two series should now be displayed from 1982, but there will be no values for the constructed real rate until 2003. To see them over a common sample, set the sample to start on January 1, 2003.

Suggested by Christopher Neely.