Real interest rate

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The **real interest rate** is the rate of interest an investor, saver or lender receives (or expects to receive) after allowing for inflation. It can be described more formally by the Fisher equation, which states that the real interest rate is approximately the nominal interest rate minus the inflation rate. If, for example, an investor were able to lock in a 5% interest rate for the coming year and anticipated a 2% rise in prices, they would expect to earn a real interest rate of 3%.[1] This is not a single number, as different investors have different expectations of future inflation. Since the inflation rate over the course of a loan is not known initially, volatility in inflation represents a risk to both the lender and the borrower.

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Risks

In economics and finance, an individual who lends money for repayment at a later point in time expects to be compensated for the time value of money, or not having the use of that money while it is lent. In addition, they will want to be compensated for the risks of having less purchasing power when the loan is repaid. These risks are systematic risks, regulatory risks and inflation risks. The first includes the possibility that the borrower will default or be unable to pay on the originally agreed upon terms, or that collateral backing the loan will prove to be less valuable than estimated. The second includes taxation and changes in the law which would prevent the lender from collecting on a loan or having to pay more in taxes on the amount repaid than originally estimated. The third takes into account that the money repaid may not have as much buying power from the perspective of the lender as the money originally lent, that is inflation, and may include fluctuations in the value of the currencies involved.

> **Nominal interest rates** include all three risk factors, plus the time value of the money itself.
> **Real interest rates** include only the systematic and regulatory risks and are meant to measure the time value of money.
> **Real** rates = **Nominal** rates minus Inflation and Currency adjustment.

The "real interest rate" in an economy is often the rate of return on a risk free investment, such as US Treasury notes, minus an index of inflation, such as the CPI, or GDP deflator.

Fisher equation

The relation between real and nominal interest rates and the expected inflation rate is given by the Fisher equation

$$1 + i = (1 + r)(1 + \pi_e)$$

where

i = nominal interest rate;
r = real interest rate;
π_e = expected inflation rate.

For example, if somebody lends $1000 for a year at 10%, and receives $1100 back at the end of the year, this represents a 10% increase in her purchasing power if prices for the average goods and services that she buys are unchanged from what they were at the beginning of the year. However, if the prices of the food, clothing, housing, and other things that she wishes to purchase have increased 25% over this period, she has in fact suffered a real loss of about 15% in her purchasing power. (Notice that the approximation here is a bit rough; since 1.1/1.25 = 0.88 = 1 - 0.12, the actual loss of purchasing power is exactly 12%.

Variations in inflation

The inflation rate will not be known in advance. People often base their expectation of future inflation on an average of inflation rates in the past, but this gives rise to errors. The real interest rate ex post may turn out to be quite different from the real interest rate (ex ante real interest rate)that was expected in advance. Borrowers hope to repay in cheaper money in the future, while lenders hope to collect on more expensive money. When inflation and currency risks are underestimated by lenders, then they will suffer a net reduction in buying power.

The complexity increases for bonds issued for a long term, where the average inflation rate over the term of the loan may be subject to a great deal of uncertainty. In response to this, many governments have issued real return bonds, also known as inflation-indexed bonds, in which the principal value and coupon rises each year with the rate of inflation, with the result that the interest rate on the bond approximates a real interest rate. (E.g., the three-month indexation lag of TIPS can result in a divergence of as much as 0.042% from the real interest rate, according to research by Grishchenko and Huang.[2]) In the US, Treasury Inflation Protected Securities (TIPS) are issued by the US Treasury.

The expected real interest rate can vary considerably from year to year. The real interest rate on short term loans is strongly influenced by the monetary policy of central banks. The real interest rate on longer term bonds tends to be more market driven, and in recent decades, with globalized financial markets, the real interest rates in the industrialized countries have become increasingly correlated. Real interest rates have been low by historical standards since 2000, due to a combination of factors, including relatively weak demand for loans by corporations, plus strong savings in newly industrializing countries in Asia. The latter has offset the large borrowing demands by the US Federal Government, which might otherwise have put more upward pressure on real interest rates.

Related is the concept of "risk return", which is the rate of return minus the risks as measured against the safest (least-risky) investment available. Thus if a loan is made at 15% with an inflation rate of 5% and 10% in risks associated with default or problems repaying, then the "risk adjusted" rate of return on the investment is 0%.

Importance in economic theory

Economics relies on measurable variables, chiefly price and objectively measurable production. Since production is "real", while prices are relative to the general price level, in order to compare an economy at two points in time, nominal price variables must be converted into "real" variables. For example, the number of people on payrolls represents a "real" variable, as does the number of hours worked. But in order to measure productivity, the nominal prices of the goods and services that labor produces must be converted to the "real" purchasing power. To do this requires adjusting prices for inflation.

