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Interest Rates and Rates of Return

Abstract

From early 2008 to 2010, the United States banking system faced significant challenges. Bank failures rose, leading the government to spend over 250 billion dollars to purchase the property of several banks, including the major ones in the country, in the fall of 2008. The issue with the banking system was that commercial banks accepted deposits and then allocated the cash into loans and securities. If the bank's investments decrease in value below the depository's value, the bank must either declare bankruptcy, voluntarily shutter, or be shut down by federal regulators and transfer its obligations to a financially stable bank. By 2009, the Bank of America, the largest bank in the United States, had a 94% decrease in its shares within the initial 18 months due to widespread investor concerns about the bank's financial stability. Failure. Why have the investments of numerous banks fallen in value? In 2007, a collapse occurred due to a rise in the number of homeowners defaulting on mortgage loans. The banks that possessed these loans experienced a drop in their value. The majority of these loans underwent securitization, which turned them into mortgages supported by bonds-like instruments. Banks have purchased numerous securities-backed mortgages, considering them secure investments that would yield better interest rates compared to other investment options. Regrettably, the value of these mortgage-backed securities decreased by 50% or more in 2008 and 2009. The banks had underestimated both the default risk and the interest rate risk associated with these bonds.

Keywords: Interest, banks, value, investments.

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Introduction

In medieval Europe, governments frequently banned moneylenders from charging interest on loans due to religious interpretations and the belief that those with money should lend to the less fortunate without interest. In the contemporary economy, households and businesses commonly seek loans to fund expenditures unrelated to essential needs. Consequently, charging interest on loans is now allowed in many countries. Today, economists define the credit rate as the cost of credit.

Why do lenders charge interest on loans?

If apple growers offered apples for free, there would be minimal supply due to low demand. If lenders did not charge interest on the loans they provided, there would be minimal loan distribution. The price of apples must account for the opportunity cost of supplying them, just as the interest rate must account for the opportunity cost of offering credit. Consider this situation as an example: You lend $1,000 to a buddy with the agreement that they will repay you within a year. Before calculating the interest charge amount, consider these three main factors:

1. When your friend returns the money to you, the purchasing power has decreased due to inflation, allowing you to buy items for a lower cost compared to before you lent the money to your friend.
2. The friend might not reimburse you.
3. While borrowing money, your acquaintance utilizes your funds while you do not. He utilizes the computer for a year after purchasing it, while you await payment of the bill. Borrowing money involves the opportunity cost of forgoing the ability to spend it on goods and services.

We consider the interest that will be applied to the loan or credit as a consequence of:

- Inflation compensation
- Default risk compensation: the chance that the borrower may not repay the loan
- Opportunity cost compensation for delaying spending your money

Make a note of two items from our list. Lenders will charge interest to account for the time value of money until the loan is settled, even if they are confident in the borrower's ability to repay and there is no inflation. Secondly, these three traits differ among individuals and loans. When lenders expect high inflation, they will raise interest rates. Lenders will raise the interest rate for borrowers who display traits resembling those of defaulters. The interest rate lenders charge is contingent on the length of time they have to wait and the creditworthiness of the borrower. The majority of financial transactions entail payments that will occur in the future. We are all acquainted with the interest rates applied to car loans, school loans, and the interest rates gained from assets like certificates of deposit in banks. The interest rate is essential to all elements of the financial system for the following fundamental reasons: The majority of financial transactions entail payments that will occur in the future. By obtaining a car loan, you commit to making monthly payments until the debt is completely repaid. When you buy a bond from "General Electric," the company commits to paying you annual interest until the bond reaches maturity. We can also cite numerous such financial transactions that entail future payments. The inclusion of future payments in financial transactions presents an issue. How can we evaluate and contrast various transactions? For instance, if you want a loan of $15,000 from the bank to buy a car, Consider two credits:

- Loan A entails monthly payments of $366.19 for a duration of 48 months.
- Loan B entails monthly payments of $318.71 for a duration of 60 months.

Which loan do you favor? The interest rate serves as a connection between the current financial situation and future financial outcomes, enabling the analysis of various financial scenarios. Loan A has the greatest monthly payment but a lower interest rate in this scenario. Loan A has an interest rate of 8%, and Loan B has an interest rate of 10%. The interest rate is a crucial component to consider when evaluating a loan; however, it is not the only one. To go deeper into how interest rates connect the current present with the financial future and to grasp the calculation of interest rates on loans like Loan A and Loan B, we must examine two key concepts: compounding and discounting.