The same is true of investment. Investment produces real gains in efficiency, and purchases productive capacity - factories, machines and so on - which is also real. To find the return on this capital, it is necessary to subtract the increases in its nominal value that are the result of increases in the general level of prices. To do this means subtracting the inflation rate from the nominal rate of return. For example, a portfolio of stocks that returns 10%, when inflation is running at 4% has a 6% real rate of return.

The real interest rate is used in various economic theories to explain such phenomena as the capital flight, business cycle and economic bubbles. When the real rate of interest is high, that is, demand for credit is high, then money will, all other things being equal, move from consumption to savings. Conversely, when the real rate of interest is low, demand will move from savings to investment and consumption. Different economic theories, beginning with the work of Knut Wicksell have had different explanations of the effect of rising and falling real interest rates. Thus, international capital moves to markets that offer higher real rates of interest from markets that offer low or negative real rates of interest triggering speculation in equities, estates and exchange rates. Related to this concept is the idea of a "natural rate of interest", that is, the expected return on savings and capital invested.

Negative real interest rates

The real interest rate solved from the Fisher equation is

$$\frac{1+i}{1+\pi} - 1 = r$$

If there is a negative real interest rate, it means that the inflation rate is greater than the nominal interest rate. If the Federal funds rate is 2% and the inflation rate is 10%, then the borrower would gain 7.27% of every dollar borrowed per year.

$$\frac{1+0.02}{1+0.1} - 1 = -0.0727$$

Negative real interest rates are an important factor in government fiscal policy. Since 2010, the U.S. Treasury has been obtaining negative real interest rates on government debt, meaning the inflation rate is greater than the interest rate paid on the debt.[3] Such low rates, outpaced by the inflation rate, occur when

the market believes that there are no alternatives with sufficiently low risk, or when popular institutional investments such as insurance companies, pensions, or bond, money market, and balanced mutual funds are required or choose to invest sufficiently large sums in Treasury securities to hedge against risk.[4][5] Lawrence Summers stated that at such low rates, government debt borrowing saves taxpayer money, and improves creditworthiness.[6][7] In the late 1940s through the early 1970s, the US and UK both reduced their debt burden by about 30% to 40% of GDP per decade by taking advantage of negative real interest rates, but there is no guarantee that government debt rates will continue to stay so low.[4][8] Between 1946 and 1974, the US debt-to-GDP ratio fell from 121% to 32% even though there were surpluses in only eight of those years which were much smaller than the deficits.[9]

Calculating Real Interest Rates using Change In Value

Bearing in mind that a real interest rate is simply the proportion of return or proportion of loss of a changed revenue stream after inflation has been factored in, we could use a simple change formula to calculate the real rate of change in income based on the new living costs.

Using the example above, for negative real rates of interest, where the standard bank loan rate is at 2% and the rate of inflation is 10%, we can use the following formula.

$$r = \frac{i - \pi}{1 + \pi} \times 100$$

Where:

r = Real Interest Rate
i = Nominal Interest Rate effect on initial investment
π = Inflationary effect on initial investment

So let's assume a consumer borrows £200,000 from this bank.

Calculating the nominal change on initial value or i is simply £200,000 × 1.02 = £204,000.

The inflationary effect on the initial value or π is calculated as £200,000 × 1.1 = £220,000. We calculate this value because we want to find the amount of money which is required to buy the same volume of goods and services in the following time period as £200,000 did in the preceding period. So:

$i - \pi$ = £204,000 − £220,000 = − £16,000.

This difference is the top line of the equation and shows that the "real" debt is negative since the price of the debt rose at a lower rate than the money supply rate. So in effect, the creditor is losing £16,000 at prices in the latest time period. This is because the £204,000 return doesn't reflect the same purchasing power in the current time period as £200,000 did in the preceding one. Assuming the borrowers annual income is £200,000, if this rose in line with inflation, she would gain £16,000 in latest money terms. If this income grew at 2%, she would find her loan no less easy or harder to pay but would find other items which grew at a higher rate of inflation more expensive.

This change represents the inflationary adjusted change in value and so by dividing it by this by the inflationary effect on the initial value and then multiplying by 100, we can get the percentage change on value based on the inflated value. Therefore:

$$r = \frac{-£16{,}000}{£220{,}000} \times 100 = -0.07272 \times 100 = -7.27\%$$

This means that assuming a person's valued income or wealth rose by the same level of inflation, the loan is around 7.27% lower in real value and would therefore represent a transfer of wealth from the bank to the repaying individual. Obviously, this would lead to commodity speculation and business cycles, as the borrower can profit from a negative real interest rate.

See also

- Real versus nominal value (economics)
- Inflation
- Deflation
- IS–LM model
- Macroeconomics
- Financial repression

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