Compounding and Discounting

Let's see an example of compounding. If you deposit $1,000 in a certified depository bank (C) with a 5% interest rate, What is the projected worth of the investment in the future? Future value is the value that investments made now will have in the future. After one year, you will receive your initial investment of $1,000 along with a 5% return, totaling $1,050.

This can be restated as:

When $1,000 is increased by 5%, the result is $1,050.

If i represents the interest rate

The principal refers to the initial amount of your investment, which in this case is $1,000.

FV = future value (the amount that $1,000 will increase by in one year)

We can define the equation as: principal multiplied by (1 + i) equals FV1.

Compounding across multiple periods: Assuming you are at the end of the year, you have chosen to reinvest your deposit for the following year. By reinvesting $1,050 for the second year, you will gain compound interest on both the original $1,000 investment and the $50 interest obtained in the first year. Economists use the term compounding to describe the process of earning interest on interest, resulting in savings growing over time. Compound interest is a significant factor in the overall earnings generated by an investment.

We can determine the future worth of your initial investment after 2 years.

$1,050 The result of multiplying 1 by 1.05 is $1,102.50.

What does this signify? First-year earnings Compounding in the second year

Future value in 2 years

We can state the equation as follows: $1,000 * (1 + 0.05) The value of 2 is $1,102.50.

Alternatively, represented symbolically as: Principal * (1 + 0.05)2 is equivalent to FV2.

An Example of Discounting – We utilized the interest rate to link the financial future to the present by initiating with a specific dollar amount in the present and observing how it will increase in the future due to compounding. To reverse the process, we can utilize the interest rate to determine the present value of future cash. The present value represents the current worth of future funds. A primary key is a unique identifier for each record in a database table. Future funds are discounted to ascertain their present value since money in the future is worth less than money in the present. The time value of money is the term used by economists to describe how the value of a payment fluctuates depending on when it is received. Why are funds in the future less valuable than funds in the present? This is because lenders charge interest on their loans for the same three reasons.

The value of dollars will decrease with time.

Dollars that are pledged or given in the future may not be honored.

Waiting to receive payments incurs an opportunity cost since you are unable to utilize the money for purchasing products and services. To compute the current value, we must discount the future money's worth. To proceed with this decrease, we reverse the compounding process. In our example, you wished to contribute $1,000 for a duration of one year. $1,000 in present value is equal to $1,050 in future value that will be received in one year. The present value of $1,050 for you is $1,000. From this viewpoint, compounding and subtraction are equal procedures. Compounding: $1,000 multiplied by (1 + 0.05) equals $1,050; or PV multiplied by (1 + i) equals FV1.

Discounting formula: Present value (PV) equals future value (FV) divided by (1 + interest rate).

Some important points about Discounting:

1. Present value is sometimes known as "discounted present value." This language highlights the process of discounting the future worth of funds to their present value.

2. The further away a payment is in the future, the lower its present value. This point can be observed by analyzing it using the discount formula. The present value (PV) is equal to the future value (FV) divided by the sum of 1 plus the interest rate (i) raised to the power of n.

3. A higher interest rate for discounting future payments results in a decreased present value of those payments. From an economic perspective, requiring a higher interest rate signifies that you place greater value on receiving a larger sum of money in the future compared to receiving a dollar today. This means that a higher interest rate decreases the present value of future dollars. We can demonstrate this using the table below. For any interest rate, the table demonstrates that when the time of receiving a payment moves further into the future, the current value decreases. For instance, with an interest rate of 5%, a $1,000 payment received in one year is valued at $952.38, but this present value decreases to $231.38 if the payment is received over 30 years. As the number of years in the future for receiving payments increases, a higher interest rate results in a decreased present value of the payment. A $1,000 payment received in 15 years is valued at $861.35 when discounted at a 1% interest rate and just $64.91 when discounted at a 20% interest rate. If you discount a $1,000 payment received in 30 years at an interest rate of 20%, its present value is only $4.21.

	Present Value of a $1,000 payment to be received in . . .			
Interest Rate	**1 Year**	**5 Years**	**15 Years**	**30 Years**
1%	$990.10	$951.47	$861.35	$741.92
2%	980.39	905.73	743.01	552.07
5%	952.38	783.53	481.02	231.38
10%	909.09	620.92	239.39	57.31
20%	833.33	401.88	64.91	4.21

4. The present value of a sequence of future payments is calculated by adding up the discounted value of each payment after it is received.

Discount and prices of financial assets

Various financial assets, like loans and shares, represent commitments from the borrower to make specific payments to the lender at a later date. Discounting enables the comparison of several financial terms to calculate the present value of future payments received at different times. Discounting provides a method for calculating the value of financial assets.

Debt Instruments and their prices

Financial assets' price equals the present value of future payments received from possessing them. Debt instruments consist of loans backed by banks and bonds issued by firms and governments. Shares are not considered debt instruments as they represent ownership in the corporation that issues them.

There are four fundamental categories of debt instruments.

1. Basic loans

2. Bonds sold at a reduced price

3. Bond coupons

4. Loans with fixed payments.

Simple loans include borrowers receiving a quantity of funds called principal from lenders and agreeing to repay the principal plus interest on a specified date.

Discount Bond: Similar to a basic loan, the borrower repays the discounted bond in a lump sum. Here, the borrower pays the lender a sum known as the "face" value but receives an amount lower than the original "face" value.

Coupon bonds differ significantly from discount bonds, despite both being classified as bonds. Borrowers who own coupon bonds pay interest through periodic coupons and refund the principal amount. The United States Treasury, state and municipal governments, and significant businesses all issue coupon bonds.

Fixed-payment loans require borrowers to make regular payments (monthly, quarterly, or yearly) to lenders. Payments consist of both interest and principal amounts. Thus, upon reaching maturity, the borrower has fully repaid the loans, with no additional principal payment required.

These loans are favored by homeowners since the loan is entirely paid off as long as all payments are made, eliminating the need for a final payment common with simple loans. Fixed payment loans benefit lenders since borrowers gradually repay some of the principal with each payment, decreasing the risk of non-payment of the whole total amount.

Bond Prices and Yield to Maturity

Let's analyze a 5-year bond with a coupon rate of 6% and a face value of $1,000. The 6% coupon rate indicates that the bond seller will pay the bond buyer $60 annually for 5 years, with a total payment of $1,000 at the end of the fifth year. Hence, the price expression, P, of the bond is the present value of the sixth payment the investor would get.

$$P = \$60 / (1+i) + \$60 / (1+i)2 + \$60 / (1+i)3 + \$60 / (1+i)4 + \$60 / (1+i)5 + \$60 / (1+i)6$$

Yield to Maturity

For the bond pricing formula to be applied, we require details on the future payment amount and the interest rate. Typically, we are aware of the bond's price and the upcoming payment, but the interest rate is not always known. Imagine you are presented with a decision similar to this: Which investment is more favorable: a 3-year $1,000 coupon bond priced at $1,050 with an 8% coupon rate, or a 2-year $1,000 coupon bond priced at $980 with a 6% coupon rate? One crucial component in deciding between these two investments is determining the interest rate that will be earned from each. We can determine the interest rate for each investment by using the present value computation, as we have the payment prices for both bonds.

Bond 1: $1,050 = $80 / (1 + i) + $80 / (1 + i) 2 + $80 / (1 + i) 3 + $80 / (1 + i)3

We can determine the value of i by using a financial calculator, an online calculator, or another tool. The result is i = 0.061, which is equivalent to 6.1%.

Second bond: The product of dividing $60 by (1 + i), $60 by (1 + i)2, and $1,000 by (1 + i) equals $980. 2

The solution for this bond is i = 0.071, which is equivalent to 7.1%.

These calculations demonstrate that Bond 1 may seem like a more favorable investment due to its larger coupon rate compared to Bond 2. A higher price for Bond 1 indicates a notably higher interest rate. Less than Bond 2 in size. If you desire a higher interest rate on your assets, select Bond 2. The calculated interest rate is the yield to maturity. This calculates the current value of the payment received from the assets based on today's asset price. Yield-to-maturity is a commonly used interest rate measure in financial markets based on current value assumptions. Participants in financial markets refer to the interest rate of a financial asset as the yield to maturity. Calculating the yield to maturity for alternative investments enables savers to compare various forms of debt instruments.

Inverse relationship between bond prices and bond yields

Government and corporate bonds usually have 30-year maturities. Over the past three decades, investors have frequently traded coupons on the secondary market. After a coupon is sold, the organization or government that issued the bonds is not directly engaged in further transactions. In the initial chapter, it was demonstrated that banks have a crucial function in the financial system. Small and medium-sized enterprises depend on bank loans for funding as they do not have the capability to sell shares and bonds to investors, a privilege reserved for giant companies. Families depend on banks for acquiring homes, vehicles, furnishings, and other significant acquisitions. Banks exacerbated the 2007–2009 recession by halting lending during the financial crisis.

What are the reasons behind the challenges faced by banks in recent years? The negative correlation between interest rates and bond prices can aid in our comprehension. Commercial banks primarily function by accepting deposits from businesses and investment entities. Banks consider granting loans and purchasing bonds as their primary investments. During the housing market expansion in the mid-2000s, banks provided substantial mortgage loans to individuals with poor credit histories who would not typically meet loan qualifications. Since the start of 2009, commercial banks have incurred losses of approximately 1 trillion dollars in their investments. In 2010, losses decreased marginally as the housing market stabilized and the prices of certain securities rose. Nevertheless, these substantial losses led to the shutdown of numerous institutions.

Bond Prices and Yields to Maturity Move in Opposite Directions

The examples have demonstrated two crucial points.
1. When the interest rates of issued bonds rise, the prices of existing bonds will decrease.
2. When interest rates on new bonds decrease, the prices of existing bonds will rise.

Time to maturity and bond prices have an inverse relationship. The relationship must be preserved, as the time to maturity serves as the denominator in each term of the bond price equation. An increase in the time to maturity leads to a decrease in the value of the coupon payment, resulting in a decrease in the price of the bonds.

Secondary Markets, Arbitrage and One Price Markets

Let's examine how bond prices and time influence market fluctuations. Trading bonds and comparable assets on the markets is akin to trading goods and services, albeit with distinct variations. Currently, the majority of financial transactions are conducted electronically, connecting buyers and sellers through computer systems, minimizing the need for in-person trading. Trading occurs rapidly, with millions of dollars worth of equities being exchanged per second during market hours. Significant volumes of bonds and equities are exchanged rapidly due to the prevalence of traders rather than long-term investors in financial markets. Investors in financial markets typically anticipate generating income through receiving payments for the securities they purchase. An investor purchases shares of Microsoft stock to get dividend payments and profit from the firm's price appreciation. Traders frequently engage in buying and selling stocks with the aim of profiting from minor price discrepancies among identical securities.

Interest rate and rates of return

When investing, the primary focus is on the potential returns over a specific timeframe. When you purchase a bond and keep it for one year, your investment return for that year is comprised of the coupon payment received and the change in the bond's price, leading to either a gain or loss of money. Typically, you are more focused on calculating your return as a percentage of the investment, which provides us with your rate of return, R.

Interest Rate Risk and Maturity

Existing bond holders see a decrease in capital value as market interest rates increase. Economists use the term "interest rate risk" to describe the possibility of a financial asset's price fluctuating due to shifts in market interest rates. Are interest rates having an equal impact on all bonds? Bonds with shorter maturities are expected to be less impacted by fluctuations in the interest rate market compared to bonds with longer maturities. The economic rationale is that as the bond matures, the buyer is at a higher risk of losing the bond's value.

Nominal interest rates vs. Real interest rates

All the interest rates we discussed were nominal. Interest rates do not account for changes in buying power due to fluctuations in the price level. Inflation can diminish the buying power of earnings from investments. For instance, if you purchase a $1,000 bond that yields $50 in annual interest for 20 years, When the purchasing power of the dollar you earn rises over time, you are essentially losing a portion of your interest income to inflation. Furthermore, inflation diminishes the purchasing power of the principals. If inflation is 5% annually, the principal's buying power decreases by $50 each year.

Answering your key question

At the start of this chapter, we inquire: What causes interest rates and securities prices to move in opposite directions? This study demonstrates that financial insurance costs are equivalent to the actual payments investors receive while holding the instrument. Present values decrease when interest rates increase and increase when rates decrease. Thus, interest rates and security finance prices should exhibit an inverse relationship.

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